
MARKING SCHEME

Date done: 16TH February 2022

Instructions to candidates.

- (i) Write your **name, school, class** and **admission number** in the spaces above.
 - (ii) **Sign** and **write** the date of examination in the spaces provided above.
 - (iii) This paper consists of **two** sections; **A** and **B**.
 - (iv) Answer **all** questions in this paper in the spaces provided
 - (v) All working must be clearly shown in the spaces provided in this booklet.
 - (vi) All **numerical answers** MUST be expressed in **decimal notation**
 - (vii) KNEC Mathematical tables and silent NON -PROGRAMMABLE CALCULATORS may be used.
 - (viii) **Candidates should answer the questions in English**
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SECTION	QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1 - 12	25	
B	13	11	
	14	12	
	15	07	
	16	11	
	17	13	
TOTAL SCORE		80	

The paper consists of 12 printed pages.

Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.

SECTION A (25 Marks)

Answer all the questions in this section in the spaces provided

1. (a) Name **two** causes of burns in the laboratory (2 marks)

Naked flame ✓1

Splashes of concentrated acid ✓1

Splashes of concentrated base

- (b) What first aid measure may be administered in case of a burn? (1 marks)

Quickly run cold water over the affected part as you seek help for further treatment ✓1

2. The level of water in a burette is at 30 cm³. 400 drops of water each of volume 0.015 cm³ was removed from the burette. Determine the new level of water in the burette (3 marks)

$$\text{Volume of drop} = 400 \times 0.015$$

$$= 6 \text{ cm}^3 \text{ ✓1}$$

$$\text{New Level} = 30 + 6 \text{ ✓1} = 36 \text{ cm}^3 \text{ ✓1}$$

3. State the SI unit of density (1 mark)

Kilogram per cubic metre ✓1 (Do not award symbol)

4. Give a reason why heat transfer by radiation is faster than heat transfer by conduction (1 mark)

Radiation is propagated by means of electromagnetic waves while conduction is by movement of particles which is prone to distraction through collisions ✓1

5. An object weighs 7N on earth where acceleration due to gravity is 10N/kg. Find the acceleration due to gravity on another planet where the same object weighs 5N. (2 marks)

$$W_1 = mg_1$$

$$7\text{N} = m \times 10\text{N/kg}$$

$$M = 7\text{N}/10\text{N/kg} = 0.7\text{kg} \text{ ✓1}$$

$$W_2 = mg_2$$

$$g_2 = 5\text{N}/0.7\text{kg}$$

$$g_2 = 7.143\text{N/kg} \text{ ✓}$$

6. a) What is surface tension?

(1 mark)

It's the force that makes a free liquid surface behave like a stretched elastic skin ✓1

b) Figure 1 shows a funnel dipped into a liquid soap solution.

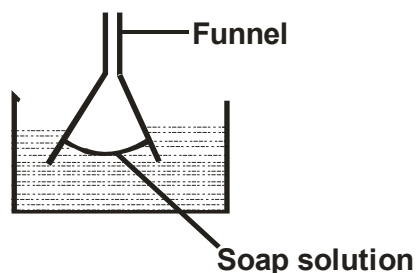


Figure 1

Explain what happens to the soap bubble when the funnel is removed from the soap solution (2 marks)

Bubble flattens to a film ✓1 and move up in the funnel in order to make its surface area as small as possible due to surface tension ✓1

7. Two identical spring balances A and B each weighing 0.8N are arranged as shown in figure 2 below.

What are the readings of A and B?

(2 marks)

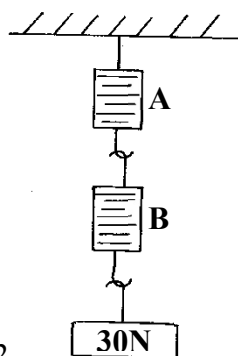
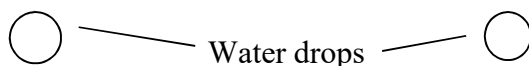


Figure 2

Readings of A = $30 + 0.8 = 30.8N$ ✓1

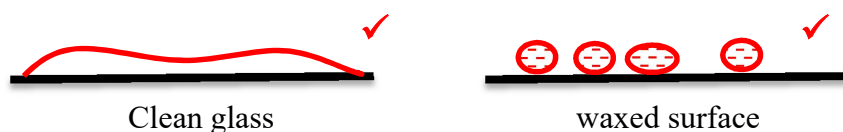
Readings of B = 30N ✓1

8. a) The diagram in figure 3 below shows water drops being placed slowly on two surfaces.



