MARKING SCHEME

Name: .....Class: ..... Adm. No. .....

232/1
PHYSICS
THEORY
Paper 1
June 2023
Time: 2 hours

Candidate's Signature: .....

KASSU JOINT EXAMINATION
JUNE 2023
Kenya Certificate of Secondary Education
PHYSICS
PAPER 1

Instructions to Candidates

- *Write your name, admission number, class and signature in the spaces provided at the top of the page. This paper consists of two sections; **A** and **B**.*
- *Answer **ALL** the questions in the spaces provided.*
- *Mathematical tables and electronic calculator may be used.*
- *All working MUST be clearly shown.*
- *This paper consists of **13** printed pages.*
- *Candidates should answer the questions in English and check to ensure that no question(s) is missing.*
- *Take:*
  Acceleration due to gravity, g=10m/s^2
  Density of fresh water=1 g/cm^3
  Density of sea water=1.2 g/cm^3

FOR EXAMINER'S USE ONLY

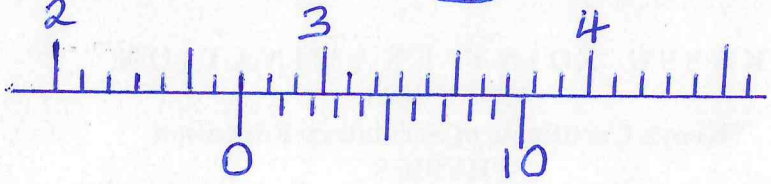
SECTION	QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1 – 13	25	
B	14	12	
	15	10	
	16	11	
	17	09	
	18	13	
	TOTAL	**80**	

SECTION A (25 MARKS)

Attempt all the questions in the spaces provided.

1. A vernier calliper has a zero error of 0.10 cm. Sketch the reading of the vernier calliper when used to measure the size of a test tube of internal diameter 2.60 cm. (1 mark)

Instrument's Reading = 2.60 + 0.10 = 2.70cm



✓1 Vernier scale MUST be complete.

2. An empty density bottle weighs 25g when empty and 70g when full of fresh water. Determine the volume of the density bottle. (2 marks)

Mass of Water = 70 − 25
= 45g

Density of water = 1g/cm³

$V = \frac{m}{\rho}$

$= \frac{45}{1}$ ✓1

$= 45\ cm^3$ ✓1

Volume of bottle = 45 cm³

3. The **figure 1** below shows a flask filled with coloured water. The flask is fitted with a cork through which a tube is inserted. The flask is placed in crushed ice and allowed to cool.

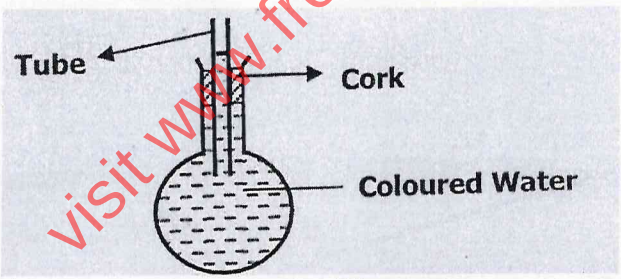


Figure 1

State and explain the observation made. (2 marks)

The level of water in the tube rises slightly and then falls steadily. The flask cools first, contracts and its volume reduces hence rise in the level of water. On cooling water it contracts faster than glass thus a fall in its level. ✓1 ✓1

4. The **figure 2** below shows a straw with a hole in use to suck milk from a glass container.

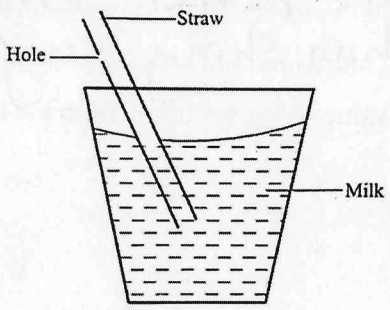


Figure 2

State and explain the observation made upon sucking. (2 marks)

Milk does not rise up the straw. On sucking, air is pulled into the straw through the hole. This causes greater air pressure inside the straw than atmospheric pressure on surface of milk hence it does not rise.

