MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education

PREMOCK EXAMINATIONS 2022

232/1 PHYSICS Form 4

June 2022 – 2 Hours

Name: ..Marking Scheme.....Adm No: .....

Class: .....Candidate's Signature: .....Date: 23/6/2022.

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 **12** pages are printed as indicated and that no questions are missing.

Take: $g = 10m/s^2$, $density\ of\ mercury = 13,600kgm^{-3}$, $density\ of\ air = 1.25kgm^{-3}$, $density\ of\ water = 1000kgm^{-3}$

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SECTION	Question	Maximum Score	Candidate's Score
A	1-11	25	
B	12	10	
	13	13	
	14	13	
	15	13	
	16	06	
TOTAL		**80**	

Victor Oduzdo

SECTION A: 25 MARKS

1. **Figure 1** shows a ball bearing of mass 0.0025 kg is held between the anvil and spindle of a micrometer screw gauge. The reading on the gauge when the jaws are closed without anything in between is 0.011cm. Use this information and the position of the scale in the figure below to answer the questions **(a)** and **(b)** below:

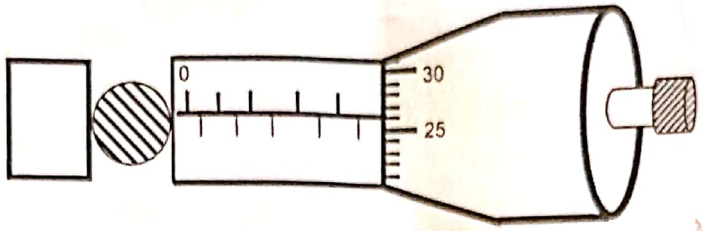


Figure 1

(a) What is the diameter of the ball bearing? (1 mark)

$4.50 + (26 \times 0.01) = 4.76mm \div 0.11mm = 4.65mm$ ✓

(b) Find the density of the ball bearing correct to 3 three significant figures (2 marks)

$\rho = \frac{m}{V} = \frac{0.0025kg}{\frac{4}{3} \times \frac{22}{7} \times (2.325 \times 10^{-3})^3 m^3}$ ✓

$4.747 \times 10^4 kg/m^3$ ✓

2. Explain why solids are good conductors of heat (2 marks)

The particles are closely packed ✓1 making the force between them strong therefore heat transfer occurs by collision of the adjacent vibrating particles ✓1

3. The barometric height at sea level is 76 cm of mercury while at a point on a highland it is 72 cm of mercury. What is the altitude of the point? (3 marks)

$h_{air} \rho_{air} g = h_{Hg} \rho_{Hg} g$ ✓1

$h_{air} \times 1.25 \times 10 = \left(\frac{76 - 72}{100}\right) m \times 13600 \times 10$ ✓1

$h_{air} = 435.2m$ ✓1

Victor Odundo. 3

4. **Figure 2** shows an arrangement of identical springs A, B, C and D.

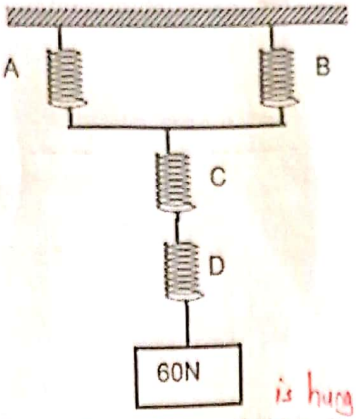


Figure 2

Each spring extends by 2 cm when a force of 5N is hung on it. Determine the extension of the system. (3 marks)

$K = \frac{5N}{2cm} = 2.5 Ncm^{-1}$ ✓1

A & B extension $= \frac{30}{2.5} = 12cm$ ✓1

C extension $= \frac{60}{2.5} = 24cm$

D extension $= \frac{60}{2.5} = 24cm$

Total = 60cm ✓1

5. A bathroom shower has 200 holes each 2.5 mm^2 in area. Water flows from a pipe of cross-section area of 15 cm^2 at 5m/s to the shower. Determine the speed of the spray. (2 marks)

$A_1V_1 = A_2V_2$

$V_1 \times 200 \times (2.5 \times 10^{-6})m^2 = (15 \times 10^{-4})m^2 \times 5m/s$

$V_1 = 15 m/s$

6. Explain how a ball and ring apparatus can be used to demonstrate contraction in solids (2 marks)

At room temperature the ball goes through the ring. ✓1

When the ring is cooled below room temperature, its diameter reduces because of contraction making the ball not to go through the ring ✓1

7. Smoke particles are observed through the eye piece of a microscope. They are seen to move randomly. Explain what causes this motion. (2 marks)

Because of uneven bombardment of smoke particles by the invisible air particles ✓1 that are always in a continous random motion ✓1

8. Explain how a cyclist maintains the stability of a moving bicycle. (2 marks)

By bending his/her body down ✓1
This lowers the C.O.G ✓ hence increased stability

9. **Figure 3** shows a U – tube manometer open at one end and the other end connected to the gas supply.

