MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education

PRE-MOCK EXAMINATIONS 2023

232/1 **PHYSICS** **Paper 1**

April 2023 – 2 Hours

MARKING GUIDE

Instructions to candidates

- This paper consist of TWO sections; A and B. Answer ALL the questions in section A and B in the spaces provided.
- ALL working MUST be clearly shown. Mathematical tables, electronic calculators and slide rules may be used.
- Candidates should check the question paper to ensure that all the **11** pages are printed as indicated and that no questions are missing.

Take: $density\ of\ water = 1gcm^{-3}$, $g = 10N/kg$

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SECTION	Question	Maximum Score	Candidate's Score
A	1-10	25	
B	11	15	
	12	10	
	13	09	
	14	12	
	15	09	
TOTAL		**80**	

SECTION A: 25 MARKS

1. The micrometer screw gauge shown in **figure 1** was found to have an error of + 0.04 mm

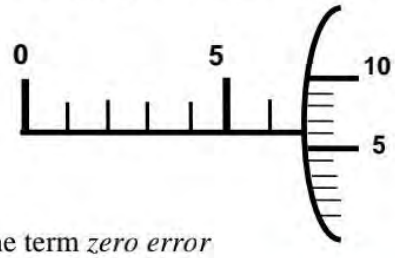


Figure 1

(a) Define the term *zero error* (1 mark)

A type of error in which an instrument gives a reading when the true reading at that time is zero ✓1

(b) Give the correct reading of the micrometer (1 mark)

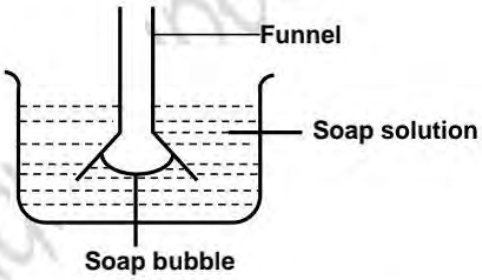
6.06mm - 0.04 = 6.02mm ✓1

2. (a) What is surface tension? (1 mark)

A force that makes the surface of a liquid to behave like a fully stretched elastic skin. ✓1

(b) **Figure 2** shows a funnel dipped into a liquid soap solution.

Figure 2



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

The soap bubble recedes until it flattens to a film at the neck of the funnel. ✓1

In so doing, it tries to make its surface as small as possible because of surface tension. ✓1

3. A boy on a bicycle accelerated uniformly at 1m/s^2 for 10 seconds from an initial velocity of 4m/s. Calculate the distance travelled in this time. (3 marks)

$S = ut + \frac{1}{2}at^2$ ✓1

$= (4 \times 10) + (\frac{1}{2} \times 1 \times 10^2)$ ✓1

$= 90m$ ✓1

4. An object is attached to a spring balance and its weight determined in air. It is then gently lowered into a beaker containing water.

   (a) State what happens to the reading. (1 mark)

   It reduces ✓1

   (b) Explain the force that causes observation in (a) above. (1 mark)

   Due to upthrust force - upward force acting on an object immersed in a fluid, hence its apparent weight is less than the real weight. ✓1

5. A metal cube weighs 1.0N in air and 0.8N when totally immersed in water. Calculate:

   (a) Volume of water it displaces. (2 marks)

   $u = v\rho g$

   $1.0 - 0.8 = v \times 1000 \times 10$ ✓1

   $v = 2.0\times10^{-5}m^3$ ✓1

   (b) the density of the cube (2 marks)

   $\rho = \frac{m}{v} = \frac{0.1kg}{2.0\times10^{-5}m^3}$ ✓1

   $= 5000kg/m^3$ ✓1

6. State how the velocity of a moving fluid varies with pressure. (1 mark)

   Inversely proportional // If pressure increases, velocity decreases; If pressure decreases velocity increases. ✓1

7. **Figure 3** shows a bottle opener.

