NAME: MARKING SCHEME ADM. No.....CLASS:.....

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232/1
Physics
Paper 1
DECEMBER 2021

# MOKASA II JOINT EXAMINATION

*Kenya Certificate of Secondary Education (KCSE)*

**Instructions to candidates**

- This paper consists of two sections *A* and *B*.
- Answer **all** the questions in the two sections in the spaces provided after each question
- All working **must** be clearly shown.
- Electronic calculators and Mathematical tables may be used.
- All numerical answers **should be expressed** in the **decimal** notations.

**For Examiner use only**

| SECTION | QUESTION | MAX MARKS | CANDIDATE'S SCORE |
|---|---|---|---|
| A | 1 – 12 | 25 | |
| B | 13 | 10 | |
| | 14 | 11 | |
| | 15 | 12 | |
| | 16 | 11 | |
| | 17 | 11 | |
| TOTAL | | 80 | |

*This paper consists of 11 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.*

## SECTION A (25 MARKS)

***Answer all the questions in this section in the spaces provided.***

1. The reading of volume of a liquid in a burette is 37.5cm³. What is the new volume when 10 ml of the same liquid is added? (1 mk)

New reading $= 37.5\text{cm}^3 - 10\text{cm}^3$ ✓

$= 27.5\text{cm}^3$ ✓ (1)

2. A block of dimension 0.2m by 0.1m by 5cm has a mass of 500g and rests on a flat surface. Determine the least pressure that can be exerted by the block on the surface. (2mks)

Mass $= 500\text{g}$

$= 0.5\text{kg}$

Weight $= (0.5 \times 10)\text{N}$

$= 5\text{N}$

Least pressure $= F/A_{max}$ ✓

$= \frac{5}{(0.2 \times 5) \times 10^{-4}}$ (2)

$= 50,000\text{NM}^{-2}$ ✓

3. The mass of a body is constant but its weight on earth is not. Explain. (2 mks)

Weight varies from place to place on the earth's surface due to the shape ✓ and the rotation ✓ of the earth whereas the amount of matter in an object never changes (2)

4. i) Two samples of bromine vapour are allowed to diffuse separately under different conditions: one a vacuum and the other in air. State with reason the condition in which the bromine vapour will diffuse faster. (2 mks)

Diffusion is faster ✓ in vacuum since there are no air particles ✓ to interfere with motion (2)

ii) What precautions should be taken when performing the experiment above (1 mk)

The experiment to be done in a fume ✓ Chamber (1)

5. What do you understand by the term carbon dating (1 mk)

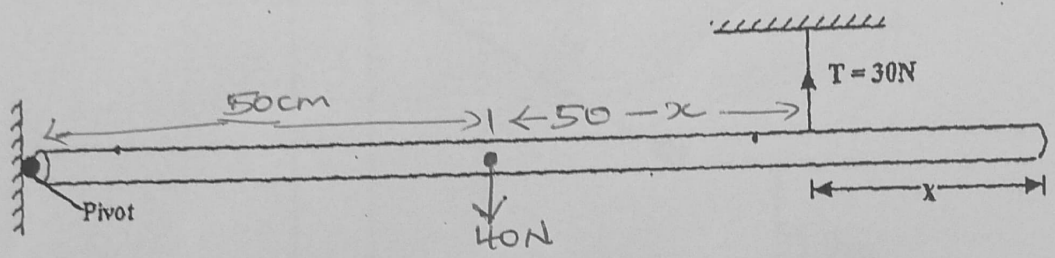
To establish the age ✓ of fossils by use of radioactive carbon-14 (1)

6. State and explain two factors which affect surface tension of a liquid. (2 mks) (2)

Temperature: Increase in temperature, the K.E of molecules of a liquid is increased. Intermolecular distance increase and force of cohesion is decreased hence surface tension is lowered

Impurities: Impurities weaken cohesive forces hence reduce surface tension.

