**DIGITAL CONTENT**

**CHEMISTRY PRACTICAL PREPARATIONS**

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**K.C.S.E**

**STUDY PACK**

**CHEMISTRY**

**PRACTICAL**

**1989 – 2016**

* + - * + **PRACTICAL QUESTIONS**
        + **COORDINATED MARK SCHEMES**
        + **PREPARATION AND CONFIDENTIAL INSTRUCTIONS**

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**Introduction**

The main aim of Chemistry Practical examination is to test a candidates ability to:

a). Follow instructions

b). Handle apparatus and chemicals

c). Make accurate observations and deductions/inferences

This book contains 26 practical examinations from 1989 - 2013 as they appeared in during the respective examinations periods. The requirements and preparation procedures for each practical has been provided.

The teacher should give minimal assistance to candidates when carrying experiments to build confidence and enable them make their own observations and inferences. Confidence is only built with constant practice. Candidates are also advised to write the observations as they ‘observe’ during the practical but not the literature they have read from the books.

In experiments involving quantitative analysis the readings show slight variations from the ones given in the answer scheme and also from region to region. Therefore in the calculations and plotting of graphs, the teachers are required to use their school values. Teachers are advised to use the scheme as a guide not as the final correct answer.

Charles Otieno

Publishing Editor & Examinations Co-ordinator

**QUANTITATIVE AND QUALITATIVE ANALYSIS**

The chemistry practical mainly tests the candidates on two parts. Qualitative analysis and quantitative analysis. Students should be exposed to various types of experiments during teaching. Where it is not possible to carry out experiments individually, a well designed demonstration should be undertaken. Teachers should avoid theoretical teaching as this has been manifested many times during the marking of this paper.

Language used to communicate the observations and results must be checked after each practical experiment. Discussion of the results and clear explanations should be given after every experiment. Apparatus must be cleaned to avoid contamination and must be assembled correctly if accurate observations are to be obtained.

**Introduction to Quantitative Analysis**

Quantitative analysis in chemistry practical examination mainly involves the volumetric analysis. Volumetric analysis is a means of estimating quantities of certain substances (often acids or alkalis) by an analytical process which involves measurement of volumes of liquids using pipettes, burettes and measuring cylinders. Weighing is also involved. It involves the use of the following apparatus

i). Thermometer

ii). Stop-watch/stop-clock

iii). Other common apparatus found in a laboratory

In the K.C.S.E Chemistry practical examination this section requires the candidate to carry out an experiment, record and interpret the data. The interpretation involves calculations and drawing graphs after a candidate has collected the data.

A candidate who is not sure with the calculations after collecting the data is advised to record all his data in the table (s) provided and finally do the calculations. About half of the total marks awarded in this section is mainly from the recording of the data.

It is important for the candidate to spend sometime reading the instructions and the procedure to ensure that all the apparatus and reagents are present and the procedure is clear. After that, the candidate can start going through the procedure step by step and recording the data

In the procedure the key words are normally written in bold letters so that the candidate does not make any mistake.

The common areas in chemistry tested in this section of the practical examination are;

a). Moles and molar solution

b). Titration i). Acid-base titration

ii). Redox titration

iii). Back titration

c). Solubility and drawing solubility curves

d). Determining melting, freezing, and boiling points

e). Molar heats of reaction e.g. solution, displacement, precipitation,, neutralization and Hess’s law

f). Rates of reactions and reversible reactions

**Possible errors made in quantitative analysis**

1. Errors made when weighing the substance by the lab. Technician or teacher

2. Contaminated solutions due to use of apparatus, which are not clean. All apparatus e.g. burettes, measuring cylinders, beakers etc should be rinsed thoroughly before using them and after use

3. Candidates not able to read the stop- watch or thermometers properly when taking measurement of time and temperature respectively

4. Candidates not able to identity the end – point accurately during titrations

**Interpretation of data and calculations**

To score maximum marks, candidates are required to be perfect in drawing of graphs

The mole concept is important to all the calculations involved in the practical examination.

As observed earlier (from the trends table) the topic on energy changes is not properly understood. Questions on energy changes are repeated yearly. More time should be allocated to its teaching and students allowed to carry out experiments on heat changes. Heats of displacement, solution are quite easy to determine. Students should be allowed to determine them. More examples on calculations involving energy changes should be given to students for practice.

**Introduction to Qualitative Analysis**

This involves the identification of various ions in a substance. The tests in this section have been kept as simple as possible to enable the learner understand he/she is doing. To avoid these complex reacts the scheme has been restricted to the detection of the following ions;

NH4+, K+, NA+, LI+, Ca2+, Ba2+, Al3+, Zn2+, Fe2+, Fe+3, Pb2+,Cu2+, CO32-, HCO3-,

SO2-3, NO3-, Cl-, Br- and I-.

This section also tests candidates on identification of organic compounds and their characteristics. When doing the practical examination. Work systematically through the experiments, in the order they are given, writing your observations and deductions as you go along.

If you are unable to make sense of a particular reaction, leave it after recording your observations and move on to the next test or experiment. Do not waste time. You should have time at the end to go over your work, correcting mistakes and checking for anything you think you have missed. Follow the instructions and the procedure carefully.

**How to make observations and deductions**

Observations are changes you see when you carry out a test or experiment. Observations are;

i). Colour changes

ii). Formation of precipitate

iii). Gases evolved, including colour, smell.

iv). Sound, heat or light produced

**Tests for gases**

Do not waste time testing for gases unless you know a gas is being produced or unless its indicated in the instructions that test for and identify any gas being produced.

**Gases can be detected by:**

i). Colour

ii). Effervescence (bubbling of gas)

iii). Smell

iv). Effect on moist litmus papers

**Deductions/Inferences**

Deductions are something you can say about the unknown substances. This can be:

i). Anions and cations present in the unknown substance (e.g. SO42-, or Fe2+ ions)

ii). the substance is an oxidizing or reducing agent

iii). the substance is saturated or unsaturated (incase of organic substances)

Deductions must be specific.

* A common mistake is to simply write; “Cu2+. You should write Cu2+ present
* Do not forget that even tests that show no precipitate formed often have a

deduction. For example; you might add Ba(NO3)2 solution to a solution of a substance and see no precipitate. From this you can deduce that there is no sulphate, SO42-, present (otherwise a white precipitate would be seen)

* Another common fault is to give the identity of gases as deduction. Your

deduction is what type of a substance has produced the gas. For example, if you add acid to a solid and observe carbon (iv) oxide then a carbonate is present.

* Deductions must be written as soon as you have recorded your observations.
* Do not leave all the deductions until you have completed all the tests. If you do

this, you may miss important observations and deductions in other tests, often need the deductions from earlier test to make sense of later tests.

**Identification of cations (metallic ions)**

The two common reagents used in the identification of cations are:

i). Sodium hydroxide solution

ii). Aqueous ammonia

However, other reagents like dilute hydrochloric acid or an aqueous solution of soluble chloride e.g. sodium chloride and dilute sulphuric acid or an aqueous solution sulphate e.g. sodium sulphate are use to identify some cations.

In most cases candidates are required to prepare small quantities of solution in a boiling tube or test tube for the unknown substance. If the substance is being tested is insoluble in water, dilute hydrochloric acid is added to the substance. If the solids still will not dissolve it is probably a lead salt and dilute nitric acid must be used.

For the identification of ions to be done the compound must be in aqueous form. The alkali is first added drop wise while the candidate records the observation and then in excess again and observation recorded.

**Addition of Sodium Hydroxide Solution to a Solution in a Test Tube**

|  |  |  |
| --- | --- | --- |
| **Test** | **Observation** | **Inference** |
| Add a few drops of NaOH solution drop wise until in excess | a). No precipitate formed | Zn2+, Al3+, Pb2+, Mg2+, or Ca2+ absent. |
| b). White precipitate ,  insoluble in excess of  NaOH(aq) | Ca2+ or Mg2+ present |
| c). White precipitate,  soluble in excess NaOH (aq)  forming a colourless solution. | Pb2+,Al3+ or Zn2+ present |
| d). Green precipitate which  turns brown on exposure to  air. | Fe2+ present |
| e). Brown precipitate  insoluble in excess NaOH(aq) | Fe3+ present |
|  | f). A blue precipitate is formed  insoluble in excess NaOH | Cu2+ ions present |

**Addition of aqueous ammonia to a salt solution in a test tube**

|  |  |  |
| --- | --- | --- |
| **Test** | **Observation** | **Inference** |
| Add a few drops of NH3(aq) solution until in excess | a). No white precipitate  formed | Ca2+ present/ Na+, K+, NH4+ |
| b). White precipitate ,  insoluble in excess of NH3(aq) | Mg2+,Pb2+ or Al3+ present |
| c). White precipitate,  soluble in excess NH3(aq). | Zn2+ present |
| d). Green precipitate insoluble  in excess | Fe2+ present |
| e). Brown precipitate insoluble  in excess | Fe3+ present |
| f). Pale blue precipitate; which  dissolves to form a deep-blue  solution in excess NH3(aq) | Cu2+ present |

**Addition of Dilute Hydrochloric Acid or Sodium Chloride Solution**

|  |  |  |
| --- | --- | --- |
| **Test** | **Observation** | **Inference** |
| Add a few drops or (a known volume) of dilute HCl or NaCl(aq) to a solution in a test tube.  ‘’ ‘’ ‘’ ‘’ ‘’ | a). White precipitate  formed | Pb2+, Ag2+ ionspresent. |
| b). No white  precipitate  formed | Pb2+ and Ag+ ionsabsent |

**Addition of Dilute H2SO4 acid or Sodium Sulphate Solution**

|  |  |  |
| --- | --- | --- |
| Test | Observation | Inference |
| Add a few drops or (known volume) of dilute H2SO4 or NaSO4 to a solution in a test tube.  ‘’ ‘’ ‘’ ‘’ ‘’ | a). White precipitate  formed | Ca2+, Pb2+ or Ba2+ present. |
| b). No white  precipitate formed | Ba2+, Pb2+,or Ca2+, absent |

**Identification of Cations Using the Flame Test**

The presence of some metallic ions can be identified by heating the substance in a flame using a platinum wire or a glass rod

**The Bunsen burner flame should be non-luminous for correct observation to be made**

|  |  |  |
| --- | --- | --- |
| Test | Observation | Inference |
| Dip a clean platinum wire or a glass rod into a solution of salt | a). Lilac or purple /orange flame | K+ present. |
|  | b). Golden yellow  flame | Na+ present |
| c). Crimson flame | Li+ present |
| d).Brick-red flame | Ca2+ present |
| e).Green-blue flame | Cu2+ present |

**Identification of Anions**

The substances to be identified must be in aqueous form before the reagents are added

The anions are commonly identified by the use of dilute acids e.g. HCl acid. Precipitation reactions with reagents listed in the table below are used as confirmatory tests.

|  |  |  |
| --- | --- | --- |
| **Test** | **Observation** | **Inference** |
| 1). Add dilute acid e.g. HCl to a solution in a test tube | Effervescence /bubbles of a gas are produced. | CO32- or HCO3- SO2-3 present |
| 2). Add barium Chloride or Barium nitrate solution to a solution in a test tube followed by dilute HCl acid | White precipitate formed which is insoluble in dilute HCl acid | SO42- present |
| 3). Add barium Chloride or Barium nitrate solution to a solution in a test tube followed by dilute nitric acid or dil. HCl respectively | White precipitate is formed which dissolves on the addition of the acid | SO32- or CO32- present |
| 4).Acid lead (II) nitrate to a solution in a test tube followed by dilute HNO3 acid | White precipitate formed which dissolved on boiling | Cl- present |
| b).White precipitate insoluble on boiling | SO42- or CO3-2 present |
| c).Pale cream precipitate formed. | Br- present |
| d).Yellow precipitate formed | I- present |
| 5).Add a small quantity of cold, iron (II) sulphate solution. Gently pour concentrated H2SO4 acid down the side of the tube. | A brown ring forms in the junction of the two layers | NO3- present |
| 6). Add dilute acid to a substance in test tube  Test with acidified KMnO4 solution or acidified K2Cr2O7 | A gas with a smell of rotten egg evolved  Gas blackens the lead ethanoate paper or lead (II) nitrate solution. | S2- present |
| 7). Add dilute acid to a substance in test tube  Test with acidified KMnO4 solution or acidified K2 Cr2 O7 | Effervescence (bubbles of a colourless gas  Pungent smell  KMnO4 turn from purple to colourless  K2Cr2O7 turn from orange to green | SO32- present |

**Action of Heat**

When heating solid substances always makes sure that the test-tube is clean and dry.

|  |  |  |
| --- | --- | --- |
| **Test** | **Observation** | **Inference** |
| Heat a small amounts of the solid in a clean and dry test tube and test for any gas or gases evolved | a). Colourless liquid formed on cooler part or upper part of test tuber OR vapour condenses to a colourless liquid | Hydrated salt or a hydrogen-carbonate or hydroxide |
|  | b). Colourless gas which gives a white precipitate with lime water | CO32- /HCO-3 present |
| c).Colourless gas that relights glowing splint | Nitrate of potassium or sodium |
| d).Pungent smell; dark brown gas which turns moist blue litmus red | NO3- present (except those of Na and K) |
| e). Pungent smelling gas which turns red litmus blue. | NH4+ present |
| f).Sublimation | Possibly NH4+ |

**Test for oxidizing and reducing agents**

The usual method of testing for an oxidizing agent is to mix it with a substance which is easily oxidized (i.e. a reducing agent) and which gives a visible change when the reaction takes place. Similarly, a suspected reducing agent is added to an oxidizing agent which undergoes a visible change when reduced.

|  |  |  |
| --- | --- | --- |
| **Test** | **Observation** | **Inference** |
| 1. Oxidising agents  a). Test with moist starch-potassium iodide paper | Papers turns blue-black | I-ions are oxidized to I2: which then react with starch |
| b). Warm with Conc. HCl | Cl2(smell, bleaches moist litmus paper | Cl- Oxidised to Cl2 |
| 2. Reducing agents  a).Add acidified KMnO4  solution | Purple solution is decolorized | Purple MnO4-(aq) reduced to colourless Mn2+(aq) ions |
| b). add acidified  K2Cr2 O7(aq) | Orange solution turns green | Cr2 O72- ions are reduced to green Cr3+(aq) ions |
| c). Add a solution of an  Iron(III)salt | Yellow solution turns pale Green | Fe3+(aq) ions reduced to Fe2+ions |

|  |  |  |
| --- | --- | --- |
| **Test** | **Observation** | **Inference** |
| Add acidified KMnO4 solution to a solution in a test-tube | The purple KMnO4 turns colourless or decolourised | SO32- ions present OR unsaturated organic compound OR a reducing agent |
| Add acidified K2Cr2O7 solution to a solution in a test tube | It turns green or colour changes from orange to green | SO32- ions present OR unsaturated organic compound OR a reducing agent |
| Add bromine water to a solution in a test tube | It is decolourised or turns colourless | SO32- ions present OR unsaturated Organic compound OR a reducing agent |
| Add chlorine water to a solution in a test tube. | Brown solution/yellow solution | Br- of I- present |
| Add bromine water to a solution in a test tube | Brown solution/black precipitate | I- present |

Candidates are advised that MARKS are only earned if observation is correct and the scientific language used to describe that observation. It should be known that if the observation is wrong or correct scientific language is not used, then all the marks will be lost.

**OCTOBER - NOVEMBER 1989**

**1*.* You are provided with;**

* + *Aqueous hydrochloric acid, solution* ***W****9 in a burette.*
  + *Solution sodium* ***W****11 containing 6.3g of a dibasic acid H2CO4****.****2H2O per litre*
  + *Aqueous sodium hydroxide, solution* ***W****12.*
  + *Phenolphthalein indicator*
  + *A pair of scissors or a sharp blade*

**You are required to;**

* Standardize the sodium hydroxide solution **W**11
* Use the standardized solution **W**11 to determine the concentration of **W**9

React the hydrochloric acid solution **W**9 with metal **M** and determine the mass per unit length of metal **M**.

**Procedure**

**I** Fill a burette with solution **W**11, pipette 25.0cm3 of solution **W**12 into a conical flask. Titrate using phenolphthalein indicator. Record your results in Table A below;

**Table A.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1st | 2nd | 3rd |
| Final Burette Reading |  |  |  |
| Initial Burette Reading |  |  |  |
| Titre (cm3) |  |  |  |

(5 marks)

1. Average volume of solution **W**11 used (1 mark)
2. Calculate the concentration of the dibasic solution W11 in mol-1

(*C*=12, *H*=1, *O*=16) (1 mark)

1. Calculate the concentration of the sodium hydroxide solution **W**12 in mol*l-1* (2 marks)

**II.** Using a 100cm3 measuring cylinder measure 90cm3 of distilled water and place it into a 250cm3 beaker then add 10cm3 of solution **W**9 (**W**9 is supplied in a burette). Mix the solution well and label it **W**10.

Fill a burette with solution W10, pipette 25.0cm3 of solution W12 into a conical flask. Titrate using phenolphthalein indicator. Record your results in Table B below.

**Table B.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1st | 2nd | 3rd |
| Final Burette Reading |  |  |  |
| Initial Burette Reading |  |  |  |
| Titre (cm3) |  |  |  |

(5 marks)

i). Average volume of solution W10 used. (1 mark)

ii). Calculate the concentration of the diluted hydrochloric acid solution W10 in mol *l-1.* (2 marks)

iii). Determine the concentration of the original hydrochloric acid solution W9 in mol *l-1* (1 mark)

**III**. Cut three pieces each of length 2cm from the metal **M** provided. From the burette containing **W**9 measure 10cm3 of **W**9 into a boiling tube. Wrap the boiling tube with tissue paper. Measure the temperature of this solution and record it in **Table C** below. Place one of the 2cm pieces of metal **M** into the hydrochloric solution **W9** in the boiling tube and measure the temperature. Record the highest temperature in table C below. Repeat this procedure using the other two, 2cm, pieces of M.

**Table C.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | 1st | 2nd | 3rd |
| Piece of metal M |  |  |  |
| Highest temperature |  |  |  |
| Initial temperature |  |  |  |
| Change in temperature, ∆T |  |  |  |

(5 marks)

i). Average change in temperature ∆T……………….0C (1 mark)

ii). Calculate the heat of the reaction between metal **M** and hydrochloric acid using the expression below; heat of reaction = 42 x ∆T Joules (1 mark)

iii). Given that the heat of the reaction is 440Kj per mole of **M**. Calculate the number of moles of **M** used in this reaction. (2 marks)

iv). Calculate the mass per unit length of metal M (M=24). (2 marks)

2. (10 Marks). You are provided with a solid Y. Carry out the tests in Table D below on Y. Record your observations and deductions in the table. Identify any gas evolved.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Observation | Deduction |
| a). | Place half a spatula end ful in a dry test-tube and heat gently first and then strongly | (1 mark) | (1 mark) |
| b). | To about half a spatula endful in a test tube add about 1cm3 of dilute hydrochloric acid | (1 mark) | (1 mark) |
| c). | Place a half a spatula end-ful in a test tube and about 6cm3 of distilled water and shake well. Divide the solution into two portions. |  |  |
| i). | To the first portion add dilute sodium hydroxide dropwise until in excess. Warm the resulting mixture gently then strongly. | (2 marks) | (2 marks) |
| ii). | To the second portion add aqueous ammonia dropwise until in excess. | (1 mark) | (1 mark) |

**OCTOBER /NOVEMBER 1990**

1. **(24 marks)**

You are provided with;

* + *A monobasic acid* ***solid D***
  + *Sodium hydroxide, solution* ***S1***
  + *0.01 M solution S2 of a dibasic acid H2A.*

You are required to:

(I) Prepare a saturated solution of **solid D**

(II) Standardize the sodium hydroxide solution **S1** using solution **S2**.

1. Determine the solubility of **Solid D** in water at room temperature.

**Procedure**

(A) Place all the **solid D** provided into a dry conical flask. measure out 100cm3 of distilled water using a measuring cylinder and add it to the **Solid D**. Shake thoroughly and leave it to stand.

(B) Fill a burette with **solution S1**. Pipette 25cm3 of **solution S2** into a conical flask. Titrate with **Solution S1**. Using a phenolphthalein indicator record the readings in the table below. Repeat to obtain three accurate readings.

**Table A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Trial | 1st | 2nd | 3rd |
| Final Burette reading |  |  |  |  |
| Initial burette reading |  |  |  |  |
| Titre (cm3) |  |  |  |  |

Average titre =…………………………………………………..……………………cm3

(Show the value s being averaged) (1 mark)

Calculations:

i). Write the equation for the reaction of the dibasic acid H2A with sodium hydroxide.………………………………… (1 mark)

ii). Calculate the concentration of sodium hydroxide Solution **S1** in moles per litre.……………………… ……………… (3 marks)

(C) Measure the temperature of the solution of **solid D**. Using **a dry filter** paper and **a dry filter** funnel. Filter the solution into **a dry conical** flask. Pipette 10cm3 of the filtrate into a conical flask, add 25cm3 of distilled water using a measuring cylinder. Shake well and then titrate with the sodium hydroxide **solution S1**, using phenolphthalein indicator.

Record the readings in the table below.

Repeat to obtain three accurate readings.

Temperature of solution of **Solid D** =……………………o C (1 mark)

**Table B.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Trial | 1st | 2nd | 3rd |
| Final burette reading |  |  |  |  |
| Initial burette reading |  |  |  |  |
| Titre (Cm3) |  |  |  |  |

(6 marks)

Average titre=……………………………………………………………

(Show the values being averaged) (1 mark)

**Calculation;**

i). Calculate the number of moles of **acid D** in 10cm3 of the filtrate,

(1 mark)

ii). Calculate the number of moles of **acid D** in 100cm3 of solution of **acid D.** (1 mark)

iii). Given that the molecular formula of **acid D** is C7H6O2, calculate the solubility of the acid in grammes per 100cm3 of water (C=2, H=1, O=16). (2 marks)

2. **(16marks)**

You are provided with a **solid Q**. Carry out the tests below and record your observations and inferences in the spaces provided on the table below. Test for any gas (es) produced.

**Table**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test | Observations | Inferences |
| a). | Place a spatula endful of Solid Q in a boiling tube and add about 20cm3 of distilled water. Shake well. Use about 2cm3 portions of the solution for the tests below | (1 mark) | (1 mark) |
| i). | Test the pH with a pH paper | (1 mark) | (1 mark) |
| ii) | Add a spatula endful of sodium hydrogen carbonate | (1 mark) | (1 mark) |
| iii). | Add two drops of potassium manganate (VII)solution | (1 mark) | (1 mark) |
| iv). | Add two drops of bromine water and warm the solution then shake it well | (1 mark) | (1 mark) |
| b). | Place a little of solid Q in a crucible (a crucible lid or a metallic spatula) and ignite it. | (1 mark) | (1 mark) |
| c). | Place about 4cm3 of ethanol in a test tube, add two drops of concentrated sulphuric acid then add a spatula endful of Solid Q. Warm the mixture carefully. Shake well and pour the mixture into about 20cm3 of cold water in a boiling tube. Note any smell | (1 mark) | (1 mark) |

**OCTOBER / NOVEMBER 1992**

1. (15 Marks)

You are provided with:

* + *Solution C2, Potassium iodate solution*
  + *Solution C3, acidified sodium hydrogen sulphite solution*
  + *Solution C4, starch indicator*
  + *A stop watch/stop clock*

You are required to find out the effect of the concentration of potassium iodate, **C2**, on the **rate** of reaction with acidified sodium hydrogen sulphite**, C3**.

**NB:** *The end-point for the reaction of potassium iodate with acidified sodium hydrogen sulphite is detected by the formation of a blue- coloured complex using starch indicator.*

**Procedure**

a). Place solution **C2** in a burette and measure out the volumes of **C2**shown in

table 1 into six dry test-tubes. Using a 10cm3 measuring cylinder, add distilled water to the test-tubes as shown in table 1.

|  |  |
| --- | --- |
| Test-tube | Volume of **C2** and water |
| i).  ii).  iii).  iv).  v).  vi). | 10cm3 of **C2**+0 cm3 distilled water  8cm3 of **C2** + 2 cm3 distilled water  6cm3 of **C2** + 4cm3 distilled water  4cm3 of **C2** + 6 cm3 distilled water  3cm3 of **C2** + 7 cm3 distilled water  2cm3 of **C2** + 8 cm3 distilled water |

b). Using a clean 10cm3 measuring cylinder, place 10cm3 of solution **C3** into a

100cm3 beaker, add 3 drops of solution **C4** and shake well. To this mixture add quickly the contents of test-tube (i) and start the stop watch/stop clock immediately. Shake the mixture and note the time taken (in seconds) for the blue colour to appear.

Record the time in Table II

Repeat this procedure using the other solutions prepared in (a) above and complete Table II

**TABLE II.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Volume of **C3** (cm3) | Volume of **C4** (drops) | Volume of **C**(cm3) | Volume of distilled water (cm3) | Time taken for blue colour to appear (seconds) |
| 10 | 3 | 10 | 0 |  |
| 10 | 3 | 8 | 2 |  |
| 10 | 3 | 6 | 4 |  |
| 10 | 3 | 4 | 6 |  |
| 10 | 3 | 3 | 7 |  |
| 10 | 3 | 2 | 8 |  |

(6 Marks)

c). On the grid below plot a graph of volume (vertical axes) of solution **C2** used versus time. (5 Marks)

d). From your graph determine the time taken for the blue colour to appear using a mixture of 7cm3 of **C2** and 3cm3 of distilled water. (2 marks)

e). How does the concentration of potassium iodate, **C2**, affect its rate of reaction with acidified sodium hydrogen sulphite, **C3**? Explain your answer. (2 marks)

2. (15 marks)

**You are provided with**:

* + *Solution C5, 0.11M hydrochloric acid*
  + *Solution C6, containing 19.2g/l of basic compound Na2B4O7****.****nH2O*

You are required to determine the value of n in compound **C6**Na2B4O7**.**nH2O.

**Procedure**

a). Place solution **C5** in the burette. Pipette 25.0cm3 (or 20.0cm3) of **C6** into a 250cm3 conical flask and titrate using methyl orange indicator. Record your results in Table III below and repeat the titration carefully to achieve consistent results

Volume of pipette…………………………..cm3

Burette readings

**Table III**

|  |  |  |  |
| --- | --- | --- | --- |
| Titration number | I | II | III |
| Final reading (cm3) | 28.5 |  |  |
| Initial reading (cm3) | 00.00 |  |  |
| Volume of **C4** use (cm3) | 28.5 |  |  |

(5 marks)

Average volume of C5 used = ……………………………..cm3 (1 mark)

b). **Calculations;**

Given that the ionic equation for the reaction is

B4O72- (aq) + 2H+(aq) + 5H2O(l) 4H3BO3(aq)

(1 mole of the base reacts with two moles of the acid)

i). Calculate the concentration of C6 in moles per litre. (4 marks)

ii). Calculate the relative molecular mass of the basic compound **C6.**  (2 marks)

iii). Calculate the value of **n** in the formula Na2B4O7**n**H2O

(B=10.8, H=1.0, Na=23.0, and O = 16.0). (3 marks)

3. **(10 marks).**

You are provided with solid C7. Carry out the following tests and record your

Observations and inferences in the spaces provided in table IV.

**Table IV**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test | Observations | Inferences |
| a). | Place a little of solid **C7** in a dry test-tube and heat gently. | (1 mark) | (1 mark) |
| b). | Place the remainder of the solid **C7** in a boiling tube. Add about 10cm3 of distilled water and shake well to dissolve the solid. Divide the solution into four positions for tests (i) to (iv) below | ( ½ mark) | (1 mark) |
| i). | To the first portion add a few drops of dilute sulphuric acid. | ( ½ mark) | (1 mark) |
| ii). | To the second portion add dropwise aqueous sodium hydroxide until in excess | ( ½ mark) | (1 mark) |
| iii). | To the third portion add one to two drops of aqueous lead nitrate | ( ½ mark) | (1 mark) |
| iv). | To the fourth portion add a few drops of barium chloride solution | ( ½ mark) | (1 ½ marks) |

**OCTOBER /NOVEMBER 1993**

**1. (26 MARKS)**

**You are provided with:**

* *Sodium hydroxide, solution A*
* *1.0 g of an ammonium salt, solid B*
* *0.01M monobasic acid, solution C*

**You are required to**:

- Dilute solution **A** with distilled water,

- Standardize the diluted solution **A** with solution C

- Determine the relative formula mass of the ammonium salt **B**

**Procedure I**

Pipette 25cm3 of solution **A** into a 250cm3 conical flask, measure 175cm3 of Distilled water using 100cm3 measuring cylinder and add it to solution **A** in the beaker. Shake well. Label this as solution D. Pipette 25cm3 of solution **D** into a 250cm3 conical flask and then titrate with solution **C** using 1 or 2 drops of Phenolphthalein indicator. Record your results in table I below. Repeat the procedure to obtain accurate values.

**Table I**

|  |  |  |  |
| --- | --- | --- | --- |
| Table I | 1st | 2nd | 3rd |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution C used (cm3) |  |  |  |

Calculations:

a). Determine the average volume of solution C used. (1 mark)

b) Calculate the concentration in moles per litre, of sodium hydroxide in solution D. (1 mark)

c). Calculate the concentration, in moles per litre of sodium hydroxide in solution A. (1 mark)

*In the process described below, sodium hydroxide reacts with the ammonium Salt B and on boiling the mixture, ammonia gas is expelled. The excess sodium hydroxide is then determined by titrating the monobasic acid, solution C.*

**Procedure II**

Place all the 1.0g of ammonium salt, solid **B** into 250cm3 conical flask. Pipette 25cm3 of the sodium hydroxide solution **A** into the conical flask containing solid **B**. Shake well until all the solid dissolve. Heat the mixture and let it boil for about 10 minutes. Add 50 cm3 of distilled water to the boiled mixture and shake well. Transfer the solution into a 100cm3 measuring cylinder then add distilled water up to the 100cm3 mark. Pour this solution back into the conical flask and label it as solution **E**. Pipette 25cm3 of solution **E** into a 250 cm3 conical flask and titrate with solution **C** using 1 or 2 drops phenolphthalein indicator. Record the results in the **table II** below. Repeat the procedure to obtain accurate value and complete **Table II**

|  |  |  |  |
| --- | --- | --- | --- |
| Table I | 1st | 2nd | 3rd |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution C used (cm3) |  |  |  |

Calculations:

a). Determine the average volume of **C** used. (1 mark)

b). Calculate:

i) The number of moles of the monobasic acid, Solution **C**, used (2 marks)

ii). The number of moles of hydroxide in 25cm3 of solution **E**. (1 mark)

iii). The number of moles of sodium hydroxide in 100cm3 of solution **E**. (1 mark)

c). Using concentration of sodium hydroxide solution, obtained in (e) above

calculate the moles of sodium hydroxide in 25cm3 of solution **A** (this gives the number of moles of sodium hydroxide added to the ammonium salt **B**) (2 marks)

d). Using the values obtained in *(e)* (iii) and *(f)* above determine the number

of moles sodium hydroxide that reacted with the ammonium salt. (2 marks)

e). Given that one mole of sodium hydroxide reacts with one mole of the

ammonium Salt **B**, what is the number of moles of salted in 1.0g of Solid **B**. (2 marks)

f). Calculate the relative formula of mass of the ammonium salt. (2 marks)

**2.** **(14 marks)**

You are provided with solid **F**. You are required to carry out the tests below and write your observation and inferences in the spaces provided. Identify the gas or gases produced.

