F1 TOPICAL REVISION

PHYSICS

A SERIES OF TOPICAL QUESTIONS IN FORM 1 PHYSICS

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MEASUREMENT I

1. (a) Distinguish between density and relative density of a substance
   (b) A ship of mass 1300 tonnes floats on sea water:
      (i) What volume of sea water is displaced (Density of sea water is 1025kg/m^3)
      (ii) Suppose it sails from sea water to fresh water, what cargo must be removed so that the same volume of water is displaced?(Density of fresh water = 1000kg/m^3
   (c) Describe an experiment to verify the law of floatation
2. Define **relative density**
3. A bathroom shower has 200 holes each 2.5mm^2 in area. Water flows from a pipe of cross-section area of 15cm^2 at 5m/s to the shower. Determine the speed of the spray.
4. A piece of metal **N** of mass 2kg weighs 18N in water and 12N in liquid M. Determine the density of ;
   (i) The metal **N**
   (ii) The liquid **M**
5. A measuring cylinder contains 50cm^3 of light oil at 0^{o}C. When a lump of dried ice is placed in the oil, the total volume is 72cm^3. Determine the density of the ice

   The ***figure 1*** below shows a manometer connected to a gas supply. The pressure of the gas supply above the atmospheric pressure is equivalent to a 20cm column of water. Use this information and the figure to answer questions 2 and 3.

FORCE

1. (a) The figure below shows a balloon carrying hydrogen gas $3m^3$ of density $0.09kgm^{-3}$. The mass of the balloon fabric is 2kg and the density of air is $1.25kgm^{-3}$

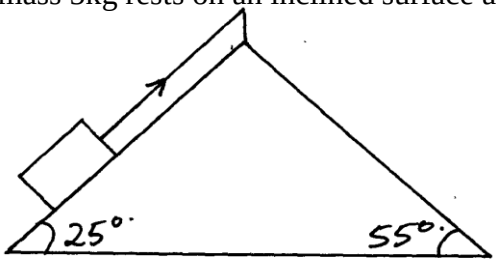
i) Determine the tension in the string

ii) If the string is suddenly cut, calculate the acceleration of the balloon upwards

iii) What is the maximum mass of the equipment the balloon can lift at a constant velocity

b) State and explain **two** features of a hydrometer that make it **sensitive** in its function

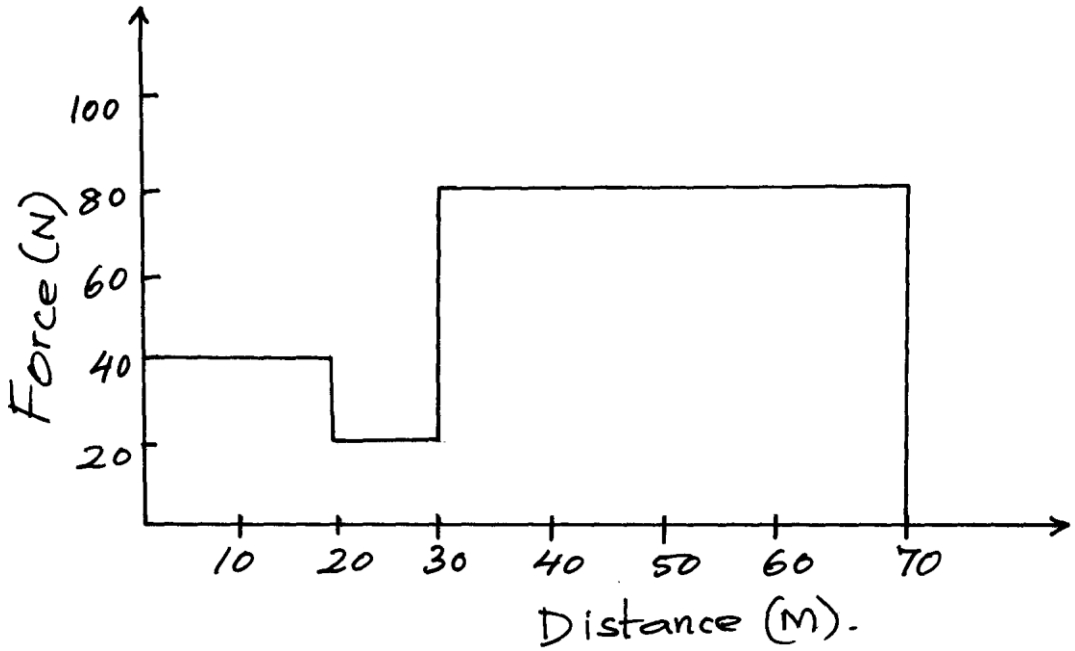
2. A block of mass 5kg rests on an inclined surface as shown in the diagram below:



Determine the static friction on the block

3. State **two** factors that would raise the boiling point of a liquid
4. Give a reason why water wets glass while mercury does not.
5. (a) Give an example where force is applied and no work is done

(b) The graph below shows the variation between force and distance for a boy pushing a concrete block of mass 25kg through a vertically height of 12m.



(i) Determine the total work done by the boy within 70m
(ii) How much energy is wasted?
(iii) Give an account for the energy wasted

6. State the principle of moments.
7. State any **two** factors that affect the earth's gravitational force
8. Figure 3 below shows a wire loop with a string that has been dipped into soap solution.

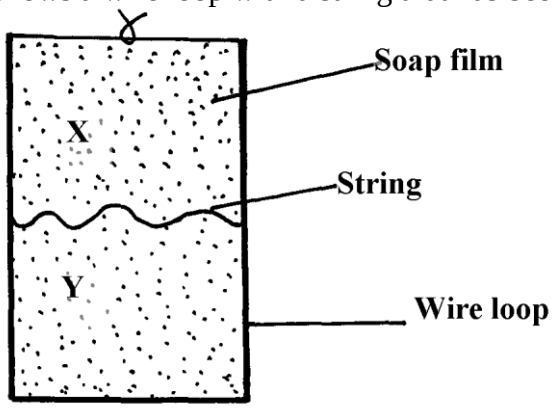
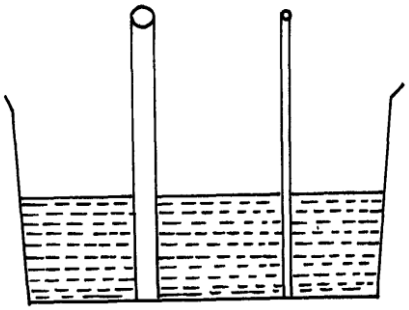


Fig. 3

i) Sketch a similar diagram to show the observed effect if the soap film is punctured at X
ii) Explain the observations made in **(i)** above

9. ***Figure 2*** shows two glass tubes of different size of bore, dipped in a glass beaker half full of water

fig. 2

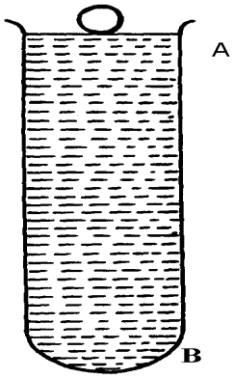


Complete the diagram to show how water will rise up in the two glass tubes

10. (a) State the conditions necessary for the law of conservation of linear momentum to hold

(b) The diagram ***figure 13*** below shows a steel ball bearing gently dipped in a viscous liquid contained in a tall cylinder