7. The uniform rod of length one metre shown in figure below is in equilibrium.




Find the value of x if the weight of the rod is 40N. (3mks)

C.M = A.C.M

$40 \times 50 = 30(50 + (50 - x))$

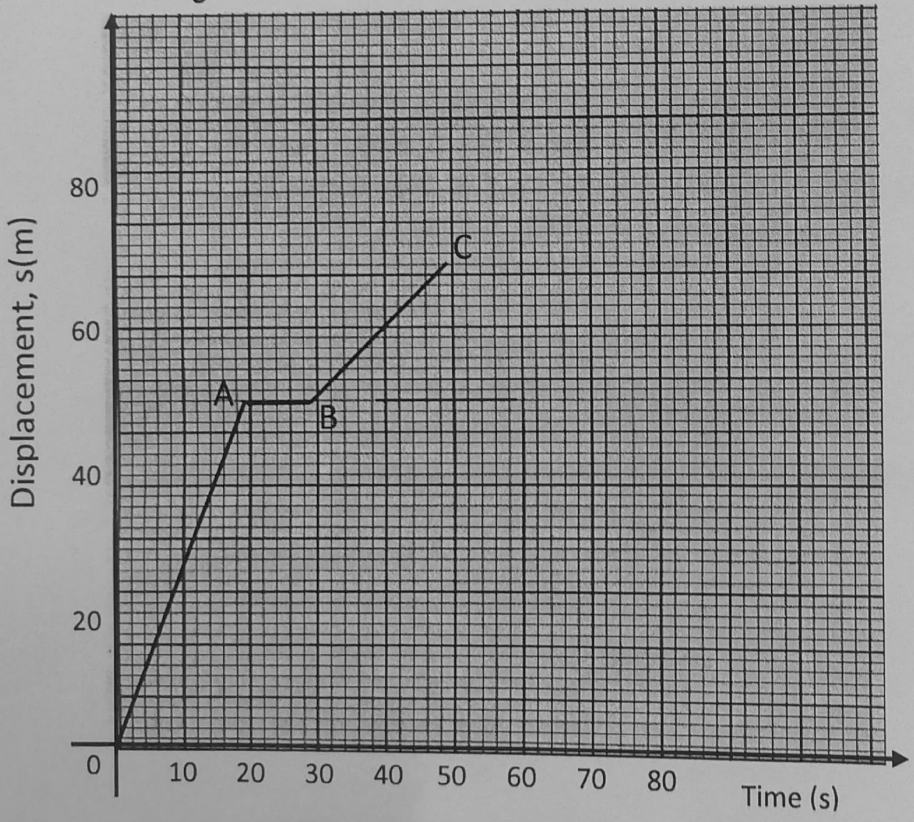
$2000 = 30(100 - x)$

$2000 = 3000 - 30x$

$30x = 1000$

$x = 33.33$ cm. (3)

8. The figure below shows the displacement – time graph for a certain body



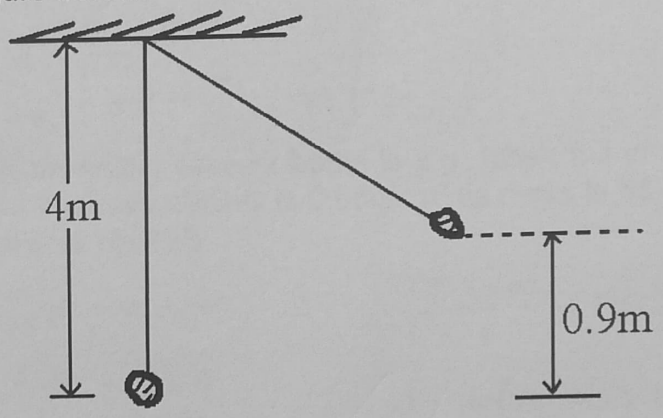

a) Describe the motion of the body between A and B (1 mk) (1)

The body is stationary, V = 0

b) Determine the velocity between OA (2 mks)

$\frac{\Delta s}{\Delta t} = \frac{50-0}{20-0} = 2.5\ ms^{-1}$ (2)

**9.**a) A body of mass 20kg hangs 4m and swings through a vertical height of 0.9m as shown in the figure below.




Determine;

i) The potential energy at its highest position. (1 mk)

