Chemistry paper 1 Marking scheme

1. (a) Give the name of the first member of alkene homologous group (1mark)

Ethene

- (b) Describe a chemical test that can be used to distinguish butanol from butanoic acid (2marks)
 - Add water to each compound separately
 - Add sodium carbonate/ sodium hydrogen carbonate to each sample
 - Butanol has no bubbles while butanoic acid has bubbles
- 2. Calculate the values of X and Y in the following nuclear equation (2marks)

 $\overset{239}{_{92}}U \longrightarrow \overset{X}{_{\gamma}}Th + 2\alpha + 2\beta$

X= 231 Y=90

3. (a) What is an inert electrode?

Inert electrode is one which does not participate in the reaction/ does not affect the

products of electrolysis/ does not react

(b) State the products formed when brine is electrolyzed using inert electrodes

Anode.....chlorine gas (1mark)

Cathode..... hydrogen gas (1mark)

4. A mixture contains ammonium chloride, copper (II) oxide and potassium chloride. Describe

how each of the substances can be obtained from the mixture (3marks)

- Heat the mixture to sublime ammonium chloride (1)
- Add water to dissolve potassium chloride, (1/2) CuO does not dissolve (1/2)
- \bullet Filter (½) and evaporate the filtrate to obtain KCl (½)



5. State two reasons why hydrogen is not commonly used as a fuel (2marks)

• Hydrogen is expensive

• Hydrogen is explosive

6. The thermochemical reaction between carbon and Sulphur is as shown by the equation below:

 $C_{(s)} + 2S_{(s)} \longrightarrow CS_{(l)} \Delta H = +1170 \text{kJmol}^{-1}$

On the grid below, sketch and label the energy level diagram for the reaction (2marks)



7. (a) Using electrons in the outermost energy level, draw the dot (.) and cross (x) diagrams for molecules of H_2O and C_2H_4 (H=1, C=6, O=8)



 C_2H_4









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(b) The formula of a complex ion is $[Zn(NH_3)_4]^{2+}$. Name the type of bond likely to exist between zinc and ammonia in the complex (1mark)

Dative/coordinate bond

- 8. A beaker contained 75.0cm³ of aqueous copper (II) sulphate at 23.7°C. When scrap ion metal was added to the solution, the temperature rose to 29.3°C
 - a) Write an ionic equation for the reaction that took place (1mark)

 $Fe_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Fe^{2+}_{(aq)} + Cu_{(s)}$

b) State the observation that was made in the experiment (1mark)

• Brown deposits / blue colour of solution fades

c) Name the type of reaction that took place in the above experiment (1mark)

• Displacement reaction

d) Given that the mass of copper deposited was 5.83g, calculate the molar enthalpy change in $kJmol^{-1}$ (specific heat capacity = $4.2Jg^{-1}k^{-1}$, density of solution = $1gcm^{-3}$) (2marks)

Moles of Cu deposited= 5.83/63.5

= 0.09181 ∆H= 75 × 4.2 × 5.6 = 1764J = 1.764kJ Molar ∆H = 1.764/0.09181 = 19.2136kJmol⁻¹

9. A water trough, aqueous sodium hydroxide, burning candle, watch glass and graduated gas jar were used in an experimental set up to determine the percentage of active part of air. Draw a labelled diagram of the set up at the end of the experiment (3marks)





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- 10. Describe an experimental procedure that can be used to extract oil from nut seeds (2marks)
 - Crush/grind using a pestle and mortar
 - Add suitable solvent(propanone/ethanol/alcohol) and stir to dissolve
 - Filter to obtain oil solution
 - Leave the solution in sunlight for propanone to evaporate leaving behind oil

11. Starting with solid sodium chloride, describe how a pure sample of lead (II) chloride can be

prepared in the laboratory (3marks)

- Dissolve sodium chloride in distilled water
- Add aqueous lead (II) nitrate
- Filter the mixture
- Wash the residue with water and dry between filter papers
- 12. 100cm³ of 0.05M sulphuric acid were placed in a flask and a small quantity of anhydrous

sodium carbonate added. The mixture was boiled to expel all the carbon (IV) oxide. 25cm³ of

the resulting solution required 18cm³ of 0.1M sodium hydroxide solution to neutralize it.