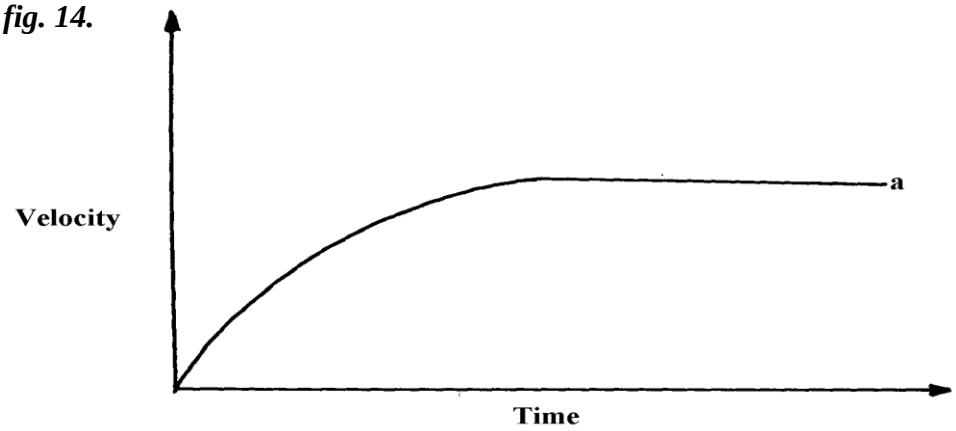
fig. 13



(i) Name giving their directions the forces acting on the ball bearing as it moves down the cylinder

(ii) The graph in ***figure 14*** below shows the velocity-time graph **(a)** for the motion of the above ball

fig. 14.



On the same diagram, draw the graph (**b)** for a steel ball of smaller radius in the same liquid

(iii) Explain the difference in the two graphs **(a)** and **(b)**

(c) (i) A breakdown truck tows a car of mass 1000kg along a level road, and accelerates at 0.5m/s^2. What is the tension in the tow line

(ii) If the tow line in (**c)(i)** above breaks when the car reaches a speed of 36km/h, how far will

the car travel before coming to rest if the breaking force is 2000N?

11. Explain why it is easier to ride a bicycle round a bend on a road if the surface is dry than when it is wet

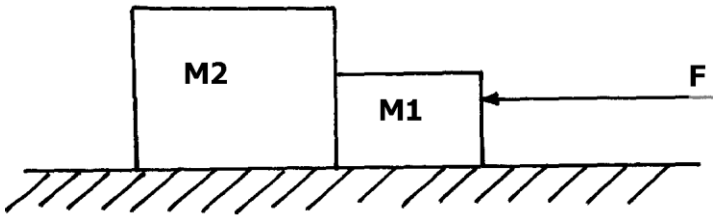
12. Give **one** difference between limiting and dynamic forces of friction

13. Mercury on a clean glass slide collects into small spherical balls as shown in figure 2 below.

Explain why

14. The ***figure 7*** below shows two blocks of masses M_1=1.5kg and M_2 = 2.0kg which are in contact on a frictionless table

fig. 7



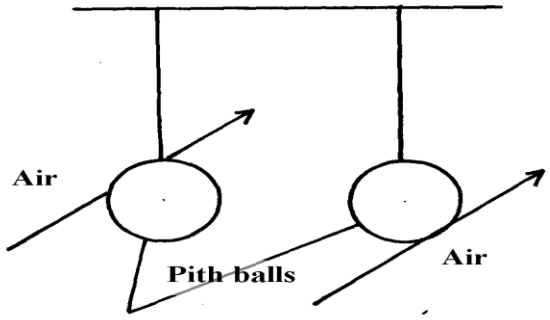
A force F=7N acts on the bodies, determine the force on mass M_2

15. State **one** factor that determines the depth to which mercury is depressed in a glass capillary tube.

PRESSURE

1. State the possible reason why, if water is used as a barometer liquid, the glass tube required to hold the column of the liquid is longer

2. State the definition of atmospheric pressure
3. What is the density of alcohol?
4. A person's lung pressure as recorded by a mercury manometer is 90 mm Hg. Express this pressure in SI units.
5. The figure below shows to light pith balls arranged as shown.



Pith balls

State what is observed when air is blown on the outer sides of the pith balls.

7. The barometric height at sea level is 76cm of mercury while at a point on a highland it is 74cm of mercury. What is the altitude of the point? (Take g = 10m/s^2 , density of mercury = 13600kg/m^3 and density of air as 1.25kg/m^3)

8. a) Define specific latent heat of fusion of a substance

b) Water of mass 200g at temperature of 60°Cis put in a well lagged copper calorimeter of mass 80g. A piece of ice at 0° C and mass 20g is placed in the calorimeter and the mixture stirred gently until all the ice melts. The final temperature, T, of the mixture is then measured. Determine:

i) The heat absorbed by the melting ice at O°C

ii) The heat absorbed by the melted ice (water) to rise to temperature T (answer may be given in terms of T)

iii) The heat lost by the warm water and the calorimeter (answer may be given in terms of T)

iv) The final temperature of the mixture

(Specific latent heat of fusion of ice = 334 000 J kg^{-1}

Specific heat capacity of water = 4 200 J kg^{-1} K^{-1}
Specific heat capacity of copper = 900J kg^{-1} K^{-1})

9. Figure 4 below shows a measuring cylinder of height 30cm filled to a height of 20cm with water and the rest occupied by kerosene.

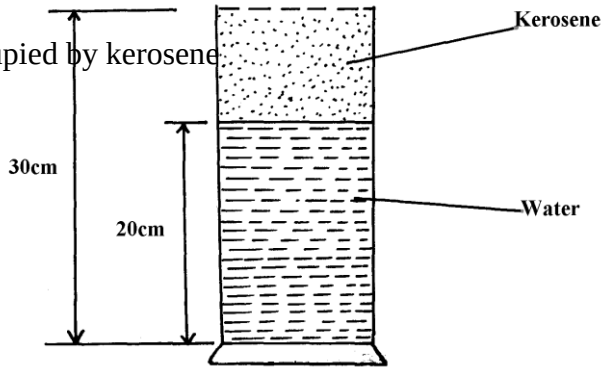


Fig. 4

Given that density of water = 1000Kgm^{-3}, density of kerosene = 800Kgm^{-3} and atmospheric
pressure = 1.03x10^5 pascals, determine the pressure acting on the base of the container

10. State Pascal's principle of transmission of pressure

11. A helical spring extends by 1 cm when a force of 1.5N is applied to it. Find the elastic potential
energy stored in it.

