NAME.....Marking Scheme..... ADM NO.....CLASS.....

232/1
Physics
Paper 1
March/April 2018
Time: 2hours

MOKASA JOINT EXAMINATION
Kenya Certificate Secondary Education
K.C.S.E

Instructions to the candidates;

- *Write your name, class and admission number in the spaces provided above.*
- *This paper consists of TWO sections: Sections **A** and **B**.*
- *Answer ALL the questions in sections **A** and **B** in the spaces provided.*
- *ALL working MUST be clearly shown.*
- *KNEC Mathematical tables and Non-programmable electronic calculators may be used.*
- ***Candidates should check the questions paper to ascertain that all the pages are printed as indicated and that no questions are missing.***

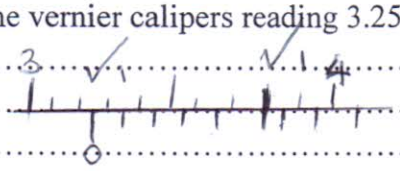
Take; g= 10N/kg

Section	Question	Maximum Score	Candidate's Score
A	1-8	25	
B	12	08	
	13	08	
	14	12	
	15	09	
	16	07	
	17	11	
	Total Score	80	

SECTION A (25 MARKS)

1. The vernier calipers has a negative error of 0.03cm.A student used such a vernier calipers to measure the diameter of a test tube and read 3.25cm.

a) Sketch the vernier calipers reading 3.25cm. (2 marks)



b) Determine the diameter of the test tube. (1 mark)

D = 3.24 + 0.03 = 3.28cm

2. Explain why a man using a parachute falls through air slowly while a stone falls through air very faster. (2 marks)

→ Parachute has large surface area thus more air resistance making it fall slowly compare to stone with small surface area and minimal air resistance. OR,
→ Upthrust in Parachute is higher than Upthrust due to stone because parachute displaces more air than stone.

3. In an experiment to determine Brownian motion in liquids pollen grains were suspended in water as shown in **Figure 1.**and its movement observed using a hand lens.

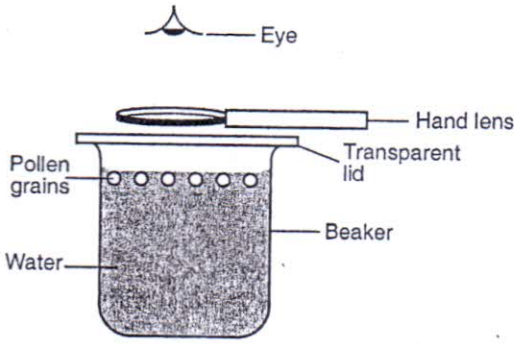


Figure1.

State and explain the motion of the pollen grains. (2marks)

Pollen grains are seen to be in constant random motion since they are being knocked by invisible water molecules.

4. **Figure 2.** Shows a simple form of a diving board

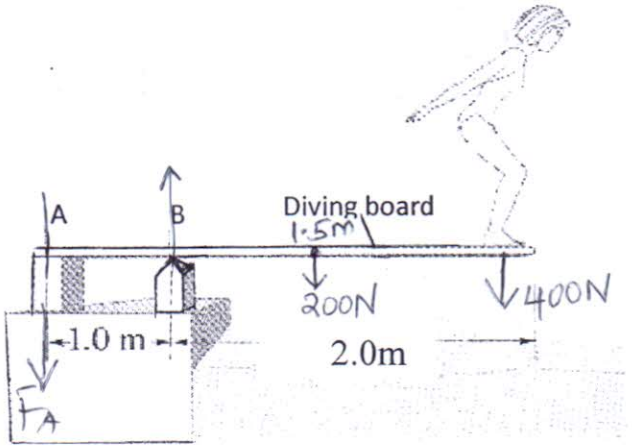
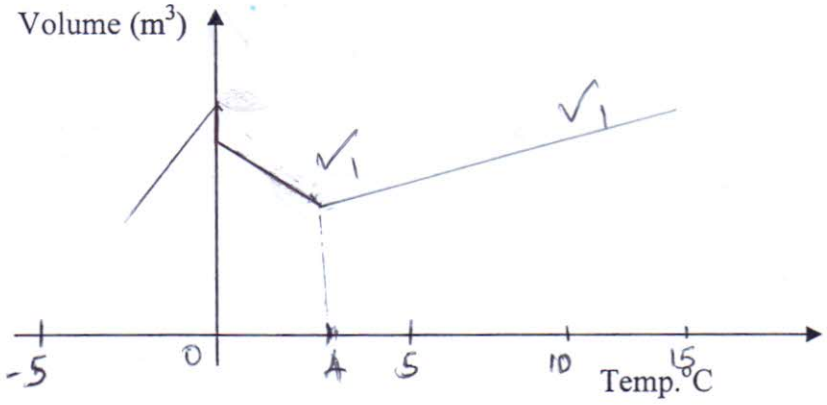