5. Two samples of bromine vapour are allowed to diffuse separately under different conditions, one in a vacuum and the other in air. It was observed that bromine diffused faster in vacuum than in air. Explain this observation. (1 mark)

In vacuum; Reduced collision of particles; or decreased compactness of molecules.

6. The **figure 3** below shows a graph of two containers having hot water and allowed to cool after sometime.

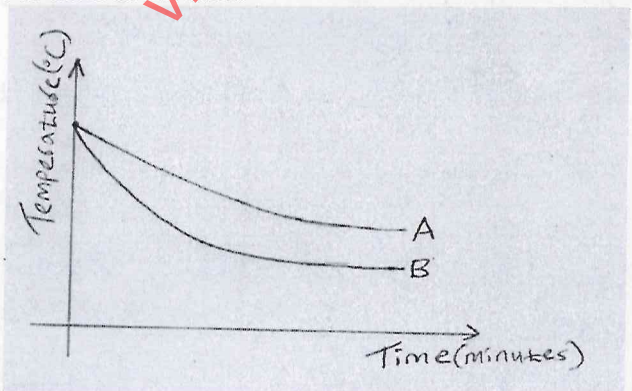


Figure 3

Graph A represents temperature in container A and B temperature in container B. With reason identify the graph that represents a container with dull surface. (2 marks)

B; dull surfaces are better emitters of radiant heat than shiny surfaces.

7. A student wanted to determine the mass of a stone using set up in **figure 4** below.

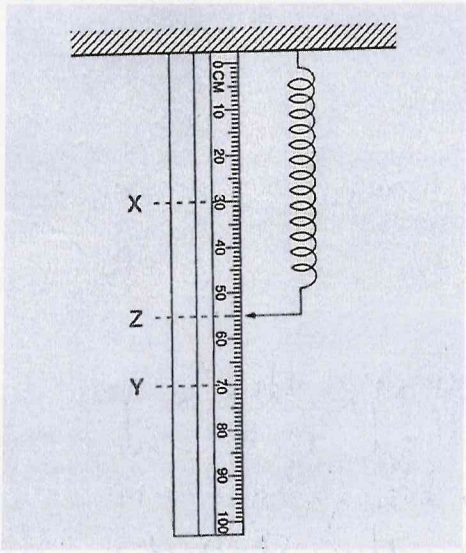


Figure 4

Initially, the pointer was at X. On hanging 200g mass on the spring, the pointer moved to point Y. When he replaced the 200g mass with the stone, the pointer moved to point Z. Given that the elastic limit of the spring was not exceeded, determine the mass of the stone.

(3 marks)

$F = 2N$; $e = 0.40m$

$F = ke$

$2 = k \times 0.4$

$k = \frac{2}{0.4}$

$= 5N/m$ ✓1

$e_2 = 55 - 30 = 25cm$

$F = ke$

$= 5 \times 0.25$

$= 1.25N$ ✓1

$W = mg$ ✓1

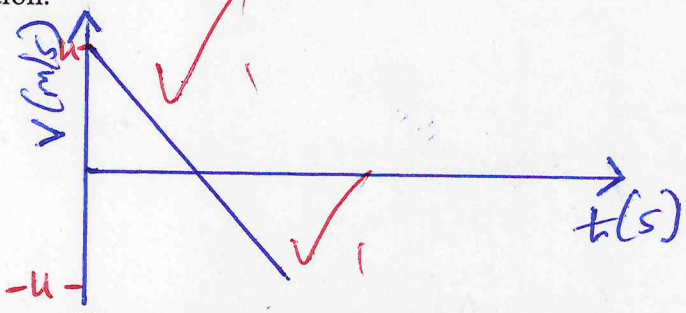
$1.25 = m \times 10$ ✓1

$m = 0.125kg$ or $125g$

8. It is dangerous to stand near the edge of a platform in a railway station when a train passes without stopping. Explain. (1 mark)

The stream of air along the train is at higher velocity hence lower air pressure between the person and the train. The greater atmospheric pressure from the outer side pushes one towards the train. ✓1

9. Sketch a velocity – time graph for a body projected vertically upwards until it falls back to its point of projection. (2 marks)



+u = -u

10. **Figure 5** below shows a uniform metre rule balanced on a knife edge.