Calculate the mass of sodium carbonate added (Na=23, O=16, C=12) (3marks)

Moles of NaOH = (18×0.1) ÷1000 = 0.0018 (1/2)

Moles of acid = 1/2×0.018 = 0.0009 (1/2)

Moles of acid in $100 \text{cm}^3 = (100 \times 0.0009) \div 25 = 0.0036(\frac{1}{2})$

Ratio of acid: $CO_3^{2-} = 1:1$

Original moles of acid = (100×0.05) ÷1000 = 0.005 (1/2)

Moles reacting with carbonate = 0.005 - 0.0036 = 0.0014 (¹/₂)

Mass of sodium carbonate = 0.0014×106 = 0.1484g (1/2)

13. Cotton is a natural polymer. State one advantage and one disadvantage of this polymerAdvantage: biodegradable (1mark)



Disadvantage: affected by acids, expensive (1mark)

- 14. Write equations to shoe effect of heat on the following:
 - a) Sodium hydrogen carbonate (1mark)

$$2NaHCO_3(s) \xrightarrow{heat} Na_2CO_3(s) + H_2O(1) + CO_2(g)$$

b) Silver nitrate (1mark)

$$2AgNO_3(s) \xrightarrow{heat} 2Ag(s) + 2NO_2(g) + O_2(g)$$

c) Iron (II) sulphate (1mark)

$$FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$$

15. The plots below were obtained when atomic number of some elements in group I and II were

plotted against atomic numbers



Explain:

a) the trend shown by Li, Na and K. (1 mark)

The atomic radii increase with increase in atomic number. This is due to increase in energy levels

b) why the atomic radii of elements Be, Mg and Ca are lower than those of Li, Na and K.(2 marks)

The group II elements have more protons than group I, hence this increases the nuclear

attraction for the outer electrons





16. Methane reacts with bromine as shown in the following equation.

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CH_{4(g)} + Br_{2(g)} \quad \longrightarrow \quad CH_3Br_{(g)} + HBr_{(g)}
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Using the bond energies in the table below, calculate the enthalpy change ΔH , for the reaction (3marks)

Bond	Bond energy (kJmol ⁻¹)
С-Н	412
C-Br	276
Br-Br	193
H-Br	366

(4(412) + 193) - (3(412) + 276 + 366)

 $= -37 k Jmol^{-1}$

17. Consider the following reaction:

 $H_2S + Cl_2 \longrightarrow 2HCl + S$

Determine the oxidation numbers of chlorine and Sulphur in the reactants and products (2marks)

	Reactants	Products
Sulphur	-2	0
Chlorine	0	-1

18. Bottles of potassium carbonate, sodium chloride and sugar have lost their labels. A student prepares and tests aqueous solutions of a sample from each bottle. The results obtained are as below.



Bottle	рН	Electrical conductivity	Correct label
1	7	Conducts	Sodium chloride
2	7	Does not conduct	Sugar
3	10	Conducts	Potassium carbonate

Complete the table by filling the correct label (3marks)

19. Study the set up in **figure 2** and answer the questions that follow.



a) State the precaution that should be taken in carrying out the experiment. Give a reason (1mark)

Should be done in a fume chamber/ open air; carbon (II) oxide is poisonous

b) State the observation made in the boiling tube (2marks)

White precipitate (1) which dissolves to form a colourless solution (1)

20. Name a suitable method that can be used to extract potassium from its ore. Explain (1mark)

Electrolysis; potassium is highly reactive

21. A current of 0.75A was passed through 300cm³ of 0.5M copper (II) sulphate solution.

Determine the time taken in seconds to deposit all the copper in the solution at the cathode