Figure 2.

The diver has a mass of 40kg. Calculate the magnitude of force acting at A and B if the board is uniform and has a mass of 20 kg (4 marks)

Taking Moment at B CM = A·M
$(F_A \times 1) = (200 \times 0.5) + (400 \times 2)$ ✓1
$F_A = 100 + 800 = 900N$ ✓1 ✓1 ✓1
F_B = Reaction at B = 900+200+400 = 1500N

5. Ice is heated from a temperature of -5^0 C to water at 15^0 C. Sketch a graph on the axes below to show the variation of its volume with temperature. (2 marks)



6. A solid copper sphere will sink in water while a hollow copper sphere of the same mass may float. Explain this observation. (2 marks)

Solid copper is denser than hollow copper, hence sinks while hollow sphere contains air which enables it to displace more water increasing upthrust making it float

7. **Figure 3**. shows a Bunsen burner

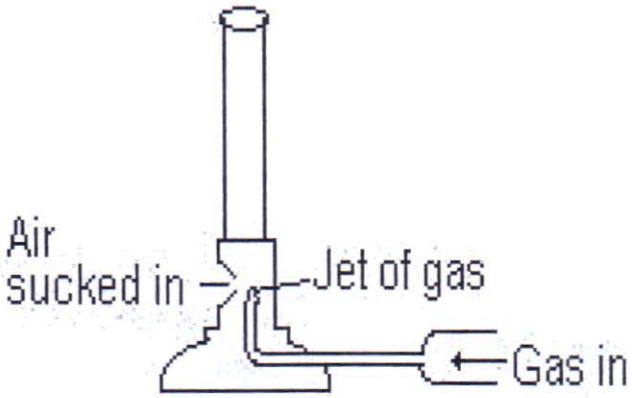
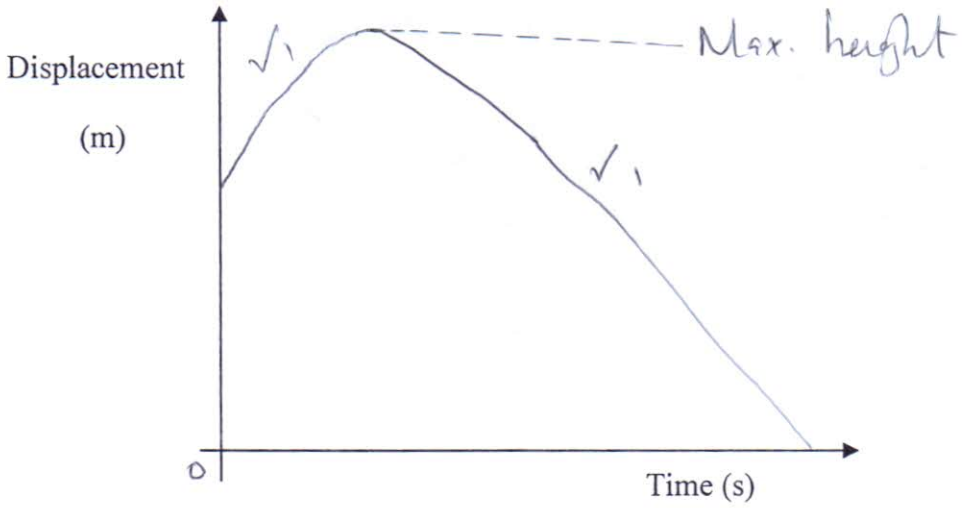


Figure 3.