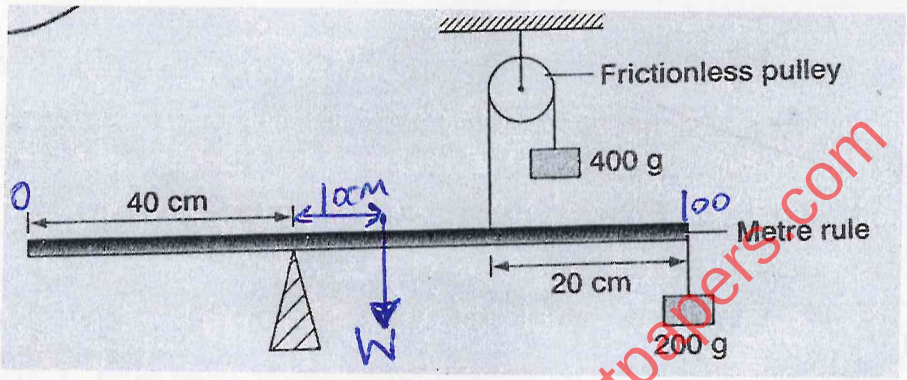


Figure 5

Determine the weight of the metre rule. (3 marks)

$F_1d_1 = F_2d_2$

$(W \times 0.1) + (2 \times 0.6) = 4 \times 0.4$

$0.1W + 1.2 = 1.6$

$0.1W = 1.6 - 1.2$

$W = \frac{0.4}{0.1}$

$= 4\ N$

11. State the S.I unit of work done by a stone mason in lifting a stone. (1 mark)

Joule or Newtonmetre

12. A certain mass of oxygen gas occupies a volume of 1.2 m^3 at a pressure of 1.4 x 10^5 Pa and temperature 15^0C. Find its volume when the temperature is 0^0c at a pressure of 1.1 x 10^5 Pa. (3 marks)

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{1.4 \times 10^5 \times 1.2}{288} = \frac{1.1 \times 10^5 \times V}{273}$

$V = \frac{1.4 \times 10^5 \times 1.2 \times 273}{1.1 \times 10^5 \times 288}$

$= 1.448\ m^3$

13. The **figure 6** below shows a block floating in a liquid.

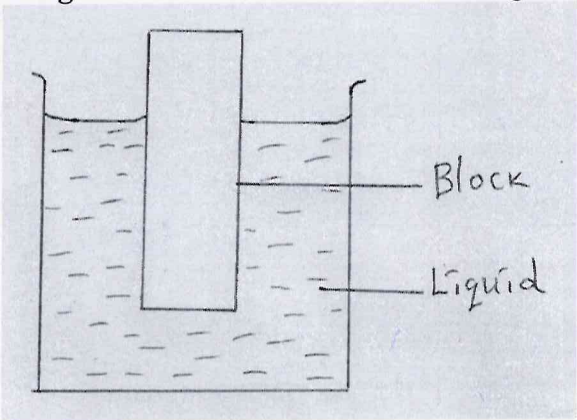


Figure 6

When the liquid B is heated, it is observed that the block sinks further. Explain this observation. (2 marks)

Volume of liquid increases upon heating hence density decreased, the block sinks more due to reduction in upthrust force acting on it ✓ ✓

SECTION B (55 MARKS)

14. (a) A ball is thrown horizontally from the top of a vertical tower and strikes the ground at a point 60m from the bottom of the tower. Given that the height of the tower is 50m, determine the;

(i) Time taken by the ball to hit the ground. (2 marks)

$h = \frac{1}{2}gt^2$ ✓

$50 = \frac{1}{2} \times 10 \times t^2$

$\frac{50}{5} = \frac{5}{5}t^2$

$t^2 = 10$

$t = \sqrt{10}$

$= 3.162$ seconds ✓ ✓

(ii) Initial horizontal velocity of the ball. (2 marks)

$R = ut$ ✓

$60 = u \times 3.162$

$u = \frac{60}{3.162}$

$= 18.97$ m/s ✓ ✓

(iii) Vertical velocity of the ball just before striking the ground. (2 marks)