**Table**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test | Observations | Inferences |
|  | Place all the solid **F** provided into a boiling tube and add distilled water with shaking until the boiling tube is half full. Use about 3cm3 portions of the solution for tests *(a)* to *(d)* below. | (1 mark) | (1 mark) |
| a) | To the 1st portion add sodium hydroxide solution drop wise until in excess | (1 mark) | (1 mark) |
| b) | To the 2nd portion add about six drops of barium chloride solution | (1 mark) | (1 mark) |
| c) | To the 3rd portion add three drops of iodine solution | (1 mark) | (1 mark) |
| d) | Dip one end of the filter paper strip provided into potassium dichromate solution and remove it. To the 4th portion add about 1cm3 of dilute hydrochloric acid, shake well, and observe for about 2 minutes. Place the dipped end of the filter paper at the mouth of the test tube and warm the contents of the test tube gently. | (3 marks) | (3 marks) |

**OCTOBER / NOVEMBER 1994**

**1. You are provided with:**

* + 0*.2M sodium hydroxide, solution* **D**
  + *0.1M solution of a carboxylic acid C3H5O (COOH) n solution* **E**

You are required to determine the value of n in the formula C3H5O (COOH)n of the carboxylic acid E

**Procedure**

a). Place solution **D** in the burette. Pipette 25.0cm3 (or 20.0cm3) of solution E into a conical flask and titrate with solution **D** using phenolphthalein indicator. Record your results in **table l** below and repeat the titration to achieve consistent results.

**Results**

Volume of pipette ……………….cm3

**Table I**

Burette readings

|  |  |  |  |
| --- | --- | --- | --- |
| Titration number | I | II | III |
| Final reading (cm3) |  |  |  |
| Initial reading (cm3) |  |  |  |
| Volume of D used (cm3) |  |  |  |

4 marks

b). Average volume of D…………………

(Show how you arrive at your answer)

c). Calculate the number of moles of sodium hydroxide used. 2 marks

d). Calculate the number of moles of E in the 25.0cm3 (or 20.0cm3) used 2 marks

e). i). Calculate the number of moles of sodium hydroxide required to

react with one mole of C3H5O(COOH)n 3 marks

ii). What is the value of n 1 mark

2. **You are provided with;**

1.0M Sodium hydroxide solution F

0.63M solution of an acid solution G

You are required to determine the molar heat of neutralization of sodium hydroxide with acid **G.**

**Procedure**

a). Place six test-tubes on a test-tube rack. Using a 10cm3 measuring cylinder,

measure 5cm3 portions of solution **G** and place them into each of the six test-tubes.

Measure 25.0cm3 of solution **F** using a measuring cylinder and place it into a

100cm3 beaker. Measure the temperature of this solution F to the nearest 0.50C

and record it in **table II.**

Pour the first portion of the 5cm3 of solution **G** from the test-tube into the beaker

containing 25cm3 of solution **F**, stir the mixture carefully and record the highest

temperature of the mixture in **table II.**

Pour the second portion of solution **G immediately** into the mixture in the

beaker, stir carefully and record the highest temperature of this mixture in

**Table II**. Continue this procedure using the remaining portions of solution G to

Complete **table II.**

**Table II**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Total volume of G added (cm3) | 0 | 5 | 10 | 15 | 20 | 25 | 30 |
| Volume of F (cm3) | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| Temperature (0C) |  |  |  |  |  |  |  |

4 marks

b). On the grid provided below, plot a graph of temperature (vertical axes) versus volume of solution G added 4 marks

c). From the graph determine:

i). The volume of the solution G required to neutralize 25cm3 sodium

hydroxide solution F 1 mark

ii). The highest temperature change, ∆T, 1 mark

d). Calculate the heat change for the reaction. (Heat change = mass x temperature change x 4.2Jg-1 0C-1. Assume density of each solution to be 1gm cm-3) 2 marks

e). Calculate the number of moles of sodium hydroxide, solution F, used. 1 mark

f). Calculate the molar heat of neutralization of the sodium hydroxide solution F. 1 mark

3. a). You are provided with the following solids:

Sodium chloride, potassium chloride, calcium chloride and solid H

Note: Solid H will also be required for Question 3 (b)

You are required to carry out flame tests on the above solids to identify the flame colour of the **cations** present in each of them.

**Procedure:**

Clean a metallic spatula and rinse it with distilled water. Dry the spatula on a Bunsen flame for about 1 minute. Allow it to cool. Place a little of sodium chloride solid of the flame as the solid burns and record it in **Table III** below. Clean the spatula thoroughly using steel wool, and repeat the procedure using each of the other solids and complete the **Table III.**

i). **Table III**

|  |  |
| --- | --- |
| Solid | Colour of flame |
| Sodium chloride |  |
| Potassium chloride |  |
| Calcium chloride |  |
| Solid H |  |

4 marks

ii). What cation is present in solid H? 1 mark

b). You are provided with solid H. Carry out the tests in table IV below and record your observations and inferences in the spaces provided. Identify any gas (es) produced.

**Table IV**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test | Observation | Inferences |
| i). | Place a little of solid H in a dry test-tube and heat strongly | (1 mark) | (1 mark) |
| ii). | Place the remainder of the solid H in a boiling tube. Add about 10cm3 of distilled water and shake well. Divide the mixture into three portions for tests (I to III) below |  |  |
|  | 1. To the first portion add aqueous sodium hydroxide until in excess | (1 mark) | (1 mark) |
|  | 1. To the second portion add aqueous ammonia until in excess | (1 mark) | (1 mark) |
|  | 1. To the third portion add about 1cm3 aqueous sodium chloride | (1 mark) | (1 mark) |

**October /November 1995**

1. (22 Marks).

**You are provided with**

* *2.0g of potassium hydrogen carbonate solid J*
* *1.0g of magnesium carbonate, solid K*
* *2.0M Hydrochloric acid*

You are required to determine the enthalpy change for the reaction between

a). Potassium hydrogen carbonate and hydrochloric acid

b). Magnesium carbonate and hydrochloric acid

c). Aqueous magnesium chloride and aqueous potassium hydrogen carbonate.

**Procedure**

1. By means of a burette place 15.0cm3 of the 2.0M hydrochloric acid in a 100cm3 beaker. Stir gently and take the temperature of the acid at every half-minute. Record your readings in table 1. at exactly 2½ minutes add all solid J to the acid, stir gently and continue taking the temperature every half-minute 5 record your readings in table I.

**Table**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ½ | 4 | 4 ½ | 5 |
| Temperature (0C) |  |  |  |  |  |  |  |  |  |  |  |

On the grid provided plot a graph of temperature against time and determine from it the fall in temperature ∆T1. Show the change ∆T1 on the graph (3 marks)

Fall in temperature ∆T1 (1 mark)

Calculations; use the following information where necessary

(H=1, C=12, O=16, Mg=24, k=39) Assume density of the solutions to be 1.0gcm3

a). **Calculate;**

i). The number of moles, n1, of potassium hydrogen carbonate (KHCO3) used during procedure I (1 mark)

ii). The enthalpy, change ∆H2 for the reaction between potassium hydrogen carbonate and hydrochloric acid. Show the sign. Use the following expression (2 marks)

∆H1 = Mass of solution x 4.2 x ∆T1 *Kjmol-1*

n1 x 1000

b). Calculate;

i). The number of moles N2, of magnesium carbonate (MgCO3) used in procedure II (1 mark)

ii). The enthalpy change ∆H2, for the reaction between magnesium carbonate and hydrochloric acid. Show the sign. Use the following expression.

Mass of solution x 4.2 x ∆T2

∆H2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Kjmol-1

n2 x 1000 (2 marks)

c). The equations for the reactions taking place in procedures I and II are;

KHCO3(s) + HCl(aq) KCI(aq) + CO2(q) + H2O(l)

and MgCO4(s) + 2HCl(aq) MgCl2 (aq) + CO2(q) + H2O(l)

Given that the enthalpy change, ∆H3 for the process.

KHCO3 (s)  KHCO3(aq) = 121 kjmol-1 determine the Enthalpy change ∆H4 for the reaction represented by the equation

MgCl2(aq) + 2KHCO3(aq)  MgCO3(s) + 2KCl(aq) + H2O(l) + CO2(g)

Use the following expression

∆H4=2∆H1 - ∆H2- 2∆H3  (2 marks)

2. ***(9 Marks)***

You are provided with solid L. You are required to carry out the tests below and write your observations and inferences in the spaces provided.

**Identify any gases evolved**

a). Describe the appearance of solid L (1 mark)

b). Place a little of solid L, in a dry clean test tube and heat strongly

Observations Inferences

(1 mark)

c). Place a little L in a dry clean test tube then add about 2cm3 of distilled water. Shake well then warm the mixture

Observations Inferences

(1 mark)

d). Place a little solid L in a dry clean test tube then add about 2cm3 of dilute hydrochloric acid

Observations inferences

(1 mark)

e). place about 2cm3 of lead nitrate solution in a clean test tube, add a little of solid L Shake well and allow to settle for about 5 minutes

Observations Inferences

(1 mark)

3. *(9 marks)*

You are provided with solid N. You are required to carry out the tests below and record your observations and inferences in the spaces provided. Identify any gases evolved using a glowing splint and litmus paper

a). Describe the appearance of Solid N. (1 mark)

b). Place a little of Solid N on a clean metallic spatula and burn it in a

Bunsen flame (1 mark)

c). Place a little of Solid N in a dry clean test tube and heat strongly

Observations inferences (1 mark)

d). Place the remaining solid N in a boiling tube and add about 20cm3 of distilled water. Shake well until all the solid dissolves. Use about 2cm3 portions of this solution for the tests below.

i). Test the 1st portion with red and blue litmus papers

Observations Inferences

(1 mark)

ii). To the 2nd portion add a few drops of dilute sodium hydroxide shake well after every drop

Observations Inferences

(1 mark)

iii). To the 3rd portion add a few drops of dilute lead nitrate. Shake well after every drop

Observations Inferences

(1 mark)

iv). To the 4th portion add about 1cm3 of dilute sodium hydroxide

followed by a small piece of aluminium foil. Warm the mixture gently and carefully

Observations Inferences

(1 mark)

**OCTOBER /NOVEMBER 1996**

**1. You are provided with:**

* + Acidified aqueous potassium manganate (VII) KMnO4**,** solution A.
  + Solution **B**, containing 23.5g of ammonium Iron (II) Sulphate (NH4)2Fe (SO4)2

6H2O, per litre.

* + Solution **C**, Containing 5.0g of a dibasic acid, H2X 2H2O, per litre

**You are required to:**

- Standardize the potassium manganate (VII), solution A, using the ammonium iron (II) sulphate, solution **B.**

- Use the standardized potassium manganate (VII), solution A, to determine the concentration of the dibasic acid, H2X 2H2O, solution **C** and then the formula mass of **X.**

**Procedure I:**

**Fill the burette with solution A.**

Pipette 25.0cm3 of solution B into a conical flask. Titrate solution **B** with solution A until a permanent pink colour just appears. Record your results in table I below. Repeat this procedure to complete table I.

a). **Table I**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution A (cm3) |  |  |  |

4 marks

b). Record average volume of solution A used, V1………………………cm3

(Show how you arrive at your answer) 1 mark

c). Calculate the concentration of the ammonium iron (II) sulphate, solution B, in moles per litre. (RFM of (NH4)2 Fe (SO4)2 **.**6H2O = 392 1 mark

d). Calculate the number of moles of iron (II) ions in the 25.0cm3 of solution B

1 mark

e). Using the ionic equation for the reaction between manganate (VII) and iron (II) ions, given below, calculate the concentration of manganate (VII) ions in solution A in moles per litre.

MnO4(aq) + 5Fe2+(aq) + 8H+(aq)  Mn2+(aq) + 5Fe3+(aq) + 4H2O*(l)*

**Procedure II**

Pipette 25.0cm3 of solution **C** into a conical flask. Heat this solution to about 700C and titrate the hot solution **C** with solution **A** until a permanent pink colour just appears. Shake the thoroughly during the titration. Record your results in **table** **II.** Repeat this procedure to complete **Table II.**

f). **Table II.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution A (cm3) |  |  |  |

4 marks

g). Record average volume of solution A used V2=………………….. cm3

Show how you arrive at your answer.

h). Calculate the number of moles of the manganate (VII) ions in volume V2

1 mark

i). Given that 2 moles of the manganate (VII) ions react with 5 moles of the dibasic acid, H2X. 2H2O, calculate the number of moles of the dibasic acid, H2X 2H2O, in the 25cm3 of solution C. 2 marks

j). Calculate the concentration of the dibasic acid, H2X. 2H2O in moles per litre 1 mark

k). Calculate the formula mass of x in the dibasic acid H2X. 2H2O (H = 1.0 O=16.0) 3 marks

2**. (8 marks)** You are provided with solid D. Carry out the tests below.

Record observations and inferences in the table. Identify any gas (es) evolved.

Divide solid D into portions

a). i). To one portion of D in a dry test-tube add about 1cm3 of 6M hydrochloric acid and warm gently for about one minute

Observation s Inferences

2 marks 1 mark

ii). Add distilled water to the mixture in (a) (i) above until the test-tube is about half-full. Shake well and filter into a boiling tube. To about 1cm3 of the filtrate in a test-tube add about 1cm3of 2M sodium hydroxide drop wise

Observations 2 marks

b). Place the remaining portion of D in a dry test-tube and about 1cm3 of 20 volume hydrogen peroxide

Observations Inferences

1 mark 2 marks

3. **(11marks)** You are provided with solid E. Carry out the tests below and record the observations and inferences in the spaces provided. Identify any gas (es) produced.

a). Place a little of E on a clean metallic spatula and ignite with a bunsen flame.

Observations inferences

1 mark 1 mark

b). Add a little of solid E to about 2cm3 of distilled water in a test-tube and shake well. Test the mixture with litmus paper.

Observations inferences

2 marks 1 mark

c). Add a little of solid E to about 2cm3 of 2M aqueous sodium hydroxide in a test-tube and shake well

Observations inferences

1 mark 1 mark

d). Place the remaining portion of E in a boiling tube, add about 10cm3 of distilled water and heat the mixture. Divide the mixture, while still hot, into two portions:

i). Add a little of solid sodium hydrogen carbonate to the first portion

Observations inferences

1 mark 1 mark

ii). Add about 2-3 drops of concentrated sulphuric acid to the second portion. Shake well, and then add about 1cm3 of ethanol. Warm the mixture.

Observations inferences

1 mark 1 mark

**OCTOBER /NOVEMBER 1997**

1. You are provided with;

* + *Sulphuric acid, solution F*
  + *0.5M sodium hydroxide, solution G*
  + *Magnesium turnings, solid H*

You are required to determine the concentration of sulphuric acid in moles per litre

**Procedure I**

Measure 50cm3 of solution **F** using a measuring cylinder and place it in a 100 cm3 beaker. Stir the solution gently with a thermometer and take its temperature after every half-minute. Record your results in **Table I.**

After one and half minutes, add all of solid **H** at once. Stir the mixture gently with the thermometer and record the temperature of the mixture after every half-minute in table **I** up to the sixth minute. Keep the solution for use in procedure **II**

a). Table I

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ½ | 4 | 4 ½ | 5 | 5 ½ | 6 |
| Temperature (0C) |  |  |  |  |  |  |  |  |  |  |  |  |  |

(5 marks)

b). Using the results in table I, determine the highest change in temperature,

∆T for the reaction

∆T………………. (1 mark)

c). Calculate the heat change for the reaction using the expression

Heat change = Mass of solution x 4.2 x ∆T Joules

(Assume density of solution = 1.0g/cm3) (3 marks)

d). Given that the molar heat of reaction of sulphuric acid with solid H is

323KJ mol-1, calculate the number of moles of sulphuric acid that were used during the reaction (2 marks)

**Procedure II**

Place **all** the solution obtained in procedure **I** in a clean **100m3 measuring cylinder.** Add distilled water to make 100cm3 of solution. Transfer all thesolution. Transfer all the solution into a beaker and shake well. Theresulting solution is ‘solution **K’**.

Fill a burette with solution **G**. Pipette 25.0cm3 of solution **K** into a conical flask. Add 2- 3 drops of phenolphthalein indicator and titrate with solution **G**. Record your results in table II. Repeat the titration two more times.

**Table II.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **I** | **II** | **III** |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution G used (cm3) |  |  |  |

(6 marks)

e). Determine the average volume of solution **G** used (1 mark)

f). Calculate the number of moles of sodium hydroxide, solution **G** that were used. (2 marks)

g). Determine;

i). The number of moles of sulphuric acid in 25.0cm3 of solution **K.** (1 mark)

ii). The number of moles of sulphuric acid in 100cm3 of solution K**.** (1 mark)

iii). Using the results from (d) and g (ii) above, calculate the total number of moles of sulphuric acid in 50cm3 of solution F.

(1 mark)

2. You are provided with solid L. Carry out the tests below. Write your observations and inferences in the spaces provided.

|  |  |
| --- | --- |
| a). | Place all of solid **L** in a dry test-tube and heat it until it just turns reddish-yellow at the bottom. Test the gas with a glowing wooden splint. Keep the residue for tests in (b)  Observations inferences    (2 marks) |
| b). i). | Allow the residue from (a) above to cool for about three minutes. Add 5-6 drops of concentrated nitric acid, then add distilled water until the test-tube is three quarters full. Filter the mixture into a boiling tube then add more distilled water to the filtrate until the boiling tube is half-full. Shake well. Use the solution obtained for the tests below  Observations  (1 mark) |
| ii). | To about 2cm3 portion of the solution in a test-tube, add 2M of sodium hydroxide dropwise until in excess  Observations inferences  (3 marks) |
| iii). | To another 2cm3 of the solution in a test-tube, add aqueous ammonia dropwise until in excess  Observations Inference    (2 marks) |
| iv). | To a third 2cm3 of the solution, add a few drops of 2M sulphuric acid  Observations Inferences  1mark 1 mark |

3. You are provided with an organic compound, solid **M**. Carry out the tests below. Write your observations and inferences in the spaces provided

Place all solid M in a boiling tube. Add distilled water until the boiling tube is half-full. Shake the mixture thoroughly until all the solid dissolves. Use the solution for the tests below.

|  |  |
| --- | --- |
| a). | To about 2cm3 portion of the solution in a test-tube, add 2-3 drops of acidified potassium permanganate then warm gently  Observations Inferences  (3 marks) |
| b). | To another 2cm3 portion of the solution, in a test-tube, add two drops of 1% bromine water and warm  Observations Inferences  (2 marks) |
| c). | To a third 2cm3 portion of the solution in a test-tube, add half-spatula end full of sodium carbonate  Observations Inferences  (2 marks) |

**OCTOBER /NOVEMBER 1998**

**1. *(20 marks)* You are provided with:**

* Solution M, hydrochloric acid
* Solution N, containing 8.8g per litre of sodium hydroxide
* 0.5g of an impure carbonate, solid P

**You are required to determine the:**

a). Concentration of solution M in moles per litre

b). Percentage purity of the carbonate, solid P.

**Procedure I.**

Fill the burette with sodium hydroxide, solution N. Pipette 25.0cm3 of hydrochloric acid, solution M into a conical flask. Add 2-3 drops of screened methyl orange indicator and titrate. (The colour of the indicator changes from pink to green) record your results in table I below. Repeat the titration two more times and complete the table.

|  |  |  |  |
| --- | --- | --- | --- |
| Table | 1 | 2 | 3 |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution N used (cm3) |  |  |  |

(4 marks)

What is the average volume of solution N used? (1 mark)

Determine;

a). The concentration of solution N in moles per litre. (Na=23.0, O=16.0, H=1.0)

(1 mark)

b). Concentration of solution M in moles per litre (1 mark)

**Procedure II**

Using a measuring cylinder, measure out 100cm3 of solution M into a 250cm3 beaker. Add all of solid P into the beaker containing solution M. Swirl the mixture and allow the reaction to proceed for about 4 minutes.

Label the solution with sodium hydroxide, solution N. Pipette 25.0cm3 of solution Q into a conical flask. Add 2-3 drops of screened methyl orange indicator and titrate. Record your results in table II below. Repeat the titration two more times and complete the table.

|  |  |  |  |
| --- | --- | --- | --- |
| Table II | 1 | 2 | 3 |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution N (cm3) |  |  |  |

(4 marks)

What is the average volume of solution N Used?

a). Calculate the:

i). Moles of hydrochloric acid in 25.0cm3 of solution Q (2 marks)

ii). Moles of hydrochloric acid in 100cm3 of solution Q (1 mark)

iii). Moles of hydrochloric acid in 100cm3 of the original hydrochloric acid solution M. (1mark)

iv). Moles of hydrochloric acid that were used up in the reaction with solid P. (1 mark)

v). Moles of the carbonate that reacted with hydrochloric acid

(1 mark)

b). Given that the relative formula mass of the carbonate is 72, calculate the;

i). Mass of the carbonate that reacted (1 mark)

ii). Percentage purity of the carbonate, solid P (1 mark)

**2. *(12 marks***)

You are provided with solid S. Carry out the tests below and record your observations and inferences in the spaces provided.

a). Place about one third of solid S in a dry test-tube. Heat the solid gently and then strongly. Test any gases produced with red and blue litmus papers.

Observations Inferences

(2 marks) (1 mark)

b). Dissolve the remaining portion of solid S in 8cm3 of distilled water. Divide the solution into four portions.

i). To the first portion, add aqueous sodium hydroxide dropwise until in excess

Observations Inferences

(1 mark) (2 marks)

ii). To the second portion, add aqueous ammonia dropwise until in excess

Observations Inferences

(1 mark) (1 mark)

iii). To the third portion, add 10cm3 of barium chloride solution.

Observations Inferences

(1 mark) (1 mark)

iv). To the fourth portion, add 1 cm3 of lead (II) nitrate solution.

Observations Inferences

1. mark) (1 mark)

**3. *(8 marks)***

You are provided with solid L. Carry out the tests below and record your observations and inferences in the spaces provided.

1. Place about half of solid L in a dry test-tube and heat it strongly. Test any gases produced with red and blue litmus papers and also with a burning splint.

Observations Inferences

(2 marks) (1 mark)

1. Place the rest of solid L in a boiling tube and add about 10cm3 of distilled water. Shake well to dissolve all the solid.

i). To about 1cm3 of the solution, add 3 drops of universal indicator solution and find its pH

Observations Inferences

(1 mark) (1 mark)

ii). To the rest of the solution, add about 5cm3 of 2M dilute hydrochloric acid dropwise. Filter the mixture and retain the residue for test(c) below.

Observations Inferences

(1 mark)

c). Transfer the residue from b (ii) above into a boiling tube. Add about 10cm3 of distilled water. Warm the mixture and add a little solid sodium carbonate

Observations Inferences

(1 mark) (1 mark)

**OCTOBER / NOVEMBER 1999**

**1. You are provided with:**

* + *Solution* ***E*** *0.099M hydrochloric acid*
  + *Solution* ***F*** *containing 15.3g per litre of a basic compound,*
  + *G2X10H2 O→14.3gNa2CO310H2O*

**You are required to determine the relative atomic mass of G.**

**Procedure:**

Place solution **E** in a burette.

Pipette 25cm3 of solution **F** into a 250cm3 conical flask. Add two drops of methyl orange indicator and titrate. Record your results in the table below. Repeat the procedure two more times and complete table I.

a). i).

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution E used (cm3) |  |  |  |

(3 marks)

**Table I**

ii). What is the average volume of solution **E**?

b). Given that one mole of **F** reacts with 2 moles of **E**. Calculate the:

i). Number of moles of the basic compound, G2X.10H2O in the volume of solution F used.

ii). Concentration of solution F in moles per litre.

iii). Relative formula mass of the basic compound, G2X10H2O.

iv). Relative atomic mass of G. (relative formula masses of X= 60 atomic

masses of H=10, O=16.0)

**2. You are provided with:**

* *Magnesium ribbon labeled solid* ***K***
* *2.0M hydrochloric acid labeled solution* ***L***
* *Stop clock /watch*

You are required to determine the rate of reaction between magnesium and hydrochloric acid at different concentrations

**Procedure.**

1. Place the five test tube on the test tube rack and label them 1,2,3,4,and 5. Using a 10cm3 measuring cylinder ,measure out the volumes of 2.0M hydrochloric acid shown, solution **L** as shown in table II and pour them into the corresponding test tube. Wash the measuring cylinder and use it to measure the volumes of water as indicated in the table and pour into the corresponding test tubes.
2. Cut out five pieces each of exactly 1cm length of magnesium ribbon.
3. Transfer all the solution in the test tube 1 into a clean 100cm3 beaker. Place one piece of magnesium into the beaker and start a stop clock/watch immediately. Swirl the beaker continuously ensuring that the magnesium is always inside the solution. Record in the table the time taken for the magnesium ribbon to disappear. Wash the beaker each time.

4. Repeat procedure III for each of the solutions in the test-tube 2, 3, 4 and 5 and complete the table.

a).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test-tube Number | 1 | 2 | 3 | 4 | 5 |
| Volume of solution L (cm3) | 10 | 9 | 8 | 7 | 6 |
| Volume of water (cm3) | 0 | 1 | 2 | 3 | 4 |
| Time taken (sec) |  |  |  |  |  |
| Rate of reaction =  1/time |  |  |  |  |  |

**Table II**

b). i). Plot a graph of rate of reaction 1/time (y-axis) against volume of

solution L (3 marks)

ii). Use the graph to determine the time that would be taken for a 1cm length of magnesium ribbon to disappear if the volume of the acid was 7.5cm3 (2 marks)

iii). In terms of rate of reaction, explain the shape of your graph.

(1 ½ marks)

3. You are provided with solid H. Carry out the tests below and write your observation an d inferences in the spaces provided.

|  |
| --- |
| a). Place about half of the solid H in a clean dry test tube. Heat the  solid gently and then strongly. Test for any gas produced using both  blue and red litmus papers  Observations Inferences  (4½ marks) |
| b). Dissolve the remaining portion of Solid H in about 8cm3 of distilled  water contained in a boiling tube. Divide the solution into three  portions.  i). To the first portion ,add aqueous sodium hydroxide drop wise  until in excess.  Observations Inferences  (2½ marks)  ii). To the second portion, add two drops of concentrated nitric acid  then add aqueous sodium hydroxide drop wise until in excess  Observations Inferences    (1½ marks)  iii). I. To the third portion, add 2-3 drops of barium chloride solution  Observations Inferences  (1½ marks)  II. To the mixture obtained in (iii) I above, add about 2cm3 of 2M  aqueous hydrochloric acid.  Observations Inferences  (2 marks) |

**OCTOBER / NOVEMBER 2000**

**1. You are provided with:**

* *Solution* **L** *containing 5.6g per litre of anhydrous sodium carbonate*
* *Solution* **M***: Hydrochloric acid*
* *Phenolphthalein indicator*
* *Methyl orange indicator*

You are required to standardize the hydrochloric acid, solution **M**.

**Procedure**

Fill the burette with solution **M**. Pipette 25cm3 of solution **L** into a conical flask. Add three drops of phenolphthalein indicator and titrate with solution M. Record the readings in **table I** below. Add 3 drops of methyl orange indicator to the contents of the conical flask and continue titrating with solution M. Record the readings in **table II** below. Repeat the procedure and complete **tables I** and **II**.

a). i). **Table I** (Using phenolphthalein indicator)

|  |  |  |
| --- | --- | --- |
|  | 1st | 2nd |
| Final burette reading |  |  |
| Initial burette reading |  |  |
| Titre (cm3) |  |  |

(3 marks)

Find average titre t1 (½ mark)

…………………………………………………………………..

**Table II** (Using methyl orange indicator)

|  |  |  |
| --- | --- | --- |
|  | 1st | 2nd |
| Final burette reading |  |  |
| Initial burette reading |  |  |
| Titre (cm3) |  |  |

(3 marks)

Find average titre t2 (½ mark)

……………………………………………………………………..

ii). Total volume of solution M used = t1 + t2 = ………………………….

(1 mark)

iii). Calculate the:

I Concentration of sodium carbonate in moles per litre (Relative formula mass of Na2CO3 = 106) (2marks)

II Moles of sodium carbonate in 25cm3 of solution (1 mark)

III Moles of hydrochloric acid in the total volume of solution M used. (1 mark)

IV Concentration of hydrochloric acid in moles per litre. (2 marks)

2. You are provided with 3.0g of Potassium nitrate labeled solid **G**. You are

required to determine the enthalpy of solution of solid **G**.

**Procedure**

Using a measuring cylinder, place 30cm3 of distilled water into a 100cm3 beaker. Stir the water gently with a thermometer and take its temperature after every half minute. Record the readings in table III below. At exactly two minutes, add all solid **G** to the water at once. Stir well and take the temperature of the mixture after every half minute up to the fourth minute

Record your results in **table III.**

**Table III**

a).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ½ | 4 |
| Temperature (0C) |  |  |  |  |  |  |  |  |  |

(3marks)  
b). On the grid provided, plot a graph of time against temperature

c). On the graph, show the change in temperature, ∆T (1 mark)

Calculate:

i). The number of moles of solid G used in the experiment.

(K=39.0, N=14.0, O=16.0) (1 mark)

ii). The enthalpy of solution, ∆Hsoln and show the sign of ∆Hsoln

(Assume density of solution = 1.0g/cm3

Specific heat capacity of solution = 4.2jg-1 k-1) (3 marks)

3. You are provided with 10 cm3 of solution **P** in a conical flask. Solution **P** contains two cations and one anion. Carry out the test below and record your observations and inferences in the spaces provided.

a). Add 20cm3 of 2M aqueous sodium hydroxide to all solution **P** provided.

Shake well. Filter the mixture into a conical flask. Retain both the filtrate and the residue.

Observations Inferences

(2 marks) (1 mark)

b).i). To about 2cm3 of the filtrate, add 2M nitric acid dropwise until in

excess (i.e. about 1cm3 of the acid). Retain the mixture.

Observations Inferences

(2 marks) (1 mark)

Divide the mixture in (b) (i) above into two portions

ii). To the first portion, add aqueous sodium hydroxide dropwise until

in excess

Observations Inferences

(2 marks) (2 marks)

iii). To the second portion, add aqueous ammonia dropwise until the

excess (i.e. about 1.5cm3 of aqueous ammonia)

Observations Inferences

(1 mark) (1 mark)

c).To 2cm3 of the filtrate, add 3 drops of 2M hydrochloric acid.