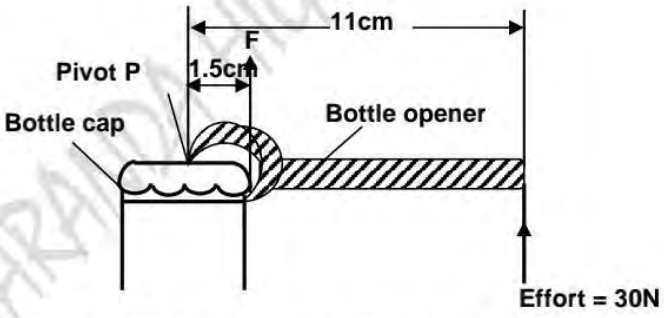


Figure 3

A force of 30N is applied at a distance of 11cm from the pivot P. A force F acts at the edge at a distance 1.5cm from P. Calculate the force F on the edge of the cap. (2 marks)

Sum of clockwise moments = Sum of anticlockwise moments

$\frac{1.5}{100} \times F = \frac{11}{100} \times 30$ ✓1

$F = 220N$ ✓1

8. **Figure 4** shows a manometer used to measure the pressure difference between the air inside a plastic container and the atmosphere outside.

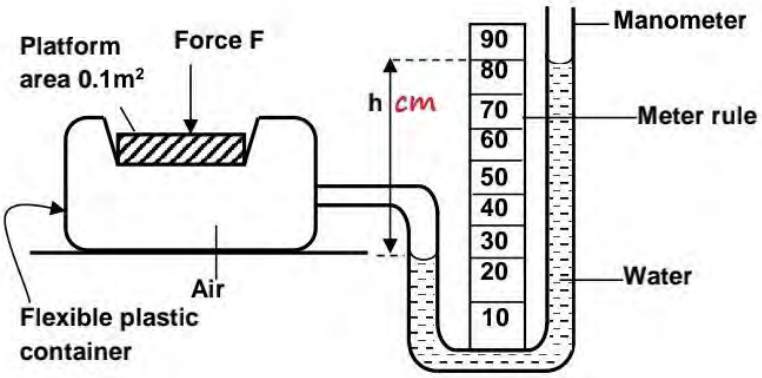


Figure 4

Calculate the force F exerted on the container. (3 marks)

$F = P \times A = h\rho g \times A$ ✓1

$= \frac{(80 - 20)}{100} \times 1000 \times 0.1 \times 10$ ✓1

$= 600N$ ✓1

9. A student observes that in the morning an overhead electrical cable is straight and taut. At midday the student observes that the same cable has sagged. Explain these observations. (2 marks)

In the morning, they are straight and taught because of the cold hence it contracted. ✓1

At midday, the cables expand due to the heat from the sun, hence sag. ✓1

10. A rubber tube is inflated to pressure of 2.7×10^5 pa and volume $3800cm^3$ at temperature of 25^0C. It is then taken to another place where the temperature is 15^0C and the pressure is 2.5×10^5 pa. Determine the new volume (3 marks)

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ ✓1

$\frac{2.7X10^5 \times 3800}{298} = \frac{2.5X10^5 \times V_2}{288}$ ✓1

$V_2 = 3966.28cm^3$ ✓1

Rev. Peter Okoth

SECTION B: 55 MARKS

11. (a) **Figure 5** shows two containers filled with two different liquids to the same height.

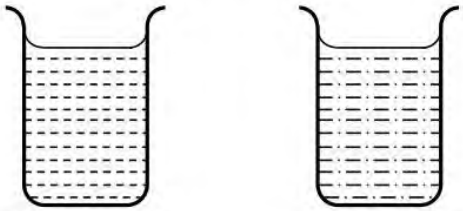


Figure 5

It was found that the pressure at the bottom of A is greater than that at B. Explain (1 mark)

A is denser than B ✓1

(b) **Figure 6** shows a car braking system. The brake fluid is an oily liquid.