Explain how air is drawn into the burner when the gas tap is opened. (2 marks)

- The gas comes out of the gas jet at a high velocity decreasing pressure inside.
- Atmospheric pressure outside near the airhole is higher than pressure inside, forcing air into the chimney.

8. A stone is thrown vertically upwards with a velocity u from the top of a cliff of height 20m falls to the ground below .Take the ground as the zero level, sketch a displacement-time graph in the axes below. (2 marks)



9. The **figure 4. (a)** below shows a spring fixed on a bench vertically. A mass of 0.5kg is placed on top as shown in **Figure 4.(b).**

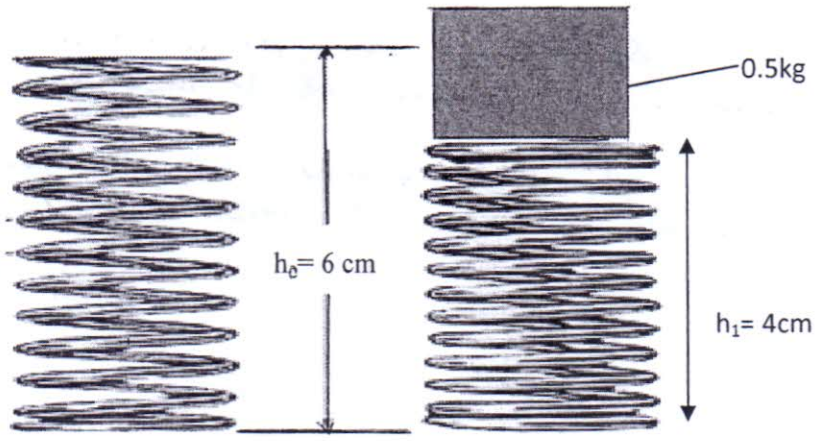


Fig. 4(a) **Fig. 4(b)**

In (a) the height h_o of spring is 6cm while in (b), the height h_1= 4cm.Calculate the energy stored in the spring in (b). (3 marks)

$e = 6 - 4 = 2cm$ ✓1

$E = \frac{1}{2}ke^2$

$F = ke$

$k = \frac{F}{e} = \frac{5}{0.02}$ ✓1

$= 250N/m$

$E = \frac{1}{2} \times 250 \times (0.02)^2$

✓1

$= 0.05J$

10. The **Figure 5**.below shows a double-decker bus.

Figure 5.

Explain how the stability of the bus can be increased. (2 marks)

- All passengers in the upper compartment are required to always be seated not to raise c-o-g
- Luggage compartments are situated in the lower part of the bus to low the c-o-g

11. Define Mechanics as a branch of Physics. (1 mark)

Mechanics is the study of motion of bodies under influence of forces

SECTION B (55 MARKS)

12. a) A stone of mass 500g is attached a string of length 50cm and which will break when the tension on the string is 105 N. The stone is whirled in a vertical circle in anticlockwise direction. The axis of rotation is 175cm above the ground as shown in **Figure 6.**