12. Two immiscible liquids are poured in a container to the levels shown in the diagram below.

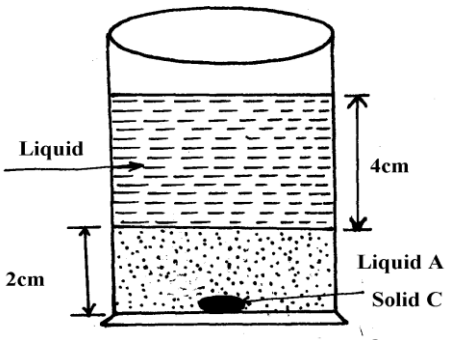


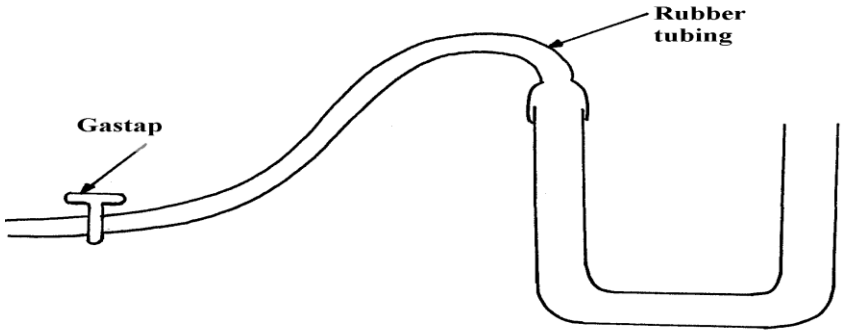
Figure 5

If the densities of the liquids **A** and **B** are 1g/cm^3 and 0.8g/cm^3 respectively, find the pressure
acting upon solid **C** at the bottom of the container due to the liquids

13. Mark the position of the water levels in the manometer when the gas supply is fully turned on

14. Calculate the pressure of the gas supply (Atmospheric pressure = 1.0x10^5Pa)

fiaure 1



15. A small nail may pierce an inflated car tyre and remain there without pressure reduction in the tyre. Explain the observation

16. (a) State **two** ways of increasing pressure in solids

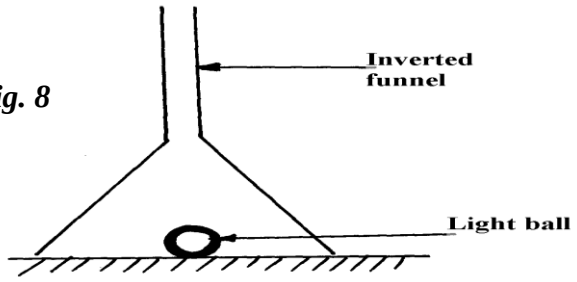
(b) The figure 1 shows a liquid in a pail

fig. 1

Suggest a reason why pail manufacturers prefer the shape shown to other shapes

17. ***Figure 8*** shows a funnel inverted over a light ball.

fig. 8



Explain the observation that would be made when streamlines of air is blown strongly down the narrow section of the funnel

18. A block measuring 20cm x 10cm by 5cm rests on a flat surface. The block has a weight of 3N.

Determine the maximum pressure it exerts on the surface.

19. The figure below shows a hydraulic press **P** which is used to raise a load of 10KN. A force **F** of 25N is applied at the end of a lever pivoted at O to raise the load

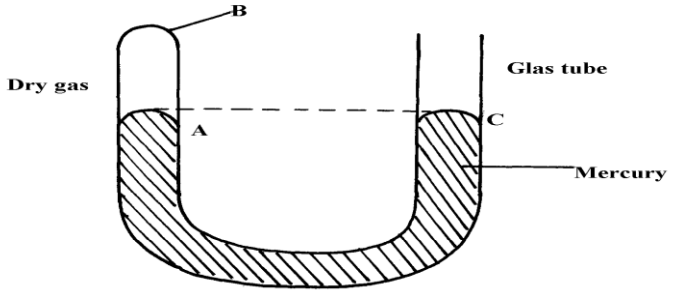
(a) State **one** property of liquid **X**

(b) Determine the distance **x** indicated on the press if force on piston **B** is 100N

19. A mercury –in-glass barometer shows a height of 70cm. What height would be shown in the barometer at the same place if water density 1.0 x 10^3kg/m^3 is used.
(Density of mercury = 13600kgm^{-3})

20. The total weight of a car with passengers is 25,000N. The area of contact of each of the four
tyres with the ground is 0.025m^2. Determine the minimum car tyre pressure

21. (a) The diagram below represents a u-shaped glass tube sealed at one end and containing mercury



(i) What is the pressure of the gas as shown in the diagram above?

(ii) Explain why the gas should be dry if it is to be used to verify a gas law

(iii) Describe how the arrangement can be used to verify Boyle's law.

(b) Use the kinetic theory of gases to explain why;

(i) the pressure of a gas increases with temperature increase

(ii) The pressure of a gas decreases as volume increases

22. The reading on a mercury barometer at Mombasa is 760mm. Calculate the pressure at Mombasa
(density mercury is 1.36xl$0^4$$Kgm^{-3}$)

23. The figure below is a manometer containing water. Air is blown across the month of one tube

and the levels of the water changes as the figure below.

Explain why the level of water in the right limb of manometer is higher.

CURRENT I

1. (a) Distinguish between natural and forced convection currents

(b) Draw the cross-section of a basic solar heating panel that uses heat from the sun to warm water which flows through pipes

(b) Explain the following as regards to the solar heater:-

(i) Why the pipe is made of copper

(ii) How the green house effect occurs and aids the working of the panel

2. State **two** advantages of generating an alternating current (a.c) to direct current (d.c) in a power station.

3. The table below shows results obtained in an experiment to determine the internal resistance of a cell

V(V)	0.4	0.5	0.6	0.7	08	1.3
R(Ω)	0.45	0.65	0.80	1.05	1.40	2.4
$^1/_V$ (V^{-1})						
$^1/_R$(Ω^{-1})						

i. Complete the table for values of $^1/_V$ and $^1/_R$ giving your answers to 3 d.p

ii. Plot a graph of $^1/_V$ against $^1/_R$

iii. Use the graph to determine the e.m.f **E** and the internal resistance **r** of the cell given that

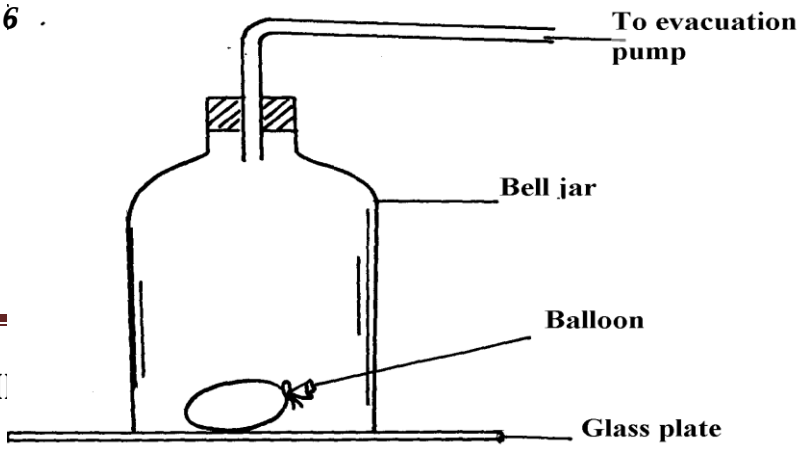
$$\frac{E}{V} = \frac{r}{R} \quad 1$$

(4mks)

PARTICULATE NATURE OF MATTER

1. (a) State the kinetic theory of matter
   (b) State **two** reasons why gas particles diffuse faster than solid particles
   (c) You are provided with a long glass-tube, fitting corks, cotton wool, concentrated solution
   hydrochloric acid and concentrated ammonia solution.
   (i) Draw a possible set-up to compare the rates of diffusion of ammonia gas and hydrochloric
   acid gas
   (ii) Outline a clear procedure on how the experiment can be carried out
   (iii) What are the possible observations and conclusion
2. Distinguish between gases and liquids in terms of inter molecule forces.
3. What is the experimental evidence that shows that molecules in gases and liquids are in a state
   of motion
4. State Newton's second law of motion.
5. Smoke particles in air when strongly illuminated were observed to describe continuous, random
   haphazard movements. Explain what would be observed when the air temperature is decreased
6. State how heat transfer by radiation is reduced in a vacuum flask
7. (a) A partially filled balloon is placed in a bell jar with its open end on a thick glass plate as shown
   in ***figure 16.*** The contact between the jar and the glass plate is greased to make it air tight:

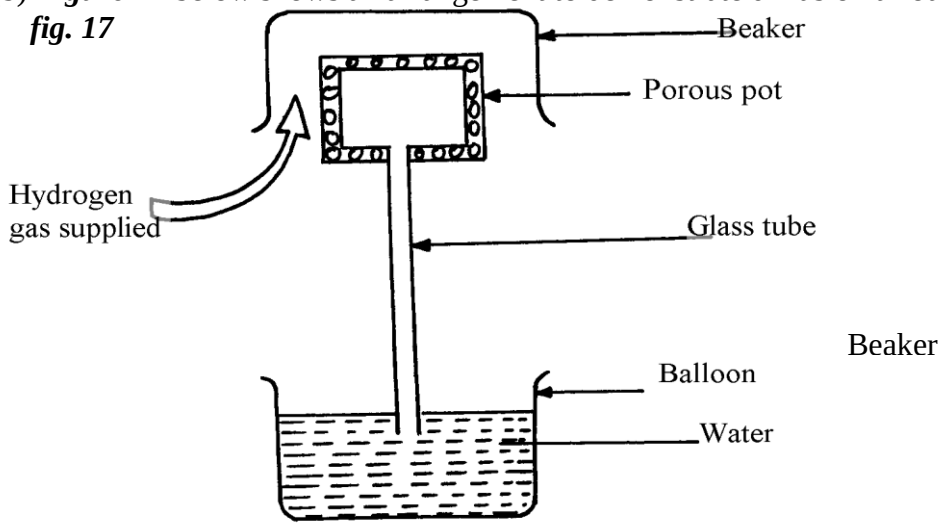
fig. 16



State and explain what happens to the balloon when air in the ball jar is slowly evacuated

(b) ***Figure 17*** below shows an arrangement to demonstrate diffusion through solids:-

fig. 17



The hydrogen gas is supplied for sometimes then stopped. State and explain what is likely

to be observed when the hydrogen gas supply:-

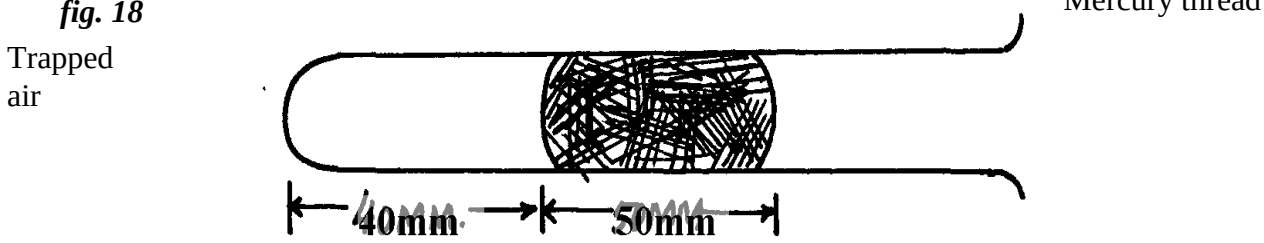
(i) is on

(ii) is stopped

(c) The diagram fig. 18 shows a glass tube containing enclosed air by a thread of mercury 50mm

long when the tube is held in a horizontal position

fig. 18



(i) The tube is slowly raised in a vertical position with the open end facing up. Determine

the new length of the trapped air (tube has same area of cross-section; atmospheric pressure = 750mmHg)

(ii) Account for the difference in the column of trapped air using kinetic theory of matter

assuming that temperature is constant.

8. Two samples of bromine vapour are allowed to diffuse separately under different conditions, one in a vacuum and the other in air. State with reasons the conditions in which bromine will diffuse faster

9. In terms of kinetic theory of matter, explain why evaporation causes cooling

10. (a) In an experiment to demonstrate Brownian motion, smoke was placed in air cell and observed under a microscope. Smoke particles were observed to move randomly in the cell.
(i) Explain the observation
(ii) Give a reason for using small particles such as those of smoke in this experiment
(iii) What would be the most likely observation if the temperature in the smoke cell was raised?
(b) An oil drop of average diameter 0.7mm spreads out into a circular patch of diameter 75cm on the surface of water in a trough
(i) Calculate the average thickness of a molecule of oil
(ii) State **two** assumptions made in **(i)** above

11. Give a reason why gases are more compressible than liquids

12. Explain the cause of random motion of smoke particles as observed in Brownian motion experiment using a smoke cell.

THERMAL EXPANSION

1. Figure 1 shows a beam balance made out of concrete and reinforced with steel

Use a diagram to explain the behaviour of the shape of the beam when heated up

2. (a) Sate **two** liquids which are used in thermometer.

(b) With a reason, state which of the two liquids in 3 (a) above is used to measure temperature in areas where temperatures are:

. (i) below -40^0c (ii) 150^0c

3. What do you understand by the statement '**lower fixed point'** on a temperature scale?

4. Name **two** adaptations that can be made to a mercury thermometer to make it more sensitive

5. **Figure 5** shows a bimetallic strip made of brass and iron. A marble is placed at end **A** of the bimetallic strip as shown below:-

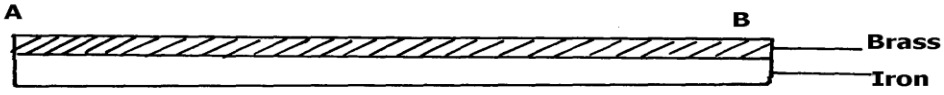
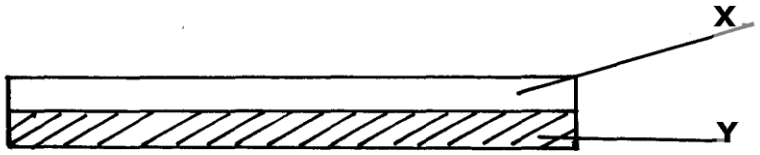


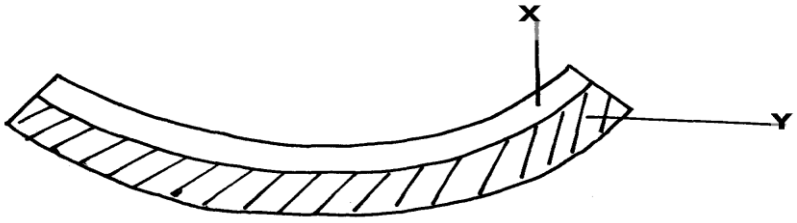
fig. 5

State and explain what will be observed when the bimetallic strip is strongly cooled

6. The figure below represents a bimetallic strip of metals **X** and **Y** at room temperature



The figure below shows its shape when dipped into crushed ice



Sketch a diagram in the space given below to show the shape when the strip is heated to a temperature above the room temperature