Observations Inferences

(1 mark) (1 mark)

d).To 2cm3 of the filtrate, add 3 drops of acidified chloride acid.

Observations Inferences

(1 mark) (1 mark)

e).To the residue, add about 5cm3 of dilute nitric acid and allow it to filter

into a test-tube. To 2cm3 of this filtrate, add aqueous ammonia dropwise until in the excess then filter into a clean test-tube.

Observations Inferences

(1 mark) (1 mark)

**OCTOBER / NOVEMBER 2001**

**1. You are provided with:**

* *Sodium hydroxide labeled solution* ***A***
* *0.128M hydrochloric acid labeled solution* ***B****.*
* *Carboxylic acid labeled solution* ***C****.*

Solution **D** prepared by diluting 25cm3 of solution A with distilled water to 150cm3 of solution. You are required to:

a). Standardise solution **D** with solution **B**

b). Determine the:

i). Reaction ratio between sodium hydroxide, solution A and the carboxylic acid solution **C**

ii). Concentration of solution **C** in moles per litre.

**Procedure I**

Fill a burette with solution B. Pipette 25cm3 of solution D into a 250cm3 conical flask. Add 2 drops of phenolphthalein indicator and titrate with solution **B**. Record your results in table 1. Repeat the titration two more times and complete the table.

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution B used (cm3) |  |  |  |

(4 marks)

a). Determine the average volume of the solution B used (1 mark)

b). Calculate the concentration in moles per litre of sodium hydroxide in:

i). solution **D** (2 marks)

ii). solution **A** (1 mark)

**Procedure II**

Using a clean burette, place 16cm3 of solution **C** into a boiling tube. Take the initial temperature of the solution in the boiling tube and record it in table II. Using a clean measuring cylinder, measure 4cm3 of solution A into 100cm3 beaker and add it to a solution **C** in the boiling tube. Stir the mixture immediately with a thermometer and record in table II the maximum (final) temperature reached. Repeat the experiment with the other sets of volumes of **C** and **A** in the table and complete it. (Rinse the thermometer and the boiling tube with distilled water after each experiment)

**Table II**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Volume of solution C(cm3) | 16 | 12 | 8 | 6 | 4 | 2 |
| Volume of solution A (cm3) | 4 | 8 | 12 | 14 | 16 | 18 |
| Final temperature (OC) |  |  |  |  |  |  |
| Initial temperature (0C) |  |  |  |  |  |  |
| Change in temperature , (∆T) |  |  |  |  |  |  |

(6 marks)

a). On the grid provided ,plot a graph of ∆T (vertical axis)against the volume of sodium hydroxide ,solution **A** (3 marks)

b). From the graph, determine the volume of sodium hydroxide solution a required to neutralize the carboxylic acid. (1 mark)

c). Calculate the volume of carboxylic acid, solution C used for neutralization. (1 mark)

d). Calculate the:

i). Ratio between the volumes of solutions **A** and **C.** (1 mark)

ii). Concentration in moles per litre of carboxylic acid, solution **C.** (assume that the volume ratio is the same as the mole ratio)

(2 marks)

2. You are provided with solid **E**. carry out the tests below and record your observation and inference in the spaces provided.

Divide solid E into two halves.

|  |
| --- |
| a). Place one half of solid E in a clean dry test-tube. Heat it gently then  strongly  Observations Inferences  (3 marks) |
| b). Place the other half of Solid **E** in a boiling tube, add 10cm3 of distilled  water and shake well until all the solid dissolves.  i). To about 1cm3 of the solution, add 2M sodium hydroxide  drop wise until in excess.  Observations Inferences  (2 marks)  ii). Place 1cm3 of the solution in a test-tube and add 2 to 3 drops of 2M  sulphuric acid  Observations Inferences  (2 marks)  iii). To about 1cm3 of the solution, add 4-5 drops of 2M lead (II)  nitrate solution and heat to boiling  Observations Inferences  (3 marks) |

3 You are provided with Solid **F**. carry out the tests below and record your

observation and inferences in the spaces provided. Place all the Solid **F**

into a boiling tube. Add 10cm3 of distilled water and shake well. Use 2cm3

portion of the mixture for the following reactions.

|  |
| --- |
| a). Test the first portion with both blue and red litmus papers  Observations Inferences  (2 marks) |
| b). To the second portion, add three drops of bromine water  Observations Inferences  (2 marks) |
| c). To the third portion, add 2 drops of acidified potassium  permanganate and shake well  Observations Inferences  (2 marks) |
| d). Warm the fourth portion slightly and add a little solid G, sodium  hydrogen carbonate  observations inferences  (2 marks) |

**OCTOBER / NOVEMBER 2002**

1. **You are provided with the following;**

* *Hydrogen peroxide labeled solution A*
* *Dilute sulphuric acid labeled solution B*
* *Sodium thiosulphate labeled solution C*
* *Potassium iodide labeled solution D*
* *Starch solution labeled solution E*
* *Distilled water in a wash bottle*

You are required to determine how the rate of reaction of hydrogen peroxide with potassium iodide varies with the concentration of hydrogen peroxide.

**Procedure**

**Experiment I.**

Label two 200ml or 250ml beakers as beaker 1 and beaker 2.

Using a burette, place 25.0cm3 of solution A into beaker 1. Into the same beaker, add 20cm3 of solution B using a 50ml or 100ml measuring cylinder. Shake the contents of beaker 1.

Using a 10ml measuring cylinder, place 5cm3 of solution C into beaker 2 followed by 5cm3 of solution D then 2cm3 of solution E. shake the contents of beaker 2. Pour the contents of beaker 2 into beaker 1 and start a stop clock/watch immediately. Swirl the mixture and let it stand. Note the time taken for the blue colour to appear. Record the time in the space provided for experiment 1 in the table below.

Clean beaker 1. Repeat the procedure with the volumes of water below. Clean beaker 1. Repeat the procedure with the volumes of water, solutions A, B, C, D and E as shown in the table for experiments 2 to 5.

Complete the table by computing 1 sec -1 7 ½ marks)

Time

a).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **BEAKER 1** | | | **BEAKER 2** | | |  |  |
| Experiment | Volume of water (cm3) | Volume of hydrogen peroxide, solution A (cm3) | Volume of dilute sulphuric acid, solution B (cm3) | Volume of sodium thiosulphate, solution C (cm3) | Volume of potassium iodide, solution D (cm3) | Volume of starch, solution E (cm3) | Time (sec) | 1  Time sec -1 |
| 1 | 0 | 25 | 20 | 5 | 5 | 2 |  |  |
| 2 | 5 | 20 | 20 | 5 | 5 | 2 |  |  |
| 3 | 10 | 15 | 20 | 5 | 5 | 2 |  |  |
| 4 | 15 | 10 | 20 | 5 | 5 | 2 |  |  |
| 5 | 20 | 5 | 20 | 5 | 5 | 2 |  |  |

b). Plot a graph of (1/time) sec -1 (y-axis) against volume of hydrogen peroxide used (solution A). (4 marks)

c). From your graph determine the time that would be taken if the contents of beaker 1 were 17.5cm3 water 7.5cm3 solution A and 20cm3 solution B.

(2 marks)

d). How does the rate of reaction of hydrogen peroxide with potassium iodide vary with the concentration of hydrogen peroxide (2 marks)

1. You are provided with solution F, solid G and sodium sulphate solution. Carry out the tests below. Write your observations and inferences in the spaces provided.

a). Place 10cm3 of solution F in a boiling tube. Add all of solid G to solution F at once. Warm the mixture for one minute then shake vigorously for about five minutes. Filter the mixture into a test-tube and use the filtrate for tests (b) to (e) below.

Observations Inferences

(1 mark) (1 mark)

b). To 2cm3 of the filtrate in a test-tube, add five drops of barium nitrate solution

Observations Inferences

(1 mark) (1 mark)

c). To 2cm3 of the filtrate in a test-tube, drop wise of aqueous sodium hydroxide dropwise until in excess solution

Observations Inferences

(1 mark) (1 mark)

d). To 2cm3 of the filtrate in a test-tube, add five drops of 2M hydrochloric acid and warm the mixture to boiling

Observations Inferences

(1 ½ marks) (1 mark)

e). To the remaining filtrate, add 5cm3 of the sodium sulphate solution provided then filter into a clean test-tube using a clean funnel. Retain the filtrate for test (f) below.

Observations Inferences

(1 mark) (1 mark)

f). To 2cm3 of the filtrate obtained in (e) above, add aqueous ammonia dropwise until in excess

Observations Inferences

(2 marks) (1 mark)

1. You are provided with solid H. Carry out the tests below. Write your observations and inferences in the spaces provided.

a). Using a clean metallic spatula, heat about one third of solid H in a Bunsen burner flame.

Observations Inferences

(2 marks) (1 mark)

b). Dissolve the remaining portion of solid H into about 10cm3 of distilled water and divide the solution into 3 portions.

i). To the first portion, add two drops of acidified potassium permanganate solution

Observations Inferences

(1 mark) (1 mark)

ii). To the second portion, add two drops of bromine water

Observations Inferences

(1 mark) (1 mark)

iii). Determine the pH of the third portion using universal indicator paper

Observations Inferences

(1 mark) (1 mark)

**OCTOBER / NOVEMBER 2003**

1. You are provided with solution **P** and **Q**.

* *Solution P is acidified potassium permanganate (the same solution will be used for question 3)*
* *Solution Q was prepared by dissolving 4.18g of solid Q in distilled water to make 250cm3 of solution.*

You are required to determine the number of moles of Q that react with one mole of potassium permanganate.

**Procedure**

Place the solution P in a burette. Pipette 25cm3 of solution Q into a 250cm3 conical flask. Titrate solution **Q** with solution P until a permanent pink colour just appears. Record your results in table I below. Repeat the above procedure two more times.

a). **Table I**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution P (cm3) |  |  |  |

(4 marks)

b). Calculate the average volume of solution **P** used. (1 mark)

c). Given that the concentration of solution **P** is 0.02M, calculate the number of

moles of potassium permanganate used. (2 marks)

d). Calculate the concentration of solution **Q** in moles per litre. (Relative formula

mass of ***Q*** is 278) (2 marks)

e). Calculate the number of moles of **Q**:

i) In 25.0cm3 of solution. (2 marks)

ii) Which react with one mole of potassium permanganate?

(1 mark)

2. **You are provided with:**

* + *1.9g of solid S. solid S is a dibasic acid, H2A*
  + *0.5M solution of the dibasic acid H2A solution T*
  + *Sodium hydroxide, solution R.*

You are required to determine:

1. i) The molar heat of solution of solid **S.**

ii) The heat of reaction of one mole of the dibasic acid with sodium hydroxide.

b) Calculate the heat of reaction of solid H2A with aqueous sodium hydroxide.

**Procedure 1**

Place 30cm3 of distilled water into a 100ml beaker. Measure the initial temperature of the water and record it in the table II below. Add the entire solid S at once. Stir the mixture carefully with the thermometer until all the solid dissolves. Measure the final temperature reached and record it in the table II.

**Table II**

a).

|  |  |
| --- | --- |
| Final temperature(0C) |  |
| Initial temperature(0C) |  |

(1½ marks)

b). Determine the change in temperature, ∆T1 (½ mark)

**Calculate the:**

c). i). Heat change when H2A dissolves in water .assume the heat capacity of the solution is 4.2jg-10c-1 and density is 1g/cm3 (2 marks)

ii). Number of moles of the acid that were used. (Relative formula mass of H2A is 126. (1 mark)

iii). Molar heat of solution H1 solution of the acid H2A. (1 mark)

**Procedure II**

Place 30cm3 of solution **T** into 100ml beaker. Measure the initial temperature and record

it in the Table III below. Measure 30cm3 of sodium hydroxide, solution **R**. Add al the

30cm3 of solution **R** at Once to the solution in the beaker.

Stir the mixture with the thermometer. Measure the final temperature and record it in

Table III.

**TABLE III**

a).

|  |  |
| --- | --- |
| Final temperature (OC) |  |
| Initial temperature (OC) |  |

b). Determine the change in temperature ∆T2

c). Determine the:

i) Heat change for the reaction (assume the heart capacity of the solution is 4.2jg-1 0C-1 and density is 1g/cm3) (2 marks)

ii). Number of moles of the acid H2A used. (1 mark)

iii). Heat of reaction H2 of one mole of the acid H2A with sodium hydroxide. (1 mark)

*Water*

d). Given that

∆H1 is the heat for the reaction H2A(s) 2H+(a(aq)+A2-(aq)

∆H2 is the heat for the reaction 2H+(aq) +2OH-(aq) 2H2O(l)

Calculate ∆H3 for the reaction H2A(s)+2OH-(aq) 2H2O(l)=A2-(aq)

3. You are provided with solid V. Carry out tests below. Write your observations and inference in the Spaces provided.

|  |
| --- |
| a). dissolve solid V in about 20cm3 of distilled water in boiling tube.  Into 5 separate test-tubes, put 2cm3 portions of the solutions and use  it for tests(b)to(f) below  Observations Inferences  ( 1 mark) |
| b). To the first portion, add 5 drops of 2M sodium hydroxide solution.  Observations Inferences  (3 marks)  c). To the second portion, add 2 or 3 drops of lead (II) nitrate solution.  Observations Inferences  (3 marks)  d). To the third portion, add all of the barium (II)chloride solution  provided followed by 2cm3 of 2M hydrochloric acid then shake the  mixture.  Observations Inferences  (3 marks)  e). To the fourth portion, add 3 drops of acidified potassium  permanganate, solution P  Observations Inferences  (2 marks)  f). to the fifth portion, add 5 drops of acidified potassium  dichromate, solution W  Observations Inferences  (2 marks) |

**OCTOBER / NOVEMBER 2004**

1. **You are provided with:**

* *Magnesium ribbon, solid A*
* *0.7M hydrochloric acid, solution B*
* *0.3M sodium hydroxide, solution C*
* *Distilled water.*

**You are required to determine the**:

i). Temperature change when magnesium reacts with excess hydrochloric acid.

ii). Number of moles of hydrochloric acid that remain unreacted

iii). Number of moles of magnesium that reacted

iv). Molar heat of reaction between magnesium and hydrochloric acid

**Procedure I**

Using a burette, measure 50cm3 of solution **B** and place it in a 100 ml beaker. Measure the temperature of solution **B** in the 100ml beaker and record the value in table 1. Put the magnesium ribbon in the 50cm3 of solution B in the 100ml beaker **immediately**, start a stop Clock or watch. Stir the mixture continuously with the thermometer making sure that the Magnesium ribbon remains inside the solution as it reacts. Measure the temperature after Every 30 seconds and record the values in table1. Continue stirring and measuring the temperature to complete table 1.

Keep the resulting solution for use in procedure 2

**Table 1**

(a)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (sec) | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 |
| Temperature (0C) |  |  |  |  |  |  |  |  |  |  |  |

(5 marks)

i). Plot a graph of temperature (y-axis) against time on the grid provided

(3 marks)

ii). On the graph, show the maximum change in temperature, ∆T, and determine its value. Value of ∆T (1 mark)

**Procedure 2**

Transfer all the solution obtained in 1 into a 250ml. conical flask. Clean the burette and use it to place 50cm3 of distilled water into the beaker used in procedure 1. Transfer al the 50cm3 of water into the 250ml conical flask containing the solution from procedure1. Label this as solution **D**. empty the burette and fill it with solution **C**. Pipette 25cm3 of solution **D** and place it into an empty 250ml conical flask. Add two drops of phenolphthalein indicator and titrate solution **C** against **D**. Record the results in table two. Repeat the titration of solution **C** against solution D and complete the table 2

**b). Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution C used (cm3) |  |  |  |

(4 marks)

i). Calculate the average volume of solution **C** used (1 mark)

ii). Calculate the number of moles of:

I 0.3M sodium hydroxide used (1 mark)

II Hydrochloric acid in 25cm3 of solution D (1 mark)

III Hydrochloric acid in 100cm3 of solution D (1 mark)

IV hydrochloric acid in 50cm3 of solution B (1 mark)

V hydrochloric acid that reacted with magnesium (1 mark)

VI magnesium that reacted (2 marks)

c). Using your answer in VI above, determine the molar heat of reaction between magnesium and hydrochloric acid (assume the heat capacity of the solution is 4.2 jg-1deg-1 and density is 1.0g/cm3

2 a). You are provided with solution H, carry out the tests below. Record

your observation and inferences in the spaces provided. Place 3cm3 of the solution H in the boiling tube. Add 12cm3 of distilled water and shake.

**Retain the remainder of solution H for use in 2(b).**

|  |
| --- |
| i). Use about 2cm3 portions of diluted solution H for tests I and II.  **I**. To the first portion ,add drop wise about 1cm3 of sodium hydroxide  Observations Inferences  ( 2 marks)  **II.** To the second portion, add 2 to 3 drops of barium chloride  Solution  Observations Inferences  (2 marks) |
| ii). To 3cm3 of the diluted solution **H**, add drop wise all the chlorine  water (source of chlorine) provided  Observations Inferences  (2 marks)  iii). To 2cm3 the diluted solution H, add all the bromine water (source of  bromine) provided.  Observations Inferences  ( 2 marks)  iv). To 2cm3 of the diluted solution H, add 2 or 3 drops of lead (II) nitrate  solution  Observations Inferences    (2 marks) |

b). **You are provided with;**

* + - *Solution* ***E*** *containing barium ions*
    - *Solution* ***F*** *containing potassium ions*
    - *Solution* ***G*** *containing sodium ions*

Carry out the tests on solutions **E**, **F, G** and **H** in order to identify the cation present in the solution **H.**

**Procedure**

Clean one end of glass rod thoroughly. Dip the clean end of the glass rod in solution **E**. Remove the end and heat it in the non-luminous part of the Bunsen burner flame. Note the colour of the flame and record it in table 3. Allow the glass rod to cool for about two minutes. Repeat the procedure with solutions **F**, **G** and **H** complete the table 3.

**Table 3**

i).

|  |  |
| --- | --- |
| Solution | Colour of the flame |
| **E** |  |
| **F** |  |
| **G** |  |
| **H** |  |

ii). Identify the cation present in solution H.

**OCTOBER / NOVEMBER 2005**

**1. You are provided with solid M in the test tube**

* *You are required to determine the freezing point of solid M.*

**Procedure**

Place 150cm3 of tap water in a 200ml or 250ml, beaker. Heat the water to near boiling. Using a test tube holder, immerse the test tube containing solid Minto hot water (ensure that half of the test tube is immersed in water) continue heating the water until the solid starts to melt. insert a thermometer into the liquid being formed in the test tube and note the temperature when **all** the solid has just melted. Record the temperatures in table 1. Remove the test tube from the water and **immediately** start the stopwatch clock /watch and record the temperature of the contents of the test tube after every half a minute and complete the table. Dip the thermometer into the hot bath to clean it then wipe it with tissue paper.

**Table 1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (Min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ½ |
| Temperature (0C) |  |  |  |  |  |  |  |  |

a). On the grid provided on page 3, plot a graph of time(Horizontal axis) against temperature.

b). From the graph determine the freezing point of solid M (1 mark)

2. You are provided with:

*-**Sodium hydroxide solution Labeled K*

*- Solution L, containing 60.0g of acid L per litre of solution*

You are required to determine the relative formula mass of acid L

**Procedure**

Using a burette, transfer 25.0cm3 of solution **K** into a 100ml beaker. Measure the temperature T1 of the solution **K** and record it in table 2. Pipette 25.0 cm3 of solution **L** into another 100ml beaker. Measure the temperature T2, of solution **L** and record it in table two add all the solution **K** at once to solution **L**. Stir carefully with the thermometer. Measure the highest temperature, T3 of the mixture and record it in table 2. Repeat the procedure and complete table 2.

**TABLE 2**

|  |  |  |
| --- | --- | --- |
|  | I | II |
| Initial temperature of solution K T1(0C) |  |  |
| Initial temperature of solution L t2(0C) |  |  |
| Highest temperature of mixture T3 (0C) |  |  |
| Average initial temperature (0C) |  |  |
| Change in temperature ∆T (0C) |  |  |

(5 marks)

**Calculate the**

a). Average T value. (1 mark)

b). Heat change for reaction

(Assume density of solution is 1g/cm3 and the specific heat capacity is 4.2jg-1K-1) (2 marks)

c). Number of moles of acid **L** used given that the heat change for the one mole of acid **L** reacting with sodium hydroxide solution is 134.4Kj.

(2 marks)

d). Concentration of acid **L** in moles per litre. (2 marks)

e). Relative formula mass of acid **L** (2 marks)

3. (a) You are provided with solid **N**. Carry out the tests below. Write your

observations and inferences in the spaces provided.

|  |
| --- |
| i). Heat about one third of solid **N** in a clean dry test-tube. Test the  gases produced with both blue and red litmus papers  Observations Inferences  ( 3 marks) |
| ii). Using a boiling tube, dissolve the rest of solid N in about 10cm3 of  distilled water and use the solution for the tests below.   1. To about 2cm3 of the solution, add aqueous ammonia   drop wise until in excess  Observations Inferences  (2 marks)  **II.** To 2cm3 of the solution, add about 5cm3 of solution  P(aqueous sodium chloride )  Observations Inferences  (2 marks)  **III.** To 2cm3 of the solution, add about 4cm3 of aqueous barium  nitrate  Observations Inferences    ( 1mark)  **IV).** To the mixture obtained in III above, add 2cm3 of dilute  hydrochloric acid.  Observations Inferences  (2 marks) |

b). You are provided with solid **Q**. Carry out the tests below. Write your observation and inferences in the spaces provided.

|  |
| --- |
| i). Place solid Q in a boiling tube. Add about 6cm3 of distilled water  and shake. Retain the solution for tests (ii) and (iii) below.  Observations Inferences  ( 2 marks) |
| ii). To about 2cm3 of the solution obtained in (b) (i) above, add a small  amount of solid sodium hydrogen carbonate.  Observations Inferences  (2 marks)  iii). To the remaining solution obtained in b(i) above, add 3cm3 of dilute  hydrochloric acid. Shake and filter the mixture. Wash the residue by  pouring 6 cm3 of distilled water to the residue while it is still on the  filter paper and dry the residue between filter papers. Using a  spatula, transfer the residue into a test-tube and add 5cm3 of distilled  water. Shake the mixture.    To about 3cm3 of the mixture, add a small amount of sodium  hydrogen carbonate  Observations Inferences    (2 marks) ( 2 marks) |

**OCTOBER / NOVEMBER 2006**

1. You are provided with:

* *4.5g of solid A in a boiling tube*
* *Solution B 0.06M acidified potassium manganate (VII)*

**You are required to determine:**

1. The solubility of solids A at different temperatures

2. The number of moles of water of crystallization in solid A

**Procedure**

a). Using a burette add 4cm3 of distilled water to solid **A** in the boiling tube . Heat the mixture while stirring with the thermometer to about 700c .When **all** the solid has dissolved allow the solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid A first appear. Record this temperature in table 1.

b). Using the burette, add 2cm3 of distilled water to the contents of the boiling tube warm the mixture while stirring with the thermometer until **all** the solid dissolves. Allow the mixture to cool while stirring. Note and record the temperature at which crystals of solid **A** first appear.

c). Repeat procedure (b) two more times and record the temperature in the table 1. **Retain the contents of the boiling tube** for use in the procedure (e).

d). i). Complete table 1 by calculating the solubility of solid **A** at the different temperature. The solubility of a substance is the mass of that substance that dissolves in 100cm3 (100g) of water at a particular temperature.

**Table 1**

|  |  |  |
| --- | --- | --- |
| Volume of water in the boiling tube (cm3) | Temperature at which crystals of solid A first appear (0C) | Solubility of solid A (g/100 g water) |
| 4 |  |  |
| 6 |  |  |
| 8 |  |  |
| 10 |  |  |

ii). On the grid provided, plot a graph of solubility of solid A (vertical axis) against temperature.

iii). Using your graph, determine the temperature at which 100g of solid **A** would dissolve in 100cm3 of water. (1 mark)

e) i). Transfer the contents of the boiling tube into a 250ml volumetric flask, rinse both the boiling tube and the thermometer with distilled water and add to the volumetric flask. Add more distilled water to make up to the mark. Label this solution **A**. fill a burette with solution **B**. Using the pipette and pipette filter, place 25.0cm3 of solution A into a conical flask. Warm the mixture to about 600C. Titrate the hot solution **A** with solution

B until a permanent pink colour persists. Record your readings in table 2. Repeat the titration two more times and complete the table2**.**

**(Retain the remaining solution B for use in question 3 (b) (i)**

**Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution B used (cm3) |  |  |  |

ii). Calculate the:

I. average volume of solution b used (1 mark)

II. Number of moles of potassium manganate (VII) used (1 mark)

III. Number of moles of A in 25cm3 of solution A given that 2 moles of potassium manganate (VII) react completely with 5 moles of A (1 mark)

IV. Relative formula mass of A, (1 mark)

iii). The formula of **A** has the form **D**.XH2O. Determine the value of x in the formula given that the relative mass of **D** is 90.0 and atomic masses of oxygen and hydrogen are 16.0 and 1.0 respectively. (2 marks)

1. You are provided with the solid **E**. carry out tests below. Write your observations

and inferences in the spaces provided.

|  |
| --- |
| a). Place about one third of solid E in a clean dry test-tube and heat it  strongly  Observations Inferences  (3 marks) |
| b). Place the remaining solid E in a boiling tube. Add about 10cm3 of  distilled water. Shake the mixture thoroughly for about one minute.  Filter and divide the filtrate into four portions  Observations Inferences  (2 marks)  i).To the first portion, add 2 drops of phenolphthalein indicator.  Observations Inferences  (2 marks)  ii).To the second portion, add 2cm3 of dilute hydrochloric acid  Observations Inferences  (2 marks)  iii). To the third portion, add 5cm3 of aqueous sodium sulphate  Observations Inferences  (3 marks) |
| iv). To the fourth portion, add dilute sodium hydroxide dropwise  until in excess  Observations Inferences  (2 marks) |

3. You are provided with solid **F.**

Carry out the following tests and record your observation and inferences in the spaces provided.

|  |
| --- |
| a). Using a metallic spatula, take one-third of solid F and ignite it  using a Bunsen burner flame  Observations Inferences  ( 2 marks) |
| b). Place the remaining solid F in a boiling tube ,add about 10cm3 of  distilled water, shake the mixture until all the solid dissolves.  i). To the first 4cm3 solutions, add two to three drops of acidified  potassium manganate (VII), solution B.  Observations Inferences  (2 marks)  ii).To about 4cm3 of the solution add 2 to 3 drops of bromine  Water. Warm the mixture.  Observations Inferences  (2 marks) |

**OCTOBER / NOVEMBER 2007**

1. **You are provided with;**

* + *Aqueous sulphuric acid labeled solution A*
  + *Solution B containing 8.0 g per litre of sodium carbonate*
  + *An aqueous solution of substance C labeled solution C.*

**You are required to determine the;**

Concentration of solution **A**

Enthalpy of reaction between sulphuric acid and substance **C**

**A. Procedure**

Using a pipette and a pipette filler, place 25.0cm3 of solution **A** into a 250ml. volumetric flask. Add distilled water to make 250cm3 of solution. Label this solution **D**.

Place solution **D** in a burette. Clean the pipette and use it to place 25.0cm3 of solution **B** into a conical flask. Add 2 drops of methyl orange indicator provided and titrate with solution **D.** record your results in table 1. Repeat the titration two more times and complete the table.

Table 1

|  |  |  |  |
| --- | --- | --- | --- |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution D used (cm3) |  |  |  |

(3 marks)

Calculate;

i). Average volume of solution **D** used (1 mark)

ii). Concentration of sodium carbonate in solution **B**

(Na=23; 0; O=16; 0, C= 12.0) (1 mark)

iii). Concentration of sulphuric acid in solution **D**  (2 marks)

iv). Concentration of sulphuric acid in solution **A** (1 mark)

**B. Procedure**

Label six test-tubes as 1, 2,3,4,5 and 6. Empty the burette and fill it with solution **A.** From the burette, place 2cm3 of solution A into test-tube number 1. From the same burette, place 4 cm3 of solution A in test-tube number 2. Repeat the process for test-tube numbers 3, 4, 5 and 6 as shown in table 2.

Clean the burette and fill it with solution **C**. From the burette, place 14cm3 of solution **C** into a boiling tube. Measure the initial temperature of solution **C** to the nearest 0.50C and record it table 2. Add the contest of test-tube number **1** to the boiling tube containing solution **C**. stirs the mixture with the thermometer. Note and record the highest temperature reached in **table 2**. Repeat the process with the other volumes of solution C given in **table 2** and complete the table.

**Table 2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test-tube number | 1 | 2 | 3 | 4 | 5 | 6 |
| Volume of solution A(cm3) | 2 | 4 | 6 | 8 | 10 | 12 |
| Volume of solution C(cm3) | 14 | 12 | 10 | 8 | 6 | 4 |
| Initial temperature of solution C(0C) |  |  |  |  |  |  |
| Highest temperature of solution C(0C) |  |  |  |  |  |  |
| Change in temperature ∆T(0C) |  |  |  |  |  |  |

(6 marks)

i). On the grid provided, draw a graph of ∆T (vertical axis) against volume of solution A used (3 marks)

ii). From the graph, determine;

I. The maximum change in temperature (1 mark)

1. The volume of solution A required to give the maximum change in temperature (1 mark)

iii). Calculate the;

I. Number of moles of sulphuric acid required to give the maximum change in temperature (1 mark)

II. Molar enthalpy of reaction between sulphuric acid and substance C (in kilojoules per mole of sulphuric acid).

Assume the specific heat capacity of the solution is 4.2jg-1 K-1 and density of solution is 1.0 gcm-3. (2 marks)

2. You are provided with solid E. Carry out the tests below. Write your observations and inferences in the spaces provided.

|  |  |
| --- | --- |
| a). | Place one half of solid E in a clean dry test-tube and heat it strongly. Test any gases produced with blue and red litmus papers.  Observations inferences  (2 marks) (1 mark) |
| b).  i). | Place the other half of solid E in a boiling tube. Add about 10cm3 of distilled water and shake until all the solid dissolves. (Use the solution for tests (i), (ii), (iii) and (iv).  Place two or three drops of the solution in a test-tube. Add 3cm3 of distilled water. Add two drops of universal indicator to the mixture obtained and then determine the pH of the mixture  Observations inferences  (1 mark) (1 mark) |
| ii). | To about 1cm3 of the solution a test-tube, add aqueous ammonia drop-wise until in excess  Observations inferences  (1 mark) (1 mark) |
| iii). | To 2cm3 of the solution in a test-tube, add three or four drops of solution G (aqueous potassium iodide)  Observations inferences  (1 mark) (1 mark) |
| iv). | To about 1cm3 of the solution a test-tube, add four or five drops of barium nitrate solution. Shake the mixture then add about 1cm3 of dilute nitric acid and allow the mixture to stand for about 2 minutes.  Observations inferences  (1 mark) (1 mark) |

3. You are provided with liquid F. carry out the tests below. Record your observations and inferences in the spaces provided.

|  |  |
| --- | --- |
| a). | Place three or four drops of liquid F on watch glass. Ignite the liquid using a Bunsen burner  Observations inferences  (1 mark) (1 mark) |
| b). | To 1cm3 of liquid F in a test-tube, add about 1cm3 of distilled water and shake thoroughly.  Observations inferences  (1 mark) (1 mark) |
| c). | To 1cm3 of liquid F in a test-tube, add a small amount of solid sodium carbonate  Observations inferences  (1 mark) (1 mark) |
| d). | To 2cm3 of liquid F in a test-tube, add about 1cm3 of solution H (acidified potassium dichromate (VI). Warm the mixture gently and allow it to stand for about one minute of distilled water and shake thoroughly.  Observations inferences  (1 mark) (1 mark) |

**OCTOBER / NOVEMBER 2008**

1. You are provided with:

* + *Solid A*
  + *M hydrochloric acid, solution B*
  + *0.1M sodium hydroxide*

You are required to determine the enthalpy change ∆H, for the reaction between solid A and one mole of hydrochloric acid.