(Cu=63.5, 1F= 96500 coulombs) (3marks)

Moles of copper = $(300 \times 0.5) \div 1000 = 0.15$

Mass deposited = $0.15 \times 63.5 = 9.525g$





 $9.525 = (0.75t \times 63.5) \div (96500 \times 2)$

Time = 38600 seconds

22. (a) State Charle's law (1mark)

The volume of a fixed mass of a gas is directly proportional to its absolute temperature at constant pressure

(b) A fixed volume of a gas occupies 246 litres at 18°C and 98.13Kpa. What will be its

temperature if its volume is reduced to 113 litres at 101.325 Kpa? (2marks)

 $\mathbf{V}_1\mathbf{P}_1 = \mathbf{V}_2\mathbf{P}_2$

 $T_1 \qquad T_2$

 $(246 \times 98.13) \div 291 = (113 \div 101.325) \div T_2$

 $T_2 = 138.02$

23. The diagram below shows an electrochemical cell.



b) On the diagram show the direction of movement of electrons (1mk)

c) Write the cell representation (1mk)

 $Pb(NO_3)_2$

24. (a) State **one** distinctive feature of dynamic equilibrium (1mark)

- The rate of forward reaction is equal to rate of backward reaction
- Concentration of reactants and products do not change



(b) Explain the effect of increase in pressure on the following equilibrium (2marks)

 $N_{2(g)} + O_{2(g)} \quad \fbox{2NO}_{(g)}$

No effect; the number of molecules are equal

25. Zinc reacts with both concentrated and dilute sulphuric (VI) acid. Write the equations for the two reactions (2marks)

 $Zn(s) + 2H_2SO_4(l) \longrightarrow ZnSO_4(aq) + SO_2(g) + 2H_2O(l)$ $Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2(g)$

- 26. (a) Name the process that takes place when:
 - i. Crystals of zinc nitrate change into solution when exposed to air (1mark)

• Deliquescency

ii. An alcohol reacts with an organic acid in the presence of a catalyst to form a sweet smelling compound (1mark)

• Esterification

(b) Propane can be changed into methane ad ethane as shown below:

 $CH_{3}CH_{2}CH_{3} \qquad High temperature \qquad CH_{4} + C_{2}H_{4}$

Name the process undergone by propane (1mark)

• Thermal cracking

27. The table below gives some information about elements I, II, III and IV which are in the same group of the periodic table. Use the information to answer the questions that follow

Element	First Ionization energy (kJmol ⁻¹)	Atomic radius (nm)
Ι	520	0.15
II	500	0.19
III	420	0.23
IV	400	0.25

State and explain the relationship between variations in the first ionization energy and the atomic radius (3marks)





Increase in atomic radius results in decrease in the first ionization energy. Increase in the atomic radius decreases the forces of attraction from the outermost electron, hence decreasing the first ionization energy down the group

- 28. State what would be observed when dilute hydrochloric acid is added to products formed when a mixture iron filings and Sulphur is heated (1mark)
 - A gas with a smell of rotten egg is formed
 - Green solution formed
 - Black solid dissolves
 - Bubbles produced Any 1
- 29. The table below shows tests carried out on a sample of water and the results obtained

	Tests	Results
Ι	Addition of sodium hydroxide solution	White precipitate soluble in excess
II	Addition of excess aqueous ammonia	Colourless solution obtained
III	Addition of dilute hydrochloric acid and barium chloride	White precipitate

a) Identify the anion present in the water (1mark)

SO₄²⁻/ Sulphate ion

b) Write an ionic equation for the reaction in III (1mark)

 $Ba^{2+}(aq) + SO^{2-}_{4}(aq) \longrightarrow BaSO_{4}(s)$

c) Write the formula of the complex ion formed in II (1 mark

$[Zn(NH_3)_4]^{2+}$

- 30. Name two apparatus used to measure accurate volumes of solutions in the laboratory (2marks)
 - Volumetric flask
 - Burette
 - Pipette