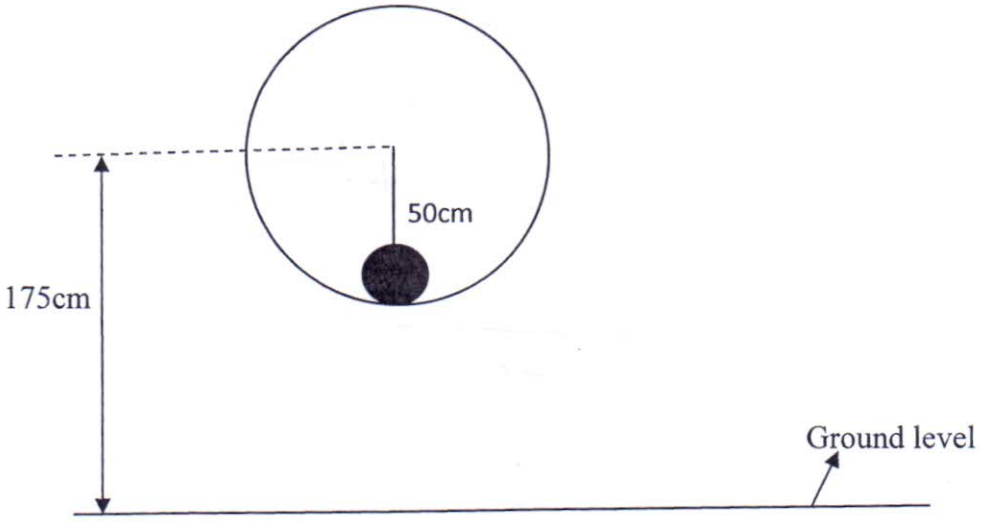


Figure 6.

The speed of rotation is slowly increased until the string breaks.

(i) Explain why the string is likely to break when it is passing the lowest point.

The point where the tension on the string is maximum. ✓1 (1mark)

(ii) Calculate the linear velocity of the stone at the point where the string breaks.