$P.E = mgh$
$= 20 \times 10 \times 0.9$
$= 180J$ (1)

ii) The speed of the body when passing through the lowest point. (2 mks)

$K.E = P.E$
$\frac{1}{2}mv^2 = 180J$
$v = \sqrt{\frac{2 \times 180}{20}}$
$v = \sqrt{18}$
$= 4.24\ ms^{-1}$ (2)

**10**. A crane lifts a load of 2000N through a vertical distance of 3.0m in 6 seconds. Determine the power developed by the crane. (2 mks)

$P = \frac{W}{t}$
$= \frac{2000 \times 3}{6}$
$= 1000J/s$ (2)

**11.** A gun of mass 10kg fires a bullet of mass 30g at a speed of 500m/s. what is the recoil velocity of the gun? (1 mk)

$M_1u_1 + M_2u_2 = 0$

$10 \times u_1 + 0.03 \times 500 = 0$

$10u_1 = 15$

$u_1 = 15/10 = 1.5$

$\therefore$ Recoil vel. $= 1.5 ms^{-1}$ ✓ (1)

**12.** The mass of an empty density bottle is x g. when full of water its mass is 70g and when full of liquid Y whose density is 0.96g/cm³ its mass is 68.4g. Determine the value of x. (density of water is 1g/cm³) (2 mks)

$M_w = (70 - x)g$

$V_w = \frac{(70-x)g}{1 gcm^{-3}}$

$= (70 - x)cm^3$

$V_w$ = Vol of bottle = $V_y$

$\therefore \frac{70-x}{1} = \frac{68.4-x}{0.96}$ ✓

$0.96(70-x) = 68.4 - x$

$67.2 - 0.96x = 68.4 - x$

$x - 0.96x = 68.4 - 67.2$

$0.04x = 1.2$ ✓

$x = 1.2/0.04 = 30g$ (2)

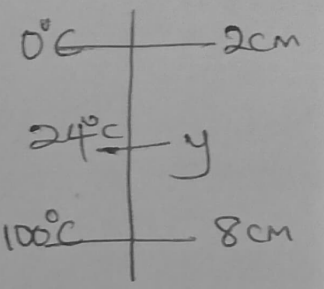
## SECTION B (55 MARKS)

***Answer all the questions in this section in the spaces provided.***

**13.**a) i) Define absolute zero temperature (1 mk)

The temperature at which the kinetic energy of particles is zero, and is the least temperature on Kelvin scale. ✓ (1)

ii) When marking the fixed points of a thermometer, it was observed that at 0°C the mercury thread was 2cm long and at 100°C the thread was 8 cm long. Determine the length that would correspond to a temperature of 24°C. (2 mks)




$\frac{8-2}{100-0} = \frac{y-2}{24-0}$ ✓

$\frac{y-2}{24} = \frac{6}{100}$

$y = \left(\frac{6}{100} \times 24\right) + 2$

$= 1.44 + 2$

$= 3.44$ cm. ✓

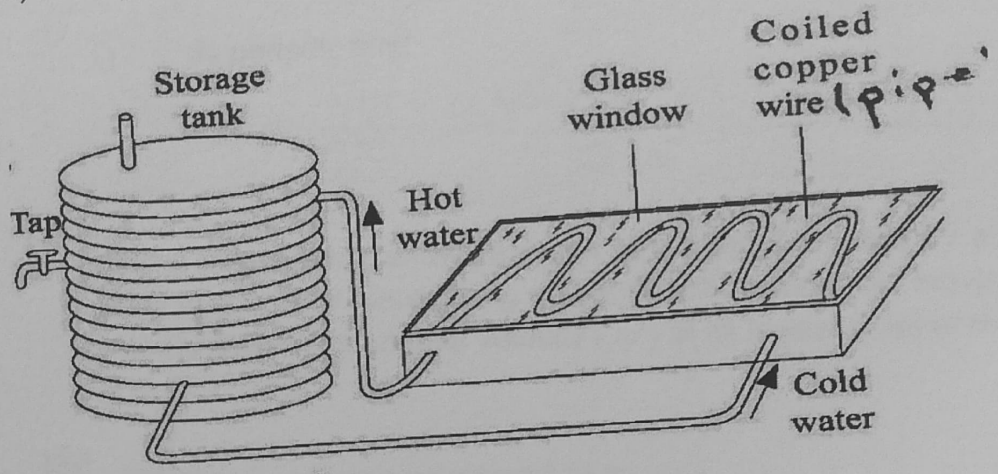
b) Why is steam preferred when determining the upper fixed point of a thermometer (1 mk)