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Figure 3



Draw the two surfaces with water drops on them.

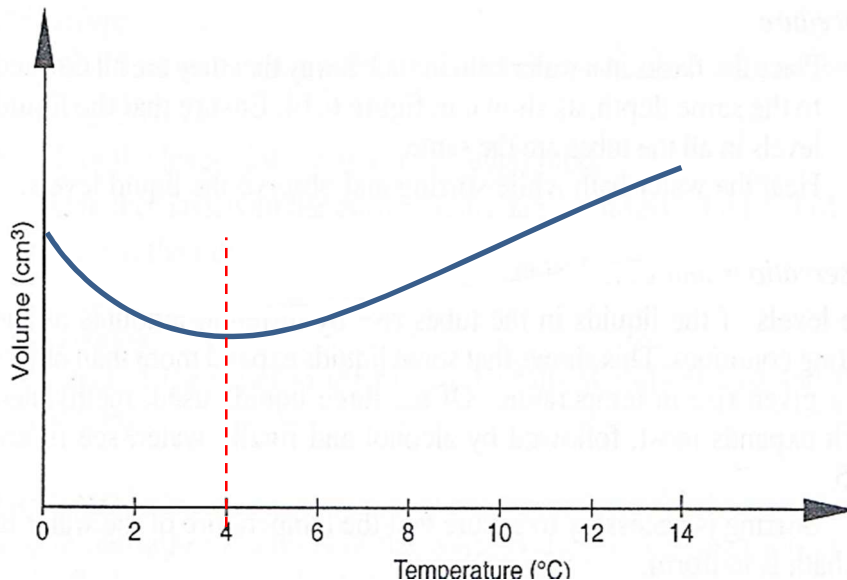
(2 marks)

b). Explain the appearance of the drop on the two surfaces.

(2 marks)

- *On clean glass adhesive forces are stronger than cohesive forces. ✓*
- *On waxed surface cohesive forces are stronger than adhesive forces ✓*

9. On the axis provided, sketch the graph which shows the relationship between volume V, and temperature of a fixed mass of water in the temperature range 0°C to 14°C (1 mark)



10. Explain why in construction, concrete beams are reinforced with steel.

(2 marks)

They are reinforced because they expand at the same rate ✓1 and have almost the same linear expansivity ✓1.

11. Give an example of a case where physics technology is used in medicine

(1 mark)

X-rays, body scanners, lasers, microscopes (award any other correct)

12. Convert each of the following temperatures to the temperature scale indicated in brackets

(2 marks)

a) 27°C (convert to K)

$$27 + 273 \checkmark \frac{1}{2} = 300 \text{ K } \checkmark \frac{1}{2}$$

b) 473 K. (convert to $^{\circ}\text{C}$)

$$473 - 273 \checkmark \frac{1}{2} = 200 \text{ K } \checkmark \frac{1}{2}$$

SECTION B (55 marks)

Answer ALL the questions in this section in spaces provided

13. a) A smoke cell contains a mixture of trapped air and smoke. The cell is brightly lit and viewed through a microscope. State and explain what is observed. (3 marks)

- ✓ *Bright specks of light in constant random motion are seen* ✓.
- ✓ *Smoke particles collide with air particles* ✓ *that are in constant motion which make them change their direction of motion and hence move randomly* ✓.

- b) When the stopper is removed from a bottle containing liquid ammonia, the ammonia can be smelled in all parts of the room after a short while. Explain this observation. (2 marks)

- *the particles of the gas spread from the bottle (high concentration)* ✓ *to all other areas (of low concentration)* ✓

- b) State two factors that affect the rate of diffusion in gases. (2 marks)

- 1) *density of the gas* ✓
- 2) *temperature* ✓

- c) Figure 4 below shows apparatus used to compare the rates of diffusion of gases.