7. Give a reason why a concrete beam reinforced with steel does not crack when subjected to

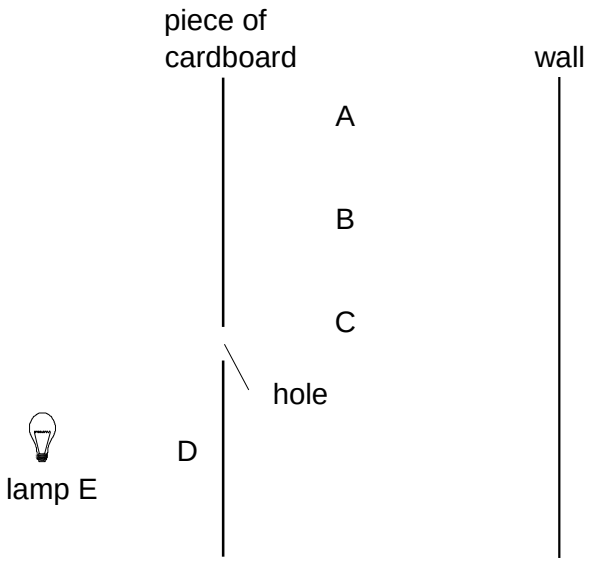
Changes in temperature.

RECTILINEAR PROPAGATION AND REFLECTION OF LIGHT

1. State the property of light associated with formation of shadows.

(1mk)

2. The diagram shows a lamp and a piece of cardboard. The piece of cardboard has a hole in it. Light from the lamp passes through the hole and forms a bright spot on a wall.



(a) (i) Which point on the wall, A B, C, D or E, is lit up by the lamp?

.....

1 mark

(ii) Explain why the **other** points on the wall are **not** lit up by the lamp.

.....

.....

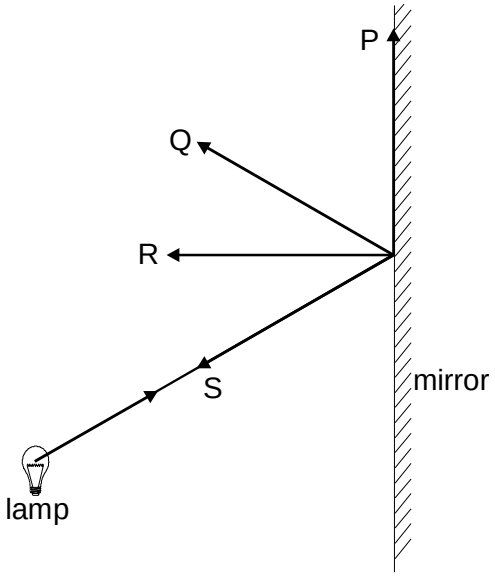
1 mark

(b) A piece of clear green plastic is placed over the hole.
What is the colour of the light which shines on the wall?

.....

1 mark

(c) The diagram shows a ray of light from a lamp hitting a mirror.



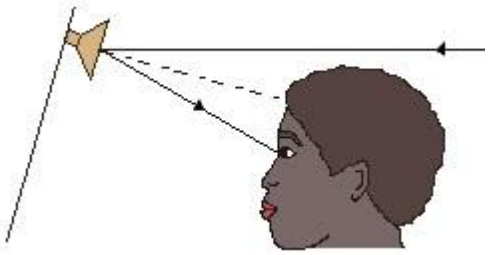
Which arrow, P, Q, R or S, shows the reflected ray?

.....

1 mark

Maximum 4 marks

3. (a) The diagram shows a motorist looking into her driving mirror.



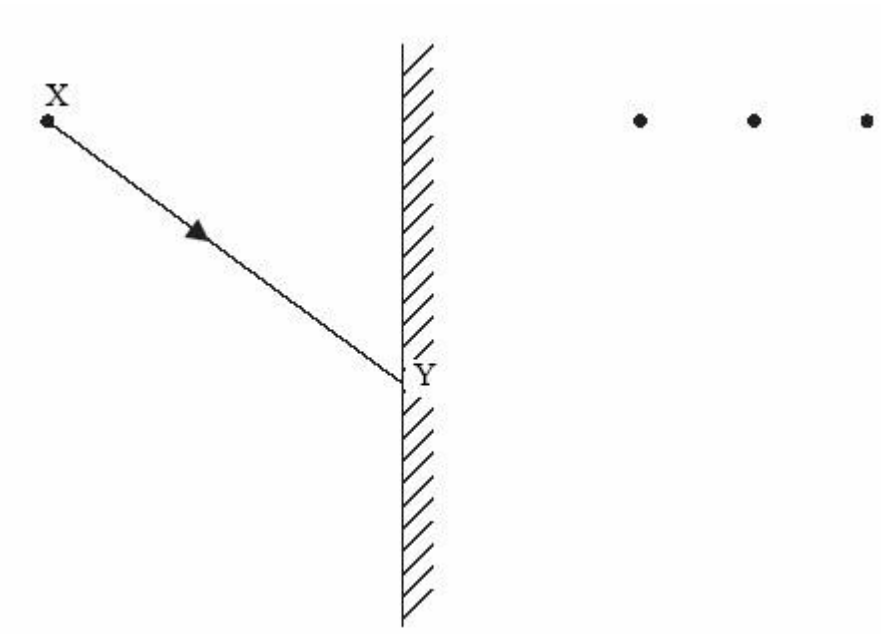
(i) Mark on the diagram: the letter 'I' to show the incident ray and the letter 'r' to show the angle of reflection.

(2 marks)

(ii) Name the dashed line shown in the diagram.

(1 mark)

4. The diagram below shows an object X placed in front of a plane mirror. A ray of light is drawn coming from the object X and striking the mirror at Y. After striking the mirror the ray of light is reflected.



(a) (i) Which of the three dots represents the correct position of the image of X? Label this dot Z.

..... **(1)**

(ii) Draw a line to represent the reflected ray at Y.**(2)**

(b) Mark on the diagram, for the ray XY at the mirror,

(i) The angle of incidence and label it *i*; **(1)**

(ii) The angle of reflection and label it *r*. **(1)**

(c) Is the image at Z real or virtual?

.....

(1)

[Total 6m]

5. James shone a ray of light at a mirror as shown below.

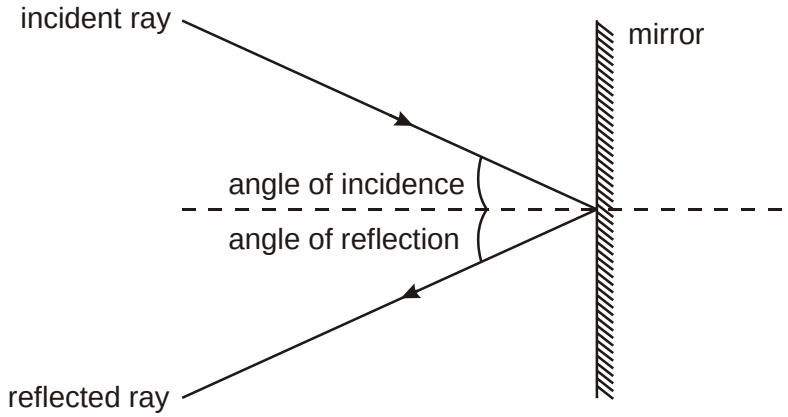


diagram 1

He measured the angle of **reflection** for different angles of incidence. His results are shown below.

angle of **incidence** (º)	30	40	50	60	70
angle of **reflection** (º)	30	40	50	65	70

(a) Which angle of reflection was **not** measured accurately?