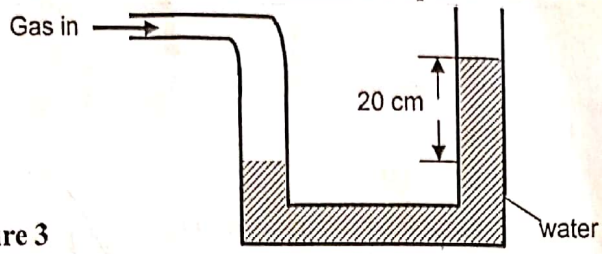


Figure 3

Given that the atmospheric pressure is 1.0×10^5 *pa* , determine the pressure of the gas (3 marks)

$P_g = P_a + h\rho g$ ✓1
$1.0\times10^5 + (0.20m \times 1000 \times 10)$ ✓1
102,000 Pa ✓1

10. State one advantage of alcohol-in-glass thermometer over mercury-in glass thermometer. (1 mark)

Can record very low temperatures

11. In the crushing can experiment, it is observed that the can crushes on cooling. Explain this observation. (2 marks)

On cooling, steam condenses creating a vacuum in the container
Hence decrease in pressure below the atmospheric pressure ✓1
A resultant force due to the pressure difference crushes the can ✓

Samwel Odhiambo.

SECTION B (55 MARKS)

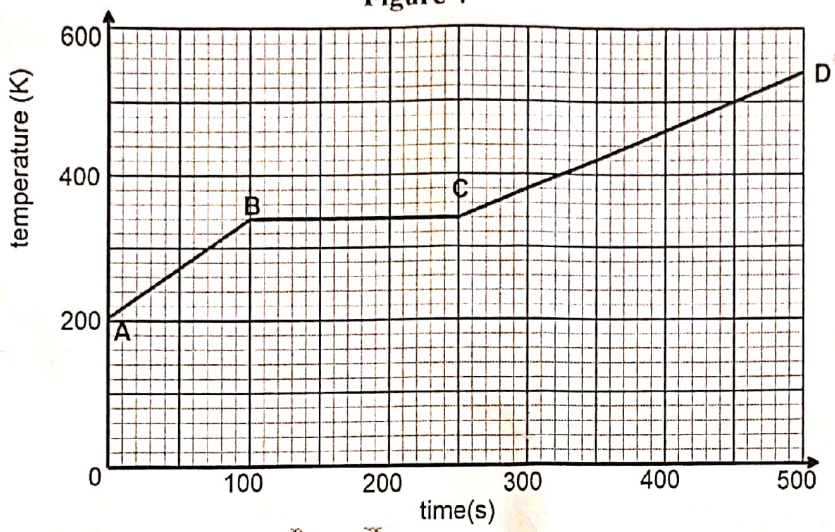
12.

(a) Explain why it is important to wipe yourself with a towel after bathing. (2 marks)

As water evaporates from the body, it absorbs latent heat of vaporization from the body which is a lot. The towel minimizes loss of this heat by absorbing the water ✓1 ✓1

(b) 200g of a solid was uniformly heated by a 0.2kW heater for some time, The graph in **figure 4** shows how the temperature of the solid changed with time.

Figure 4



(i) Explain what is happening between BC and CD. (2 marks)

BC - Heat energy absorbed is used to break the bonds hence changing from solid to liquid ✓1

CD - Heat energy absorbed is used to raise the temperature of the liquid ✓1

(ii) Calculate the specific heat capacity of the solid. (3 marks)

$Pt = m.c.\Delta T$ ✓1

$200W \times 100s = \frac{200}{1000} \times c \times (340-200)$ ✓1

$c = 714.29\ Jkg^{-1}K^{-1}$ ✓1

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

$Pt = mL_f$ ✓1

$200W \times (250-100) = \frac{200}{1000} \times L_f$ ✓1

$L_f = 150000\ Jkg^{-1}$ ✓1

13. .