$V = u + gt$
$= 0 + 10 \times 3.162$ ✓1
$= 31.62$ m/s ✓1

(b) State one factor that affects centripetal force acting on a body. (1 mark)

Angular velocity of the body
Radius of the path.
Mass of the body ✓1

(c) A point on the rim of a wheel has a velocity of 5.6 m/s. If the rim has a radius of 0.4m, calculate;

(i) The angular velocity of the point. (2 marks)

$V = r\omega$
$5.6 = 0.4 \times \omega$ ✓1
$\omega = \frac{5.6}{0.4}$
$= 14$ rad/s ✓1

(ii) its centripetal acceleration. (2 marks)

$a = \frac{V^2}{r}$
$= \frac{5.6 \times 5.6}{0.4}$ ✓1
$a = 78.40$ m/s^2 ✓1

(d) State the reason why an object moving in a circular motion is said to be accelerating while the speed is constant. (1 mark)

Instantaneous velocity change every time due to change in direction of motion. ✓1

15. (a) A body of mass M_1 moving at velocity 'u' collides with another stationary body of mass M_2. Given that the two bodies coalesce after impact and move at a uniform velocity of V. Derive an expression for the final velocity of the bodies after the impact. (2 marks)

Initial momentum of body 1 = $M_1 u$
Initial momentum of body 2 = $M_2 \times 0 = 0$
Final momentum after collision = $(M_1 + M_2)V$
Since momentum is conserved;
$M_1 u + 0 = (M_1 + M_2)V$
$V = \frac{M_1 u}{M_1 + M_2}$

(b) Given the following apparatus.
- ✓ Empty density bottle of volume V
- ✓ Liquid x
- ✓ Beam balance

Describe briefly how you can obtain the density of liquid X. (3 marks)

Measure mass of empty density bottle as M_1
Fill the density bottle with liquid X, replace stopper and wipe the outside dry. Measure its mass with liquid X, as M_2. Density of liquid X = $\frac{M_2 - M_1}{V}$

(c) (i) Define terminal velocity (1 mark)

Constant velocity attained by a body falling through a fluid when the sum of upthrust and viscous drag equals its weight.

(ii) The **figure** 7 below shows a velocity time graph for a small sphere falling through water.

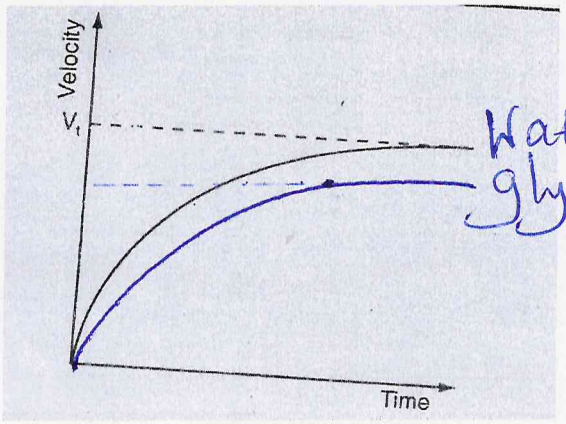


Figure 7

On the same axes sketch the graph for the sphere when allowed to fall through glycerine. (1 mark)

(iii) Explain the difference in the graphs in (ii) above. (1 mark)

Glycerine being more dense than water has greater viscous drag or viscosity.

(d) A liquid flows along a horizontal pipe of cross section area 24 cm^2 with a speed of 3 m/s. The speed increases to 9 m/s where there is a constriction. Calculate the cross-section area of the constriction. (2 marks)

$A_1V_1 = A_2V_2$

$\frac{24 \times 3}{9} = \frac{9 \times A}{9}$

$A = 8\ cm^2$

16. (a) State the meaning of 'specific latent heat of fusion". (1 mark)

Quantity of heat energy required to change the state of a unit mass of a substance from solid to liquid without change in temperature.

(b) The **figure 8** below shows a setup of apparatus used in an experiment to determine the specific latent heat of fusion of ice.