.....°

How can you tell this from the table?

.....

.....

1 mark

(b) James set up a different experiment as shown below.

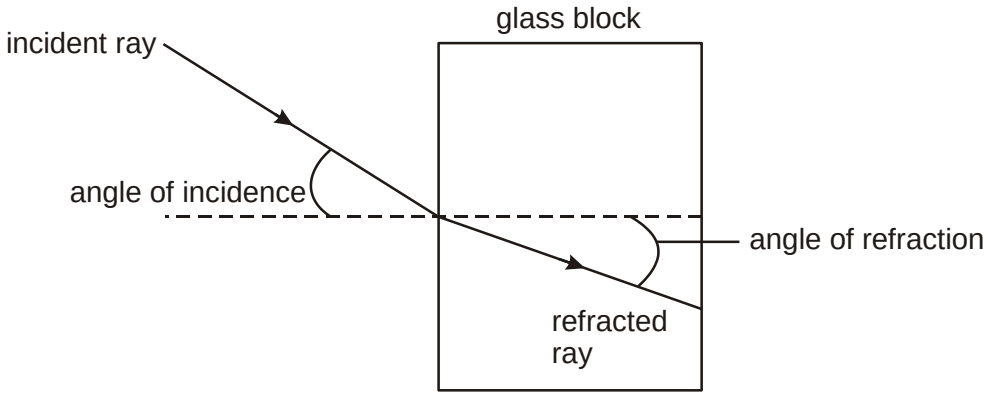
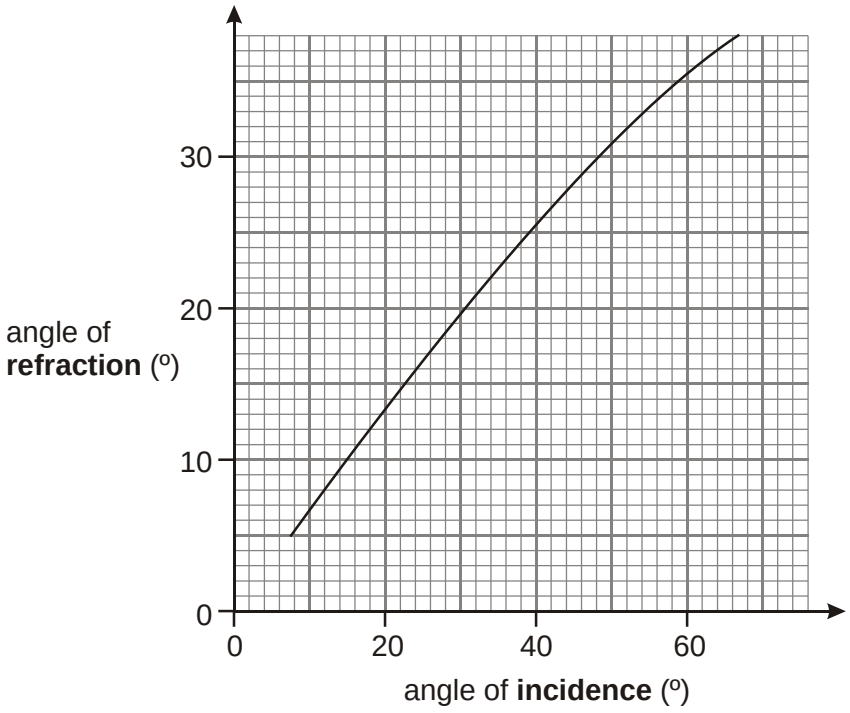


diagram 2

He measured the angle of **refraction** for different angles of incidence.

His results are shown in the graph.



Use the graph to answer the questions below.

(i) When the angle of **refraction** is 20°, what is the angle of **incidence**?

.....°

1 mark

(ii) What conclusion could James draw from his graph? Complete the sentence below.

When light passes from air into glass, the angle of **incidence** is

always ..... the angle of **refraction**.

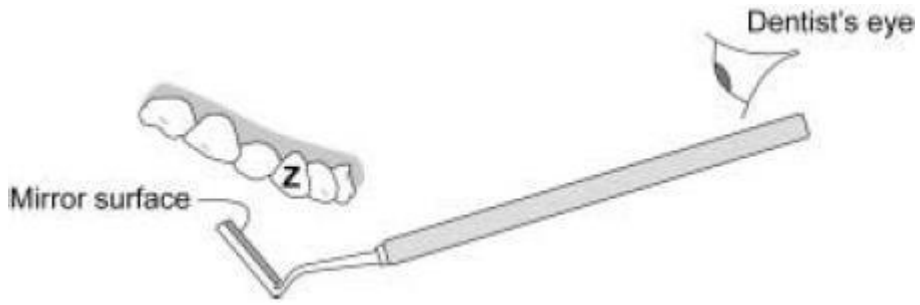
1 mark

(c) **On diagram 2,** draw a line to continue the refracted ray as it leaves the glass block.

1 mark

maximum 4 marks

6. The diagram shows a plane mirror used by a dentist to see the back of a patient's tooth.



(a) Use a ruler to draw a ray of light on the diagram to show how the dentist is able to see the tooth labelled **Z**.

(3)

(b) Describe the image formed by a plane mirror.

.....

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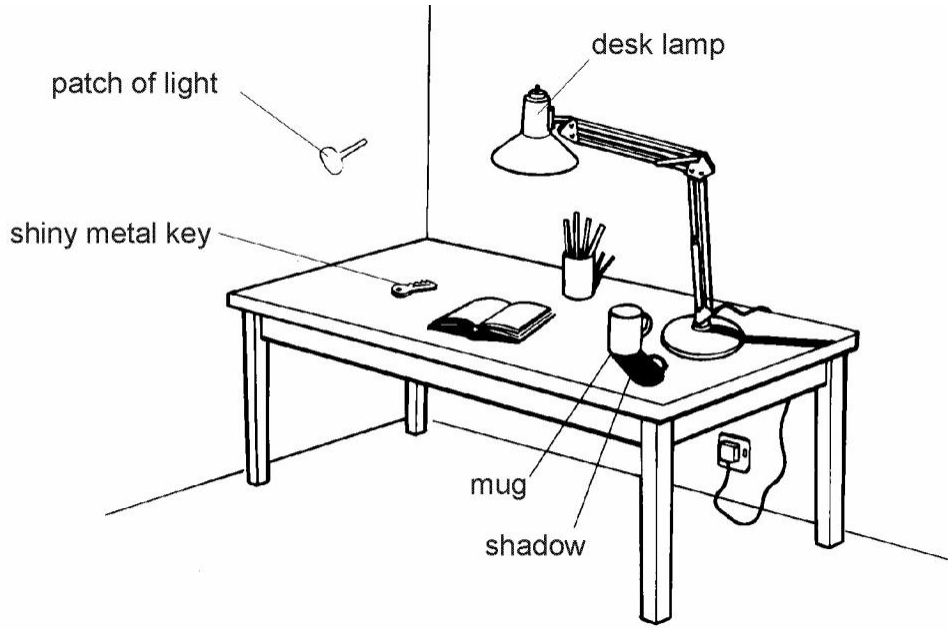
(2)
(Total 5 marks)

7. It is night-time and the desk lamp is on. Light shines onto the key.



(a) (i) Draw **one** ray of light on the diagram to show the light shining from the lamp onto the key. Use a ruler.