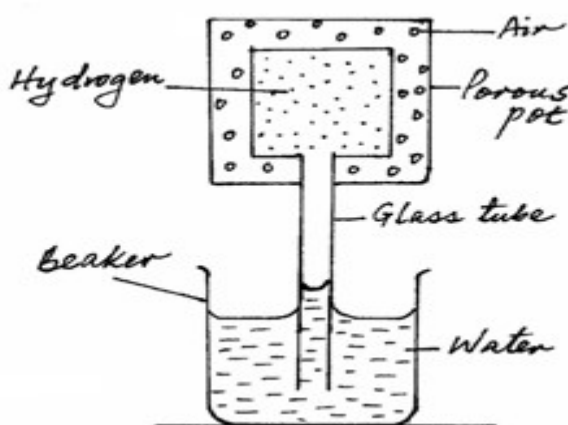


Figure 4

- Water is observed to rise up the glass tube. Explain this observation. (2 marks)

- *Hydrogen diffuses out of the porous pot faster than air diffuses into the porous pot.* ✓
- *The pressure inside the porous pot reduces and the higher atmospheric pressure pushes the water up the glass tube.* ✓

d) A beaker is filled completely with water. A spoon full of common salt is added slowly. The salt dissolves and the water does not overflow.

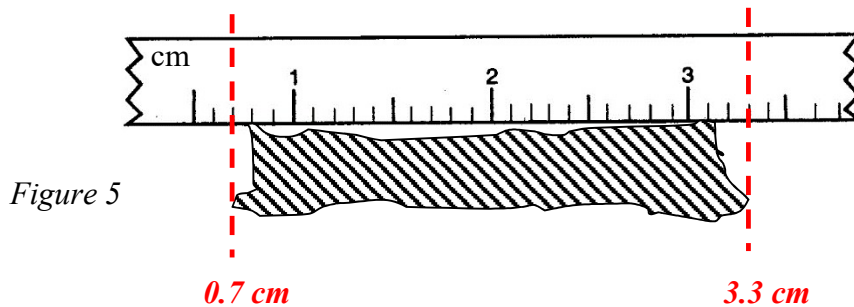
- (i) Why is salt added slowly? (1 mark)

To give enough time for the salt to dissolve to prevent displacement of water ✓

- (ii) State the reason why water does not overflow. (1 mark)

Particles of salt enter into spaces between larger water particles ✓

14. (a) The length of a piece of wood is measured with an instrument as shown in figure 5 below.



- i. State the accuracy of the instrument (1 mark)

0.1 cm ✓ (with units)

- ii. Determine the length of the piece of wood. (2 marks)

3.3 cm – 0.7 cm ✓

= 2.6 cm ✓ (with units)

.....

(b) Complete the table below by converting the given quantity into the stated units. Show your working

hours	minutes	seconds
$\frac{28800}{3600} \checkmark \frac{1}{2} = 8 \checkmark \frac{1}{2}$	$\frac{28800}{60} \checkmark \frac{1}{2} = 480 \checkmark \frac{1}{2}$	28,800

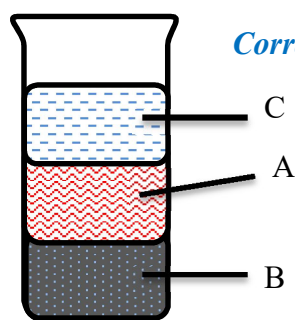
(2 marks)

(c) A sheet of paper measures 25 cm by 15 cm. Calculate its areas in SI units (2 marks)

Area = 0.25 m x 0.15 m ✓

= 0.0375 m² ✓ (with correct units)

- (d) Three immiscible liquids of density A = 0.7g/cm³, B = 0.8g/cm³ and C = 0.65g/cm³ are mixed together in a measuring cylinder and allowed to settle. Draw and label the liquids in the measuring cylinder. (2 marks)