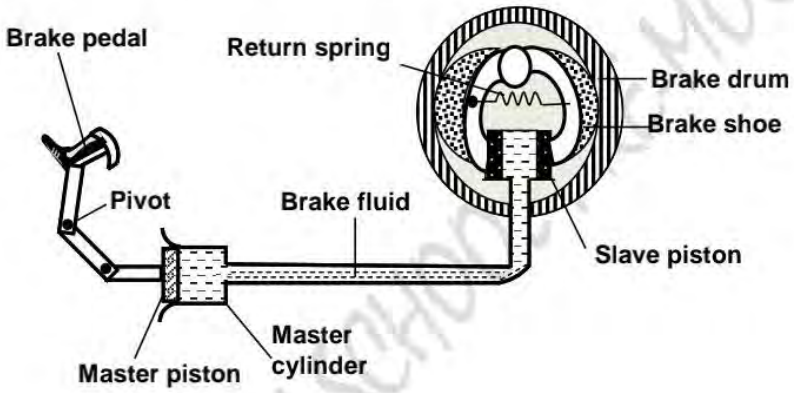


Figure 6

The brake drum rotates with the wheel of the car.

(i) Explain how pushing the brake pedal makes the brake rub against the drum. (4 marks)

When the pedal is pushed, pressure is generated in the master cylinder. ✓1

This pressure is transmitted to the slave cylinder. ✓1

This causes the pistons of the slave cylinder to open the brake shoe; ✓1

Hence the brake lining presses the drum [to cause braking action]. ✓1

(ii) The cross-sectional area of the master piston is 2.0 cm^2. A force of 140N is applied to the master piston.

(I) Calculate the pressure created in the brake fluid by the master piston. (2 marks)

$P = \frac{F}{A} = \frac{140}{2X10^{-4}m^2}$ ✓1

$= 700,000N/m^2 \parallel 700,000Pa$ ✓1

(II) The cross-sectional area of each slave piston is 2.8 cm^2. Calculate the force exerted on each slave piston by the brake fluid. (2 marks)

$F = P \times A$

$= 700\,000 \times 2.8X10^{-4}$ ✓1

$= 196N$ ✓1

(III) The force exerted on the master piston is greater than the force applied by the foot on the brake pedal. Using the principle of moments, explain this (2 marks)

Distance from the foot to pivot is larger than distance from piston to the pivot. ✓1

Since the product of force and distance remains constant. ✓1

(c) **Figure 7** shows a master cylinder sealed at one end. Instead of brake fluid, the cylinder contains air.

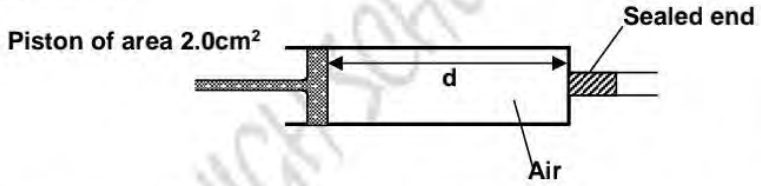


Figure 7

When a force is applied to the piston, the length d changes from 6.0 cm to 4.0 cm. The pressure of the air increases but the temperature stays constant.

(i) Describe how the molecules of air exert a pressure. (1 mark)

Molecules hit against the walls/piston. ✓1

(ii) Explain why the pressure increases even though the temperature stays constant. (1 mark)

Molecules hit more frequently due to smaller volume. ✓1

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(iii)The initial pressure of the air inside the cylinder is 1.0 x 10^5 pa. Calculate the final pressure of the air. (2 marks)

$P_1V_1 = P_2V_2$ ✓1

$1X10^{-5} \times 6cm = P_2 \times 4cm$

$P_2 = 1.5x10^5$ Pa ✓1

12. .