(a) **Figure 5** shows a simple set up for pressure law apparatus

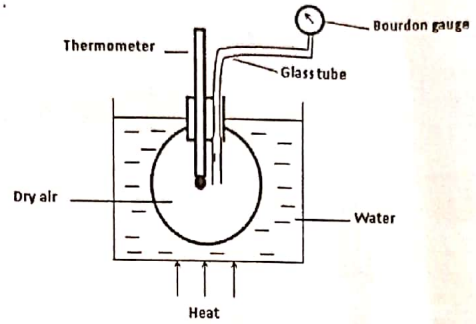


Figure 5

(i) State the measurements to be taken (2 marks)

Temperature of the gas. ✓1

Pressure of the gas ✓1

(ii) State the physical quantities that are kept constant (2 marks)

Mass of the gas. ✓1

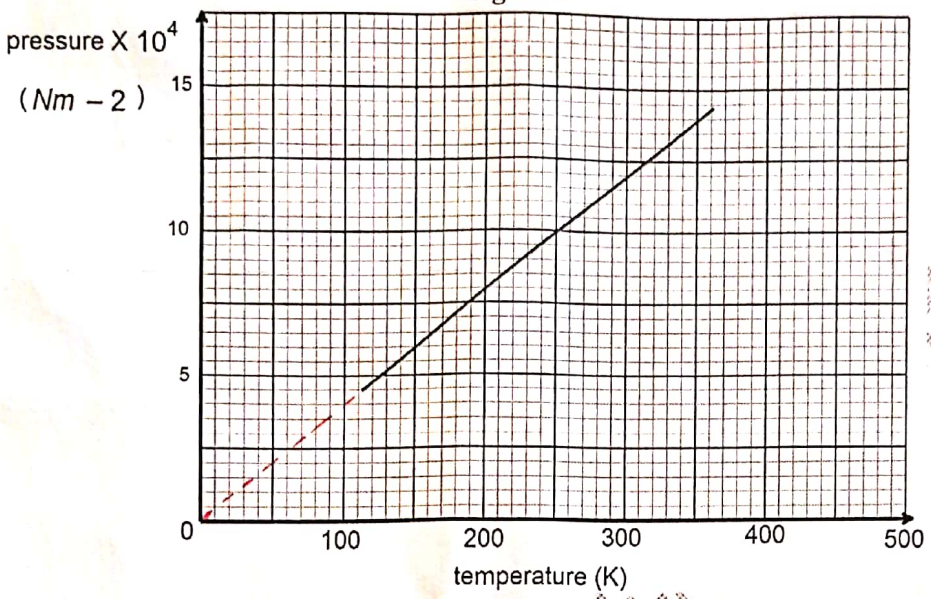
Volume of the gas ✓1

(iii)Explain how the measurements taken in (a) above can be used to verify the law. (3 marks)

- Initial temperature and pressure readings are taken and recorded ✓1
- Different temperatures readings and corresponding pressure readings are tabulated ✓1
- A graph of pressure against absolute temperature is plotted. The graph is a straight line, positive gradient, through origin thus verifying the law ✓1

(b) The graph in **figure 6** shows the relationship between the pressure and temperature for a fixed mass of an ideal gas at constant volume.

Figure 6



(i) Given that the relationship between pressure, P and temperature, T in Kelvin is of the form $P = kT + C$ where k and C are constants, determine from the graph, the value of:

I. k (2 marks)

= Slope of graph = $\frac{\Delta P\ (Nm^{-2})}{\Delta T\ (K)}$ ✓1

= $\frac{(12-8)\times 10^4\ Nm^{-2}}{(300-200)\ K}$ ✓1

= $400\ Nm^{-2}K^{-1}$

II. C (1 mark)

= y-intercept = 0 ✓1

(ii) Explain why it would be impossible for the pressure of the gas to be reduced to zero in practice. (1 mark)

Because at absolute temperature (0K) the particle has low kinetic energy and hence do not collide with each other

Pamela Azuma 8

(c) A gas is put into a container of fixed volume at a pressure of $2.1\times10^5\ Nm^{-2}$ and temperature 27^0C. The gas is then heated to a temperature of 327^0C. Determine the new pressure. (2 marks)

$\frac{P_1}{T_1} = \frac{P_2}{T_2}$ | $\frac{2.1\times10^5}{300} = \frac{P_2}{600}$ ✓1

$P_2 = 4.2\times10^5\ Nm^{-2}$ ✓1

14. .