Correct diagram of instrument showing immiscibility ✓1

Correct order ✓1

(marks awarded together)

- (e) Water of density 1 g/cm³ and volume 2 cm³ is mixed with milk of density 2.4 g/cm³. If the resulting mixture has density 1.9 g/cm³, determine the mass, m and volume, v of milk in the mixture. Give your answer in g and cm³ (3 marks)

Let x be the volume of milk,

Mass of milk = 2.4x ✓½

$$\rho \text{ of mixture} = \frac{2+2.4x}{2+x} = \frac{1.9}{1} \quad \checkmark \frac{1}{2}$$

$$3.8 + 1.9x = 2 + 2.4x$$

$$1.8 = 0.5x$$

$$\text{Volume of milk} = 3.6 \text{ cm}^3 \quad \checkmark$$

$$\text{Mass of milk} = 2.4 \times 3.6$$

$$= 8.64 \text{ g} \quad \checkmark$$

15. (a) The diagram in figure 6 below shows a set up used by a student to show variation of pressure in a liquid. The thistle funnel is wrapped with an elastic membrane. Use it to answer the question that follow.

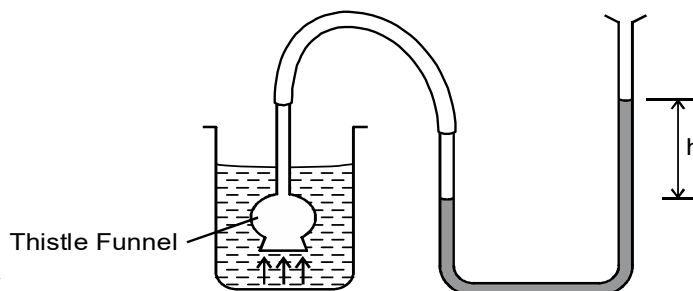


Figure 6

State and explain the effect on the height, h, when the thistle funnel is moved upwards towards the surface of the liquids. (2 marks)

- the height reduces ✓

- pressure acting on the trapped gas reduces with depth ✓

(b) Two immiscible liquid water and liquid L are put in a U tube as shown in figure 7 below.

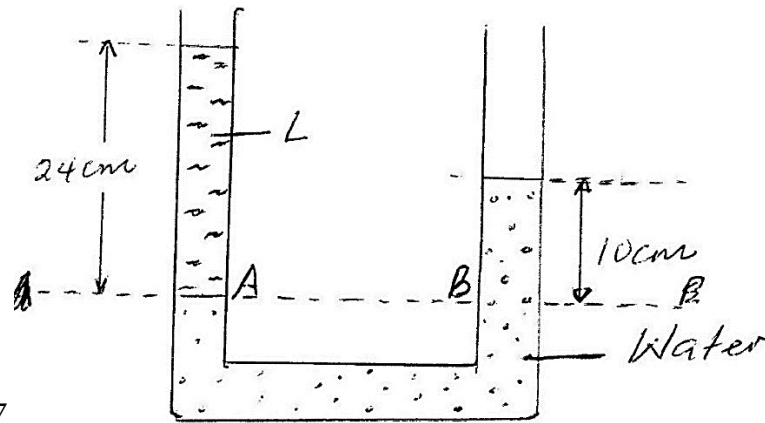


Figure 7

Use the diagram to find;

a) Pressure at B

(2 marks)

$$\begin{aligned}
 \text{Pressure at B} &= \rho h g \checkmark^{1/2} \\
 &= 1000 \times 10/100 \times 10 \checkmark^{1/2} \\
 &= 1000 \text{ Pa} \checkmark
 \end{aligned}$$

b) Pressure at A.

(1 mark)

$$\begin{aligned}
 P_A &= P_B \\
 &= 1000 \text{ Pa} \checkmark
 \end{aligned}$$

c) Density of liquid L.