It is pure, has no impurities ✓1

c) State the purpose of a constriction in a clinical thermometer (1 mk)

to prevent backflow of liquid. ✓1

d) The figure below shows a solar water system




a) State the following in regard to the solar water system

i) Why the pipes are made of copper (1 mk)

Copper is a good conductor of heat. ✓1

ii) Why the pipe is coiled several times (1 mk)

To increase the surface area for heat absorption. ✓1

iii) Why the panel front is covered with glass (1 mk)

Glass acts as a heat trap ✓1.

iv) Why the copper pipes are blackened (1 mk)

Black surfaces is a good heat absorber, ✓1
This is to increase the rate of heat absorption.

b) What can be done to minimize heat losses as the water moves through the hot water pipe (1 mk)

Lagging; Covers the pipes with an insulator. ✓1

**14.** a) A particle moving along a circular path of radius 10cm describes an arc of 5cm every second. Determine

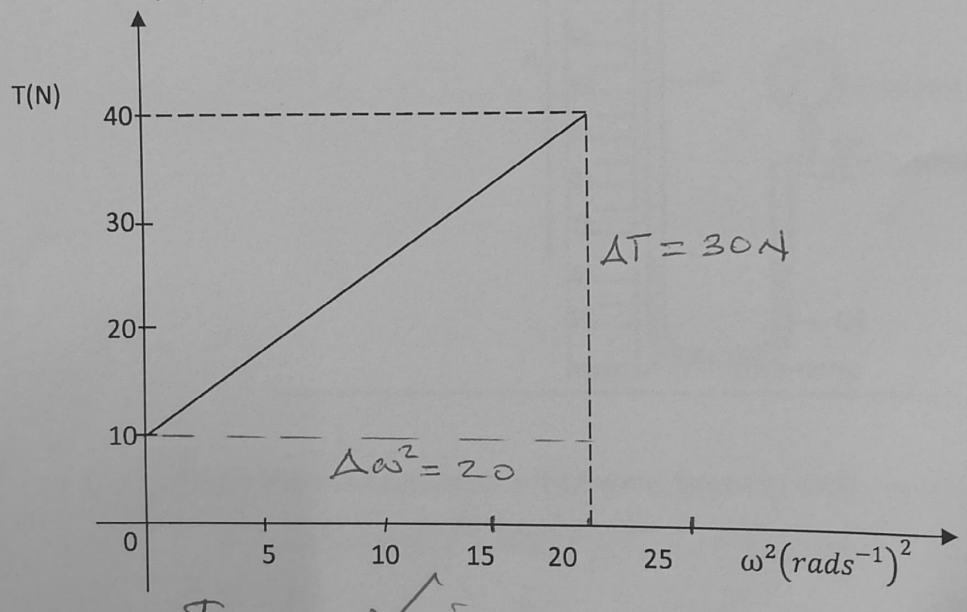
i) The angular velocity (2 mks)

$\omega = \frac{s}{r} = \frac{0.05}{0.10} = 0.5\ rads^{-1}$ ✓2

ii) Its periodic time (1 mk)

$T = \frac{2\pi}{\omega} = \frac{2 \times 3.142}{0.5} = 12.57\ s$ ✓1

b) The figure below shows a graph of tension **T** exerted by a stone whirled in a circle in a vertical plane using an inextensible string and moving at an increasing velocity against its angular velocity ( $\omega^2$) at its lowest point of rotation.




i) Explain what caused the increase in tension (2 mks)

Increase in velocity increases centripetal force hence increasing tension. ✓2

ii) $T = mr\omega^2 + mg$ ✓1

ii) Write an expression governing the graph (1 mk)

c) Use the graph to determine:

i) The mass of the stone (2 mks)