(a) **Figure 7(a) and (b)** shows a set up used by a student to determine upthrust in paraffin.

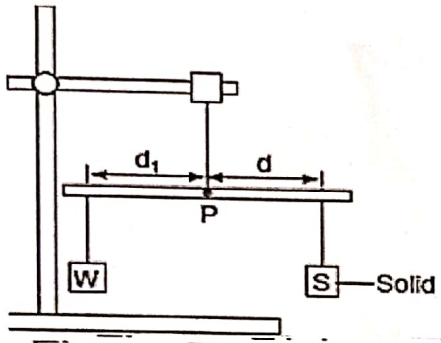


Figure 7(a)

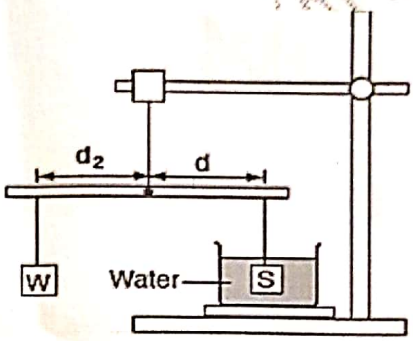


Figure 7(b)

Given that:

- Weight of solid W in air that balances with solid S of weight $W_1\ N$ when in equilibrium in air = $W\ N$
- Perpendicular distance of solid W from the pivot = $d_1\ cm$
- Perpendicular distance of solid S from the pivot = $d\ cm$
- Apparent weight of solid S in water = $W_2\ N$
- Apparent weight of solid S in paraffin = $W_3\ N$
- Perpendicular distance between solid W and pivot when solid S is immersed in water = $d_2\ cm$
- Perpendicular distance between solid W and pivot when solid S is immersed in paraffin = $d_3\ cm$

Pamela Azuma

Show that:

(i) Relative density of solid S is given by $\frac{d_1}{d_1 - d_2}$ (3 marks)

Taking moments about O. $Wd_1 = W_1 d \Rightarrow W_1 = \frac{Wd_1}{d}$ ✓ both

$Wd_2 = W_2 d \Rightarrow W_2 = \frac{Wd_2}{d}$

$R.d = \frac{\text{Weight in air}}{\text{Upthrust in water}} = \frac{W_1}{W_1 - W_2} = \frac{\frac{Wd_1}{d}}{\frac{Wd_1}{d} - \frac{Wd_2}{d}}$ ✓1 $\frac{W}{d}(d_1)$ / $\frac{W}{d}(d_1 - d_2)$

$= \frac{d_1}{d_1 - d_2}$ ✓1 (shown)

(ii) Relative density of paraffin is given by $\frac{d_1 - d_3}{d_1 - d_2}$ (3 marks)

Upthrust in water $= \frac{W}{d}(d_1 - d_2)$ ✓1

Upthrust in liquid $= \frac{W}{d}(d_1 - d_3)$ ✓1

$R.d \text{ of the liquid} = \frac{\text{Upthrust in Paraffin}}{\text{Upthrust in water}} = \frac{\frac{W}{d}(d_1 - d_3)}{\frac{W}{d}(d_1 - d_2)} = \frac{d_1 - d_3}{d_1 - d_2}$ ✓1 (shown)

(b) **Figure 8** shows a block of wood of dimensions 14 *cm* × 7 *cm* × 2 *cm* floating with $\frac{1}{3}$ of its size submerged in a liquid.

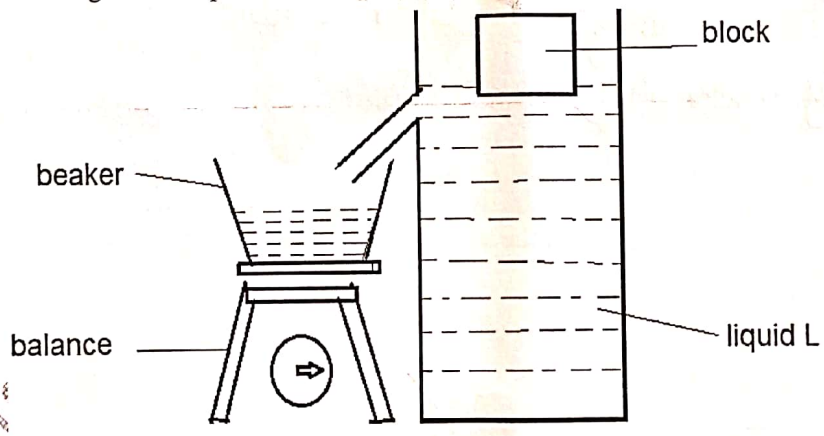


Figure 8

During an experiment with the set-up, the following results were obtained:

- Initial reading of the top pan balance with empty beaker = 32 *g*
- Final reading of the top pan balance = 186 *g*

Use the above results to determine:

(i) the density of the block. (3 marks)

Mass of block = Mass of water displaced = 186 − 32 = 154g ✓1

Volume of block = 14 × 7 × 2 = 196 cm³

∴ $\rho_{block} = \frac{154\ g}{196\ cm^3}$ ✓1 $= 0.7857\ g/cm^3$ ✓1

(ii) the density of the liquid. (3 marks)

Upthrust = $V\rho g$ ✓1

$\left(\frac{154}{1000} \times 10\right) N = \frac{1}{3} \times 196 \times 10^{-6}\ m^3 \times \rho \times 10\ N/kg$ ✓1

$\rho = 2357\ kg/m^3$ ✓1

(c) Explain the purpose of the wide bulb of a hydrometer. (1 mark)

15.. To displace large volume of liquid to provide higher upthrust sufficient to keep the hydrometer upright ✓1

(a) Explain why a body moving in a uniform circular path with constant speed accelerates. (1 mark)

Because there is change in direction of velocity at every instant as the body moves in a circular path ✓1

(b) A wooden block of mass 150 g is placed at various distances from the centre of a turntable which is rotating at constant angular velocity. It is found that at a distance of 8.0 cm from the centre, the block just starts to slide off the table. If the force of friction between the block and the table is 0.5 N

Calculate:

(i) The angular velocity of the table (2 marks)

$F = m\omega^2 r$ ✓1

$0.5 = \frac{150}{1000} \times \omega^2 \times \frac{8}{100}$

$\omega = 6.455\ rads^{-1}$ ✓1

(ii) The force required to hold the block at a distance of 14.0 cm from the centre of the table (3 marks)

$F = m\omega^2 r$ ✓1

$\frac{150}{1000} \times 6.455^2 \times \frac{14}{100}$ ✓1

0.875 N ✓1

(iii) A similar block of mass 300 g is now placed at distance of 8.0 cm from the centre of the turntable in (i) above and the turntable rotated at the same angular velocity. State with a reason whether or not the ball will slide off. (2 marks)

The ball will slide off ✓1

Because the centripetal force is greater than the friction between the block and the table ✓1

(c) A funfair ride of diameter 12 m makes 0.5 revolutions per second.

(i) Determine the angular velocity of the funfair. (2 marks)

$\omega = 2\pi f$ ✓1

$\frac{2 \times 22}{7} \times 0.5$

3.143 rads^{-1}

(ii) If the mass of the child is 30 kg, find the centripetal force that keeps the child in the motion. (3 marks)

$F_c = m\omega^2 r$ ✓1

$30 \times 3.143^2 \times 12$ ✓1

3556 N ✓1

Peter Ochieng (D.O.S.)

16. A student performed an experiment using a pulley as shown in **figure 9**

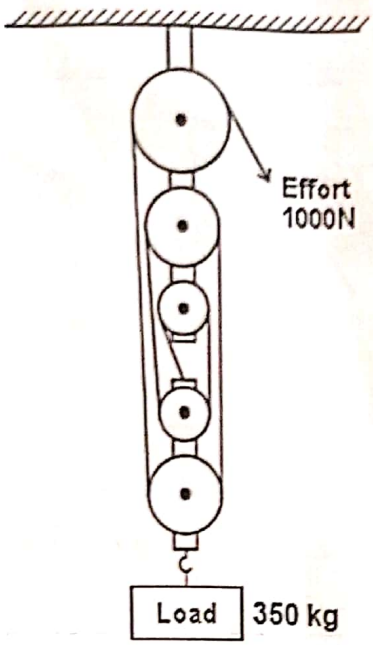


Figure 9

(a) State the V.R. of the system (1 mark)

5 ✓1

(b) Determine the M.A. of the system (2 marks)

$M.A = \frac{L}{E} = \frac{3500N}{1000N}$ ✓

3.5

(c) Calculate the efficiency of the system. (3 marks)

$\eta = \frac{M.A}{V.R} \times 100\%$ ✓1

$\frac{3.5}{5} \times 100\%$ ✓1

70% ✓1