Put an arrow on the ray to show the direction of the light.

2 marks

(ii) There is a patch of light on the wall. This light has been reflected from the key. Draw a reflected ray of light on the diagram. Use a ruler.

1 mark

(b) There is a dark shadow on the table beside the mug. Explain how this shadow is formed.

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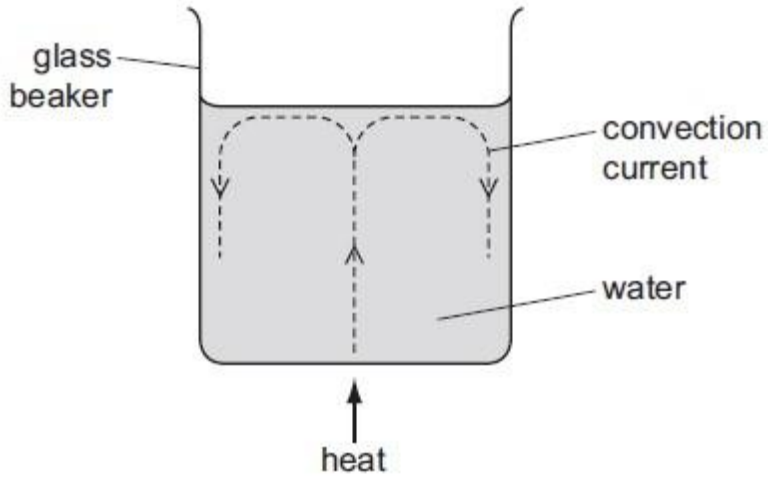
HEAT TRANSFER

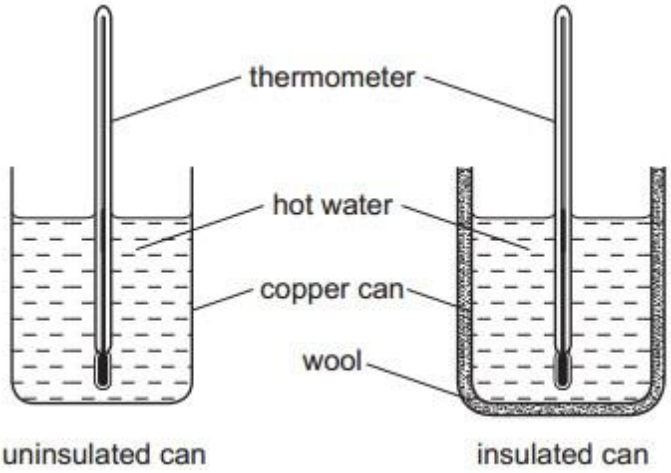
1. A glass beaker contains water. When the centre of the base of the beaker is heated, a convection current is set up.



Which statement explains this?

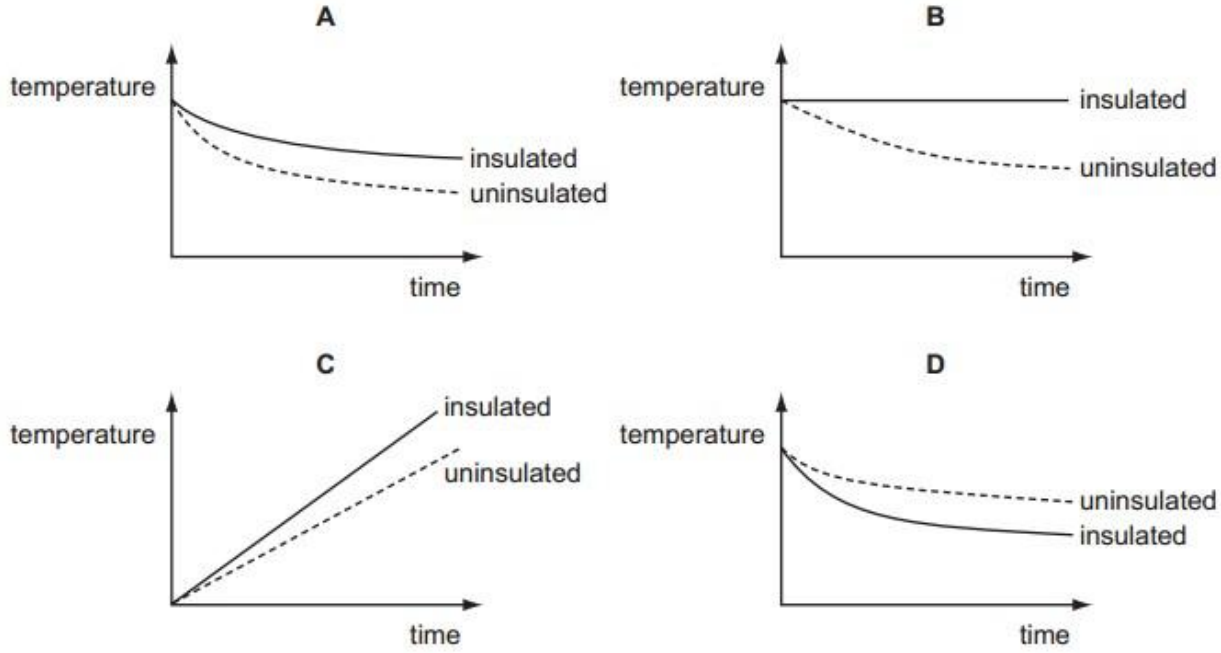
A. The evaporation of water causes water molecules to rise to the surface.
B. The expansion of water molecules causes them to rise to the surface.
C. The water above the heat source rises because it becomes less dense.
D. The water at the sides sinks because it becomes less dense.

2. Two identical copper cans are filled with boiling water.



One can is insulated with wool. The temperature of the water in each can is taken every minute for several minutes. Graphs of the results are plotted.

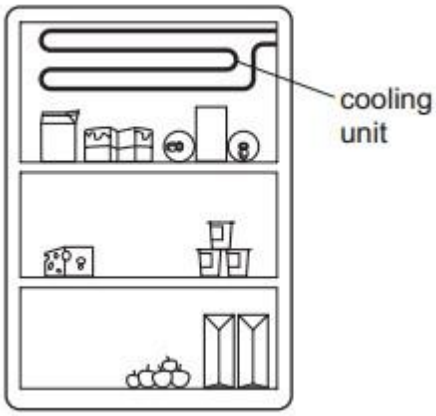
Which graph shows the results obtained?



3. In a vacuum flask, which methods of heat transfer are prevented by the vacuum?

A conduction only
B convection only
C conduction and convection only
D conduction, convection, and radiation

4. The diagram shows a cooling unit in a refrigerator.



Why is the cooling unit placed at the top?

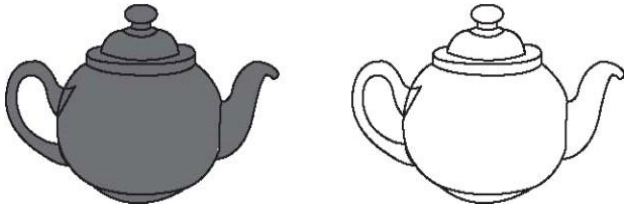
A Cold air falls and warm air is displaced upwards.

B Cold air is a bad conductor so heat is not conducted into the refrigerator.