**Procedure A**

Using a burette, place 20.0cm3 of 2.0M hydrochloric acid, solution **B** in a 100ml. Beaker. Measure the temperature of the solution after every half-minute and record the values in table 1. At exactly 2 ½ minutes, add **all** of solid **A** to the acid. Stir the mixture gently with the thermometer. Measure the temperature of the mixture after every half-minute and record the values in table 1. **(Retain the mixture for use in procedure B)**.

**Table 1.**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ½ | 4 | 4 ½ | 5 |
| Tem (0C) |  |  |  |  |  |  |  |  |  |  |  |

(4 marks)

i). Plot a graph of temperature (Y= axis) against time (3 marks)

ii). Using the graph, determine the change in temperature ∆T (1 mark)

iii). Calculate the heat change for the reaction (assume that the specific heat capacity of the mixture is 4.2jg-1K-1 and the density of the mixture is 1g/cm3 (2marks)

**Procedure B**

Rinse the burette thoroughly and fill it with sodium hydroxide. Transfer **all** the contents of the 100ml. beaker used in procedure **A** into a 250ml. volumetric flask. Add distilled water to make up to the mark. Label this solution **C**. Using a pipette and a **pipette filler**, place indicator and titrate against sodium hydroxide. Record your results in table 2. Repeat titration two more times and complete table 2.

**Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Titre (cm3) |  |  |  |

Calculate the:

i). Average volume of sodium hydroxide used (1 mark)

ii). The number of moles of

I. Sodium hydroxide used (1 mark)

II. Hydroxide acid in 25cm3 of solution **C** (1 mark)

III. Hydrochloric acid in 250cm3 of solution **C** (1 mark)

IV. Hydrochloric acid in 20.0cm3 of solution **B** (1 mark)

V. Hydrochloric acid that reacted with solid **A**  (1 mark)

iii). Calculate the enthalpy of reaction between solid A and one mole of

hydrochloric acid (show the sign ∆H) (2 marks)

2. You are provided with solid **D**. Carry out the tests below. Write your observations and inferences in the spaces provided.

|  |  |
| --- | --- |
| a). | Place all of solid **D** in a clean dry-test-tube and heat it strongly until no further change occurs. Test any gases produced with both blue and red litmus papers. Allow the residue to cool and use it for test (b).  Observations inferences  (2 marks) (1 mark) |
| b). | Add about 10cm3 of 2M hydrochloric acid to the residue and shake for about three minutes. **Keep the mixture for test (c)**  Observations inferences  (1 mark) (1 mark) |
| c). i). | Place about 1cm3 of the mixture in a test-tube and add aqueous ammonia dropwise until in excess  Observations inferences    (1 mark) (1 mark) |
| ii). | To the rest of the mixture, add all of solid E provided and shake the mixture well.  Observations inferences  (1 mark) (1 mark) |

3. You are provided with solid F. Carry out the tests below. Write your observations and inferences in the spaces provided

|  |  |
| --- | --- |
| a). | Place about one third of solid F on a metallic spatula and burn it using a Bunsen burner  Observations inferences  ( ½ mark) ( ½ mark) |
| b). | Place the remaining of solid F in a test-tube. Add about 6cm3 of distilled water and shake the mixture well. (Retain the mixture for use in test (c)  Observations inferences  (1 mark) (1 mark) |
| c). i). | To about 2cm3 of the mixture, add a small amount of solid sodium hydrogen carbonate  Observations inferences  (1 mark) (1 mark) |
| ii). | To about 1cm3 of the mixture, add 1cm3 of acidified potassium dichromate (VI) and warm  Observations inferences  (1 mark) (1 mark) |
| iii). | To about 2cm3 of the mixture, add two drops of acidifies potassium manganate (VII)  Observations inferences  (1 mark) (1 mark) |

**OCTOBER / NOVEMBER 2009**

**1. You are provided with;**

* + *Solid A, a metal carbonate M2CO3*
  + *Solution B, hydrochloric acid for use in question 1 and 2*
  + *Solution, C 0.3M sodium hydroxide*
  + *Methyl orange indicator*

**You are required to:**

Prepare a dilute solution of hydrochloric acid and determine its concentration

Determine the solubility of solid A in water

**Procedure I**

***Dry conical flask for use in step 4)***

**Step 1** Place all of solid A in a 250ml dry beaker. Add 100cm3of distilled water to solid A in the beaker. Using a glass rod, stir the mixture thoroughly for about two minutes. Leave the mixture to stand and proceed with steps 2 and 3.

**Step 2** Using a pipette filler, place 25.0cm3 of solution B in a 250ml volumetric flask. Add about 200cm3 of distilled water. Shake the mixture well and add distilled water to make up to the mark. Label this as solution D.

**Step 3** Fill a burette with solution C. Using a pipette and pipette filler, place 25.0cm3 of solution D into a 250ml conical flask. Add two drops of the indicator provided and titrate solution D with solution C. Record your results in table 1. Repeat the titration two more times and complete the table 1. Retain the remaining solution D for use in step 5.

**Step 4** Filter the mixture obtained in step 1 using filter funnel into a dry conical flask. Lable the filtrate as solution

**Step 5** Clean the burette and fill it with solution D. using a pipette and a pipette filler, place 25.0cm3 of solution A into a 250ml conical flask. Add two drops of the indicator provided and titrate solution with solution D. record your results in table 2. Repeat the titration two more times and complete table 2.

**Table 1**

|  |  |  |
| --- | --- | --- |
| I | II | III |
| Final burette reading |  |  |  | |
| Initial burette reading |  |  |  | |
| Volume of solution C used (cm3) |  |  |  | |

a). Calculate;

i). The average volume of solution C

ii). Moles of sodium hydroxide in the average volume of solution C used

iii). Moles of hydrochloric acid in 25.0cm3 of solution D

iv). The morality of hydrochloric acid, solution D

**Table 2**

|  |  |  |
| --- | --- | --- |
| I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution D used (cm3) |  |  |  |

b). Calculate;

i). The average volume of solution D used

ii). Moles of hydrochloric acid in the average volume of solution D used

iii). Moles of the metal carbonate, solid A in 25.0cm3 of solution A

iv). The solubility of the metal carbonate, solid A in water

(Relative formula mass of metal carbonate = 74, assume density of solution =1g/cm3)

2. You are provided with solid E. Carry out the following tests and write your observations and inferences in the spaces provided.

a). Place about one-half of solid E in a dry test-tube. Heat it strongly and test any gas produced using hydrochloric acid, solution B on a glass rod.

Observations Inferences

(2 marks) (1 mark)

b). Place the rest of solid E in a boiling tube. Add about 10cm3 if distilled water. Shake well and use 2cm3 portions for each of the tests below.

i). To one portion, add aqueous ammonia dropwise until in excess

Observations Inferences

(1 mark) (1 mark)

ii­). To a second portion, add about 1cm3 of hydrochloric acid solution B.

Observations Inferences

(1 mark) (1 mark)

iii). To a third portion, add two drops of aqueous lead (II) nitrate and heat the mixture to boiling;

Observations Inferences

(1 mark) (1 mark)

3. You are provide with solid F. Carry out the following tests and record your observations and inferences in the spaces provided.

a). Place about one half of solid F in a dry test-tube. Retain the other half of solid F for use in (b). Add all of the absolute ethanol provided to solid F in the test-tube. Shake the mixture.

Observations Inferences

(1 mark) (1 mark)

Divide the mixture into two portions

i). Determine the PH of the first portion using universal indicator solution and PH chart.

Observations Inferences

(1 mark) (1 mark)

ii). To the second portion, add one half of the solid sodium hydrogen carbonate provided.

Observations Inferences

(1 mark) (1 mark)

b). Place the remaining amount of solid F in a boiling tube. Add 10cm3 of distilled water and shake. Boil the mixture and divide it into three portions while still warm.

i). To the first portion, add the remaining amount of solid sodium hydrogen

Observations Inferences

(1 mark) (1 mark)

ii). To the second portion, add three drops of acidified potassium dichromate (VI) solution and warm

Observations Inferences

(1 mark) (1 mark)

iii). To the third portion, add five drops of bromine water

Observations Inferences

(1 mark) (1 mark)

**OCTOBER /NOVEMBER 2010**

**1.** **You are provided with;**

* + *Acid A labeled solution A*
  + *M sodium hydroxide solution labeled solution B*
  + *Solutions C containing 25.0 g per litre of an alkanoic acid*

You are required to:

a). Prepare a dilute solution of solution hydroxide, solution B

b). Determine the:

i). Molar mass of the alkanoic acid

ii). Reaction ratio between sodium hydroxide and acid A

**Procedure I**

Using a pipette and a pipette filler, place 25.0cm3 of solution B into a 250.0ml volumetric flask. Add about 200cm3 of distilled water. Shake well. Add more distilled water to make upto the mark. Label this solution D. Retain the remaining solution B for use in procedure II.

Fill a burette with solution C. using a clean pipette and a pipette filler, place 25.0cm3 of solution D into a 250ml conical flask. Add two drops of phenolphthalein indicator and titrate with solution C. record your results in table

**I.** Repeat the titration two more times and complete the table.

|  |  |  |  |
| --- | --- | --- | --- |
| Table | 1st | 2nd | 3rd |
| Final burette reading |  |  |  |
| Final burette reading |  |  |  |
| Volume of solution C used (cm3) added |  |  |  |

(4 marks)

**Determine the:**

i). Average volume of solution C used (1 mark)

ii). Concentration of solution D in moles per litre (1 mark)

iii). Concentration of the alkanoic acid in solution C in moles per litre (1 mole of the acid reacts with 3 moles of the base) (1 mark)

iv). Molar mass of the alkanoic acid (1 mark)

**Procedure II**

Fill a clean burette with solution A. place 5cm3 of solution A into a 100ml beaker.

Measure the initial temperature of solution A in the beaker record it in table II.

Using a 10ml or a 100ml measuring cylinder, measures 25cm3 of solution B. add

it to solution A in the beaker and immediately stir the mixture with the

thermometer. Record the maximum temperature reached in table II. Repeat the

experiment with other sets of volumes of solutions A and B complete the table.

**Table II**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Volume of solution A (cm3) | 5 | 9 | 13 | 17 | 21 | 25 |
| Volume of solution B (cm3) | 25 | 21 | 17 | 13 | 9 | 5 |
| Maximum temperature (0C) |  |  |  |  |  |  |
| Initial temperature (0C) |  |  |  |  |  |  |
| Change in temperature, ∆T |  |  |  |  |  |  |

(6 marks)

1. On the grid provided, plot a graph of ∆T (Vertical axis) against the volume

of solution A (3 marks)

1. From the graph, determine the volume of solution A which gave the

maximum change in temperature (1 mark)

1. Determine the volume of solution B that reacted with the volume of

solution A in (b) above (1 mark)

1. Calculate the:

i). Ratio between the volumes of solutions A and B that neutralized

one another. (1 mark)

ii). Concentration in moles per litre of the acid in solution A. (assume

that the volume ratio is the same as the mole ratio). (1 mark)

**2. You are provide with solids E, F and G.**

Cary out the tests below and write your observations and inferences in the spaces provided

a). Place all of solid E in a boiling tube. Add 20cm3 of distilled water and shake until all the solid dissolves. Label this as solution E.

i). To about 2cm3 of solution E in a test-tube, add 4 drops of 2M sulphuric (VI) acid.

Observations Inferences

(1 mark) (2 marks)

ii). To about 2cm3 of solution E in a test-tube, add 2M sodium hydroxide dropwise until in excess.

Observations Inferences

(1 mark) (1 mark)

iii). Place one half of solid F in a test-tube. Add 2cm3 of distilled water and shake well. Add 4 drops of this solution to about 2cm3 of solution E in a test-tube.

Observations Inferences

(1 mark) (1 mark)

iv). To about 2cm3 of solution E in a test tube, add 2 drops of aqueous potassium iodide.

Observations Inferences

(1mark) (1 mark)

1. To about 2cm3 of the solution obtained in (ii) above, add 3 drops acidified potassium manganate (VII).

Observations Inferences

(1 mark) (1 mark)

1. To about 2cm3 of the solution obtained in (ii) above, add 2 drops of bromine water.

Observations Inferences

(1 mark) (1 mark)

1. To the remaining solution G in the boiling tube, add the other half of solid F.

Observations Inferences

(1 mark) (1 mark)

**OCTOBER /NOVEMBER 2011**

**1.** You are provided with:

* *1.60g of solid* ***A*** *, dibasic acid*
* *Solution* ***B*** *containing 4.75g per litre of salt* ***B****.*
* *Aqueous sodium hydroxide, solution* ***C.***
* *Phenolphthalein indicator.*

**You are required to prepare a solution of solid A and use it to determine the:-**

* Concentration of sodium hydroxide, solution **C**
* React salt **B** with excess sodium hydroxide and then determine the relative molecular mass of salt **B**.

**Procedure I**

(a)Using a burette, place 25.0cm3 of solution B in each of two 250ml conical flasks. Using a pipette and a pipette filler, add 25.0cm3 of solution **C** to eachof the twoconicalflasks. The sodium hydroxide added is in excess). Label the conical flasks 1 and 2.

(b)Heat the contents of first of the first conical flask to boiling and then let the mixture boil for five minutes. Allow the mixture to cool.

(c) Repeat procedure (b) with second conical flask. While the mixtures are cooling, proceed with procedure II.

**Procedure II**

1. Place **all** solid **A in** a 250ml volumetric flask. Add about 150cm3 of distilled water, shake well dissolve the solid and then add water to make up to the mark. Label this as solution A.
2. Place solution A in a clean burette. Using a pipette and a pipette filler, place 25.0cm3 of solution C in a 250ml conical flask. Add 2 drops of phenolphathein indicator and titrate with solution A. Record your results in Table 1. Repeat the titration two more times and complete the table.

**Table 1**

|  |  |  |
| --- | --- | --- |
| I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution **A** used (cm3) |  |  |  |

(4 marks)

**Calculate the:**

1. Average volume of solution A used: ( ½ mark)
2. Concentration in moles per litre of the dibasic acid in solution A;

(Relative molecular mass of A is 126) (2 marks)

1. Moles of the dibasic acid used; (1 mark)
2. Moles of sodium hydroxide in 25.0cm3 of solution **C**. (1 mark)
3. Concentration of sodium hydroxide in moles per litre (2 marks)

**Procedure III**

Add 2 drops of phenolphthalein indicator to the contents of the first conical flask prepared in procedure I and titrate with solution A. Record your results in Table 2. Repeat the procedure with the contents of the second conical flask and complete the table.

**Table 2**

|  |  |
| --- | --- |
| 1st Conical flask | 2nd Conical Flask |
| Final burette reading |  |  |
| Initial burette reading |  |  |
| Volume of solution A used (cm3) |  |  |

(3 marks)

Calculate the: -

(i) average volume of solution A used; ( ½mark)

(ii) Moles of the dibasic acid used; (1 mark)

(iii) Moles of sodium hydroxide that reacted with the basic acid. (1 mark)

(iv) Moles of sodium hydroxide that reacted with 25.0cm3 of salt **B i**n solution **B;**

(2 marks)

(v) Given that 1 mole of salt B reacts with 2 moles of sodium hydroxide . Calculate

the : -

1. Number of moles of salt **B** in 25.0cm3 of solution **B;** ( 1 mark)
2. Concentration in moles per litre of salt **B** in solution **B** ; ( 1 mark)
3. Relative molecular mass of salt **B**; ( 2 marks)

2. (a) (i) You are provided with solid **D.** Carry out the followingtests and

write **your** observations and inferences in the spaces provided

Observations Inferences

(2 marks) (1 mark)

(ii) Place the rest of solid D in a boiling tube. Add about 10cm3 of

distilled water. Shake well.

To a 2cm3 portion of the solution, add about 1cm3 of hydrogen peroxide and shake well. To the resulting mixture, add aqueous sodium hydroxide drop wise until in excess.

**Observations Inferences**

(1 mark) (1 mark)

(b) You are provided with solution E. Carry out the following tests and write your observations and inferences in the spaces provided.

Divide solution **E** into **two** observations.

1. To one portion of solution E in a test tube, add 3 drops of barium nitrate. **Retain the mixture for use in test (ii) below.**

**Observations Inferences**

(1 mark) (2 marks)

1. To mixture obtained in (i) above, add about 5cm3 of 2M nitric (V) acid

**Observations Inferences**

(1 mark) (1 mark)

**OCTOBER /NOVEMBER 2012**

**1. You are provided with:**

* *Solution* ***A*** *containing an oxidising agent* ***A****;*
* *Solution* ***B****, 0.05M aqueous sodium thiosulphate;*
* *Solution* ***C*** *, containing a reducing agent* ***C****;*
* *Aqueous potassium iodide;*
* *Solution* ***D****, starch solution.*

**You are required to determine the:**

* Concentration of solution A
* Rate of reaction between the oxidising agent A and the reducing agent **C**.

**Procedure 1**

1. Using a pipette and a pipette filler, place 25.0cm3 of solution **A** into a 250ml conical flask.

2. Measure 10cm3 of aqueous potassium iodide and add it to solution **A in** the conical flask. Shake the mixture. Add 10cm3 of 2M sulphuric (VI) acid to the mixture and shake.

3. Fill a burette with solution **B** and useitto titratethe mixture **in the conical flask until** it just turns orange – yellow. Add 2cm3 of solution **D** to the mixture in a conical flask. Shake thoroughly. Continue titrating until the mixture just turns colourless. Record your results in **table 1** below.

4. Repeat the procedure and complete table 1. **Retain the remainder** of solution A and solution **D** for use in procedure II.

**Table 1**

|  |  |  |
| --- | --- | --- |
| I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution **B** used (cm3) |  |  |  |

(4 marks)

1. Calculate the:
2. Average volume of solution B used; ( 1mark)
3. Number of moles of sodium thiosulphate . ( 1mark)
4. Given that one mole of A reacts with six moles of sodium thiosulphate,

calculate the;

1. Number of moles of A that were used; ( 1mark)
2. Concentration of solution A in moles per litre. ( 2marks)

**Procedure II**

1. Label six test tubes as 1, 2, 3, 4, 5 and 6 and a place them in test- tube rack.

2. using a clean burette, measure the volumes of distilled water shown n table 2 into the labelled test tubes

3. Using a burette, measure the volumes of solution A shown in table 2 into each of the test tubes

4. Clean the burette and rinse it with about 5cm3 of solution C.

5. Using the burette, measure 5cm3 of solution C and place it into a 100ml beaker.

6. Using a 10ml measuring cylinder, measure 5 cm3 of solution D and add it to the beaker containing solution C. Shake the mixture

7. Pour the contents of test – tube number 1 to the mixture in the beaker and immediately start a stop watch. Swirl the contents of the beaker. Record the time taken for a blue colour to appear in table 2.

8. Repeat steps 5 to 7 using the contents of test- tube numbers 2,3,4,5 and 6.

9. Complete table 2 by computing Rate = 1/Time (S-1)

**Table 2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test-tube number | 1 | 2 | 3 | 4 | 5 | 6 |
| Volume of distilled water (cm3) | 0 | 2 | 3 | 5 | 6 | 7 |
| Volume of solution A (cm3) | 10 | 8 | 7 | 5 | 4 | 3 |
| Time (seconds) |  |  |  |  |  |  |
| Rate = 1/Time (S-1) |  |  |  |  |  |  |

a). Plot a graph of rate (y-axis) against volume of solution A. (3 marks)

b). What time would be taken for the blue colour to appear if the experiment was repeated using 4 cm3 of distilled water and 6 cm3 of solution A? (2 marks)

2. You are provided with solid E. carry out the experiments below. Write your observations and inferences in the spaces provided.

Place all of solid E in a boiling tube. Add 20 cm3 of distilled water and shake

until all the solid dissolves, label the solution as solution E. Use solution E for

experiments (i) and (ii).

i). To 2cm3 of solution E, in a test-tube in each of experiments I, II, III and IV, add;

I. Two drops of aqueous sodium sulphate;

**Observations Inferences**

(1 mark) (1 mark)

II. Five drops of aqueous sodium chloride; **Observations Inferences**

(1 mark) (1 mark)

III. Two drops of barium nitrate;  **Observations Inferences**

(1 mark) (1 mark)

IV. Two drops of lead (II) nitrate; **Observations**   **Inferences**

(1 mark) (1 mark)

ii). To 2cm3 of solution E, in a test-tube, add 5 drops of aqueous sodium hydroxide. Add the piece of aluminium foil provided to the mixture and shake. Warm the mixture and test any gas produced with both blue and red litmus papers. (1 mark)

**Observations Inferences**

(2 marks) (1 mark)

3. You are provided with solid F. Carry out the following tests. Write your observations and inferences in the spaces provided.

a). Place all of solid F in a boiling tube. Add about 20 cm3 of distilled water and shake until all the solid dissolves. Label the solution as solution F.

Add about half of the solid sodium hydrogen carbonate provided to 2cm3 of solution F.

**Observations** **Inferences**

(1 mark) (1 mark)

b). i). Add about 10cm3 of dilute hydrochloric acid to the rest of solution

F in the boiling tube. Filter the mixture. Wash the residue with about 2cm3 of distilled water. Dry the residue between filter papers. Place about one third of the dry residue on a metallic spatula and burn it in a Bunsen burner flame

**Observations**  **Inferences**

(1 mark) (1 mark)

ii). Place all the remaining residue into a boiling tube. Add about 10cm3 of distilled water and shake thoroughly. Retain the mixture for the tests in (C).

**Observations**  **Inferences**

(½ mark) (½ mark)

c). Divide the mixture into two portions:

i). To the first portion, add the rest of the solid sodium, hydrogen carbonate

**Observations**  **Inferences**

(1 mark) (1 mark)

ii). To the second portion, add two drops of bromine water

**Observations** **Inferences**

(1 mark) (1 mark)

**OCTOBER / NOVEMBER 2013**

**You are provided with:**

* *Solution A, aqueous copper (II) sulphate:*
* *Solid B, iron powder:*
* *0.02 m acidified potassium manganate (VII), solution C.*
* *You are required to determine the molar heat of displacement of copper by iron.*

**Procedure I.**

Using a burette, place 50.0cm3 of solution A in a 100ml beaker. Measure

**PROCEDURE I.**

Using a burette, place 50.0cm3 of solution A in a 100 ml beaker. Measure the temperature of the solution and record it in table I below. Add all of solid B provided at once and start a stop watch. Stir the mixture thoroughly with the thermometer and record the temperature of the mixture after every one minute in the table. Retain the mixture for use in procedure II below.

**Table I.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (Min.) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Temperature (0C) |  |  |  |  |  |  |  |  |

1. i). Plot a graph of temperature (vertical axis) against time in the grid provided.

ii). From the graph, determine the:

1. Highest change in temperature, △T: (1 mark)
2. Time taken for reaction to be completed ( ½ mark)
3. Calculate the heat change for the reaction. (Specific heat capacity of

solution is 4.2Jg-1 K-1; Density of the solution is 1 gcm3). (2 marks)

**PROCEDURE II**

Carefully decant the mixture obtained in procedure I into a 250ml volumetric flask. Add about 10cm3 of distilled water to the residue in the 100 ml beaker. Shake well, allow the mixture to settle and carefully decant into the volumetric flask. Immediately, add about 50cm3 of 2M sulphuric (VI) acid to the mixture in the volumetric flask. Add more distilled water to make 250.0 cm3 of solution. Label this as solution D.

Fill a burette with solution C. Using a pipette and pipette filler, place 25.0cm3 of solution D into a 250 ml conical flask. Titrate solution D against solution C until the first permanent pink colour is obtained. Record your results in table 2 below. Repeat the titration two more times and complete the table. Retain the remaining solution C for use in question 3.

**Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution C used (cm3) |  |  |  |

(4 marks)

a). Determine the average volume of solution C used (1 mark)

i). Transfer about half of the dry residue into a dry test-tube. Heat the residue strongly and test any gas produced using a burning splint

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

ii). Place the rest of the residue in a dry test-tube. Add 4cm3 of 2M hydrochloric acid. Retain the mixture for test (iii) below.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

iii). To 2cm3 of the solution obtained in (ii) above, add 6cm3 of aqueous ammonia dropwise.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

b). i). To 2cm3 of the filtrate obtained in (a) above, add about 3cm3 of aqueous

ammonia (Excess).

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

ii). To 2cm3 of the filtrate, add about 2cm3 of 2M hydrochloric acid.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

iii). To 2cm3 of the filtrate, add one or two drops of barium nitrate solution.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

3. You are provided with solid G. Carry out the tests in (a) and (b) and write your observations and inferences in the spaces provided. Describe the method used in part (c).

a). Place about one third of solid G on a metallic spatula and burn it in a Bunsen burner flame

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

b). Dissolve all of the remaining solid G in about 10cm3 of distilled water in a boiling tube. Use the solution for tests (b) (i), (ii) and (c).

i). Place 2 cm3 of the solution in a test-tube and add 2 drops of acidified potassium manganate (VII); solution C.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

ii). To 2cm3 of the solution, add all of solid sodium hydrogen carbonate provided.

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

c). Determine the p H of the solution obtained in (b) above

|  |  |
| --- | --- |
| Observations | Inferences |
| (1 mark) | (1 mark) |

**CO-ORDINATED MARK SCHEMES**

**NOVEMBER 1995**

**MARK SCHEME**

1.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ½ | 4 | 4 ½ | 5 |
| Temperature (0C) | 23.5 | 23.5 | 23.5 | 23.5 | 23.5 |  | 15.5 | 16.0 | 16.5 | 17.0 | 17.5 |

**Table I**  (3 Marks)

*- Complete with 10 readings; if 1st reading > 40 or <10 then unrealistic (award 0)*

*- Decimal (D) – ½ - Accept whole numbers and or decimals to 1.d.c.p only c 1st d.c.p value as 0 or 5 only*

*- Accuracy – ½ - 1st reading should be within +20 of school value*

*- Trends – 1 – (1/2, ½) as i).Readings betweens 0 -2 minutes should be constant (½)*

*ii).Readings between 3 -5 min should use continuously (½)*

***NB;*** *Reaction is endothermic hence temperature must drop in minute 3. If not penalize ½ mark*

**26**

**25**

**24**

**23**

**22**

**21**

**20**

**19**

**18**

**17**

**16**

**15**

**14**

**13**

**∆T1**

**Extrapolation (EXT)**

**0**

**1.0**

**2.0**

**3.0**

**4.0**

**5.0**

**Time (Min)**

**Temp**

*Fall in temperature ∆T1=………… 15 – 0 – 23.5 = - 8.50C*

*(1 mark)*

*Graph I (3 Marks)*

*Scale (sc) – ½ - plots should cover (4 ½ x 3 ½ squares) or more*

*Plots (Pt) – 1 – if 3 readings incorrect give ½ but if more than 3 incorrect (award 0) If correct scale intervals correct only.*

*Lines (Lns) – 1 – ½ (for each line) lines should pass through at least three points for each line*

*Xtrapolation (ext) – ½ - for the second line extended downwards*

*∆ T1 = 1 – a). show ∆T1 on graph at 2 ½ minute ( ½ mark)*

*b). Ignore sign of ∆T value*

a). i). n1 = 2/100 = 0.02

*Penalize ½ mark for wrong units i.e. m or M. Accept figure continuous units.*

*If wrong RFM used but shown how found, penalize ½ and mark answer if correct (using wrong RFM)*

ii). Mass of solution x 4.2 x ∆T1

∆H1 n1 x 1000 *Kjmol-1*

*Same as for graph I*

*For correct substitution of ∆T1 and n1*

*Size 3 ½ x 3 ½ sq*

*Correct answer*

*Correct answer should*

*Be within +2 units correct in the 1st D.C.P (otherwise penalise ½)*

*Have correct sign (+ve) (otherwise per ½ mark)*

*Penalized ½ if wrong units used – accept lack of units (on second line only)*

1. i). n2 = 1/84v = 0.0119

= 0. 012

*Accept answer to 3 or 4 D.C.P only (Not 2 d.c.p)*

*If RFM is wrong (but shown it was calculated) Penalize ½ mark and mark answer if correct using*

*the wrong RFM*

ii). For correct subt of n2 + ∆T2 = Correct answer

*Answer should be correct to within 12 units in 1st D.C.P*

*Answer should bear correct sign (-ve) otherwise penalize ½ mark*

*Accept units missing otherwise penalize ½ mark for wrong units used.*

c). *1 Mark - for correct substitution of ∆H1, ∆H2 and ∆H3 including their respective signs*

e.g ∆H4 = 2 (26.8) – (- 43.8) – 2(121)

= - 144.6 kj/mol

*1 mark – for correct answer*

*Penalize ½ mark for wrong sign on answer*

*Award 0 marks for wrong substitution or wrong sign transferred with ∆H in the substitution.*

*Penalise ½ mark for wrong units used*

*Penalize ½ mark for wrong transfer of any of the ∆H values*

***9 marks***

|  |  |  |
| --- | --- | --- |
| 2 (a) | Silvery / shiny grey/ metallic luster silvery white / shining metal  Reject shiny, wrong colour etc, silvery white etc | |
|  | Observations | Inferences |
| (b) | turns black/grey/white | L reacts with oxygen in air to form oxide or L is oxidize |
| (c) | Effervescence/bubbles/  gas produced / burns with a pop sound | metal L is above hydrogen in the reactivity series/ or mention any metal above H in reactivity series OR just metal up in the series |
| (d) | Effervescence/bubbles/ gas produced/ gas burns with a pop sound. | metal L is above hydrogen in the reactivity series/  or mention any metal above H in reactivity series  OR just metal up in the series |
| (e) | Black/grey/dark coating OR deposit or ppt or substance | Metal L is above Lead in reactivity series OR Lead is displaced by L |