(3 marks) ✓1

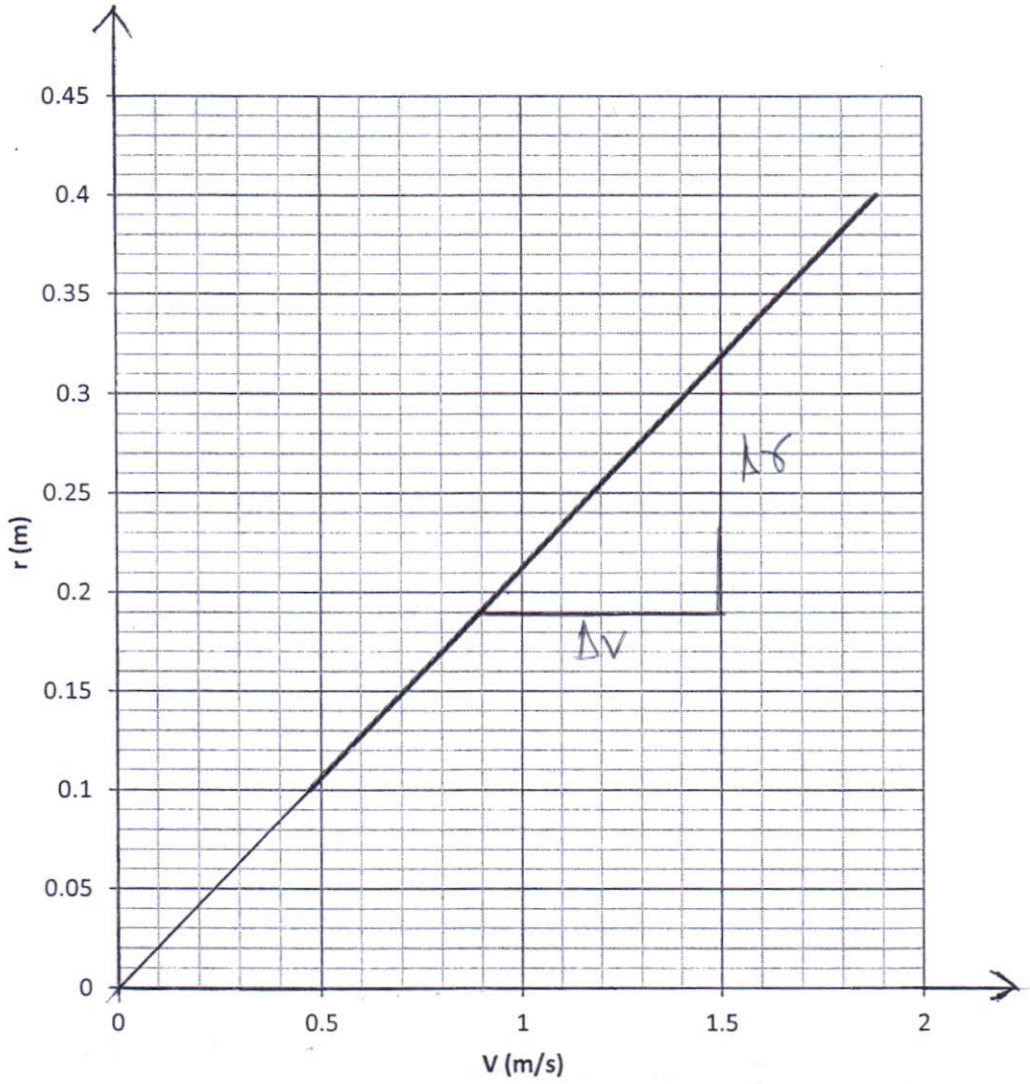
$T = \frac{mv^2}{r} + mg$ ✓1

$105 = \frac{0.5v^2}{0.5} \times 5$ ✓1

$105 = v^2 + 5$

$v = \sqrt{100} = 10m/s$ ✓1

(b) Below is a graph of r (m) against v (m/s). Given that $\mathbf{v = r\omega}$



From the graph determine;

(i) Angular velocity, ω (2 marks)

$\omega = \frac{1}{\text{slope}} \Rightarrow \text{slope} = \frac{\Delta V}{\Delta r} = \frac{0.32 - 0.19}{1.5 - 0.9} = \frac{0.13}{0.6} = 0.2167\ m/s/m$

$\omega = \frac{1}{0.2167} = 4.615\ rad s^{-1}$

(ii) The periodic time, **T** (2 marks)

Periodic time $T = \frac{2\pi}{\omega} = \frac{2 \times 3.142}{4.615} = 1.362\ s$

13. (a) **Figure 7**. Shows a set up of apparatus used to verify Charles Law.

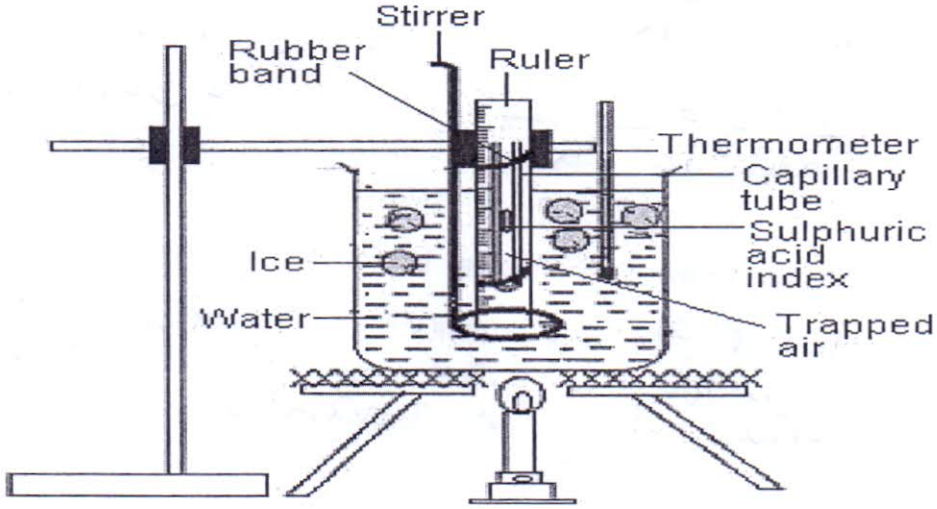


Figure 7.