(2 marks)

$$\begin{aligned}
 P_A &= \rho h g \\
 1000 &= \rho_A \times 0.24 \times 10 \checkmark \\
 \rho_A &= \frac{1000 \times 100}{24 \times 10} \\
 &= 416.667 \text{ Kg/m}^3 \checkmark \\
 &\text{(with correct unit)}
 \end{aligned}$$

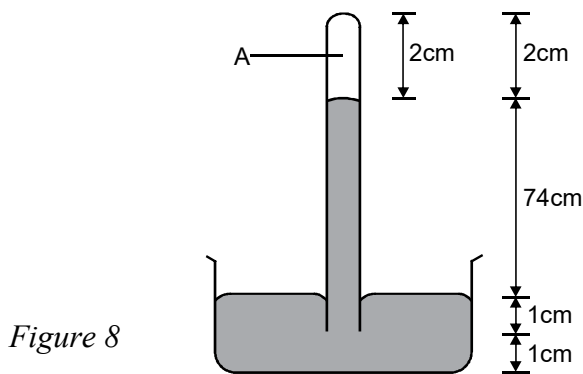
ALTERNATIVELY

$$\begin{aligned}
 \rho_L h_L &= \rho_w h_w \\
 \rho_L \times 0.24 \text{ m} &= 1000 \text{ Kg/m}^3 \times 0.1 \text{ m} \checkmark \\
 \rho \text{ of L} &= \frac{1000 \times 0.1}{0.24} \\
 &= 416.667 \text{ Kg/m}^3 \checkmark
 \end{aligned}$$

(c) Explain why it is difficult to remove the lid from preserving jar which was closed when the space above the food was full of steam (2 marks)

When a can is heated, air molecules are expelled from the can $\checkmark^{1/2}$. When sealed the steam pressure balances the atmospheric pressure $\checkmark^{1/2}$. On cooling the steam condenses creating partial vacuum on the inside $\checkmark^{1/2}$. The outer atmospheric pressure acting on the lid is greater than the pressure inside the can making the lid difficult to open $\checkmark^{1/2}$.

(d) Figure 8 below shows a simple barometer.



- (i) What name is given to region A? (1 mark)

- *Torricellian vacuum* ✓

- (ii) What keeps the mercury in the tube? (1 mark)

- *the atmospheric pressure* ✓

- (iii) What is the value of the atmospheric pressure being shown by the barometer? (1 mark)

74 cmHg ✓

- (iv) What would happen to the reading if the barometer was taken up a high mountain? (1 mark)

- *the reading will reduce* ✓

- (v) Give a reason for (iv) above. (1 mark)

- *the atmospheric pressure is low at high altitude ✓¹/₂ and therefore a shorter column of mercury is supported ✓¹/₂*

- (vi) State what would be observed if the test tube is tilted assuming the instrument is functioning normally. (1 mark)

- *the mercury gradually fills the space A until it finally fills the whole tube* ✓

16. In an experiment to determine the density of sand using a density bottle, the following measurement were recorded:

Mass of empty density bottle = 43.2 g

Mass of density bottle full of water = 68.2g

Mass of density bottle with some sand = 67.5g

Mass of density bottle with the sand filled up with water = 82.3g

Take the Density of water to be 1 g/cm³

Use the above data to determine the:-

- a) Mass of water that completely filled the bottle (½ mark)

$$68.2 \text{ g} - 43.2 \text{ g} = 25.0 \text{ g} \checkmark^{1/2} \text{ (ignore units, but deny if wrong units)}$$

- b) Volume of water that completely filled the bottle. (1 mark)

$$\begin{aligned} \text{volume of water} &= \frac{25.0 \text{ g}}{1 \text{ g/cm}^3} \checkmark^{1/2} \\ &= 25.0 \text{ cm}^3 \checkmark^{1/2} \text{ (ignore units, but deny if wrong units)} \end{aligned}$$

- c) Mass of sand (½ mark)

$$67.5 \text{ g} - 43.2 \text{ g} = 24.3 \text{ g} \checkmark^{1/2} \text{ (ignore units, but deny if wrong units)}$$

- d) Mass of water that filled the space above the sand. (½ mark)

$$82.3 \text{ g} - 67.5 \text{ g} = 14.8 \text{ g} \checkmark^{1/2} \text{ (ignore units, but deny if wrong units)}$$