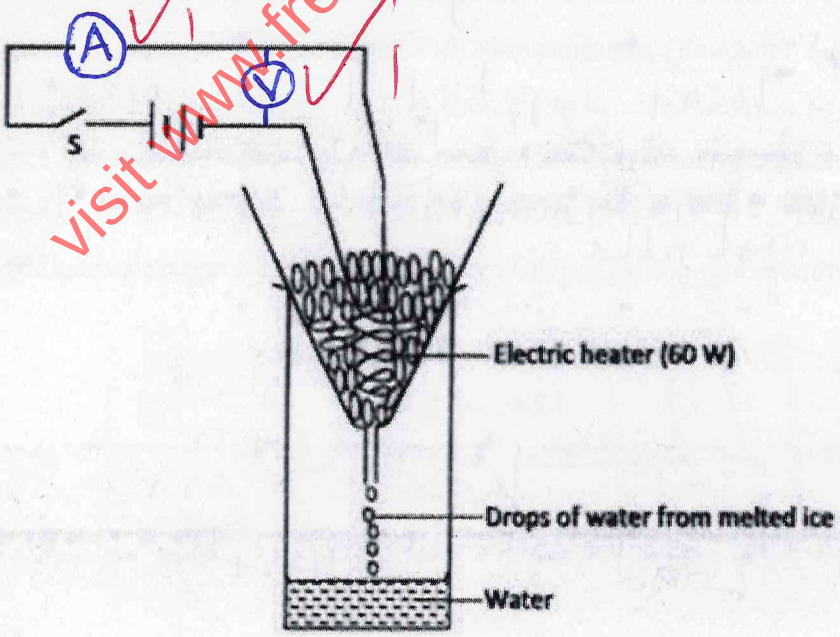


Figure 8

(i) On the diagram insert the ammeter and the voltmeter. (2 marks)

(ii) From the experiment above, give the measureable quantities required to achieve the objective. (2 marks)

- Voltmeter reading ✓
- Ammeter reading ✓ @ ½ mk each
- Mass of melted ice ✓
- Time ✓ using stopwatch

(iii) The following readings were obtained after the heater was switched on for 10 minutes. (Mass of melted ice = 18g) Determine:

I. Energy supplied by the 60W heater in the 10 minutes. (2 marks)

$Q = Pt$ ✓

$= 60 \times 10 \times 60$ ✓

$= 36,000\ J$ ✓ 2

II. Specific latent heat of fusion of ice. (3 marks)

$Q = mL_f$ ✓

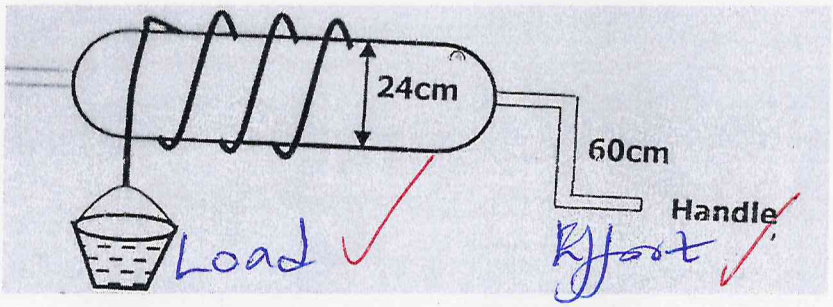
$\frac{36000}{0.018} = \frac{0.018 L_f}{0.018}$ ✓

$L_f = 2.0 \times 10^6\ J/kg$ ✓

(iv) State any assumption in the experiment. (1 mark)

- No heat supplied by heater is lost to the surrounding. ✓
- Mass of ice melted due to room temperature is negligible.

17. The diagram below shows the different parts of a wheel and axle machine.



(a) (i) Indicate on the diagram the effort and load. (1 mark)

Tied mark

(ii) Given that the handle wheel moved through a circular path of radius R and the axle moves through a circular path of radius r. Show that the velocity ratio of a wheel and axle is given by V.R = $^{R}/_{r}$. (2 marks)

V.R = distance covered by effort in one Revolution / distance covered by load

= $\frac{2\pi R}{2\pi r}$ ✓1

V.R = $\frac{R}{r}$

(b) In a wheel and axle, the wheel's radius is 60cm, while the axle's diameter is 24cm. the effort is 1.0N and the load is 4N. Work out:

(i) The velocity ratio. (2 marks)

V.R = $\frac{R}{r}$ = $\frac{60\text{ cm}}{12\text{ cm}}$ ✓1

= 5 ✓1

(ii) The mechanical advantage. (2 marks)

M.A = $\frac{L}{E}$ = $\frac{4N}{1N}$ ✓1

= 4 ✓1

(iii) The efficiency of the system. (2 marks)

$\eta = \frac{M.A}{V.R} \times 100\%$

= $\frac{4}{5} \times 100\%$ ✓1

= 80% ✓1

18. (a) A spherical buoy of diameter 0.6m and mass 50kg is connected to a rope tied to a sea bed so that ¾ of its volume is below the surface, as shown in the **figure 9** below.

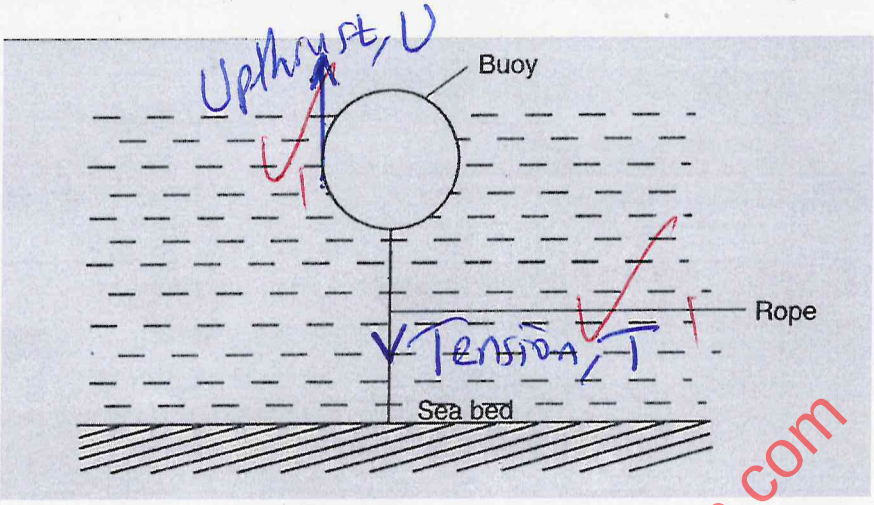


Figure 9

(i) On the diagram, indicate two forces acting on the buoy apart from weight, W. (2 marks)

(ii) Determine:

I. The weight of the buoy (1 mark)

$W = mg$
$= 50 \times 10$
$= 500\ N$

II. The upthrust on the buoy (2 marks)

$U = \rho V g$
$= 1200 \times \left(\frac{4}{3} \times 3.142 \times 0.3^3\right) \times \frac{3}{4} \times 10$
$= 1018\ N$

III. The tension, T, on the rope. (2 marks)

$T = U - W$
$= 1018 - 500$
$= 518\ N$

(b) The **figure 10** below shows a simple hydrometer.

State the reason why;

i. The upper stem is made narrow (1 mark)

To improve sensitivity of the hydrometer

ii. The lead shots are placed in the glass bulb. (1 mark)

To enable the hydrometer float upright

(c) The hydrometer above has a mass of 25g and allowed to float in oil of density $0.8g/cm^3$ with 6 cm of its stem above the oil. If the cross-sectional area of the stem is $0.5cm^2$, find the length of its stem out of freshwater, if it is transferred and made to float in freshwater. (4 marks)

Vol. above oil $= 0.5 \times 6 = 3cm^3$

Weight = Upthrust of oil on it

$\frac{25}{1000} \times 10 = 800 \times V \times 10$

Vol. displaced $= 31.25 cm^3$

Vol. of hydrometer $= 31.25 + 3$

$= 34.25 cm^3$

Again,

Weight = Upthrust of water

$0.25 = 1000 \times V \times 10$

$\frac{0.25}{10000} = \frac{10000V}{10000}$

$V = 25cm^3$

Vol. above water $= 34.25 - 25$

$= 9.25 cm^3$

But $V = A \times L$

$L = \frac{9.25}{0.5}$

$= 18.5 cm$