(i) State one function of Sulphuric acid index (1 marks)

any one

- Act as a pointer for the volume ✓1
- Is a drying agent

(ii) Briefly explain how the set up above is used to verify Charles Law. (4 marks)

- Before heating record the temp: θ_0 and h_0 of the air column.
- Heat the water bath as you stir it continuously.
- Take the temp: reading θ and its corresponding height h of the column (volume) ✓1
- Repeat for several other value of θ and h and record or tabulate your results ✓1
- Plot a graph of h (volume) against absolute temp T. ✓1
- The graph is a straight line passing through the origin showing that an increase of volume with absolute temp: which is charles Law. ✓1

(b) A bicycle pump, with its exit hole closed, contains $80cm^3$ of air at 760 mmHg pressure and a temperature of 7^oC. When the air has been compressed to $38cm^3$ under 1720 mmHg pressure, its temperature rises. Calculate the rise in temperature. (3 marks)

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

$\frac{760 \times 80}{280}$ ✓1 $= \frac{1720 \times 38}{T_2}$

$T_2 = \frac{280 \times 1720 \times 38}{760 \times 80}$ ✓1 ✓1

$= 301K$ or $28°C$

14. (a) Define the term specific latent heat of vaporization of a substance. (1 mark)

Amount of heat required to change the state of a unit mass of a substance from liquid to vapour (gas) without change in temperature.

(b) Water of mass 200g at a temperature of 5^oC was added into an insulated copper calorimeter of mass 60g. Steam at 100^oC was passed through the water for some time. When the calorimeter and its content were weighed again, the mass was found to be 266g. Given that specific heat capacity of water is 4200J/Kg K, specific heat capacity of Copper is 390J/Kg K, specific latent heat of vaporization of steam is 2.26×10^6J/Kg and the final temperature of the mixture was T^o C.

(i) Determine the expression for the heat gained by water in the calorimeter in terms of T^oC (2marks)

$Q_w = mc\Delta\theta = 0.2 \times 4200 \times (T-5)$ ✓1

$= 840(T-5) = (840T - 4200)$ Joules ✓1

(ii) Determine the expression for the heat gained by the calorimeter. (2 marks)

$Q_c = Mc\Delta\theta = 0.06 \times 390 \times (T-5)$ ✓1

$23.4(T-5) = (23.4T - 117)$ Joules ✓1

(iii) Calculate the mass of steam which condenses to water. (1 mark)

$M = 266 - (200 + 60) = 266 - 260 = 6g$ or $0.006kg$ ✓1

(iv) Determine the expression for the heat lost by steam as it condenses to water at T° C.

(3 marks)

$Q = M_s L_v + M_s C_w \theta$

$= (0.006 \times 2260000) + (0.006 \times 4200 \times (100 - T))$ ✓1

$= 13,560 + 25.2(100 - T)$ ✓1

$= 13,560 + 2520 - 25.2T = (16,080 - 25.2T)$ Joule ✓1

(v) Determine the final temperature, T°C attained. (3 marks)

Heat gained = Heat lost

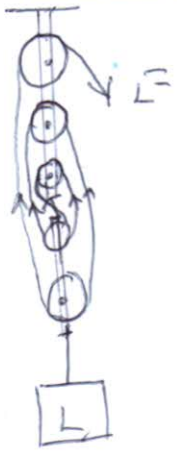
$840T - 4200 + 23.4T - 117 = 16080 - 25.2T$ ✓1

$863.4T - 4317 = 16080 - 25.2T$ ✓1

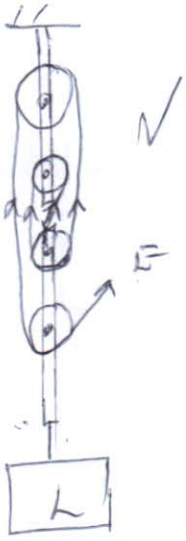
$888.6T = 20,397$

$T = 22.95°C$ ✓1

15. (a) Draw a block and tackle pulley system with a velocity ratio 5. (1 mark)



Or



(b) A block and tackle of V.R 5 is used to raise a load of 400N through a height of 10m.If the work done against friction is 1000J. Calculate;

(i) Work done by effort. (2 marks)

Workdone by effort = (400x10) + 1000 ✓1

= 5000J ✓1

(ii) The effort applied if the efficiency is 80%. (3 marks)

V.R = 5 e = 80%

M.A = V.R x 0.8 ✓1

= 5 x 0.8 = 4

MA = L/E ⇒ E = L/M.A

E = 400/4 = 100N ✓1

(c) The **Figure 8**. shows part of a hydraulic press. The plunger is the position where effort is applied while the Ram piston is the position where the load is applied. The plunger has a radius r (m) while the Ram has a radius of R (m).When the plunger moves down a distance d, the ram piston moves up a distance D.