***9 marks***

|  |  |  |
| --- | --- | --- |
| 3 (a) | White Crystalline solid/white powder /white solid | |
| (b) | Burns with Lilac /purple/ violet flame / Reject blue flame | |
| (c) | Gas relights burning splint  Solid melts forming colourless  liquid  If melts to colourless solution  (Reject if just melts) | Oxygen/O2 evolved  possibly KNO3  Accept NaNO3 if not scored in (b) |
| (d)(i) | No visible change no effect on litmus paper | Neutral solution |
| (ii) | No Precipitate / reject no observable change | Zn2+, Al3+, Pb2+,  Ca2+, Mg2+ (Any 3 absent)  Or K+ , Na+  Present |
| (iii) | No precipitate. | CO32-, SO42- OR Cl- absent  (Any two mentioned) |
| (iv) | - Colourless fumes/gas/effervescence  which turns moist red litmus blue  - Grey / black mixture/solid precipitate | - NH3 evolved  - Solid contains Nitrogen  or NO3- ions |

**NOVEMBER 1996**

**MARK SCHEME**

**Principles of averaging**

Values averaged must be shown and must be within + 0.20cm3 of each other

1. c). Concentration of solution B = 23.5 Mol-1

392

= 0.05995 Mol-1

Note: (i) Accept answer given as 0.060 mol-1 but reject 0.06 mol-1

(ii) Units need not be shown but if wrong units are given penalize ½ mk

(iii) Penalise ½ mark for wrong arithmetic

d). No of moles of iron (II) ions in 25cm3 of solution B = 25 x Ans. in (c)

1000

= correct answer

***Conditions***

*i). Accept rounding off of answer to 4 d.p*

*ii). penalize ½ mark if answer is rounded off to the 3rd d.p*

*iii). If wrong units are given, penalize ½ mark*

***Use of 1st Principle***  ***Use of Formula Method***

e). 5 moles of Fe2+ = 1mole of MnO4- M1V1 = 5

No of moles of A (in litres) used M2V2 1

= 1/5 x ans in (d)

No of moles of A in 1000cm3 ans (a) x pipette = 5

= 1/5 x ans in (d) x 1000/titre M2 x titre 1

Correct answer M2 = Ans in © x Pipette

5 x titre

Correct answer

***Conditions Note***

*i). If step 1 not sown but correct a). If steps (i) and (ii) are not*

*mole ratio used in step 2, credit shown but step (iii) and*

*1 mark ans are correct*

*ii). Penalise ½ mark max 1 ½ marks*

*for wrong arithmetic b). if step (ii) and (iii)are*

*iii). Penalize ½ mark for wrong combined to make M2*

*units given the subject award 1 mark*

*iv). Accept rounding of to the for the combined step*

*3rd and 4th d.p*

**Procedure II**

h). No of moles of manganate (VII) ions in V2 = Ans in (e) x Titre

1000

= correct answer

***Conditions***

*i). Accept rounding off of answer to the 4th d.p*

*ii). Penalise ½ mark if the mark is rounded off to the 3rd d.p*

*iii). If wrong units are given, penalize ½ mark*

i). 2 moles of MnO4- ions = 5 moles of dibasic acid

No of moles of the dibasic acid in 25cm3 of sol C = 5/2 x ans in (h)

***Conditions***

*i). Penalise ½ mark for wrong units used*

*ii). Penalise ½ mark for wrong arithmetic if not within 2 units in the 4th decimal place*

j). Concentration of the dibasic acid in mol l-1 = Ans in (i) x 1000

Pipette

***Conditions***

*i). Penalise ½ mark for wrong arithmetic if not within +2 units in the decimal place*

*ii). Answer should be written to at least 3 decimal places, unless it divides exactly. Otherwise penalize ½ mark*

*iii). Penalise ½ mark for wrong units used*

k). RFM of the dibasic acid = 5.0

ans in (j)  *½ mark*

= correct answer *½ mark*

X + 2 + 36 = RFM of dibasic acid *½ mark*

X + 38 = RFM of dibasic acid *½ mark*

Formula mass of X = RFM of dibasic acid – 38 *½ mark*

Correct answer

|  |  |  |
| --- | --- | --- |
|  | Observations | Inferences |
| 2a (i) | Effervescence that increases with heating  Green – yellow gas evolved  Gas changes moist blue litmus paper red and then bleaches it | Gas evolved is chlorine  D is an oxidizing Agent  Note: Chlorine is tied to either greenish – yellow Colour of gas or the Bleaching action of the gas |
| (ii) | Colourless filtrate obtained  brown ppt that is insoluble in  excess alkali formed | Fe3+ ions present |
| b | Effervescence/bubbles/gas evolved gas has no effect on moist litmus paper. Produced gas relights a glowing split | oxygen gas  D is a catalyst  D is probably MnO2 |
| *Note In (a) (i) and (b) above credit ½ mark for ’gas’ given in place of effervescence /bubbles so long as properties of the gas given in the observation column are not contradictory, otherwise no mark for the ‘gas’* | | |

|  |  |  |
| --- | --- | --- |
| 3 | Observations | Inferences |
| a) | Melts to a colourless liquid. And burns with a smoky /sooty. Flame *Note: accept melts on its own without Mentioning of colourless liquid. Unless contradictory colour given Accept –yellow sooty flame. But not yellow flame* | E is an unsaturated organic compound Note:- credit either E has  C: H ratio or E contains C=C or –C=C- in place  of ‘’unsaturated’’ unsaturated tied to smoky flame  Organic tied to melting & burning |
| b) | Solid E does not dissolve readily  solid E is sparingly partially  soluble /solid E dissolves  H+(aq) ions present red. | E is an organic acid  E is an acidic compound  hydrated hydrogen ions  H+(aq) ions present |
| c) | Solid E dissolved readily in aqueous NaOH | E is organic acid/or E is a carboxylic acid Or Acidic Compound / H+ ions present. |
| d)(i) | Effervescence/bubbles/ gas evolved colourless gas evolved extinguishes a burning / glowing  Splint changes moist blue litmus paper  Faint red / pink | Organic acid or carboxylic  aid or Acidic compound/ H+ ions present |
| (ii) | A sweet smelling substance is formed / fruity smell/ pleasant smell | Ester is formed O  E is a carboxylic acid/ R – COOH / - C - OH  alkanoic acid |

**NOVEMBER 1997**

**MARK SCHEME**

1. a).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ½ | 4 | 4 ½ | 5 | 5 ½ | 6 |
| Temperature (0C) | 20 | 20 | 20 | X | 25 | 29 | 31 | 31 | 33 | 34 | 34 | 34 | 34 |

*½ max for each entry*

*Maximum 5 marks*

b). ∆T= 34 – 20 = 140C *1 mark*

c). Energy change = 50 x 4.2 x 14 *(1)*

= 2940 Joules *(1)* *2 marks*

d). Moles = 2940  *(1)*

323 x 1000

= 0.009 moles *(1)*  *2 marks*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **I** | **II** | **III** |
| Final burette reading (cm3) | 32.8 | 15.9 | 31.9 |
| Initial burette reading (cm3) | 15.8 | 0.0 | 16.0 |
| Volume of solution G used (cm3) | 17.0 | 15.9 | 15.9 |

(6marks)

e). 15.9 + 15.9 *( ½ )*

2

= 15.9cm3 *( ½ )* *1 mark*

f). 15.9 x 0.5

1000 *(1)*

= 0.008 moles *(1) 2 marks*

g). i). Moles of sulphuric acid = 0.008

2

= 0.004 moles *( ½ )* *1 mark*

ii). 25cm3 = 0.004 ( ½ )

100cm3 = 0.016 moles *( ½ )*  *1 mark*

iii). Total moles of F = 0.009 + 0.016 *(½)*

= 0.025 moles *( ½ )* *1 mark*

iv). 50cm3 = 0.025 moles

1000cm3 = 0.025 x *1000 ( ½ )*

50

= 0.5M *(½)* *1 mark*

|  |  |  |
| --- | --- | --- |
| 2 | Observations | Inferences |
|  | Colourless gas that relights  a glowing splint *(1)*is produced | oxide present also allow chlorate nitrate, permanganate *(1)* |
| 1. (i) | Residue turns black  Colourless solution after filtration *1 mark* |  |
| (ii) | White Ppt (½)  Soluble in excess *( ½ )* *3 marks* | Al 3+ Pb 2+ or Zn2+ *(2)* |
| (iii) | White Ppt *( ½ )*  insoluble in excess *( ½ )* | Pb2+ or Al3- *(1)* |
| (iv) | White ppt | Pb2+ |
| 3 a) | Decolourise *(1)* | - C = C (1) or –OH*(1)* |
| b) | Decolourise *(1)* | - C = C present *(1)* |
|  | Vigorous effervescence *(1)* | Solid M is an acid  or ROOH *(1)* |

**NOVEMBER 1998**

**MARK SCHEME**

**1. Table 1**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **I** | **II** | **III** |
| Final burette reading | 25.40 | 48.00 | 24.40 |
| Initial burette reading | 1.30 | 24.10 | 0.40 |
| Volume of solution N(cm3) | 24.10 | 23.90 | 24.0 |

*1 mark for accuracy; 1 table ; 1 use of decimal; 1 averaging; 1 final*

*Total marks 4 marks*

Average of solution N = 24.10 + 23.90 + 24.0 *( ½ mark)*

3

= 24.00cm3 *1 mark*

a). Concentration of solution N = 8.8

40 = 0.22M *(½)* *1 mark*

b). 24.0 x 0.22 = 25M (½) M = 24 x 0.22

25

= 0.21M (*½)* *1 mark*

**Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **I** | **II** | **III** |
| Final burette reading | 12.50 | 12.50 | 29.40 |
| Initial burette reading | 0.00 | 0.0 | 17.0 |
| Volume of solution N(cm3) | 12.50 | 12.50 | 12.40 |

*1 mark for accuracy; 1 table ; 1 use of decimal; 1 averaging; 1 final*

*Total marks 4 marks*

Average of solution N= 12.50 + 12.50 + 12.4 *( ½ mark)*

3

= 12.47cm3 ( ½ ) *1 mark*

i). 12.47 x 0.22 *(1)*

1000 = 0.00274 moles *(1)* *2 marks*

ii). 0. 00274 x 4 ( *½* ) = 0.00100 = ans a (i) x 100/25 *1 mark*

iii). 0.21 x 100

1. = ans (b) x 100/1000

= -0.021 moles *( ½ )* = ans a (iii) *1 mark*

iv). 0.02 – 0.0109 *( ½ )*

= 0.01 *( ½ )* = ans (ii) - ans (ii)

= ans a (iv) *1 mark*

v). 0.01 *( ½ )* = ans a (i)

2 2

= 0.005 ( *½ )* = ans a (v)  *1 mark*

c). i). 72 x 0.005 *( ½ )* = 0.36g ( ½)

= 72 x ans a (iv) = ans b (i)

ii). 0.36 x 100 *( ½ )*

0.5

= ans b (i) x 100

0.5

= 72 % ( ½ ) = ans (ii) *1 mark*

|  |  |  |
| --- | --- | --- |
| a). | Observations | Inferences |
|  | Hissing sound  White fumes with choking smell that changes  Moist blue litmus paper red and red litmus paper remains red  Colourless liquid condenses on cool parts of test tube *( ½ )* | hydrated salt present  (3 marks) |
| i). | white precipitate *( ½ )*  soluble in excess *( ½ )* | Al 3+ (aq) Pb2+ (aq) or Zn(aq)2+  *(2marks) for all three 1 mark for two)* (3 marks) |
| ii). | white precipitate *( ½ )*  Insoluble in excess *( ½ )* | Al3+ *( ½ )* or Pb 2+ *( ½ )*  *OR Penalise ½ mark each contradiction* (2 marks) |
| iii). | No white precipitate *(1)*  Reject no observable change | Absence of SO42-(aq) CO32-(aq) or SO32-(aq) *(1 mark for all 3 correct ½ mark for 2 correct)Penalize ½ mark each contradiction.* (2 marks) |
| iv). | White precipitate (1) | Cl(aq) present  (2 marks) |

3*.*

|  |  |  |
| --- | --- | --- |
| a). | Observations | Inferences |
|  | Hissing /sound White fumes  with choking smell changing moist red litmus blue  Melts into a colourless liquid  White sublimate  Extinguishes a burning splint  *(2 marks for any four observations correct)* | NH4+ *(1)*  Tied to litmus changing to blue  (3 marks) |
| b). | i). Turns from colourless to green - yellow  OR  pH 7 -8 | Weekly alkaline *(1)*  Accept neutral (2 marks) |
|  | ii) White precipitate | L is acidic |
| c) | - White ppt dissolves on warming  - Effervescence | Carboxylic acid; COOH , H+  Accept acidic compound. |

**NOVEMBER 1999**

**MARK SCHEME**

1 (a)(i) Table I

Table (T) = 2mks

Decimal (D) = 1mk

Accuracy (A) = 1mk

Principle of Av (PA) = 1mk

Final answer (F) = 1mk

Note: - 3 titration consistent = 2mks

2 titration consistent = 1 ½ mks

2 titrations inconsistent 1mk

1 titration done = 1mk

(ii) Average volume of solution E

(b) (i)No. of moles of basic compound G2X.10 H2O

No. of moles of E = titre x 0.099

1000

No. of moles of F = titre x 0.099 x ½

1000

= Ans (4 d.p)

(ii)Conc. of solution F in moles per litre

25cm3 of F = Answer in (b) (i)

1000cm3 of F = Ans (b) (I) x 1000

25

= Ans ( 3 dp)

(iii) Relative formula mass of basic compound G2X.10 H2O

15.3 = Molarity (Ans. (b) (ii)

RFM

RFM = 15.3 = Ans

Ans in (b) (ii)

(iv) Mass of 10 moles of H2O = 10 (16 + 2) = 180

2G + 180 + 155 = Ans (b) (iii)

2G = Ans (b) (iii) - 335

G = Ans (b) (iii) – 335

2

= Ans (± 0.5)

**2. (a) Table III**

T = 5 mks

D = ½

A = 1mk (± 5 secs)

T = 1

(b) (i) S = 1 mk

C = 1 mk

P = 1 mk

(ii) Showing on the graph = ½ mk

Stating correct values ½ mk

Expression t = 1 = ½ mk

Correct value

Rate at 7.5cm3 (½ mk**)**

(iii) - Straight line (+ve gradient) = ½ mk

- Rate of reaction increases as concentration

**OR**

**-** Rate is directly proportional to concentration

- Straight line (+ ve gradient) = ½ mk

|  |  |  |
| --- | --- | --- |
| 3a). | Observations | Inferences |
|  | - Light green solid turns brown  - Colourless liquid/moisture/ vapour condenses on  cooler part of test tube  **-** Pungent gas with irritating smell which changes  moist blue litmus paper turns red  - Red litmus paper remains 2½mks) | - Fe2+ present  - Hydrated salt/ water of  crystallization |
| bi). | - Green precipitate which is insoluble in excess (1mk) | - Fe2+ present (½ mk) |
| ii). | Yellow /brown/Reddish brown solution  Brown ppt. Insoluble in excess(1½ marks) | - Fe2+ Oxidised to F3+ |
| 1. I | - White precipitate | - SO32-, SO42-, CO32- |
| II | **-** White ppt remains | **-** SO42- |

**NOVEMBER 2000**

**MARK SCHEME**

**Table I**

* 2 titrations consistent = 1 ½ marks
* 2 titration inconsistent = 1
* 1 titration = 1
* Penalise maximum ( - ½ mark) for wrong amounts > 50.0 or 1.0cm3

**Table II**

Decimal (D) = ½ mark.

Accuracy (A) = ½ mark

* School value ( SV) ± 0.2 cm3
* If more or less that value = 0 mark.

(iii) I Conc. of Sodium carbonate in moles per litre (RFM Na2CO3 = 106)

5.6 = 0.05283M.

106

Answer given to at least 3 dp. If not, do not award for answer. Wrong units ½ mark

II Moles sodium carbonate in 25cm3  of solution

25 x Ans I = Ans

1000

= 25 x 0.0528

1000

= 0.0013207mol . (at least 4d.p)

III Moles of hydrochloric acid in total volume of solution used

NaCO3 (aq) + 2 HCl 2NaCl (aq) + H2O + CO2(g)

Ans (II) x 2 = Ans.

IV Concentration of hydrochloric acid in moles per litre

Total titre in (a) (ii) = Ans in III

Therefore in 1000cm3 =

= Ans III x 1000 = Ans 3 d.P

Total titre

**Table III**

Table (T) = 1 mark

* 8 readings = 1 mk
* 6 readings = ½
* Less than = 0 mk
* Values > 400C or < 100C ( from t = 0 to t = 1 ½ ) = - ½ mk

Decimals (D) = ½ mk

Accuracy (A)

* Compare with school values (SV) at t = 1 ½ if ± 20 c = ½ mk ; If not = 0mk

Trend (T) = 1 mark

- Trend - t = 0 to t = 1 ½ being constant = ½ mk

OR

- -t = ½ to t 1 ½ being = ½ mk

2nd Trend - t = 2 ½ to t= 4 being constant and lower than between t = 0 to t = 1 ½ = ½ mk.

**OR**

-t = 3 to t = 4 being constant and lower than between t = 0 to t = 1 ½ = ½ mk

(b) The candidate should use the data obtained in table III.

**∆ T**

**Temp 0C**

**Time (min)**

**Scale (S) ½ mk ; Labelling (L) = ½ mk ;**

**Plotting (P) ½ mk ; Shape (S) = ½ mk**

(c) See graph in b above of Temperature change ∆ **T**

(d) (i)No. of moles of solid G used. (K = 39.0, N = 14.0, O = 16) 1 mark

RFM of KNO3 = 101

Moles of G = 3 /101 = 0.0297( 4 d.p)

(ii) Enthalpy of Solution ∆ Hsoln and show sign of ∆ Hsoln

Heat absorbed = 30 x 4.2 x ∆ T = Ans.

Heat absorbed by 1 mole = Ans. Above = Ans J/mol

Ans C

**Ans in Kj / mol**

|  |  |  |
| --- | --- | --- |
| **3** | **Observation** | **Inferences** |
| (a) | **-** Blue residue /solid ppt (1mk)  **-** Colourless filtrate | Cu2+ ions present |
| (b) (i) | **-** White ppt (1mk)  - Dissolves in excess (1mk) |  |
| (ii) | **-** White ppt (1mk)  - Dissolves in excess (1mk) | Al3+, Zn2+, Pb2+ present |
| (iii) | **-** White ppt (½ mk)  - Insoluble in excess | - Pb2+ , or Al3+  - Zn2+  absent |
| (c) | - No white precipitate is formed | Al3+ present  Pb2+ absent |
| (d) | - White Precipitate | SO42- |
| (e) | - Blue precipitate  - Dissolve in excess to form deep blue  solution | - Cu2+ present |

**NOVEMBER 2001**

**MARK SCHEME**

1. (a) T = 1mk; AC = 1mk; FA = 1mk, D = 1mk; PA = 1mk

(b) Solution D

Conc. of NaOH

Moles of HCl = Moles of NaOH

Molarity = titre x 0.128 x 1000

1000 x 25

= Ans

**Solution A**

Molarity of A = Ans in (a) above x 150

25

= Ans

**Or**

Ans in (a) above x 6

Procedure II, Table II

S = ½ mk

L **= ½** mk

P = 1mk

S = 1mk

**∆ T (0C)**

**Volume of A (cm3)**

* 1. From the graph determine the volume of sodium hydroxide, solution A required to neutralize the carboxylic acid
  2. Calculate the volume of carboxylic acid, solution C used for neutralization

(= 20 - Ans (b) above)

(d) (i) = A:C = Ans (b) : Ans (c) = 2: 1

(ii) Conc. In moles per litre of the carboxylic acid solution C

Moles of A = Ans. b (ii) x Ans (b) above

1000

Moles of C = ½ x moles of A

Molarity = ½ x Ans. b (ii) x Ans (b) x 1000

1000 x Ans (c)

|  |  |  |
| --- | --- | --- |
| 2. | Observations | Inferences |
| (a) | - Cracking sound  - Colourless liquid forms on cooler  Parts of test tube.  - NO effect on both red and blue litmus papers | - Hydrated salt  - Neutral substance |
| b(i) | - White precipitate | Ca2+, Mg2+ or Ba2+ present |
| (ii) | - White Precipitate | Ca2+, Mg2+ or Ba2+ present  OR Mg2+ absent ½ mark |
| (iii) | - White precipitate which dissolves on warming | Cl- present |

|  |  |  |
| --- | --- | --- |
| 3 | **Observations** | **Inferences** |
| a | - Moist blue litmus paper changes to red  - Moist on red litmus paper | - Acidic substance / or H+ present |
| b | - Brown bromine water is not decolourised | C = C or C = C - **absent**    **OR**  Saturated compound present ½  C = C or - C = C - **absent**  **OR**  Saturated compound present ½  Alkene / alkyne absent **½** |
| c | Purple or KMnO4 is not decolorized  Purple KMnO4 colour persists | Absence of C = C or  R – OH absent |
| d | Effervescence or bubbles of gas  OR Fizzing / Hissing sound | Acidic Compound present  Or H+ ions |

**NOVEMBER 2002**

**MARK SCHEME**

a).

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Vol of A H2O2 | Vol. H2O | Vol of B.  H2SO4 | Vol of C Na2S2O3 | Vol of D  KI | Vol of E  Starch |  | Time (sec) | 1/time sec |
| 25 | 0 | 20 | 5 | 5 | 2 |  | 18 | 56x10-2 |
| 20 | 5 | 20 | 5 | 5 | 2 |  | 22.5 | 4.4x10-2 |
| 15 | 10 | 20 | 5 | 5 | 2 |  | 29 | 3.4x10-2 |
| 10 | 15 | 20 | 5 | 5 | 2 |  | 43.5 | 2.3X10-2 |
| 5 | 20 | 20 | 5 | 5 | 2 | 90.5 | 90.5 | 1.1X10-2 |

b). ½ for each axis

2 marks for plotting 5p/s correctly

1 mark for best straight line 4 marks

c). 1/time = 1.7 x 10-2(I)

Time = 58.82sec 2 marks

d). Rate decreases – with the decrease in the concentration of hydrogen peroxide 2 marks

|  |  |  |
| --- | --- | --- |
| **2** | **Observations** | **inferences** |
| a | Shiny metal is coated with a Black/grey substance (½)Colourless filtrate obtained (½) | metal G is more reactive  than metal whose ions are  In solution F (I)  OR displacement reaction  Occurred |
| b | No white ppt(1) Or  Rej no observable change | Absence of  SO42- CO32- or SO32-(ions)  award 2 marks for all 3  Award 1 mark for 2  Award ½ mark for 1 |
| c | White PPt (½)  Soluble in excess (½) | Pb2+, Al3+ or Zn2+ as in (b) above 3 marks |
| d | White PPt (½) which dissolves on boiling (I) | Pb2+ (I) present  2 ½ marks |
| e | White PPt (½)  colourless filtrate ( ½ ) | Pb2+ confirmed (I)  2 marks |
| f | White PPt (I)  Soluble in excess (I) | Zn2+ present (I) 3 marks |

|  |  |  |
| --- | --- | --- |
| **3** | **Observations** | **inferences** |
| a | Melts ( ½ ) into colourless liquid ( ½ ) burns with a smoky flame (1) | unsaturated organic  compound  accept long chain hydrocarbon or aromatics |
| b(i) | The purple KMnO4 decolourised/changes to colourless. The colour of KmnO4 changes from purple to colourless (I) 3 marks | Could be an alcohol or unsaturated compound (I) R – OH , - C = C - C = C - 2 marks |
| (ii) | Brown bromine is decolorized/ changes t colourless Decolourised (I) | Unsaturated (I) compound 2 marks |
| (iii) | Turns orange ( ½ )  pH = 5 ½ 2 marks | compound is a weak acid (I) 2 marks |

**NOVEMBER 2003**

**MARK SCHEME**

1**.** (a)Volume of solution P = 15.0cm3

(b) Average volume of solution P 15.0 + 15.0 = 15.0cm3

2

(c) 15.0 x 0.02 = 0.0003 moles

1000

(d) gdm3 = 4.18 x 1000

250

= 16.72gdm3

16.72 from (d) above = 0.060M

278

(e) Moles of Q in 25.0cm3

0.06 x 25 = 0.0015 moles

1000

(ii) 0.003 moles rxts 0.0015 of Q

1 mole = 1 x 0.0015

0.0003

= 5 moles

2. **Procedure I**

(a) Table II Table - ½ mk , Decimal – ½ mk ; Accuracy = ½ mk

(b) Final temp – Initial temp

(c) (i) Heat change when H2A dissolve in water (assume heat capacity of the solution is 4.2)

30 x 4.2 x ∆ T = Ans in J. Or 30 x 4.2 x ∆T = kJ

1000

(ii) Number of moles of acid used (RFM of H2A is 126)

1.9 = 0.01508 moles

126

(iii) Molar heat of solution ∆H1 soln of the acid H2A

∆ H c (i) = J/mole Or Kj/mole

c (ii)

**Procedure II**

(a) and (b) as in procedure 1

(c) (i) Heat change. (heat capacity 4.2 J/g/0C and density 1 g/cm3

60 x 4.2 x ∆ T = Ans in J or kJ

(ii) Number of moles of the acid H2A used

0.5 x 30 = 0.015

1000

(iii) Heat of reaction ∆ H2 of one mole of the acid H2A with Sodium hydroxide

∆ H2 = C (i) = Ans

C (ii)

Or

60 x 4.2 x ∆ T = Ans. (in J or KJ)

C (ii)

(d) ∆ H3 for the reaction H2A (s) + 2 OH- (aq) 2H2O (l) + A2- (aq)

∆ H3 = ∆ H2 + ∆ H2 = Ans (-ve kJ /mole)

|  |  |  |
| --- | --- | --- |
| **3** | **Observations** | **Inferences** |
| (a) | Colourless solution formed | Coloured ions absent e.g Cu2+ , Fe2+,  or Fe 3+  absent |
| (b) | No white precipitate formed | Pb2+’ Al3+, Zn2+ , Mg2+ Or Ca2+ absent |
| (c) | White precipitate formed | Cl-, SO42-, SO32- , or CO32+ present |
| (d) | White precipitate formed dissolves in HCl (aq) | SO32- or CO32- present |
| (e) | Purple KMnO4 is (aq) decolorized or changes to colourless | SO32- present Or Reducing |
| (f) | Green solution formed OR Colour changes Orange to green | SO32- present Or Reducing |

**NOVEMBER 2005**

**MARK SCHEME**

1**.** (a)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ½ |
| Temp (0C) | 82 | 73 | 69 | 68 | 68 | 68 | 66 | 65 |

*1 Mark fore the two axis*

*1 mark for all points correctly plotted*

*1 mark for plot occupying ¾ of the grid provided*

b). 680C

2

|  |  |  |
| --- | --- | --- |
|  | I | II |
| Initial temperature of solution KT1 (0C) | 26 | 26 |
| Initial temperature of solution L T2 (0C) | 25 | 26 |
| Highest temperature of mixture T3 (0C) | 30.5 | 31 |
| Average initial temperature (0C) | 25.5 | 26 |
| Change in temperature ∆T (0C) | 5 | 5 |

(5 marks)

Table 1

½ mark for each entry

a). Average 5 + 5 = 5

2 (1 mark)

b). Heat change = 50 x 4.2 x 5 (1)

= 1050 Joules (2 marks)

c). Number of moles of acid L

1050

143.4 x 1000

= 0.0078125 (2 marks)

d). 25cm3 = 0.0078125 moles

= 0.0078125 x 1000

25  
 = 0.3125M (2 marks)

e). Relative formula mass of acid L

60 = 0.3125 – (L)

R.F.M

R.F.M = 192 (l)

(2 marks)

|  |  |  |
| --- | --- | --- |
| **3** | **Observations** | **Inferences** |
| (a) (i) | Cracking sound  Colourless liquid  Gas with pungent smell  Colourless gas is produced which changes moist red litmus paper blue  (2 marks for four correct observations | N is hydrated  a basic gas is formed  ( ½ mark for each)  (correct inference) |
| (i) | White Ppt (½) | Al3+ or Pb2+ ions, Mg2+ ions present |
| (ii) | No white precipitate is formed | Al3+  ion ; Mg2+  ion present; Pb2+ ions absent |
| (iii) | White Ppt | SO42-, SO32- CO32-  Cl- 1 mark for two (2 marks) |
| (iv) | White Ppt  persists (l) | SO42- ion present –(l) (2 marks) |
| b(i) | A clear colourless solution (l) | Salt is soluble (l) (2 marks)  Acid solution is formed ( 1) |
| (ii) | No effervescence (l) | (H+ absent (l) (2 marks) |
| (iii) | White solid formed (l)  Slightly soluble in excess ( ½ )  On addition of NaHCO3  There is effervescence ( ½ )  Colourless gas ( ½ )  Give maximum 2 marks for observations) ( 3 marks) | Acid solution is formed ( 1) |

**NOVEMBER 2006**

**MARK SCHEME**

**1. Table 1**

(i)

|  |  |  |
| --- | --- | --- |
| Volume of water in the boiling tube (cm3) | Temperature at which crystals of solid A first appear ( 0C ) | Solubility of solid A  (g/100g water |
| 4 | 66 - 67 | 112.5 |
| 6 | 56 – 57 | 75 |
| 8 | 49 – 50 | 56 |
| 10 | 44 – 45 | 45 |
|  |  |  |

1 mark for temp value within range

½ mark for each value ± 20C

½ mark for each value of solubility correctly calculated

(ii) - S – 1; P – 1; C – 1

(iii) 63 ± 0.5 0C

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading | 24.40 | 48.60 | 26.20 |
| Initial burette reading | 0.00 | 24.40 | 26.40 |
| Volume of solution B used (cm3) | 24.40 | 24.40 | 24.20 |

**(Award for each titre value ± of the teachers value**

I24.20 + 24.20= 24.20cm3

2

II 0.06 x 24.20= 1.45 x 103 moles

1000

III 1.45 x 10-3 x 5 = 3.63 x 10-3 moles

2

IV 3.63 x 10-3 x 10

= 3.63 x 10-2 moles

= 4.5

x 10-2

= 124

1. DxH2O

90 + 18 x = 124

X = 34

= 1.9

= 2

**2**.

|  |  |
| --- | --- |
| Observations | **Inferences** |
| 1. Colourless liquid condenses on cool parts of test tube. White solid remains | Probably hydrated salt/ compound (1) present |
| 1. - Colourless filtrate ( ½ )   - White residue | Compound sparingly soluble |
| 1. Solution turns pink 2. No effervesnce 3. White ppt formed 4. No white ppt | Compound is basic OH-, HCO3 or CO32- present  OH- present or HCO3 or CO32- absent.  Ca2+ , Ba2+, Pb2+  present (2mks for all three 1 mk for 2  Ba2+ present or Ca2+ or Pb2+ |

**3.**

|  |  |
| --- | --- |
| (a) Burns with luminous ( yellow, smoky)  flame | Unsaturated compound OR Long chain hydrocarbon   * C = C - / - C = C - Or Hydrocarbon with   high C: H ratio Or aromatic cpd   * NB – Each these tied to burning with smoky/sooty flame |
| (b) (i) Purple Potassium manganate (VII) is  Decolourised (changes from purple  to colourless | Alkene or alcohol present   * C = C - or R – OH |
| (ii) Brown bromine water is decolorized (  Changes from red to Colourless) | Alkene present // - C = C – present |

**NOVEMBER 2007**

**MARK SCHEME**

1. a).