(a) What is a machine? (1 mark)

It is an apparatus used to make work easier. ✓1

(b) Two gear wheel have an 80 teeth (driven) and 20 teeth (driving) and lock with each other. They are fastened on axles of equal diameters such that a weight of 150N attached to a string round one axle will just raise 450N on the other axle.

Calculate:

(i) M.A (2 marks)

$= \frac{Load}{Effort} = \frac{450N}{150N}$ ✓1

$= 3$ ✓1

(ii) V.R (2 marks)

$= \frac{No.\ of\ teeth\ in\ driven\ wheel}{No.\ of\ teeth\ in\ driving\ wheel} = \frac{80}{20}$ ✓1

$= 4$ ✓1

(iii) Efficiency of the machine. (2 marks)

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

$= \frac{3}{4} \times 100\%$ ✓1

$= 75\%$ ✓1

(c) The graph in **figure 8** shows the variation of force with distance for a body being towed.

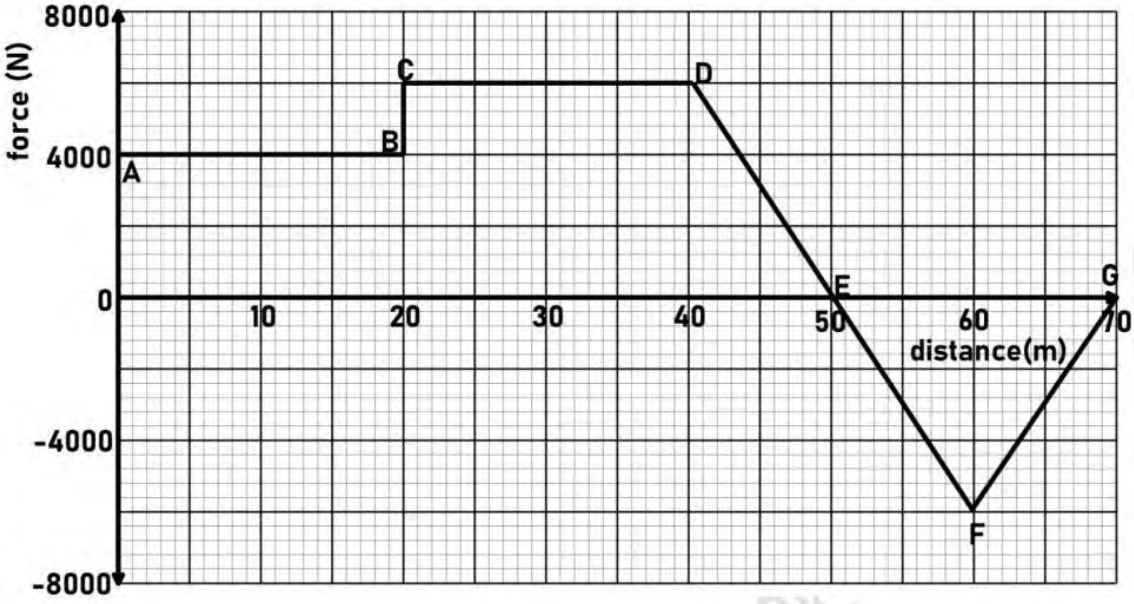

Figure 8

Calculate the total work done on the body. (3 marks)

Work done = Area under curve ✓1

= (4000 X 20) + (6000 X 20) + (0.5 X 10 X 6000) + (0.5 X 20 X -6000) ✓1

= 170,000J ✓1

13. .

(a) Distinguish between distance and displacement. (2 marks)

Distance is the complete length of the path between two points, while ✓1

displacement is the direct length between any two points when measured ✓1

along the minimum path between them (w.t.t.e.)

(b) A jet fighter moving horizontally at a speed of 200m/s at a height of 2 km above the ground is to drop a bomb to hit a target on the ground. How long does the bomb stay in air after release before it hit the target? (3 marks)

$S = ut + \frac{1}{2}gt^2$ (for vertical motion, $u = 0$) ✓1

$2000 = 0 + \frac{1}{2} \times 10 \times t^2$ ✓1

$t = 20s$ ✓1

(c) Two equal masses travel towards each other on a frictionless air track at speeds of 60cm/s and 40cm /s as shown in **figure 9**.