C Cold air is a good conductor so heat is conducted out of the refrigerator.

D Cold air remains at the top and so prevents convection.

5. Two metal teapots are identical except that one is black on the outside and the other is white on the outside, as shown below.



The teapots each contain the same amount of hot water.

State and explain which teapot will cool down more quickly.

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.....

.....

[3]

[Total3m]

6. Logs of wood are burning in a camp-fire on the ground. A person is sitting nearby.

(a) (i) State two types of energy that the burning logs possess.

1. .....

2. .....

(ii) State the main method of heat transfer by which energy from the fire reaches the person sitting nearby.

.....

[3] (b) A spark jumps out of the fire.

(i) State the name of the type of energy that the spark possesses due to its movement.

.....

(ii) The spark lands on the person's hand.

State which method of heat transfer causes the person to feel the spark.

.....

(iii) The pain caused by the spark makes the person stand up.

1. State the type of energy that has increased, now that he is standing.

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2. State the type of energy stored in his body that enabled him to stand.

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[4]

7. The main parts of a cold store are shown in Fig. 4.1.

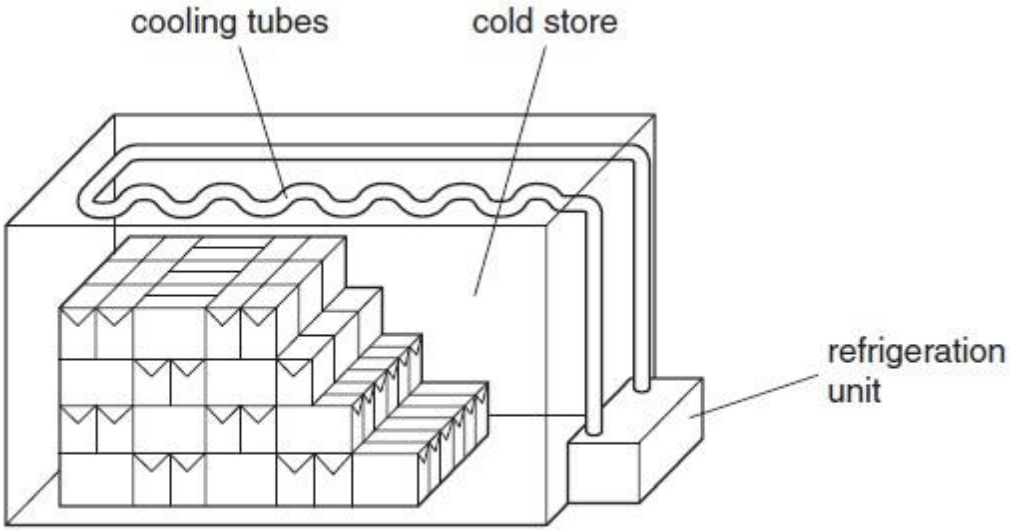

Fig. 4.1

(a) Explain why the cooling tubes are positioned at the top of the store.

[1]

(b) Suggest why the refrigeration unit is outside the cold store.

[2]

(c) The walls are made of thick thermally-insulating material. Why is it important to have the walls made like this?

[2]

(d) Even when the refrigeration unit is running continuously, there comes a time when the temperature in the store stops falling, and remains constant. Explain why this happens.

8. Fig. 7.1 shows a refrigerator in which a liquid absorbs thermal energy from the cold compartment and evaporates. As the vapour is compressed by the pump, work is done on it. The vapor condenses, giving out thermal energy to the surroundings through the cooling fins on the back of the refrigerator.

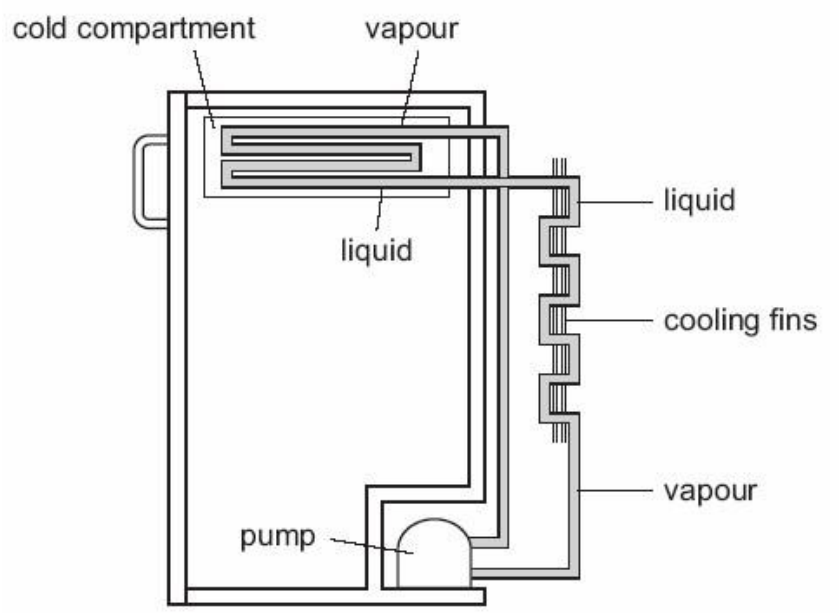

Fig. 7.1

(a) Explain the difference between boiling and evaporation.

[3]

(b) Explain why the pump compresses the vapour much more than it could compress a liquid.

[2]

(c) Explain the effect that a refrigerator has on the temperature of the air surrounding it.

[1]

(d) The pump is rated at 220 V, 110W.

(i) Calculate the working current of the pump.
Show your working.

[3] (ii) Calculate the working resistance of the pump.

[2]
[Total 11m]

9. Three horizontal rods are placed with one end just above a Bunsen flame. The other end of each rod is coated with wax, as shown in Fig. 3.1.

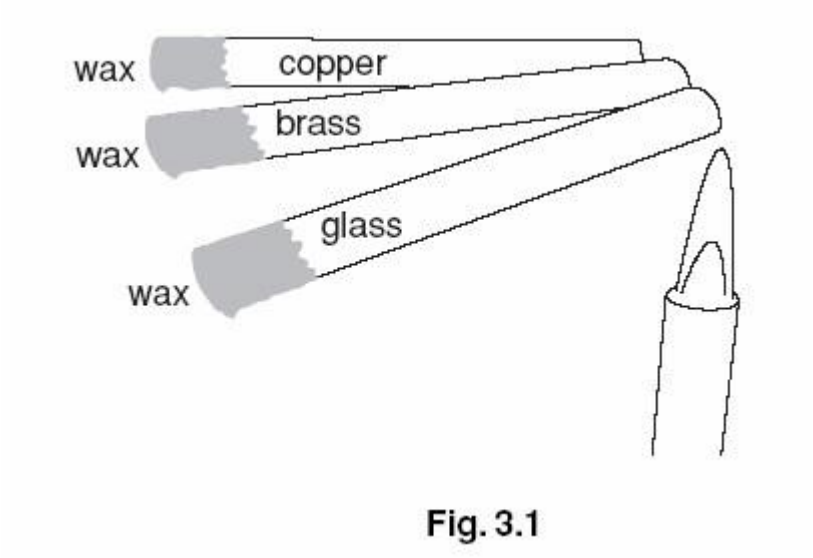

Fig. 3.1

Describe how you would use the apparatus to discover which rod is the best conductor of heat.

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