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading | 21.8 | 21.6 | 43.6 |
| Initial burette reading | 0.0 | 0.0 | 22.0 |
| Volume of D used (cm3) | 21.8 | 21.6 | 21.6 |

(3 marks)

i). 21.6 + 21.6

2 = 21.6cm3  (1 mark)

ii). R.F.M of Na2CO3 = 106

Conc. 8 = 0.075M

106

iii). Moles of Na2CO3  25 x 0.075M

1000

= 0.001875

Moles of H2SO4 = 0.001875

Conc. of H2SO4 = 0.001875 x 1000

21.6

= 0.0868M

(2 marks)

iv). 0.0868 x 10 = 0.868M

(1 mark)

b). i).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test-tube number | 1 | 2 | 3 | 4 | 5 | 6 |
| Volume of solution A (cm3) | 2 | 4 | 6 | 8 | 6 | 4 |
| Volume of solution C (cm3) | 14 | 12 | 10 | 8 | 10 | 12 |
| Initial temperature of solution C (0C) | 20.5 | 20.5 | 20.5 | 20.5 | 20.5 | 20.5 |
| Highest temperature of mixture (0C) | 23 | 25.5 | 28.0 | 29.5 | 26.5 | 24.5 |
| Change in temperature ∆T | 2.5 | 5.0 | 7.5 | 9.0 | 6.5 | 4.5 |

ii). Graph

(3 marks)

iii). I ∆t = 9.5 + 0.10C (1 mark)

II Maximum volume of A = 7.6cm3 + 0.1

iv). I Moles of sulphuric acid = 7.6 x 0.868

1000

= 0.0066 moles (1 mark)

II Heat evolved = 16 x 4.2 x 9.5

= 638.4 joules

Molar Heat = 638.4

0.0066

= 96.727272KJ mol-1 (2 marks)

|  |  |  |
| --- | --- | --- |
| **2** | **Observations** | **Inferences** |
| (a) | Gas with pungent/irritating/choking smell is produced which changes moist blue litmus paper turns red  Colourless liquid formed on cool part of test tube  Solid turns reddish brown | hydrated salt  acidic gas evolved |
| (b) (i  (ii)  (iii)  (iv) | Reddish brown solution pH 1, 2, 3  Brown precipitate insoluble in excess  Brown /Black solid formed or solution  Changes from yellow to brown  White precipitate settles at the bottom of the test tube | strongly acidic  Fe3+  Iodide ions/ I- ions present |

|  |  |  |
| --- | --- | --- |
| **3** | **Observations** | **Inferences** |
| (a) | Clear blue flame | saturated low carbon organic compound ( 2marks) |
| (b) | No separation or forms a solution  two liquids are miscible | Mixture is miscible or polar  organic compound (1 mark) |
| (c) | No effervescence | Liquid not acidic or absence of H+ (2 marks) |
| (d) | Solution changes from orange to green | F is likely to be  Alcohol or R-OH (2 marks) |

**NOVEMBER 2008**

**MARK SCHEME**

1. **PROCEDURE**

**TABLE 1 (4 Marks)**

**Award a total of 4 marks distributed as follows**

i). Complete table (1mark)

ii). Table with 10 readings (1mark)

**a). Penalties**

*i). Penalize ½ km once for any space not filled subject to at least 5 readings being given otherwise penalize fully*

*ii). Penalize ½ mark for unrealistic temperature reading (i.e. from t=o min to t =2m if reading of T400C or T> 40OC ) for the whole table once.*

*iii). If temperature reading are all constant from t=o to t=5 min penalize ½ mark on complete table*

*iv). Penalise ½ mark on complete table if temperature reading at t=30min is either the same on greater higher than the temperature reading at t=2 min*

*v). If 2 or more rows of temperature reading are given, penalize ½ mark on complete table and mark table based on the row used to plot the graph. However, if the graph is not drawn then mark the first row of readings.*

***b). Use of decimals*** *(1 mark)*

*i). accept temperature readings and award 1 mark only. If consistency given either aswhole numbers a to 1 decimal place otherwise penalize fully*

*ii). Reflect and ward 0 mark if decimal place has other values other than a ‘0’ or ‘5’ e.g. 20.2, 18.9*

***c). Accuracy***

*Compare the S.V. to the candidates temperature reading at 2 min and award 1 mark if the reading is within +2.00C of the S.V. otherwise award zero mark*

***Note***

S.V refers to the teacher’s temperature readings at t = 0 min where all the five initial temperature reading are the same or the temperature reading at t=2 minutes in case the 5 initial temperature readings are not the same

**d). Trends (1 mark)**

Award two halves as follows

i). If temperature reading from 0 to 2 min are constant award ½ mark or at least from E-1

ii). Award ½ mark if temperature readings from t=3 min to t=5 min shows a rise after the initial drop without another drop

**Note**

i). The reaction is endothermic a hence temperature must drop if not penalize ½ (in 3 minutes) on trend. i.e. to award the 2nd ½ mark for the trend there must have been a drop in temperature after 2 ½ minutes

ii). Reject trend in the 2nd part of the table the addition of solid A to the acid otherwise accept a minimum of two readings if they are lower and show a rise

- Show the tick accuracy on the table

**GRAPH**

Award a total of 3 marks distributed as follows

a). Labeling of axes ……………………………… ½ mark

award ½ mark only if both axes are correct labeled (i.e. temperature on vertical and time on horizontal )

**Penalties**

i). Penalise fully for inverted axes

ii). Penalise fully if wrong units are used otherwise ignore if units are omitted

/not used

iii). Penalise fully if one axis is correctly labeled

**b). Scale ………………… ½ mark**

**Conditions**

i). Area covered by plots should be at least half the provided on both axes i.e. at least 5 big squares on vertical and 4 ½ big squares on horizontal

ii). Scale intervals must be consistent

iii). Scale chosen must be able to accommodate all points or plots whether plotted or not check range of readings on the axes.

**Note**

Penalise fully if any of the above conditions are not met

**c). Plotting ………………………………………………….1 mark**

i). If 10 or 9 points are correctly plotted award 1 mark

ii). If 8 or 7 points correctly plotted award ½

iii). If less than 7 points are correctly plotted award 0 marks

2. If scale interval changes mark plots (if any ) within the first scale interval and treat to rest of the plots even if the axes are inverted or interchanged and award accordingly

**d). The lines and extrapolation ……………………….(1 mark)**

i). Award ½ mark if the plots are joined by two straight lines, accept the lines of best fit

ii). Award another ½ marks if for extrapolation where each of the two lines is extended to the 2 ½ minutes mark

iii). Accept lines and extrapolation even if the axes are inverted

Temperature

(OC)

Time (minutes)

**∆T**

Temp

(OC)

**Temperature (0C)**

Time (minutes)

Temp

(OC)

Temp

(OC)

Time (minutes)

Temp

(OC)

Time (minutes)

Temperature

(OC)

**Table 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Time (min) | 0 | ½ | 1 | 1 ½ | 2 | 2 ½ | 3 | 3 ½ | 4 | 4 ½ | 5 |
| Temp (0C) | 18.0 | 18.0 | 18.0 | 18.0 | 18.0 | X | 13.0 | 13.0 | 13.5 | 13.5 | 14.0 |

ii). ∆T = Correct reading 60C 1 mark

**Conditions**

a). Accept the correct value of ∆T from an extrapolated correct graph with or without showing on the graph for 1 mark

b). award ½ mark for correct showing on an extrapolated correct graph if reading for ∆T is wrong or missing

c). Ignore sign for ∆T

d). Penalise ½ mark for wrong units used otherwise ignore if no units are used/shown

e). Reject readings/showing from a wrong graph and award 0 mark for ∆T reject ∆T if coming from the table or wrong graph but accept in (iii) below if used correctly

f). Reject ∆T if from the table or wrong graph but accept if it is used correctly otherwise penalize fully if ∆T is strange

iii). ∆H = MC∆T √(expression)

= 20 x 4.2 x Answer (ii) above(6)

= 504 joules

**Or**

∆H = MC∆T

= 20 x 4.2 x Answers (ii) above

1000

= Correct Answer

**Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **I** | **II** | **III** |
| Final burette reading | 16.50 | 32.20 | 32.20 |
| Initial burette reading | 0.00 | 16.00 | 16.00 |
| Titre (cm3) | 16.50 | 16.20 | 16.20 |

**Award a total of 5 marks distributed as follows**

(i) Average Titre = 16. 20 + 16.20 = 16 .20cm3

2

(ii) The number of moles of:

I Moles of NaOH used = 0.1 x Titre

1000

II Moles of NaOH: HCl = 1 :1

Moles of HCl = Ans I above Or Moles of HCl in 25cm3 of soln = Ans I above.

III Ans II x 250 = correct answer

25

Or

Ans II x 10 = Correct Ans

**Conditions**

i). Penalise ½ mark for wrong transfer of answer (II)

ii). Penalise fully for strange figure

iii). Answer as expected otherwise penalize ½ mark (don’t work at accuracy, d.p) for

wrong answer

**Notes**

i). Award fully if correct answer given is based on statement implying

multiplication of ten

IV). 2 x 20

1000 = 0.04

Answer as expected otherwise penalize ½ mark

V) Moles of HCl reacted with solid A = Ans IV – Ans III

= Correct Ans

**Conditions**

Answer (IV) III must be transferred intact otherwise penalize ½ mark for wrong transfer of either of item or both. However for strange figures penalize fully.

**Note**

i. If soluble or dissolve is not given but blue ppt mentioned accept and award 1 mark for blue solution

ii. If ppt and dissolve are not mentioned but a candidate mentions deep blue solution in excess credit ½ mark and reject the inference.

c). Ans (iii) Procedure A = Correct ans

ANS v UNITS j Mol- OR Kj Mot

Or

Ans v = Ans iii procedure A

: I Mole of HCl = Ans (iii) Procedure A

Ans V

=Correct Ans

JMol-1

Or

Ans v = Ans (i) Procedure A (Joules)

; 1 Mole of HCl = Ans (iii) Procedure A

Ans V x 1000

Jmol-1 or KJ mol-1

|  |  |  |
| --- | --- | --- |
| 2 | Observations | Inferences |
| a | Green solid turns black/ Green solid forms black solid/ residue ; Colourless liquid forms on the cooler part of the test tube/ Colourless vapour condenses on the cooler part of the test tube ; Blue litmus turns red; Red litmus remains red/ the same colour.  Penalise fully for contradiction on colour properties  *Rej. Colourless liquid condenses / colourless vapour forms/moisture condenses/No effect on red litmus/Red litmus remains the same colour* | * Hydrated salt/compound or contain water of crystallization (Tied to colourless vapour condensing) Acidic gas produced (Tied to blue litmus turning red. |
| b | Black solid / residue reacts dissolves to form green solution Or Green solution formed Ignore – No effervescence Rej. Blue solution/ No change/ reaction | Black solid/ residue is basic/ Colored ion present / or Cu2+, Fe2+  ions present |
| c (i) | Blue ppt/ suspension /solid formed / Blue ppt dissolves in excess aqueous ammonia to form a deep blue solution | Cu2+ Present  ( tied to blue ppt and deep blue solution  Must |
| (ii) | Effervescence occurs / bubbles formed/ Fizzing; Rej hissing/ Brown/ reddish brown solid deposited/ Green solution turns colourless / Test tube becomes warm /hot | E is a metal above copper in the ECS / Metal E displaces copper/ metal E is more reactive than cooper / metal E reduced Cu2+ ions to Cu ( Tied to brown solid deposit) |

|  |  |  |
| --- | --- | --- |
| 3 | Observations | Inferences |
| a | Burns with a yellow sooty smoky flame  ½ mark  Burns with a luminous sooty/smoky  flame | – long chain/ unsaturated  organic/ hydrocarbon with a  high C: H ratio C = C or - C = C ½ marks  ***Reject***  *C = C, C = C*  *Carbon to carbon double or triple bond in words*  *Alkaline /alkaline* |
| b | Dissolves/ soluble to form a colourless solution | Polar organic compound  Note Accept soluble /substance/salt/compound present |
| c (i) | Effervesnce occurs or bubbles are formed | R – COOH / H+/ H3O+  *Accept - Acidic compound /solution*  *Organic compound ; Carboxylic acid* |
| (ii) | Orange colour K2Cr2O7 solution persists / remain the same / orange / orange colour  *Rej – Yellow used in place of orange*  *K2Cr2O7 not decolourised* | R – OH absent  *Note : Penalise fully if any other functional groups are mentioned* |
| (iii) | Purple KMnO4 soln is decolorized or KMnO4 soln changes from purple to colourless  *Note : Rej Solution remains / becomes / turns colourless* | - C=C- / C = C - present  *Accept for unsaturated organic compound present* |

**NOVEMBER 2009**

**MARK SCHEME**

1.

|  |  |  |
| --- | --- | --- |
| I | II | III |
| Final burette reading | 22.20 | 21.50 | 22.50 | |
| Initial burette reading | 0.00 | 0.00 | 1.00 | |
| Volume of solution C used (cm3) | 22.20 | 21.50 | 21.50 | |

(4 marks)

a). i). Average volume of solution C used

= 21.50 + 21.50

2

= 21.50 (1 mark)

ii). Moles of sodium hydroxide in the average volume of solution C used.

100cm3 of sodium contains 0.3 moles of NaOH

21.50cm3 of solution contains 0.3 x 21.5

1000

= 0.00645 moles (1 mark)

iii). Moles of hydrochloric acid in 25.0cm3 of solution D

= 0.00645 moles (1 mark)

iv). Morality of hydrochloric acid in solution D.

25cm3 of solution contains 0.00645 moles Hcl

0.00645 x 1000

100cm3 of solution contains 25

= 0.25M (1mark)

Table 2

|  |  |  |
| --- | --- | --- |
| I | II | III |
| Final burette reading | 21.50 | 20.90 | 20.90 | |
| Initial burette reading | 0.00 | 0.00 | 0.00 | |
| Volume of solution D used (cm3) | 21.50 | 20.90 | 20.90 | |

(4 marks)

b). i). Average volume of solution D used

20.90 + 20.90

2 = 20.90cm3 (1 mark)

ii). Moles of hydrochloric acid in average volume of solution D used 1000cm3 of solution contains 0.258 moles of HCl

20.90cm3 of solution contains 0.258 x 20.90 moles

1000

= 0.0054 moles (1 mark)

iii). Moles of the metal carbonate, solid A in 25.0cm3 of solution A.

Mole ratio of acid to carbonate 2: 1 (1 mark)

½ x 0.0054

= 0.0027 moles (1 mark)

iv). The solubility of the metal carbonate in g/100g of solution

mass of carbonate = 0.0027 x 74

in 25.0cm3 of solution = 0.1998g

100g of solution will contain 0.1998 x 100g of carbonate

25

= 0.7992g/100g of solution (1 mark)

2. a).

**Observations**  **Inferences**

Colourless liquid hydrated salt/ compound or contains

Condenses on the cooler parts of test tube water of crystallization (Tied to

Gas produced forms white Colourless liquid forming after

fumes with fumes HCl. (2 marks) Or condensation

solid sublimes/forms a white sublimate Ammonia gas (NH4+ ) present ( tied to

white solid formed on the cooler parts gas forming with HCl

of the test tube

b). i).

**Observations** **Inferences**

White ppt. insoluble in Pb2+ or Al3+ Present (1 mark)

Excess aqueous ammonia (1 mark) Note: Ignore Mg2+  if mentioned as as present. Penalise ½ mark for each

Contradictory ion given to a max penalty of ½ mk.

ii).

**Observations** **Inferences**

No white ppt / No white solid Pb2+ absent

No white suspension No effervescence/ No bubbles or Al3+ present tied to white ppt Note: if a candidate mentions Pb2+ in

Rej. No observable change Place of Al3+  present credit ½

No ppt / change/reaction CO32- and SO3 absent Tied to no

No white substance Effervescence. (2 marks)

Colourless soln formed *NB. To award ‘Al3+ present it must have*

Soln remains colourless *been credited in b (i) ; To award*

No colour change *Pb2+ absent it must have been mentioned as present in b (i); Ignore mention of Ag+ absent*

iii).

**Observations**  **Inferences**

White ppt /solid/suspension - SO42- present which does not dissolve on boiling - If a candidate mentions Cl- without

giving SO42- present award ½ mark

*Penalise fully for any contradictory ion*

(1 mark) *Formulae of the ion must be given*

*correctly in all the above inferences. Rej ions given in words only (2 marks)*

3. a). **Observations** **Inferences**

White solid dissolves to F is a non polar compound

form a colourless solution (1 mark) (1 mark)

*Accept a colorless solution formed*

*Without mention of dissolve or soluble*

*For 1 mark*

*Forms a solution / clear solution without*

*Mention of dissolve or soluble for 1 mk*

1. **Observations**  **Inferences**

PH = 7 Neutral solution (1 mark) (1 mark)

*Note: Ignore mention of colour*  *Accpt: Soln neither acidic nor alkaline*

*of mixture; Reject pH range Rej basic used in place of alkaline*

ii).

**Observations**  **Inferences**

No effervescence/ No bubbles (1 mark) H+ absent

*Accept soln not acidic for ½ mk in the absence of H+ absent*

*Ignore R – COOH absent*

b). i). **Observations**  **Inferences**

Effervescence giving off a Carboxylic/alkanoic acid preset

Colourless solution formed Or – COOH present/ H+/ H3O+

*Accept Fizzing used in place of*

*Effervescence or bubbles for*

(1 mark) (1 mark)

1. **Observations**  **Inferences**

Does not turn green. Orange Alcohol absent / R - OH

Color of K2 Cr2 O7 (1 mark) Rej – OH (2 marks)

*Note both initial colour and*

*Final colour must be given*

*Otherwise penalize fully*

Accpt: Orange colour of

*K2Cr2O7 solution persists /*

*remains;*

Rej: Yellow used in place of

orange

iii).

**Observations**  **Inferences**

Bromine water not decolourised C = C / - C = C - absent

Accept yellow/ Orange / red Accept unsaturated organic compound absent

colour of bromine water persists for ½ mk. Penalise fully for any contradictory / functional groups

/ remains (1 mark) (1 mark)

**NOVEMBER 2010**

**MARKSCHEME**

Q1. Table 1………………………. 5 marks

a). Complete table …………………. 1 mark

**NOTE;** i). In case there was wrong arithmetic /substration in the table, use the correct values in averaging for the final answer.

ii). Where there are two possible average titles use the value which gives the candidates maximum credit.

iii). If wrong values are averaged, pick the correct values (if any) following the principles of averaging, average and award accordingly.

e.g. 1 S.V = 15.80cm3

Conditions values are 15.4cm3, 15,6cm3, 15.8cm3

Candidates working

Either 15.4 + 15.6 + 15.8

3

= 15.60cm3 (1 mark)

OR 15.4 + 15.6

2

= 15.5cm3 (1 mark)

Examiner to pick = 15.6 + 15.8 = 15.7cm3

1. (1 mark)

2 S.V = 15.50cm3

Candidates values are 15.8, 15.6, 15.6

Candidates working

15.6 + 15.6

2 = 15.6cm3 ½ mark

3 S.V = 15.90cm3

Candidate’s values are 16.0, 15.8, and 15.6

Candidates working

15.8 + 15.6

2 = 15.70cm3

*And award 1 mark instead of ½ mark if the candidates value are used*

CT – 1; D - 1; A – 1; PA – 1; FA - 1

**CALCULATIONS**

i). No. of moles of NaOH in 25cm3 of solution B = 2 x 25

1000

Moles of NaOH in 250cm3 of solution D = 2 x 25

1000

Hence Conc. of solution D = 2 x 25 x 1000

1. 250

= 0.200 mols

Or

Conc of solution D = 2 x 25 x 1000

1000 250

= 0.200 mol L

Or

Mc Vc = Md Vd = M1 V1 = M2 V2 /Mg Vg = Md Vd

Md (Or M2) or md = 2 x 25

100

Or

Conc of solution D = 2 x 1

10

= 0.200 mol-1

iii). Moles of NaOH in 25cm3 of solution D used

= Ans (II) x 25

1000

Moles of alkanoic acid used = 1/3 x ans (II) x 25

1000

Hence conc of solution C = 1/3 x ans (II) x 25 x 1000

1000 Titre

= correct ans.

OR

Conc of solution C = 1/3 x ans (II) x 25

Titre

= Correct ans.

OR

Ma Va = 1/3 = Ma = 1/3 x ans (II) x 25

MbVb Titre

= correct answer

iv). Molar mass of the alkanoic acid

= 25.0

Ans (III)

= Correct answer

Note: i). Penalise ½ mark for wrong transfer of ans (III) otherwise penalize fully for

strange figures used.

ii). Penalise ½ mark for wrong answer if arithmetic error is outside +5 units in the 1st d.p

iii). Penalise ½ mark for either omission of the (g) units or for wrong units used

**Procedure**

Table II………………………. 6 marks

GRAPH

a). Labelling of axes ………………………………………. ½ mark

to award the ½ mark both axes must by correctly labelled

Conditions

i). Penalise fully for wrong units used otherwise accept correct labeling even if no units are shown

ii). Penalise fully if only one axis is correctly labelled

iii). Change in temperature (∆T) must appear on the vertical axis and volume of solution A on horizontal axis, otherwise penalize fully for inverted Axes

iv). Reject labeling of axes if temperature alone is used instead of change in temperature (∆T) in vertical axis.

b). Scale …………………………………………………… ½ mark

i). Area covered by the actual plots must be at least 3 ½ big square (vertical axis) by 4 ½ big square (horizontal axis)

ii). The scale internal must be constant on each axis

iii). Scale chosen must be able to accommodate the plots, whether plotted or not (chalk the range of values on both axes)

NB: i). Penalise fully if any of the above conditions is not met

ii). Award for the scale even if the axes are in interchanged so long as the above conditions are met

c). Plotting ……………………………………………….. ½ mark

i). For 5 or 6 points plotted correctly award 1 mark

ii). If 4 or 3 points are correctly plotted award ½ mark

iii). For less than 3 points correctly plotted award 1 mark

iv). If the scale interval changes, make the plots (if any) in the first scale interval only. Consider the rest of the plots (If any) as wrong plots

v). Accept the correct plots even if the axis are inverted /interchanged

d). The line/shape…………………………………….. 1 mark

**Conditions**

i). Award ½ mark for straight line showing a risk

ii). Award another ½ mark for an extrapolated line showing a drop

NB: *Accept lines of best fit*

iii). If the axes, are interchanged /inverted reject the lines and the readings from the graph in (b) but accept the reading in subsequent workings in (c) and (d)

*Award 1 mark*

Volume of solution A (cm3)

∆T

iv). Accept any one of the following for ½ mark

*Award 1 mark*

Volume of solution A (cm3)

∆T

*Award 1 mark*

Volume of solution A (cm3)

∆T

*Award 1 mark*

Volume of solution A (cm3)

∆T

*Award 1 mark*

Volume of solution A (cm3)

∆T

b). Volume of solution A= Vcm3

NB:

i). Accept correct reading of V with or within showing on extrapolated graph for 1 mark

ii). If shown on the graph correctly but reading is wrong or not given award only ½ mark for correct showing on the graph

iii). Penalise ½ mark for wrong units otherwise ignore if units not given

iv). If value of V > 25cm3 reject and award

vi). Reject showing and reading of V from a wrong graph but accept in (c) below if need correct

c). Volume of B = 30 – Ans (b) above (30 –v)

correct ans.

NB; i). V of 30cm3 is unrealistic and unacceptable and hence penalize fully and

consequently. Reject working in both d (i) and d (ii) below and award o mark in each case

ii). Penalise ½ mark for wrong units and another ½ mark if working not shown

d). i). Ratio of volume A and B

= Ans (b); Ans (c)

Or

Ans (c); Ans (b)

= 1: 1

NB: If ratio is not 1: 1 penalise ½ mark but accept the ratio in d (ii) if used correctly

Moles of acid used = Moles of NaOH

Molarity of acid = 2 x Ans (c ) x 1000

1. Ans (b)

= corr. Ans

OR

Conc of solution A = 2 x Ans (c)

Ans b

= Correct Ans

OR

MA VA = MB VB

MA = 2 x Ans

Ans(b)

= Corr. Ans

**Conditions**

i). Accept answer tied correct arithmetic otherwise penalise ½ mark

for arithmetic error outside +2 marks in the 1st d.p

ii). Penalise ½ mark for wrong transfer of ans in (c) or (b) in both otherwise penalise fully for strange figure in either

NB: Penalise fully for any calculation noted beyond the expected ans.

|  |  |  |
| --- | --- | --- |
| 2 | **Observation** | **Inferences** |
| a (i) | White ppt | B2+Ca2+, Ba2+, If all the 3 given 2 marks  If only 2 given – 1 mark  If only 1 given – ½ mark  ***Note***: for any contradictory mark out of 1 ½ ,penalize ½ mark for any contradictory |
| ii) | White ppt which dissolves in excess.  reject residue  Suspension  Accept white solid | Pb2+, NB: Credit Pb2+ only if mention in (i) above, penalize fully for any contradiction |
| iii) | White PPt | -F contains SO42-, Cl-, SO32-, Cl-, or SO42-, Cl-,  SO32-, CO32-, 4 ions given – 1 mark  3 or 2 ions given – ½ mark  ions given – 0 mark  Penalties  Penalise fully if candidate E contains the above ions – penalize ½ mark for contradictory ions |
| iv) | Yellow PPt | Pb2+  Penalise fully for any contradictory ions |
| bi) | Burns with a smoky/sooty flame/sooty flame Accept – yellow sooty | - C=C- / -C=C-  Accept ; long chain hydrocarbon,  carbon; hydrogen ratio  *Penalise fully for any contradictory functional group.* |
| (ii) **I** | I pH is 1 or 3 accept red for ½ mk but reject inference given but reject inference given on its strength *Reject PH range, penalize*  *Fully for colour and correct*  *PH NB: If a wrong colour* | strongly acidic  Reject – acidic given alone  G – is a strong acid  ignore – carboxylic acid |
| **II** | KMnO4 decolourised  Or KMnO4 turns from  Purple to colourless  Reject  KMnO4 turns colourless  Solution turns colourless  Solution decolourised  Solution discolurised | - C = C- or – C = C-  R – OH ½  Reject the groups in words – OH  Penalise ½ mk for each contractor  functional group |
| iii | Effervescence /bubbles /fizzing odourless gas  odourless to differentiate between SO2 & CO2  *Reject ; Hissing*  *Odourless mentioned alone* | CO32- present in F (tied to part (a) (iii)  Ignore mention of acid  ii). Penalise fully for contradiction  iii).The inference is tied to effervescence  bubbles and odourless |

**NOVEMBER 2011**

**MARKSCHEME**

**Conditions (ii)**

1. Value 1.60 must be intact otherwise penalize fully
2. Ans. Should be at least 3 dec. place
3. Penalise ½ mark for arithmetic error if outside + 2 units in the 3rd depth
4. Units may not be given but if given must be correct penalize ½ mark for errors units used

|  |  |  |  |
| --- | --- | --- | --- |
|  | **1** | **2** | **3** |
| Final burette reading | 29.70 | 33.40 | 44.60 |
| Initial burette reading | 0.00 | 4.00 | 15.30 |
| Volume of solution A used (cm3) | 29.70 | 29.40 | 29.30 |

ii). **Concentration in moles per litre of the dibasic acid in solution A**

Relative molecular mass of A is 126.

1.60 x 1000 1.60 1.60 x 1000 1.60 x 4

250 = 6.4 126 = 0.0127 126 126 126

6.4 moles in a litre = 0.051M

126 = 0.05 0.0127 x 1000

250

= 4 x 0.00127

= 0.051

2 marks

iii). Moles of the dibasic acid used;

Answer in (ii) above x litre

1000

= correct answer 1 mark

iv). Moles of sodium, hydroxide in 25.0cm3 of solution C

Ans in (iii) above x 2

=correct answer

1 mark

v). Concentration of sodium hydroxide in moles per litre

Answer (iv) above x 1000 Answer (iv) above x 40

25

Correct answer Or Mb = Ans (iv) above x titre x 2

25

Correct answer

Or Ans (iv) x titre

Mb x 25

= Correct answer

**i). Calculate the;**

i). Average volume of solution A used;

|  |  |  |
| --- | --- | --- |
|  | **1st Conical flask** | **2nd Conical Flask** |
| Final burette reading | 21.20 | 33.60 |
| Initial burette reading | 9.70 | 21.20 |
| Volume of solution A used (cm3) | 11.50 | 11.40 |

ii). Moles of the dibasic acid used:

Ans (ii) procedure II x titre (table 2)

1000

= Correct ans

1 mark

iii). Moles of sodium hydroxide that reacted with the dibasic acid

= Ans (ii) above x 2

= Correct ans

1 mark

iv). Moles of sodium hydroxide that reacted with 25.0cm3 of salt B in solution B;

=Ans (iv) procedure II = Ans (iii) above

=Correct ans.