- e) Volume of the sand (1½ marks)

$$\begin{aligned} \text{volume of water} &= \frac{14.8 \text{ g}}{1 \text{ g/cm}^3} \checkmark^{1/2} & \text{Volume of sand} &= 25.0 \text{ cm}^3 - 14.8 \text{ cm}^3 \\ &= 14.8 \text{ cm}^3 \checkmark^{1/2} & &= 10.2 \text{ cm}^3 \checkmark \\ & & & \text{(ignore units, but deny if wrong units)} \end{aligned}$$

- f) Density of the sand (1 marks)

$$\begin{aligned} \text{density of sand} &= \frac{24.3 \text{ g}}{10.2 \text{ cm}^3} \checkmark^{1/2} \\ &= 2.3824 \text{ g/cm}^3 \text{ (ignore units, but deny if wrong units)} \end{aligned}$$

17. (a) The set up in figure 9 below was used by form 1 students to investigate one of the modes of heat transfer.

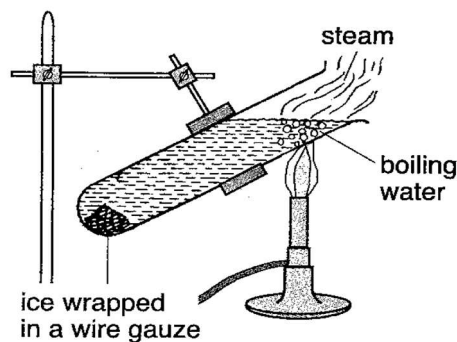


Figure 9

(i) State the mode of heat transfer being investigated (1 mark)

- *Conduction* ✓^{1/2}

(ii) It's observed that the water boils at the top of the boiling tube but the ice wrapped in wire gauze does not melt. explain (1 mark)

- *Water is a poor conductor of heat* ✓. *Therefore heat takes a long time to reach the bottom of the container*

(iii) Why is ice wrapped in a wire gauze? (1 mark)

- *Ice is less dense than water thus floats on water* ✓^{1/2} : *to keep the ice at the bottom of the tube* ✓^{1/2}, *it is wrapped in a wire gauze.*

(b) Ice at 0°C is stored in a thermos flask placed in a relatively warm room and after some time, it is noted that the temperature of the ice does not change

(i) What is the role of the silvery surface in keeping the ice cold? (1 mark)

- *The silvery surface reflect heat from outside away* ✓^{1/2} *minimizing heat that might be gained by radiation* ✓^{1/2}

(ii) What feature of a thermos flask prevents heat transfer by radiation? (1 mark)

- *The silvered surface* ✓

(iii) What modification can be made on the cork lid of the thermos flask to prevent heat loss through it (1 mark)

- *The cork must be made of a non-conductor material* ✓ *such as wood or plastic to prevent heat loss and gain by evaporation*

(c) Using the idea of particles, differentiate between solid and liquid in terms of intermolecular distance. (2 marks)

- *In solids the particles are held by strong cohesive force (or intermolecular force)* ✓^{1/2} *hence shorter distance between the particles* ✓^{1/2} *while in liquid the particles are held together by weak cohesive force (or intermolecular force)* ✓^{1/2} *hence the intermolecular distance is larger than solid* ✓^{1/2}.

(d) Why are solids better conductors of heat than liquids

(1 mark)

Distance between vibrating neighboring particles is smaller in solids than in liquids. ✓^{1/2}

Collisions between particles of solid is thus higher than in liquids, ✓^{1/2} *hence conduction of heat is better in solids than in liquids*

(e) The rate of heat flow in thermal conductivity increases with increase in cross-section area of the conductor. Explain this observation.

(1 mark)

Increase in cross sectional area increases the number of electrons per unit area that conduct heat resulting in increased thermal conductivity ✓

(f) Name two adaptations that can be made to a mercury thermometer to make it more sensitive

(2 marks)

✓ *The walls of the bulb should be very thin* ✓

✓ *The capillary bore/tube should be very thin and have uniform cross sectional area* ✓

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