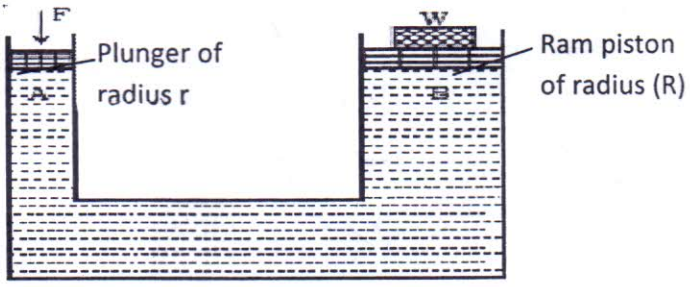


Figure 8.

Derive an expression for the velocity ratio (V.R) in terms of R and r. (3 marks)

Volume of fluid leaving the plunger = Volume entering the ram

$A_A d = A_B D$ | $V_1 R = \frac{d}{D} = \frac{R^2}{r^2}$

$\pi r^2 d = \pi R^2 D$

16. A railway truck of mass 2.4 tonnes travelling at a velocity of 4.7m/s collides with a stationary truck **m** on a level track. After collision the two trucks move together with common velocity of 1.2m/s. Calculate,

(i) The mass **m** of the stationary truck. (2 marks)

$(2.4 \times 4.7) + M_s(0) = (2.4 + x)1.2$ ✓1

$11.28 = 2.88 + 1.2x$

$8.4 = 1.2x$

$x = 7t$ or $7000kg$

(ii) The original kinetic energy of the first truck (2 marks)

$K.e = \frac{1}{2}mv^2 = \frac{1}{2} \times 2400 \times 4.7 \times 4.7$ ✓1

✓1

$= 26,508J$

(iii) The total kinetic energy of both trucks after collision. Account for the apparent loss in kinetic energy. (3 marks)

Total $k.e = \frac{1}{2}(m_1 + m_2)v^2$ ✓1

$= \frac{1}{2}(7000 + 2400)(1.2)^2 = 67625$ ✓1

After collision part of k.e is transferred to internal energy lost as sound energy, heat energy and rest left as k.e. ✓1

17. (a) State Archimede's Principle (1 mark)

When a body is fully or partial immersed in a fluid it experiences an upthrust which is equal to the weight of the fluid displaced.

(b) The **figure 9.** shows a wooden block of dimensions 50cm by 40cm by 20cm held in position 40cm below the surface of water, by a string attached to the bottom of a swimming pool. The density of the block is 600kg/m^3 and density of water is 1g/cm^3.