2 marks

v). **Given that I mole of salt B reacts with 2 moles of sodium hydroxide, calculate the;**

I. Number of moles of salt B in 25.0cm3 of solution B

Ans (iv) above

2

Correct ans

1 mark

II. Concentration in moles per litre of salt B in solution B

Ans I above x 1000

25

Ans I above x 40

= Correct ans

1 mark

III. Relative molecular mass of salt B;

= 4.75

Ans in II above

= Correct answer > and > 140 penalise ½ mark for ans

2. a).i). **Observation Inferences**

Gas that turns moist litmus paper NH4+ present (tied to red litmus

Blue given off turning blue)

Condenses on the cooler parts of Solid D is hydrated /Solid D

The tube to form colourless liquid contains water of crystallisation

Droplets (tied to idea of condensation)

White sublimate formed solid

Sublimes to form white sublimate

A gas given off that turns moist blue

Litmus paper red

A brown residue /solid formed

*NB: Ignore mention of any other ions present*

**ii). Observations Inferences**

Yellow /brown solution formed Fe2+ oxidized to Fe3+

On addition of H2 O2 solution or

Brown ppt formed which is in soluble Fe3+ formed

In excess NaOH solution NB: ignore Accept Fe3+ present in

Mention of initial colour of solution mixture of Fe2+ in

unless It contradictory solution

*NB: Reject Fe3+ present /solid or solution D contains Fe3+*

**b).** i). **Observations Inferences**

A white ppt formed SO42-, SO32- CO32- present

*NB: Penalise ½ mark for each contradictory ions for a max of ( 1 ½ mark)*

ii). To the mixture obtained in (i) above, add about 5 cm3 of 2M nitric acid (V) acid

**Observations Inferences**

Effervesces occurs /bubbles of SO32- presents

Gas seen

The white ppt dissolves disappears *NB: credit only if correctly inferred*

*Correct inference tied to either observation or both*

*Penalise ½ mark for each contrition to a max of 1 mark*

*Ignore SO42 mentioned as absent*

iii). To portion two of solution E in a test-tube, add 2 drops of acidified potassium dichromate (VI) and warm the mixture

**Observations Inferences**

Acidified K2Cr2O7 solution SO32- presents

Changes from orange to green *NB: credit only if correctly inferred*

*Correct inference tied to either observation or both*

*Penalise ½ mark for each contrition to a max of 1 mark*

*Ignore SO42 mentioned as absent*

3 **a). Observations inferences**

Burns with a blue flame Reject C = C / C C absent

Saturated organic compound/organic

Compound with low C: H ratio

Absence of unsaturated organic compound

Ignore R-OH if mentioned

**b). Observations Inferences**

No of effervescence /No bubbles Absence of H+ or liquid is not acidic

/No of fizzing

Ignore does not dissolved Absence of R- COOH

No reaction Ignore H3O+ if mentioned

Reject: No hissing on it’s own

c). **Observations Inferences**

K2Cr2O7 changes from orange to R - OH

green/solution changes from orange Reject; 1 – alcohol written in

to green words 2-OH

Reject: soln turns green, NB: Penalise fully for any contradicting functional groups

**NOVEMBER 2012**

**MARKSCHEME**

1. **Question I – Procedure**

**a). i). Moles of Sodium thiosulphate (Solution B)**

0.05 x Average titre

1000

= Correct answer

**Conditions**

b). i). Moles of solution A in 25.0cm3

Moles ratio moles of A : Moles of Na2S2O3 . 5H2O

1 : 6

Moles of A = 1

Moles of Na2SO3 SH2O

Moles of A = ans a (ii) moles

6 = Correct answer

ii). Concentration of A in moles per litre

25cm3 of A contains ans b(i) above

1000 cm3 of A contains

Ans b(i) x 1000

25

= correct answer

OR

Ans b(i) x 40

= Correct answer

OR MA VA = 1

MB VB 6

MA = 0.05 x Average titre

6 x 25

= Correct answer

OR

Answer (b) (i) x 1000 = Correct answer

25

**Conditions**

a). Penalise ½ mark fro wrong transfer of ans b(ii) or average titre otherwise

penalise fully for strange figure

b). Answer must be given to at least 3 d.p unless it works out exactly to less than 3

d.p otherwise penalise ½ mark

c). Penalise ½ mark for answer if arithmetic error is outside +2 units in the 3rd d.p

d). Units may not be given but if given must be correct otherwise penalise ½ mark

for wrong units used

e). When formula is wrongly given in the formula method penalise fully

**NB:** *Penalise ½ mark for the answers in calculation a (i) and b (ii) if*

*candidate work beyond the expected answer*

**PROCEDURE II**

**Table 2 – 6 marks**

**Distribution of marks**

Complete table …………………………………………. (3 marks)

1. **ACCURACY**

Compare the candidates 1st time reading to the S.V if within +2s award 1mk otherwise penalise fully

***Note:***

i). The S.V is the teacher first time reading

ii). Put a tick (√ ) on the candidate value if right

1. **TREND (Tied to the time row)**

Award (1 mark) for time reading increasing continuously otherwise penalise fully

**Graph**

1. **Labelling**

Conditions

i). Accept labeling even if no units are shown, otherwise penalise fully if wrong units are shown

ii). Penalise fully for inverted axis

iii). Penalise fully if only one axis is correctly labeled

1. **Scale**

i). Area covered by the actual plots (including the origin) must be at least 4 x 4 large squares ( ½ the grid) otherwise penalise fully

ii). The scale internal must be consistent on each axis

iii). The scale chosen must accommodate all the plots

***Note:***

Penalise fully if any of the above is not met

Award for the scale even if the axis are inverted

**C. Plotting**

**Conditions**

If 5 or 6 points are correctly plotted ………………. (1 mark)

If 3 or 4 points are correctly plotted ………… (½ mark)

If less than 3 points …………………………… (0 marks)

**D. Line**

Accept a straight line passing through at least 2 points correctly plotted and through the origin on extrapolation otherwise penalise fully

**Calculations**

i). For correct showing of i/t  on the graph ½ mark

ii). For stating the correct reading

e.g R = 0.003

iii). For t = 1/correct value

v). Correct value ½ (Must have units)

**Conditions**

i). Accept correct readings without showing

ii). Award ½ mark for showing on the graph and 1 mark. If applied correctly in the expression and ½ mark for the answer

iii). Answer must be at at least 1 d.p or whole no (if it works out) otherwise penalise

iv). Allow showing of reading for the candidates graph irrespective of the line as long as the scale is correct(Intervals)

v). Award where not shown not stated but correct reading if done for him/her (do it)

**Penalise**

*Penalise ½ mark for W.A if the answer is not within +2 units in the 1st d.p*

*Correct units must be shown otherwise penalise ½ mark*

**2. a).i). I). Observations Inferences**

A white precipitate Presence of Pb2+, Ba2+, Ca2+

Only 2 – ½ mark

Penalise ½ mark for each contradictory ion

**II). Observations Inferences**

No white ppt Presence of Ba2+, Ca2+

Pb2+ absent ½ where the above

Not mentioned penalise ½ mark for each contradictory ions

**III). Observations Inferences**

No white precipitate Cl- absent

Penalise fully for any contradictory ion

Ignore mention of S042-, SO32 of CO32- as absent

ii). **Observations**

Effervescence/bubbled Solid contain NO3

Colourless gas/pungent choking (Tied to red litmus turning blue)

Smell

Red Litmus – blue

Blue – remains blue

3. a). **Observations Inferences**

No effervescence/no bubbles Solid F is not acidic

No fizzing OR

Absence of H+/H30+

b). i). **Observations Inferences**

Burns with a sooty flame Unsaturated /long chain /high C-H organic cpd organic cpds ratio present

Smoky flame or luminous Flame / Carbon –carbon double/triple

Yellow flame bond written in words or aromatic cpds

ii). **Observations Inferences**

White suspensions Compound is slightly soluble

Or Or

White solid remains undissolved Cpd is partially soluble

or

cpd is insoluble/cpd is nonpolar

c). i). **Observations Inferences**

Effervescence /Bubbles /fizzing The mixture is acidic

Or Or

Accept colorless gas given off RCOOH or H+/H3O present

ii). **Observations Inferences**

Bromine water is not decolourised Carbon – carbon double/triple

Or bond absent

Yellow/orange/brown/red Or

Remains persists Compound is saturated

Bromine water remain yellow

**NOVEMBER 2013**

**MARKSCHEME**

**Procedure I.**

**Table 1.**

I. Complete table (All readings recorded) ……….

i). Penalise ½ mark once for any space not filled, subject to at least 4 readings beings given otherwise penalize

ii). Penalise ½ mark for unrealistic temperature reading either below 100C or more than 400C at t=0

iii). Penalise ½ mark for temperature reading, they should all be constant from t=0 to t=7

iv). If two or more rows of temperature readings are given, penalize ½ mark for complete table based on the rows used to plot the graph. However if the graph is not drawn then mark the first rows of the temperature reading.

v). If two or more graphs are plotted, mark the complete table based on the first row.

II. Use of decimals (tied to at least two readings) accept the temperature reading for ½ mark only if consistently given as either 1 o

i). Whole number ii). 1 decimal point of either ‘0’ or ‘5’

Otherwise penalize fully

III. Accuracy…………………………….

Compare the candidate temperature reading at t=0 with the school value (S.V) and award ½ mark. If the reading is within +2C of the S.V otherwise penalize fully

Trend …..

*Awarded as follows;*

i). ½ mark for continuous rise upto the maximum

ii). 2nd ½ mark for temperature being either content at maximum or constant followed by a continuous drop or continuous drop after maximum.

**Graph……**

**Distribution as follows.**

**I. correct labeling of both axes ………………………..**

**Penalties**

i). Penalise fully for inverted axes

ii). Penalise fully for wrong units used other ignore if units are omitted

iii). Penalise fully if only one axis labeled

**II. Scale……………………………………………….**

i). Area covered by plot should be atleast half of grid provided i.e 4 ½ by 3

ii). Scale interval should be consistent each axis

iii). All plots/points whether plotted or not (check the range of reading on the note. Penalise fully if any of the above conditions is not met

**III. Plotting……………………………..**

**Conditions**

i). If 8 or 7 correctly plotted ………

ii). If only 6 to 4 points correctly plotting

iii). If less than 4 points correctly plotted ….

Note:

i). If the scale interval changes mark plots if any within the first scale interval and the first as wrong

ii). Accept correct plots even if the axes are inverted and award accordingly

iii). Mark all plots on the graph to verify the award

**IV. Line/Shape………….**

i). Accept 2 straight lines intersecting on extrapolation for ……………….

ii). Accept 2 straight lines not extrapolated whether joined or not for…

iii). Accept 1st line of best fit only if it passes through the initial temperature the following are the versions accepted even if the axes are inverted.

Time

Temperature

Time

Temperature

Time

Temperature

Time

Temperature

Time

Temperature

Time

Temperature

**Highest change in temperature, OT.**

I. i). Accept correct value of OT from correctly extrapolated graph

with/without showing ………. Provided 1st line passes through the plot at t=0 i.e limited temperature.

ii). Award ½ mark for correct showing on a correctly DT value is wrong or missing

iii). Award 0 max for DT stated from a wrong graph

Note: a). Ignore +ve or –ve sign on the DT value

b). Penalise ½ mark for wrong units otherwise ignore if omitted

II. Time taken for reaction to be completed

Accept correct time reading from correctly extrapolated with or without showing for ….

If wrong units of time are given penalize fully, otherwise ignore omission of units

**Conditions**

i). Ignore the formula for working DH, but if given MUST be correct otherwise penalize ½ mark where wrong formula is given

ii). Penalise ½ mark for wrong units or omission of units on the answer

iii). Accept correct transfer of DT even if rejected in a(iii) I above

iv). Penalise ½ mark for wrong arithmetic on answer if it is outside + 200 joules or + 0.2 KJ

iv). Ignore if no sign is given on the answer otherwise penalize ½ mark for positive sign (+)

**Procedure II**

**Table 2 …………………….**

**A. Complete table ………………………**

**Conditions**

i). Complete table with 3 titrations done

ii). Incomplete table with 2 titrations done ……..

iii). Incomplete table with only one titration ……………….

**Penalties**

i). Wrong arithmetric when determining the titre values

ii). Inverted tables

iii). Burette readings beyond 50ml unless explaining

iv). Unrealistic titre values below 1 ml or in hundreds

v). Penalise ½ mark for each to a maximum of ½ mark

**B. TABLE 2 ………………………**

**Use of decimals …. Tied to 1st row and 2nd row only**

**Conditions**

i). Accept 1 dp or 2 dp used consistently; otherwise penalize fully

ii). If 2 dpts are used the second decimal value must be ‘O’ or ‘S’ otherwise penalize fully

iii). Accept inconstancy in the use of zero’s used as initial burette reading i.e o,0.0 0.00

**C. Accuracy (Tied to correct titre value …..**

Compare the candidate’s titre values with the S.V and award marks as follows

i). If at least one is within +0.1 of S.V award …

ii). If none is within + 0.1 but at least one is within + 0.2 of S.V award

iii). If no value is within +0.2 award 0 marks

**Note:**

**If there is;**

i). wrong arithmetic or subtraction in the table, then compare the worked out.

Correct value and award accordingly.

ii). Where there are two possible S.V’s from the Teacher’s results, indicate both values on the script and use one which is closer to the candidate value to award for accuracy and final answer

iii). If no S.V is given or can’t be worked out from teacher’s value as per principles of averaging

a). All candidates correct average tutors should be written down and close values picked for averaging per session

b). If candidates average values are too varied ignore them and use KNEC value

**Compare the candidate’s average titre with S.V**

i). If within +0.1 of S.V award

ii). If not within + 0.1, but within + 0.2 of S.V award….. ½ mark

iii). If not within + 0.2 of S.V award …………… 0 mark

**Note;**

i). If there are 2 possible average titre values use the one that is closer to the S.V and credit accordingly

ii). if wrong litre values are averages by candidates, pick correct values (if any) average them and award accordingly

b). i). Moles of MnO4- = 0.02 x AV. Titre

1000

=Correct Ans.

ii). Moles of FE2+ in 25cm3

Fe2+ : Mn04- = 5: 1

= 5 x Ans b(i) above

= Correct Ans.

iii). Moles of iron (i) ions in 250cm3 = Ans b(ii) x 250cm3

25cm3

Or Ans b(ii) x 10

= Correct Ans

**D. PRINCIPLES OF AVERAGING**

**Conditions**

i). If 3 consistent values averaged …..

ii). If 3 titrations done, but only2 are consistent and averaged

iii). If only 2 titrations done, are consistent and averaged

iv). If 3 titrations done, but are inconsistent are averaged……

v). If 3 titrations done, and all can be averaged but only 2 are averaged

vi). If only 2 titrations are done, are inconsistent and averaged ….

**Penalties**

i). Penalise ½ mark for wrong arithmetic if the error is outside +2 units in the 2nd d.p

ii). Penalise ½ mark for no working shown but correct answer is written

/stated

iii). If wrong answer is stated with no working

iv). If wrong working shown with correct answer however accept

**Note:**

i). Accept rounding off/truncation of answer to 2d.p e.g 17.666 = 17.67 or

17.66

Otherwise penalize rounding off to 1 dp or to a whole number

ii). Accept answer if it works out exactly to 1 d.p or to a whole number

**E. FINAL ACCURACY *(Tied to correct average titre)***

**Penalties/Conditions**

i). Penalise ½ mark for wrong units used in part b(i)- b(ii) otherwise ignore omission of units

ii). Penalise ½ mark for wrong transfer in b(i) – b(ii) otherwise penalize fully for strange figure in each case

iii). Answer in b(i)- b(iii) should be at least unless it works out exactly to less than 4 d.ps otherwise penalize ½ mark on the answer

iv). Penalise ½ mark for wrong arithmetic in ans b(i) if the error on the answer is outside 2 units in the 5th d.p

v). Answer in b(ii) – b(iii) must be as expected, otherwise penalize ½ mark on the answer

**C. Molar heat of displacement of CU2+ ions**

CU2+: Fe = 1:1

= Ans a(iii)

b(iii)

= correct ans.

**Penalties/conditions**

i). Penalise ½ mark for wrong transfer of either a(iii) or b(iii) otherwise penalize fully for strange figure

ii). Penalise 1 mark for arithmetic error outside 200 units of expected answer if the answer is in joules or outside 0.2 units if answer is in k

iii). Penalise ½ mark on correct answer if either the correct sign (-ve) or correct unit is missing or both are wrong/missing

iv). Penalise fully for unrealistic answer i.e beyond 200 KJ/mole or 200,000 J/Mole

**Note:**

For continued working, mark only the 1st correct areas.

**1. Procedure I.**

a). i).

ii). I). extrapolated graph

showing/without showing 1 mark

II). from extrapolated graph – wrongly stated but shown on the

graph ½ mark

iii). DH = MCDT

= 50 x 4.2 x DT

= Correct answer Joules J.j

Or = 50 x 4.2 x D.J

1000

= Correct answer (Kilo joules K.J)

-Ignore formula for working DH. Given must be correct otherwise penalize ½ mark for wrong formula.

- Penalise ½ mark for wrong units or omission

-Ignore if no sign is given otherwise if no sign is given otherwise penalize ½ markf or (+) sign

1 ½ mark

**2. Procedure II.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution C used (cm3) |  |  |  |

4 marks

a). 1 + 11 + 1

3 = ans

1 mark

i).

|  |  |
| --- | --- |
| Observations | Inferences |
| -Colourless  -Odourless gas produced  -Gas extinguishes a burning splint  -White residue or solid turns yellow when heated and turns white on cooling  (1 mark) | -CO3 2- (Extinguishes burning splint)  -Zn2+/ZnO formed (turned to white on cooling )  (1 mark) |

*Award ½ mark upto a maximum of 1 mark*

*Penalise ½ mark for each contradictory low in each case*

*Reject; ZnO present.*

ii).

|  |  |
| --- | --- |
| Observations | Inferences |
| -Colourless  -Odourless gas produced  -Gas extinguishes a burning splint  -White residue /solid turns yellow when heated and turns white on cooking  (1 mark) | -CO3 2- present  Penalize fully for any contradictory ion  Zn2+ present  (1 mark) |

*Reject ; Hissing /Fizzing*

iii).

|  |  |
| --- | --- |
| Observations | Inferences |
| -White ppt  -soluble in excess (1 mark) | -Zn2+/Zno formed (turned to white )  (1 mark) |

*Penalise fully for contradictory ions*

b). i).

|  |  |
| --- | --- |
| Observations | Inferences |
| -White ppt  -ignore if ppt is insoluble in excess  (1 mark) | -Al3+, Pb2+, Mg2+ present  Note  (1 mark) |

*Penalize fully for ppt dissolves*

ii).

|  |  |
| --- | --- |
| Observations | Inferences |
| - No effervescence  -No white ppt    (1 mark) | -CO32-, SO32- absent  (both ½ mark)  -Al3+, Mg2+ present  (1 mark) |

*Accept : No ppt*

*½ mark – colourless solution formed*

* *Solution remains colourless*

iii).

|  |  |
| --- | --- |
| Observations | Inferences |
| -White ppt formed  -penalise fully if ppt dissolves  (1 mark) | -Pb2+ ions absent penalized ½ mark for any contradictory ion  SO42- present  (1 mark) |

*Penalise fully for any contradictions ions*

*Accept if ions are written in words*

3. a).

|  |  |
| --- | --- |
| Observations | Inferences |
| - melts and burns with a sooty/luminous / yellow smoky flame  (1 mark) | -‘C=C’/ C=C-  -Organic compound with high C;L  -Long chain organic compound  - Unsaturated organic  (1 mark) |

*Melts on its own for ½ mark*

*Carbon – carbon dissolves*

*C=C/C=C*

*Alkalines/alkynes*

*Long chain hydrocarbon*

**Note:**

*Penalise fully for any contradictory ion*

b). i).

|  |  |
| --- | --- |
| Observations | Inferences |
| -KMNO4/H+ is not decolouress colour of KMN04/H+ remains purple/purple colour of KMNO4/H+ persists or remains the same   1. mark) | -H+/H3O+ or 4 – COOH or carboxyli growing in words/solutions in acidic  1 mark |

*Saturated organic compound present for ½ mark*

|  |  |
| --- | --- |
| Observations | Inferences |
| -Effervescence /bubbles /fizzing  (1 mark) | - H+/H3O+ or 4 –COOH or carboxyli growing in words /solution is acidic (1 mark) |

*Accept : Colourless gas for ½ mark*

*Reject : Hissing/fizzling*

c).

|  |  |
| --- | --- |
| Observations | Inferences |
| -Dip the p H /universal paper into the solution from (b) above  -match the colour obtained with the p H chart and not the p H= 1 or 2  (1mark) | -Solution is strongly acidic  (1 mark) |

*Reject: p H range ( p H = 1 -2)*

**CONFIDENTIAL AND PREPARATION INSTRUCTIONS TO SCHOOLS**

**October - November 1989**

**Instructions to Schools.**

This is information that enables the Head of the school and the teacher in charge of Chemistry to make adequate preparations for Chemistry Practical Examination.

In addition to the fittings and substances ordinarily contained in a chemical laboratory, the following should be provided.

**Requirements per Candidate**

**Each candidate will require the following:**

* About 75cm3 of solution **W9**
* About 150cm3 of solution **W11 (oxallic acid)**
* About 1g of solid **Y**
* About 10cm of metal **M (magnesium ribbon)**
* 1 pipette of 25.0cm3
* 3 conical flasks
* 1 burette
* 1 measuring cylinder of 100cm3
* 1 beaker of 250cm3
* Tissue paper
* 1 boiling tube
* 1 thermometer (accuracy 0.50C)
* 1 ruler
* 1 spatula
* 5 test-tubes
* A sharp blade or pair of scissors
* A small funnel

**Access to**

* 250cm3 of distilled water
* Dilute hydrochloric acid
* Phenolphthalein indicator
* Dilute sodium hydroxide
* Aqueous ammonia

**Preparations**

1. Solution W9 is made by dissolving 90cm3 of concentrated hydrochloric acid in distilled water and making it to one litre of solution. This solution MUST be supplied in a burette placed at a central position where it should be accessible to 5 to 10 candidates.
2. Solution W11 is made by dissolving 6.30g of solid W11 in distilled water and making it up to one litre of solution.
3. Solution W12 is made by dissolving 3.20g of sodium hydroxide pellets in distilled water and making it up to one litre of solution.
4. Metal M should be cleaned with sand-paper the day before the examination.

**October /November 1990.**

**Requirements for Candidates**

In addition to the fittings, substances and apparatus ordinarily found in a chemistry laboratory each candidate will require the following;

* Between 1.0g and 1.5g of solid D,
* About 250cm3 of solution S1, (Sodium hydroxide)
* About 150cm3 of solution S1,
* About 1.0g of solid Q
* About 400cm3 of distilled water
* One burette
* One 25cm3 of pipette
* One 10cm3 pipette
* One 100cm3 measuring cylinder
* One filter funnel
* One filter paper
* conical flasks (250cm3)
* One thermometer (0-100C – 0-1100C)
* One crucible or crucible lid or a metallic spatula
* One spatula
* One test tube holder
* test tubes
* Two boiling tubes
* One dropper

**Access to:**

* Phenolphthalein indicator
* pH paper (range 1-14)
* Solid sodium hydrogen carbonate
* 1% potassium manganate (VII) solution
* 1% bromine water
* Burner
* Concentrated sulphuric acid supplied with a dropper pipette
* About 6cm3 of ethanol

**Preparations**

(i) Solids D and Q will be provided by the Kenya National Examinations Council.

(ii) Preparations of solution S1:

I). Dissolves 4.0g of sodium hydroxide in distilled water and make it up to one litre of solution

II). Take 200cm3 of the sodium hydroxide solution prepared in (i) above and dilute with distilled water to make up one litre of solution (SI)

(iii) Preparation of solution S2:

I) Dissolve 56cm3 of concentrated sulphuric acid in about 500cm3 of distilled water.

II). Take 10cm3 of the sulphuric acid solution prepared in (i) above and dilute it by adding distilled water to make it up to one litre of solution (S2).

**October / November 1992**

**Requirements for Candidates**

**In addition to fittings and apparatus found in a chemistry laboratory, each candidate will require:**

* 60cm3 of solution C2,
* 100cm3 of solution C3
* 150cm3 of solution C5
* 150cm3 of solution C6
* About 1g of solid C7
* One, 50cm3 burette
* One, 100cm3 beaker
* One, 25cm3 (or 20cm3 ) pipette,
* One, 10cm3 measuring cylinder
* Three, 250cm3 conical flasks
* Seven, clean dry test-tubes placed in a rack
* One, stop watch / stop clock,
* One, boiling tube
* One, spatula.

**Access to:**

* Methyl orange indicator solution,
* 0.5M lead nitrate solution
* 0.5M barium chloride solution
* About 10cm3 of solution C4
* Dilute sulphuric acid
* Dilute sodium hydroxide solution,
* Source of heat (Bunsen burner)
* 300cm3 of distilled water
* Note: all the solutions should be freshly prepared and supplied accompanied by droppers.

**Preparations**

1. Solution C2 is prepared by dissolving 2g of solid C2 in distilled water and making it up to one litre
2. Solution C3 is prepared by dissolving 0.40g of solid C3 in about 200cm3 of distilled water, adding 20cm3 of 1M sulphuric acid, shaking well and making it up to one litre with distilled water.
3. Solution C4 is prepared by placing 1.0g of solid C4 in 100cm3 beaker, adding 2cm3 of distilled water to make a paste and pouring the paste into 100cm3 of boiling distilled water, boiling the mixture for about one minute and allowing it to cool. Solution C4 is to be prepared on the morning of the examination.
4. Solution C5 is peppered by adding 10cm3 of concentrated hydrochloric acid (specific gravity of 1.18 or 1.9) in 500cm3 of distilled water and making it up to one litre.
5. Solution C6 is prepared by dissolving 19.2 of solid C6 in about 500cm3 of warm distilled water, cooling the solution, transferring it into a volumetric flask and making it up to one litre with distilled water.

**October /November 1993**

**Requirements for Candidates**

In addition to the equipments, apparatus and chemicals found in an ordinary chemistry laboratory, each candidate will require the following;

* 75cm3 of solution A
* 1.0cm3 of solid B
* 200cm3 of solution C
* About 1g of solid F
* One, 50cm3 burette
* One 25cm3 pipette
* Five 25cm3 conical flasks
* One, 100 cm3 measuring cylinder
* One, filter funnel
* Six, test tubes
* One, spatula
* One boiling tube
* One filter paper cut into small strips of about 1cm and at least 5cm long

**Access to:**

* Phenolphthalein indicator
* About 500cm3 of distilled water
* 0.05M iodine solution
* 2 M hydrochloric acid solution
* 2M sodium hydroxide solution
* 0.24M barium dichromate solution
* A wall clock placed in a position visible for all candidates
* Two labels

**Preparations**

i). Solution A is prepared by dissolving 40g of sodium hydroxide pellets in about 500cm3 of distilled water then making it up to one litre of solution

ii). Solution C is prepared by dissolving 9.7g of solid C in about 500cm3 of distilled water and making it up to one litre of solution

iii). The 1.0g solid B should be weighed accurately for each candidate and supplied in a dry weighing bottle or test tube or any other small dry container

iv). 0.05M iodine solution is prepared by dissolving 20g of potassium iodide crystals in 600cm3 of water then adding 12.7g of iodide crystals dissolving and making it up to one litre solution

**October / November 1994**

**Requirements for Candidates.**

In addition to fittings and apparatus found in a chemistry laboratory, each candidate will require.

* 200cm3 of solution D
* 150cm3 of solution E
* 50cm3 of solution F
* 50cm3 of solution G
* About 1.5g of solid H
* One, 50cm3 burette
* One, 100cm3 beaker
* One, 10cm3 measuring cylinder
* One 100cm3 measuring cylinder
* One 25cm3 (or 20cm3 ) pipette
* Three, 250cm3 conical flasks
* Eight, clean dry test-tubes.
* One thermometer (-100C to 1100C
* One metallic spatula
* About 0.5g of solids - Sodium chloride
  + - Potassium chloride
    - Calcium chloride
* One boiling tube
* Stirring rod
* About 1g of steel wool

**Access to.**

* Phenolphthalein indicator
* 2M sodium hydroxide.
* 2M aqueous ammonia
* 2M sodium chloride
* Bunsen burner (heat source)
* Distilled water
* Each of the above solutions should be supplied with a dropper.

**Preparations**

1. Solution D is prepared by dissolving 8.0g of sodium hydroxide pellets in distilled water and making it up to one litre.
2. Solution E is prepared by dissolving 19.2g of solid E in distilled water and making it up to one litre.
3. Solution F is prepared by dissolving 40.0g of sodium hydroxide pellets in distilled water and top it up to one litre.
4. Solution G is prepared by dissolving 79.4g of solid G in distilled water and making it up to one litre.

**October /November 1995**

**Requirements for Candidates**

In addition to the equipment, apparatus and chemicals found in an ordinary chemistry laboratory, each candidate will require the following;

* 2.0g of solid J, weighed accurately
* 1.0g of solid K, weighed accurately
* About 0.2g of solid L
* About 0.8g of solid N
* 100cm3 of 2.0M hydrochloric acid
* One, 50cm3 burette
* One, thermometer
* One, stopwatch/stopclock/watch with a second hand
* One, 100cm3 beaker
* Two pieces of aluminium foil (2cm3 each)
* Six test-tubes
* Two wooden splints
* Three blue and three red litmus papers
* One metallic spatula
* One boiling tube
* One 10cm3 measuring cylinder
* One glass rod

**Access to:**

* About 500cm3 of distilled water
* 2.0M hydrochloric acid (labeled as dilute)
* 2.0M sodium hydroxide (labeled as dilute)
* Bunsen burner
* About 50cm3 of 0.1M lead nitrate solution

**Preparations**

The 2.0M hydrochloric acid should be prepared accurately by adding 175cm3 of concentrated

hydrochloric acid to about 700cm3 of distilled water. Shake well and make it up to the one litre

**October /November 1996**

**Candidates requirements**

In addition to the apparatus and chemicals found in an ordinary Chemistry laboratory, each candidate will require the following:

* 150cm3 of solution A
* 100cm3 of solution B
* 100cm3 of solution C
* One 50cm3 burette
* One 25cm3 pipette
* One thermometer (00C to 1000C)
* One filter funnel
* About 0.5g of solid D
* Six clean dry test-tubes on a test-tube rack
* Two boiling tubes
* One metallic spatula
* Two filter papers
* Wooden splint
* Four red and four blue litmus papers
* One teat pipette dropper
* About 0.5g of solid E
* About half a spatula full of solid sodium hydrogen carbonate
* One conical flask

**Access to**

* Bunsen burner
* About 500cm3 of distilled water
* 20 volume hydrogen peroxide
* 2M sodium hydroxide
* 6M hydrochloric acid
* Concentrated sulphuric acid
* Ethanol

***NB:*** Each of the above reagents should be supplied with a dropper.

**Preparations**

i). Solution A is prepared by dissolving 3.16g of solid A in 400cm3 of 2M sulphuric acid and making it up to one litre of solution with distilled water.

ii). Solution B is prepared by dissolving 23.5g of solid B in 200cm3 of 2M sulphuric acid and making it up to one litre of solution with distilled water. This solution should be prepared in the morning of the examination.

iii). Solution C is prepared by dissolving 5.0g of solid C in 600cm3 of distilled water and making it up to one litre of solution with the distilled water

**October / November 1997**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

**A**

* 120cm3 of solution F, sulphuric acid.
  + 100cm3 of solution G, 0.5M sodium hydroxide
  + 0.2g of solid H weighed accurately – mg
  + One 50cm3 burette
  + One 25.0cm3 pipette
  + One 100cm3 measuring cylinder
  + One 100cm3 beaker
  + Two conical flasks
  + One thermometer 00C – 1100C
  + One 250cm3 beaker
  + One label
  + One stopwatch/ stopclock or a watch with seconds hand
  + About 0.5g of solid L
  + 6 clean dry test-tubes
  + One wooden splint
  + One filter funnel
  + One spatula
  + Two blue and two red litmus papers
  + About 0.5g of solid M
  + About 0.5g of sodium carbonate
  + One boiling tube
  + One test-tube holder
  + One filter paper.