Figure 9

If they stick together on impact, what is the velocity of the masses after impact? (2 marks)

$m_1u_1 + m_2u_2 = (m_1 + m_2)V_c$ ✓1

$(m \times 60) + (m \times -40) = (m + m)V_c$ ✓1 $V_c = 10cm/s$ ✓1

(d) **Figure 10** shows a simple pendulum oscillating between Y and Z.

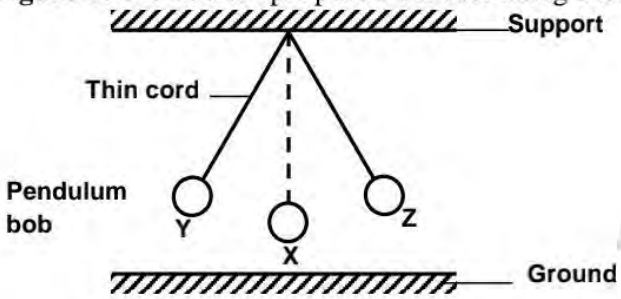

Figure 10

State the type of energy the body possesses at:

(i) Position Y (1 mark)

Potential energy ✓1

(ii) Position X (1 mark)

Kinetic energy ✓1

14. .

(a) Define the term *latent heat of fusion*. (1 mark)

Quantity of heat required to change state of a given mass from solid to liquid or liquid to solid without change in temperature. ✓1

(b) In an experiment to determine the power of an electric heater, melting ice was placed in a container with an outlet and the heater placed in the ice as shown in **figure 11**. The melted ice was collected.

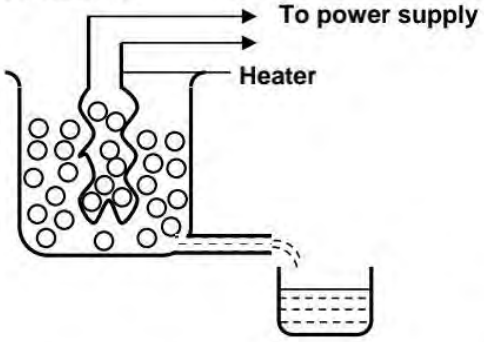

Figure 11

(i) Other than the current and voltage, state the measurement that would be taken to determine the quantity of heat absorbed by the melted ice in unit time. (1 mark

- mass of melted ice, m - time taken to melt the ice, t ✓1

(ii) If the latent heat of fusion of ice is L_f , show how measurement in (i) above would be used in determining the power P of the heater. (2 marks)

Heat given out by heater = Heat absorbed by melting ice ✓1

$Pt = VIt = mL_f$

$P = \frac{mL_f}{t}$ ✓1

(iii)It is found that the power determined in this experiment is lower than the manufacturer's value indicated on the heater. Explain. (1 mark)

Not all the heat supplied by the heater is used to melt the ice, some are lost to the surrounding hence lower value. ✓1

(c) A mass of wax of 1kg was heated uniformly by a 100W heating element until it melted. The graph in **figure 12** shows how the temperature of the wax varies with time.