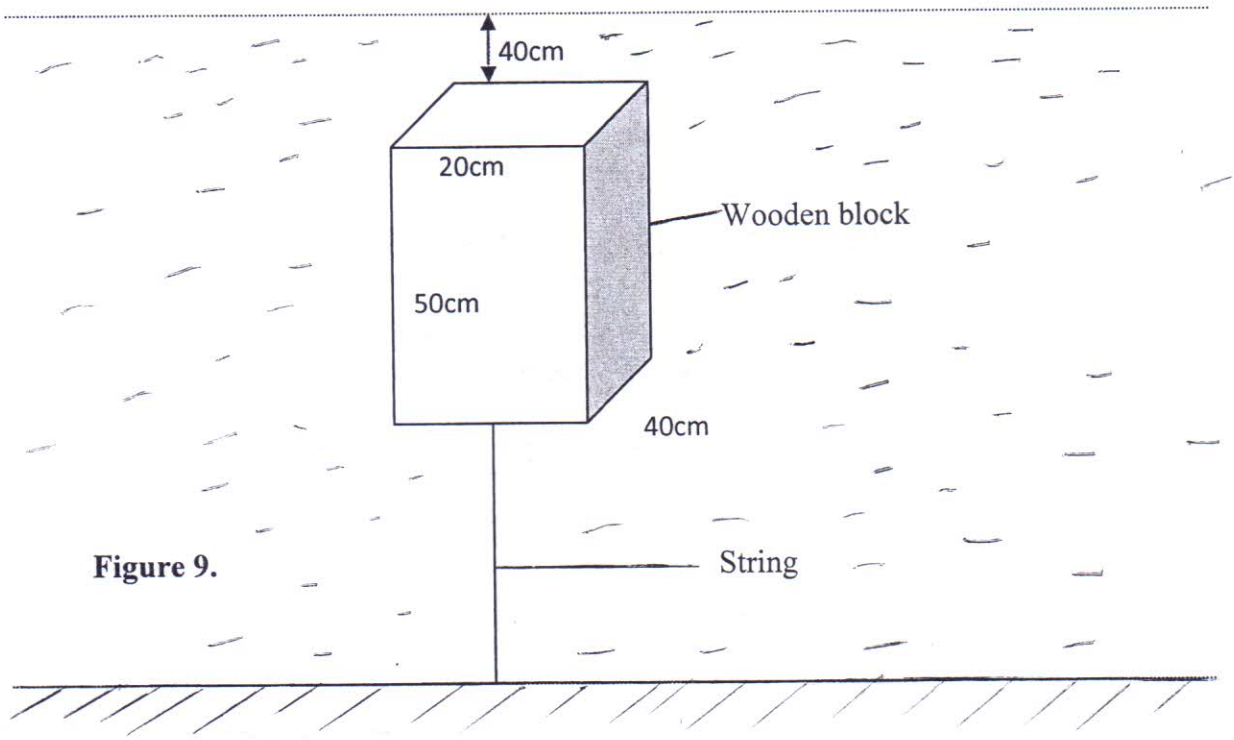


Figure 9.

(i) State the three forces acting on the block and write an equation linking them when the block is stationary (2mark)

- Upthrust ✓1
- Weight } one mark for any two correct (ties)
- Tension

U = W + T ✓1

(ii) Calculate Upthrust on the block. (2 marks)

U = $V_s \rho_L g$ = (0.5×0.2×0.4) × 1000 × 10 ✓1
= 400 N ✓1

(iii) Determine the Tension on the string. (2 marks)

mg = ρVg = 600 × 0.5 × 0.2 × 0.4 × 10 = 240N ✓1
T = U − mg = 400 − 240 = 160N ✓1

.....

.....

(c) Determine the pressure on the bottom surface of the block (2 marks)

$P = h\rho g = 0.9 \times 1000 \times 10 = 9000\ N/m^2$

.....

.....

.....

(d) The **figure 10.** shows a diagram of a hydrometer which is suitable for measuring density of liquids varying between 0.8 and 1.2g/cm^3.

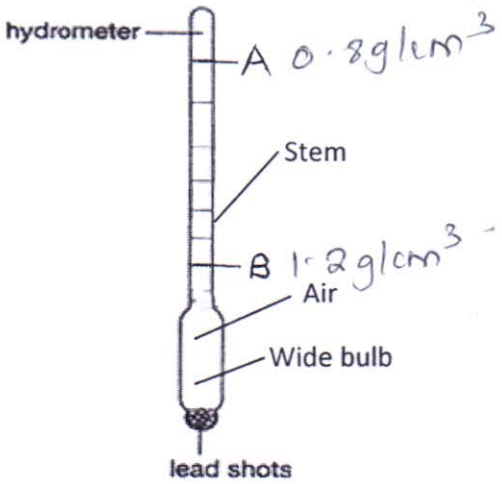


Figure 10.

(i) Indicate on the diagram the label corresponding to 0.8 and 1.2 g/cm^3. (1 mark)

(ii) State one function of lead shots (1 mark)

Enable the hydrometer to float upright

This is the last printed page