1. Access to.

* Concentrated nitric acid
* 2M sulphuric acid
* 2M NaOH
* Phenolphthalein indicator
* 2M aqueous ammonia
* 1% Bromine water
* Acidified potassium permanganate
* Distilled water in a wash bottle
* Bunsen burner

NB/ Each of the solutions in Bottle should be supplied with a dropper.

**Preparations**

1. Solution F is prepared by accurately adding 27.8cm3 of con. H2SO4 (s.g. 1.84) to about 400cm3 of distilled H2O then making it to one litre of solution.
2. Solution G is prepared by dissolving 10.0g of NaOH pellets in 600cm3  of distilled H2O then making it to one litre of solution
3. Acidified potassium permanganate is prepared by dissolving 31.6g of solid KMnO4 in 400cm3 of 1M H2SO4 acid and making it to one litre of solution.
4. 1% Bromine water is prepared by adding 1cm3 (CARE) of liquid Bromine to 100cm3 of distilled H2O in a fume cupboard and shaking thoroughly

**October / November 1998**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

* 250cm3 of hydrochloric acid, solution M.
* 150cm3 of sodium hydroxide, solution N
* 0.50g of solid P weighed accurately
* Burette 0 – 50cm3
* Pipette 25cm3

**Means of labeling.**

* 100cm3 measuring cylinder
* 250cm3 beaker
* Two conical flasks
* About 0.3g of solid L
* Six dry test-tubes
* 2 red and 2 blue litmus papers
* 2 boiling tubes
* One wooden splint
* Filter paper
* Filter funnel
* About 0.2g of Na2CO3
* about 0.3g of solid S
* A spatula
* A test-tube holder.

**Access to:**

* 10cm3 measuring cylinder
* Distilled water
* Universal indicator solution supplied with a dropper
* pH chart
* 2M hydrochloric acid supplied with a dropper
* 2M aqueous ammonia supplied with a dropper
* Wall clock
* 2M aqueous sodium hydroxide supplied with a dropper
* 0.2M barium chloride supplied with a dropper
* Bunsen burner
* 1M lead(II) nitrate solution supplied with a dropper
* Screened methyl orange indicator supplied with a dropper.

**Preparations**

1. Solution M is prepared by adding 18.0cm3 (S.G = 1 = 1.18) of concentrated hydrochloric acid into 600cm3 of distilled water contained in a one litre volumetric flask and diluting to one litre of solution.
2. Solution N is prepared by dissolving 8.80g of sodium hydroxide in 600cm3 of distilled water contained in a one litre volumetric flask and diluting to one litre of solution.
3. Screened methyl orange is prepared by dissolving 0.10g of solid R in 100cm3 of distilled water and labelled screened methyl orange indicator.

**October / November 1999**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require the following.

* One burette 0 – 50cm3
* One pipette 25cm3
* About 100cm3 of solution E
* About 120cm3 of solution F
* Two conical flasks ) 250cm3
* 8 clean dry test-tubes
* About 0.4g of solid H (supplied on the morning of examination)
* One boiling tube
* One spatula
* Both blue and red litmus papers
* Stop clock/ watch
* Ruler
* 10cm3 measuring cylinder
* Cutting blade / scissors
* 6cm3 length of magnesium ribbon, labelled solid K
* About 50cm3 of 2.0M hydrochloric acid, labelled solution L
* Means of labeling test-tube holder
* One 100cm3 beaker
* Test-tube rack.

**Access to:**

* Distilled water
* Methyl orange indicator
* Bunsen burner
* Concentrated nitric acid supplied with a dropper
* 2M hydrochloric acid supplied with a dropper
* 1M barium chloride solution supplied with a dropper
* 2M sodium hydroxide solution.

**Preparations**

1. Solution E is prepared by accurately measuring 10.0cm3 of concentrated hydrochloric acid (1.18gm/cm3) using a burette and adding it to about 500cm3 of distilled water and diluting to one litre of solution.
2. Solution F is prepared by accurately adding 15.3g of solid F in about 800cm3 of distilled water and diluting to one litre of solution.
3. Solution L is prepared by accurately adding 172cm3 of concentrated hydrochloric acid (1.18g/cm3) to about 500cm3 of distilled water and diluting to one litre of solution.

**October / November 2000**

**Requirements to Candidates**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

* About 90cm3 of solution L
* About 150cm3 of solution M
* One burette 0 – 50cm3
* One pipette 25cm3
* One thermometer 0 – 1100C
* Two conical flasks
* One filter funnel
* 3 filter papers
* 10cm3 of solution P contained in a conical flask
* 6 clean dry test-tubes
* 50 or 100cm3 measuring cylinder
* 3 g of solid G
* 100cm3 beaker
* Stop clock / watch
* 30cm3 of 2M sodium hydroxide in a beaker
* One 10cm3 measuring cylinder.

**Access to**

* Methyl orange indicator – supplied with dropper
* Phenolphthalein indicator – supplied with dropper
* Distilled water
* 2M sodium hydroxide – supplied with dropper
* 2M aqueous ammonia – supplied with dropper
* 2M nitric acid – supplied with dropper
* 2M hydrochloric acid – supplied with dropper
* 1 M acidified barium chloride – supplied with dropper.

**Preparations**

1. Solution L is prepared by dissolving 5.6g of solid L in 600cm3 of distilled water and diluting to one litre of solution.
2. Solution M is prepared by accurately adding 9cm3 of concentrated hydrochloric acid (density 1.18g/cm3) to about 500cm3 of distilled water and diluting to one litre of solution.
3. Solution P is prepared by mixing 80g of solid Q and 20g of solid R and dissolving the mixture in about 800cm3 of distilled water then diluting to one litre of solution.

**October / November 2001**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

* About 20cm3 of solution A.
* about 100cm3 of solution B
* About 60cm3 of solution C
* About 100cm3 of solution D.
* One burette
* One pipette
* Two conical flasks (250cm3)
* One filter funnel
* One boiling tube
* One thermometer 0 – 1100C
* One 10cm3 measuring cylinder
* 50 or 100cm3 measuring cylinder
* 1g of solid E
* 4 clean dry test-tubes
* One test-tube holder
* 2 blue and 2 red litmus papers
* 0 – 3 g of solid F
* 0 – 2g of solid G
* 100cm3 beaker
* One spatula.

**Access to.**

* Distilled water
* Phenolphthalein indicator
* 2M sodium hydroxide – supplied with a dropper
* 2M sulphuric acid - supplied with a dropper
* 2M lead (II) nitrate - supplied with a dropper
* Bromine water - supplied with a dropper
* Acidified potassium permanganate
* Bunsen burner.

**Preparations.**

1. A is prepared by dissolving 24g of sodium hydroxide pellets in about 800cm3 of distilled water and diluting to one litre of solution
2. B is prepared by adding 12cm3 of hydrochloric acid (specific gravity 1.18g/cm3) (measured accurately) in about 500cm3 of distilled water and diluting to one litre of solution.
3. C is made by dissolving 75.6g of solid C in about 900cm3 of distilled water and diluting to one litre of solution.
4. D is prepared by adding 167cm of solution A to 600cm3 of distilled water and diluting to one litre of solution
5. Bromine water is prepared by adding 2ml of liquid bromine to 100cm3 of distilled water and the mixture stirred well in a fume cupboard
6. Acidified potassium permanganate is made by adding 3.16g of solid potassium permanganate to 400cm3 of 2M sulphuric acid and diluting to one litre of solution using distilled water.

**October / November 2002**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

**A**

* about 120cm3 of solution A
* about 150cm3 of solution B
* about 40cm3 of solution C supplied with a dropper
* about 40cm3 of solution D supplied with a dropper
* about 150cm3 of distilled water in a wash bottle
* about 0.2g of solid G
* about 0.5g of solid H
* 10cm of sodium sulphate solution
* about 15cm3 of solution E supplied with a dropper
* two 200ml or 250ml beaker
* one 10cm3 measuring cylinder
* one burette 0 – 50ml
* one 50ml or 100ml measuring cylinder
* 15cm3 of solution F
* one boiling tube
* one filter funnel
* two pieces of filter paper (whatman no.1 size 11.0cm)
* 6 clean dry test-tubes
* one test-tube holder
* one clean metallic spatula
* two labels
* one stopwatch / clock
* Atleast 6cm length of universal indicator paper (full range) pH 1 – 14.

**B. Access to**

* Bunsen burner (in good working condition).
* Barium nitrate solution supplied with a dropper
* 2M sodium hydroxide – supplied with a dropper
* 2M hydrochloric acid - supplied with a dropper
* 2M aqueous ammonia - supplied with a dropper
* pH chart pH 1 - 14
* bromine water - supplied with a dropper
* acidified potassium permanganate supplied with a dropper

**Preparations**

1. Solution A is prepared by adding 200cm3 of fresh 20 volume hydrogen peroxide to about 600cm3 of distilled water and diluting to one litre of solution. (This solution should be prepared one day before the day of examination, stored in Stoppard container and supplied on the morning of the examination).
2. Solution B is 2M sulphuric acid
3. Solution C is prepared by dissolving 12g of solid C in about 800cm3 of distilled water and diluting to one litre of solution.
4. Solution D is prepared by adding 10g of solid D in about 700cm3 of distilled water and diluting to one litre of solution.
5. Solution E is prepared by dissolving 10g of solid E in about 600cm3 of warm distilled water and diluting with warm water to one litre of solution.
6. Solution F is prepared by dissolving 30g of solid F in about 900cm3 of distilled water and diluting to one litre of solution.

**October / November 2003**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

* about 80cm3 of solution P
* about 120cm3 of solution Q
* one burette 0 – 50ml
* one pipette 25ml
* two conical flasks 250ml
* 1.9g of solid S weighed accurately
* 35cm3 of solution T
* one thermometer 0 – 110oC
* one 100ml beaker
* one 50ml or 100ml measuring cylinder
* about 200ml of distilled water in a wash bottle
* 0.3g of solid V
* one 10ml measuring cylinder
* one boiling tube
* one spatula
* 6 clean dry test-tubes
* 1ml of 0.5M barium chloride supplied in a test-tube and labelled 0.5MBaCl2
* 2cm3 of 2M hydrochloric acid supplied in a test-tube and labelled 2MHCl
* About 35cm3 of solution R.
  1. **Access to**
* 2M sodium hydroxide
* 1M lead (II) nitrate solution
* Solution W

These solutions should be supplied with droppers.

**Preparations**

1. Solution P is prepared by dissolving 3.2g of solid P in 400cm3 of 1M sulphuric acid and diluting to one litre of solution using distilled water.
2. Solution Q is prepared by dissolving 16.7g of solid Q in 400cm3 of 1M sulphuric acid and diluting to one litre of solution using distilled water. This solution is to be prepared in the morning of the examination and supplied to candidates in containers sealed with aluminum foil. (The solid should be dissolved in the sulphuric acid immediately after weighing).
3. Solution W is prepared by dissolving 5g of solid W in 500cm3 of 1M sulphuric acid and diluting to one litre of solution using distilled water.
4. Solution R is prepared by dissolving exactly 40.0g of sodium hydroxide pellets in about 800cm3 of distilled water and diluting to one litre of solution and allowed to cool to room temperature.
5. Solution T is prepared by dissolving 63g of solid T in about 900cm3 of distilled water and diluting to one litre of solution and allowed to attain room temperature.

NB/ The quantities in the above preparations will depend on the number of candidates in a centre.

**October / November 2004**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

* Exactly 3cm3 length of solid A.
* About 80cm3 of solution B
* About 120cm3 of solution C
* one burette (0 – 50ml)
* one pipette 25ml
* one thermometer (0 – 1100) C
* one 100ml beaker
* two 250ml conical flasks
* one stopwatch / clock
* 6 clean dry test-tubes
* one boiling tube
* about 200cm3 of distilled water in a wash bottle.
* one label
* about 5cm3 of solution E in a test-tube
* about 5cm3 of solution F in a test tube
* about 5cm3 of solution G in a test tube
* about 6cm3 of solution H in a test tube
* one clean glass rod
* one 10ml measuring cylinder
* 1 ml of chlorine water supplied in a -tube and sealed with aluminium foil
* 2 ml of 1% bromine water supplied in a test-tube and sealed with aluminum foil.
  1. **Access to**
* 2M sodium hydroxide supplied with a dropper
* phenolphthalein indicator
* 0.5M barium chloride supplied with a dropper
* 0.05M lead (II) nitrate solution supplied with a dropper
* Bunsen burner in good working condition.

**Preparations**

1. Solution B is prepared by dissolving 60.2 cm3 of concentrated hydrochloric acid density 1.18g/cm3 in about 600cm3 of distilled water and diluting to one litre of solution.
2. Solution C is prepared by dissolving 12g of solid sodium hydroxide pellets in about 800cm3 of distilled water and diluting to one litre of solution.
3. Solution E is prepared by dissolving 60g of solid E in about 900cm3 of distilled water and diluting to one litre of solution.
4. Solution F is prepared by dissolving 30g of solid F in about 500cm3 of distilled water and diluting to one litre of solution.
5. Solution G is prepared by dissolving 30g of solid G in about 700cm3 of distilled water and diluting to one litre of solution.
6. Solution H is prepared by dissolving 60g of solid H in about 600cm3 of distilled water and diluting to one litre of solution.
7. Chlorine H2O is prepared by dissolving 250cm3 of 5% chlorine H2) (5% sodium hypochloric) to 750cm3 of distilled H2O.
8. 1% bromine H2O is prepared by adding 1cm3 of liquid bromine to 100 of distilled H2O and shaking one mixture well to dissolve (This mixture will dissolve ( this should be done in the same chamber)

**October / November 2005**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

* About 100cm3 of solution K
* About 75cm3 of solution L
* One burette 0 – 50 ml.
* one pipette 25ml
* 1.5g of solid M accurately weighed and supplied in a clean dry test-tube.
* one tripod stand with a wire gauze
* one 200ml or 250ml beaker
* one Bunsen burner
* one thermometer 0 – 1100C
* one stopwatch / clock
* one test-tube holder
* about 0.5g of solid N
* 5 clean and dry test-tubes
* one boiling tube
* one 10ml measuring cylinder
* about 10cm3 of solution P
* about 0.5g of solid Q
* about 1g of solid sodium hydrogen carbonate.
* one blue and one red litmus paper
* 5 pieces of filter paper
* one spatula
* about 150cm3 of distilled water supplied in a wash bottle
* two 100ml beakers
* one filter funnel
* one 100ml measuring cylinder
* a small roll of tissue paper (approximately 25cm3 long)
  1. Access to
* 2M aqueous ammonia
* 0.5M barium nitrate solution
* 2M hydrochloric acid.

**Preparations**

1 Solution K is prepared by dissolving 37.32g of sodium hydroxide pellets in about 600cm3 of distilled water and diluting to one litre of solution.

1. Solution L is prepared by dissolving 60.0g of solid L in about 600cm3 of distilled water and diluting to one litre of solution.
2. Solution P is prepared by dissolving 50g of solid P in about 700cm3 of distilled water and diluting to one litre of solution.

**October / November 2006**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require

* 4.5g of solid A supplied in a boiling tube
* 110cm of solution B
* about 450cm3 of distilled water supplied in a wash bottle
* about 0.5g of solid E supplied in a dry stoppered container
* about 0.5g of solid F supplied in a dry stoppered container
* about 10cm3 of aqueous sodium sulphate supplied in
* one burette 0 – 50mls
* one pipette 25ml
* one pipette filler
* one thermometer -10 oC – 110 o C
* one 250ml volumetric flask
* two 250mls conical flask
* one Bunsen burner
* one tripped sled and wire gauge
* 5 dry test tubes
* one boiling tube
* 2 filter papers (whatman no.1 125mm)
* one filter funnel
* one filter holder
* one metallic spatula
* one 10ml measuring cylinder
* means of labeling
* one clean dropper.

**Access to:**

* 2M NaOH supplied with a dropper
* 2M HCl
* Bromine H2O supplied with a dropper
* Phenolphthalein indictor supplied with a dropper
* Wall clock.

**Preparations**

1. Solution B is prepared by dissolving 9.48g of solution B in about 400cm of 2M sulphuric acid and diluting to one litre of solution with distilled water.

2. Aqueous sodium sulphate is prepared by dissolving 10g of solid Na SO4 Diluting with distilled water to one litre of solution

3. Bromine water is prepared by diluting 1ml of liquid bromine with 100cm3 of distilled water in a

fume cupboard

4. Solid A should be weight accurately in a fume clipboard or a well ventilated room.

**October / November 2007**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

* About 120cm3 of solution A.
* about 120cm3 of solution B
* About 100cm3 of solution C.
* one pipette 25.0ml
* one pipette filler
* one volumetric flask 250ml
* one burette 0 – 50ml
* two conical flasks
* 8 clean dry test-tubes
* test-tube rack
* one thermometer – 100C – 1100C
* two boiling tubes
* about 0.5g of solid E in a stoppered container
* one blue and one red litmus paper
* one 10ml measuring cylinder
* about 500ml of distilled water in a wash bottle
* one test-tube holder
* one PH chart paper range 1 to 14
* about 2cm3 of solution G
* 1g of sodium carbonate (solid)
* one watch glass
* about 5cm3 of solution H
* about 10cm3 of ethanol (absolute) in a Stoppard container labelled liquid F
* spatula
* two clean dropper
* Means of labeling.

**Access to:**

* Methyl orange indicator supplied with a dropper
* Bunsen burner
* universal indicator supplied with a dropper
* 2M aqueous ammonia supplied with a dropper
* 0.5M barium nitrate solution
* 2M nitric acid
* Wall clock.

**Preparations**

1. Solution A is prepared by dissolving 50.0cm3 of 1.84g/cm (98%) concentrated sulphuric acid in about 600cm3 of distilled water and diluting to one litre of solution.
2. Solution B is prepared by dissolving 8.0g solid B in about 500cm3 of distilled water and diluting to one litre of solution.
3. Solution C is prepared by dissolving 60.0g of sodium hydroxide pellets in about 700cm of distilled water and diluting to one litre of solution.
4. Solution G is prepared by dissolving 100g of solid G in about 400cm3 of distilled water and diluting to one litre of solution.
5. Solution H is prepared by dissolving 25g solid H in about 600cm3 of 2M sulphuric acid and diluting to one litre of solution.

NB/ The test-tubes provided should have a capacity of at least 15cm3.

**October / November 2008**

**Requirements to candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

* 2.1g of solid A weighed accurately and supplied in a dry stoppered container
* about 60cm3 of solution B
* about 130cm of sodium hydroxide solution
* one thermometer – 10 oC – 110 oC
* one stop watch/clock
* one 100ml beaker
* one burette 0 – 50ml
* one pipette 25ml
* one bolometric flask 250ml
* about 500cm3 of distilled water supplied in a wash bottle
* one label or means of labeling
* one pipette filler
* two conical flasks
* about 0.5g of solid D supplied in a stoppered container
* 0.2g of solid E supplied in a stoppered container.
* about 0.5g of solid F supplied in a stoppered container
* six clean dry test-tubes
* one blue and one red litmus paper
* one 10ml measuring cylinder
* one metallic spatula
* about 0.3g of sodium hydrogen carbonate (solid)
* one test-tube holder
* 15cm3 of 2M hydrochloric acid.

**Access to.**

* Bunsen burner
* 2M aqueous ammonia supplied with a dropper
* acidified potassium dichromate (IV) supplied with a dropper
* acidified potassium manganate (VII) supplied with a dropper
* Phenolphthalein indicator supplied with a dropper.

**Preparations**

1. Solution B is prepared by adding 172.0cm3 (1.18g/cm) of concentrated hydrochloric acid to about 500cm3 of distilled water and diluting to one litre of solution.
2. Acidified potassium dichromate (VI) is prepared by dissolving 25g of solid potassium dichromate (VI) in about 600cm3 of 2M sulphuric acid and diluting to one litre of solution.
3. Acid KMnO4 3.16 g in 500cm3 of 2M H2SO4 dilute to 1l.
4. NaOH\_\_\_\_\_\_\_\_ 4.0g \_\_\_\_\_\_700cm3 H2O \_\_\_\_\_\_\_\_\_ diluting to 1 litre

**October / November 2009**

**Requirements to Candidates.**

In addition to the fittings and apparatus found in a chemistry laboratory, each candidate will require.

* 1.8g of solid a weighed accurately and supplied in a stopperd container.
* about 60cm3 of solution G
* one 250ml volumetric flask
* one pipette, 250ml and a pipette filler
* one burette 0 – 50ml
* 2 labels
* about 120cm3 of solution C
* three dry conical flasks (250ml)
* one dry filter funnel
* one 250ml dry beaker
* one filter paper whatman 125mm no.1
* 0.5g of solid E supplied in a stoppered container
* six dry test tubes
* one 100ml measuring cylinder
* one 10ml measuring cylinder
* about 500cm3 of distilled water supplied in a wash bottle
* one oiling tube
* one glass rod
* 0.5g solid F supplied in a stoppered container.
* 5cm3 of absolute ethanol supplied in a stoppered container on the day of examination.
* 0.2g of solid sodium hydrogen carbonate
* spatula
* one test-tube holder

**Access to:**

* Bromine water supplied with a dropper
* acidified potassium dichromate (VI) supplied with a dropper
* 2M aqueous ammonia supplied with a dropper
* Bunsen burner
* tissue paper
* aqueous lead (II) nitrate supplied with a dropper
* universal indicator solution pH 1 – 14 supplied with a dropper
* pH chart range 1 – 14
* freshly prepared methyl orange indicator supplied with a dropper

**Preparations**

1. Solution B is prepared by dissolving 215cm3 of conc. HCl of density 1.18g/cm3 in abut 500cm3 of distilled water and making to one litre of solution using distilled water and labelled solution B.
2. Solution C is prepared by dissolving 12.0g of NaOH pellets in about 800cm3 of distilled water and making to one litre of solution using distilled water and labelled solution C.
3. Acidified potassium dichromate (VI) is prepared by dissolving 25g of solid potassium dichromate (VI) in about 400cm3 of 2M H2SO4 acid and making to one litre of solution using distilled water and labelled acidified potassium dichromate (VI) solution.
4. Bromine water is prepared by adding 1cm of liquid bromine to 100cm3 of distilled water and stirring well in a well in an efficient fume clipboard.
5. Lead (II) nitrate is prepared by adding 30g of solid lead (II) nitrate in about 700cm3 of distilled water and making up to one litre of solution using distilled water and labelled lead (II) nitrate solution.

**October /November 2010**

**Candidates Requirements**

In addition to the apparatus and fittings found in a chemistry laboratory, each candidate will require the following;

* About 150cm3 of solution A labeled solution A
* About 150cm3 of solution B labeled solution B
* About 80cm3 of solution C labeled solution C
* One pipette 25.0ml
* One pipette filler
* One volumetric flask (250.0ml)
* Four labels
* About 500cm3 of distilled water
* One burette 50.0ml
* Three conical flasks
* One 10ml measuring cylinder
* One 100ml measuring cylinder
* Two boiling tubes
* One thermometer -100 C to 1100C
* About 0.5 g of solid E supplied in a stopper container
* Six clean dry test-tubes
* About 0.1g of solid F supplied in a stopper container
* About 0.5g of solid G supplied in a stopper container
* pH chart 1-14; and universal indicator solution supplied with a dropper
* One 100ml beaker
* One metallic spatula
* One clean dropper

**Access to**

* Phenolphthalein indicator supplied with a dropper
* 2 M sulphuric (VI) acid supplied with a dropper
* 2 M sodium hydroxide supplied with a dropper
* 0.5M potassium iodide supplied with a dropper
* Bromine water supplied with a dropper
* Acidified potassium manganate (VII) supplied with a dropper
* Bunsen burner

**Preparations**

1. Solution A is prepared by taking 190.0cm3 of concentrated hydrochloric acid (Specific gravity 1.18) adding it to 600cm3 of distilled water in a 1 litre volumetric flask and diluting it to the mark. Label this solution as solution A.
2. Solution B is prepared by dissolving 80.0g of sodium hydroxide pellets in 800cm of distilled water and diluting it to the mark. Label it as solution B.
3. Solution C is prepared by dissolving 25g of solid C in 600cm3 of distilled water and diluting it to the mark. Label this as solution C
4. Bromine water is prepared by taking 1cm3 of liquid bromine and dissolving it in 100cm3 of distilled water in a fume cupboard. This must be fleshly prepared and supplied in a dropper battle
5. Acidified potassium manganate (VII) is prepared by dissolving 3.16g of solid potassium manganate (VII) in about 600cm3 of 2M Sulphuric (VI) acid and adding distilled water to make 1 litre.

**October /November 2011**

In addition to the apparatus and fittings found in a chemistry laboratory, each candidate will require the following;

**A.**

**1.** 1.60g of solid A weighed accurately and supplied in a stoppered container.

2. About 80cm3 of solution B.

3. about 200cm3 of solution C

4. One burette 0 – 50ml

5. One pipette 25.0ml

6. One pipette filler

7. One 250ml volumetric flask

8. Three 250ml conical flasks

9. 4 labels

10. About 0.5g of solid D in a stoppered container

11. one spatula

12. Six clean dry test – tubes

13. One boiling tube

14. one red and one blue litmus papers

15. 4cm3 of solution E in a test tube and labeled solution **E.**

16. about 500cm3 of distilled water in a wash bottle

17. about 10cm3 of liquid F supplied in a stoppered test tube and labeled liquid **F.**

**(Liquid** F is absolute ethanol)

18. One clean and dry watch glass

19. 0.2gm of solid sodium hydrogen carbonate

20. one test – tube holder

21. one stop watch

22. One 10ml measuring cylinder

**B. ACCESS TO:**

1. Bunsen burner

2. Phenolphthalein indicator supplied with a dropper

3. 2M sodium hydroxide supplied with a dropper.

4. 20V hydrogen peroxide supplied with a dropper

**October /November 2012**

In addition to the apparatus and reagents found in a chemistry laboratory, each candidate will require the following:

1. about 150cm3 of solution A

2. about 100cm3 of solution B

3. about 45cm3 of solution C

4. about 50cm3 aqueous potassium iodide

5. about 60cm3 of solution D

6. about 50cm3 of 2M sulphuric (vi) acid

7. one pipette 25.0ml

8. One pipette filler

9. One burette 0 – 50ml

10. two 250ml conical flasks

11. One 10ml measuring cylinder

12. Six dry test tubes

13. One stop watch or clock

14. Test – tube rack

15. about 0.5g of solid E supplied in a stoppered container

16. two boiling tubes

17. one red and one blue litmus papers

18. test – tube holder

19. 3 x1 cm piece of aluminium foil

20. about 0.5 of solid F in a stoppered container

21. about 0.2g of solid sodium hydrogen carbonate

22. about 20cm3 of 2M hydrochloric acid

23. three 12.5cm whatman No. 1 filter papers

24. one filter funnel

25. one metallic spatula

26. about 500cm3 of distilled water

27. one 100ml beaker

28. 8 small labels

Access to:

1. aqueous sodium sulphate supplied with a dropper

2. aqueous sodium chloride supplied with a dropper

3. aqueous barium nitrate supplied with a dropper

4. aqueous lead (II) nitrate supplied with a dropper

5. 2M sodium hydroxide supplied with a dropper

6. Bunsen burner

7. Bromine water supplied with a dropper

NB: Solids A, C, D, E and F will be supplied by the Kenya National Examination Council

1**.** Solution **A is** prepared by dissolving 1.20g of solid A in about 600cm3 of distilled water and diluting to one litre of solution. Label this solution as solution A.

2**.** Solution **B** is prepared by dissolving 12.40g of solid sodium thiosulphate (Na2S2O3. 5H2O) in about 800cm3 of distilled water and diluting to one litre of solution. Label this as solution B.

3. Solution **C** is prepared by dissolving 0.40g of solid **C** in about 800cm3 of distilled water and diluting to one litre of solution. Label this as solution **C.**

4. Potassium iodide is prepared by dissolving 5gm of solid potassium iodide in about 800cm3 of distilled water and diluting to ne litre of solution. Label this as potassium iodide.

5. Solution **D** is prepared by placing 10g of solid **D** in 1000cm3 of distilled water. Heating the mixture to boiling and allowing it to cool to room temperature. Label this as solution **D**

6. Sodium sulphate solution is made by dissolving 14.2g of solid sodium sulphate in about 800cm3 of distilled water and diluting to one litre of solution. Label this as aqueous sodium sulphate.

7. Sodium chloride solution is made by dissolving 5.85g of solid sodium chloride in about 800cm3 of distilled water and diluting to one litre of solution. Label this as aqueous sodium chloride.

8. Barium nitrate solution is prepared by dissolving 26.0gm of solid barium nitrate in about 800cm3 of distilled water and diluting to one litre of solution. Label this as aqueous barium nitrate.

9. Lead (II) nitrate is prepared by dissolving 33.0gm of solid lead (II) nitrate in about 800cm3 of distilled water and diluting to one litre of solution. Label this as aqueous lead (II) nitrate.

10. Bromine water is prepared by adding 1cm3 of liquid bromine in 100cm3 of distilled water and shaking well in a fume cupboard. Label this as bromine water.

**October /November 2013**

In addition to the apparatus and reagents found in a chemistry laboratory, each candidate will require the following:

1. about 80cm3 of solution A

2. 1.60g of solid B weighed accurately and supplied in a stoppered container

3. about 100cm3 of solution C

4. one burette 0 – 50.0 ml;

5. one 100ml beaker

6. one thermometer - 100 – 1100C

7. One stop watch/ clock;

8. one 250ml volumetric flask

9. One 10ml measuring cylinder

10. about 70cm3 of 2M sulphuric acid (VI) acid

11. about 500cm3 of distilled water supplied in a wash bottle

12. two labels

13. one 25.0ml pipette

14. one pipette filler

15. two 250ml conical flasks;

16. 2.0g of solid E supplied in a stoppered container

17. two boiling tubes

18. 3 filter papers ( whatman no 1 125mm)

19. One filler funnel

20. six dry test tubes

21. One burning splint

22. 0.5g of solid G supplied in a stoppered container

23. One metallic spatula

24. 0.2g of solid sodium hydrogen carbonate supplied in a stoppered

25. Fresh universal indicator

26. pH chart range 1- 14

27. One test tube holder

**Access to:**

1. Bunsen burner

2. 2M hydrochloric acid

3. 2M aqueous ammonia supplied with a dropper

4. 0.5 barium nitrate supplied with a dropper

**Preparations**

1. Solution A is prepared by dissolving 125.2g of hydrated copper (II) sulphate is about 800cm3 of distilled water and diluting tone litre of solution and labeled solution A.

2. Solution C is prepared by placing 3.2g of solid C in one litre volumetric flask, adding 100cm3 of 2M sulphuric (VI) acid followed by 700cm3 of distilled water shaking to dissolve then diluting to the mark. Label this as solution C.

3. Solid E is prepared by weighing 0.5 of solid E1 and 0.5 g of zinc carbonate putting both of them in onestoppered container and labeled solid E