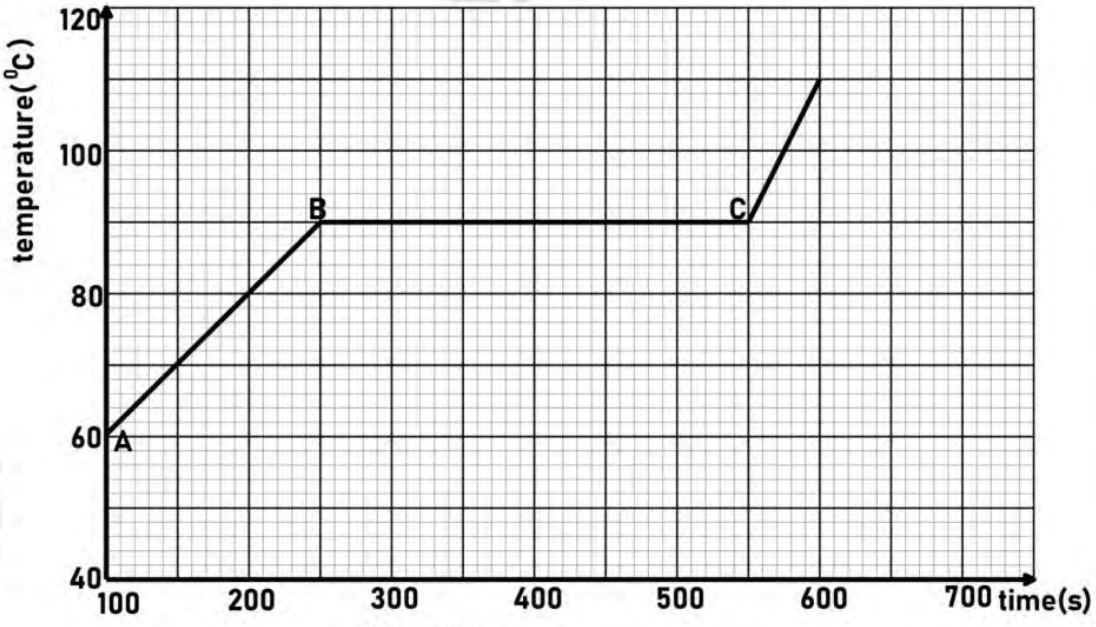

Figure 12

(i) Explain what is happening in the region AB (2 marks)

As heat is supplied to the wax, the temperature of the wax increases from 60°C to 90°C. ✓1 The heat supplied is used to raise the temperature of wax. ✓1

(ii) Calculate the specific heat capacity of the wax. (2 marks)

$m \cdot c \cdot \Delta\theta = P \cdot t$ ✓1

$1 \times c \times (90 - 60) = 100 \times (250 - 100)$ ✓1

$c = 500\ J/kgK$ ✓1

(iii) Calculate the specific latent heat of fusion of wax. (3 marks)

$m \cdot L_f = P \cdot t$ ✓1

$1 \times L_f = 100 \times (550 - 250)$ ✓1

$L_f = 30{,}000\ J/kg$ ✓1

15. .

(a) A stone of mass 450g is rotated in a vertical circle at 3 revolutions per second as shown in **figure 13**.

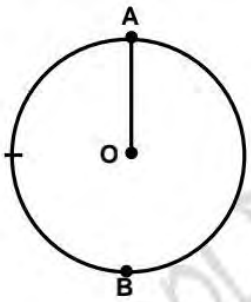

Figure 13

If the string has a length of 1.5m, determine:

(i) the linear velocity (3 marks)

$\omega = 2\pi f$

$= 2 \times \frac{22}{7} \times 3$

$= 18.86 rad/s$ ✓1

$V = r\omega = 2\pi f \times r$

$= 1.5 \times 18.86$ ✓1

$= 28.29 m/s$ ✓1

(ii) The tension of the string at positions A and B. (4 marks)

At A: $T = \frac{mv^2}{r} - mg$

$= \frac{450}{1000}\left(\frac{28.29^2}{1.5} - 10\right)$ ✓1

$= 235.6N$ ✓1

At B: $T = \frac{mv^2}{r} + mg$ ✓1

$= \frac{450}{1000}\left(\frac{28.29^2}{1.5} + 10\right)$ ✓1

$= 244.6N$ ✓1

(b) State two factors affecting centripetal force. (2 marks)

- mass of the object ✓1
- radius of the circle
- linear velocity of the object ✓1