$(g = m\ 10ms^{-2})$

$mg = 10N$ ✓

$m = \frac{10N}{10ms^{-2}} = 1.0kg$ ✓ (2)

ii) The radius **r** of rotation of the stone (3 mks)

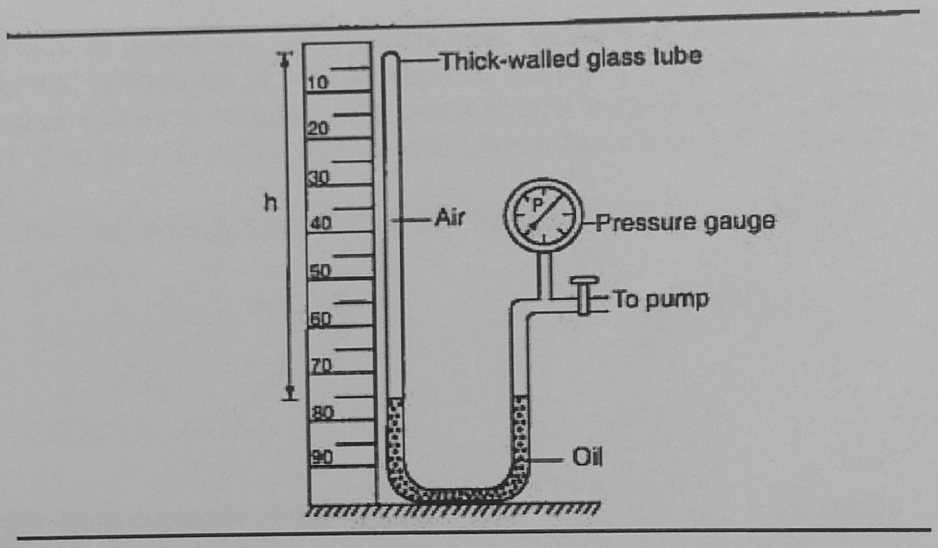
Gradient $= mr$ ✓ ✓ $= \frac{30}{20}$ ✓ $= 1.5$

$r = \frac{\text{Gradient}}{m}$ ✓ $= \frac{1.5}{1} = 1.5m$. (3)

**15.a)** State Boyle's law of gases (1 mk)

The pressure of a fixed mass of a gas is inversely proportional to its volume, provided the temperature is kept constant ✓

b) The diagram below shows an experiment set up to investigate Boyle's law




i) State the measurements that were taken in order to verify the law (2 mks)

- Volume / height of air column ✓
- Pressure of the gas. ✓ (2)

ii) Explain how the measurements can be used to verify the law (3 mks)

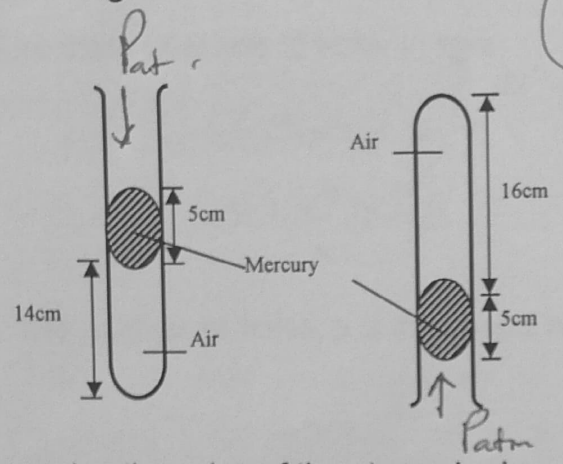
Vary pressure of the gas ✓ and record corresponding volumes for a set of five values ✓

Plot a graph of pressure against $\frac{1}{\text{Volume}}$ (3)

— A straight line through origin is attained

Then $P \propto \frac{1}{V}$.

c) A column of air 14 cm long is trapped by mercury thread 5cm long as shown in the figure below. When the tube is vertically inverted the air column now becomes 16cm long.




$(P_{atm} + 5cmHg)14 = 5cmHg + (P_{at} - 5cmHg)16$

$14P_{at} + 70cmHg = 16P_{at} - 80cmHg$

$150cmHg = 2P_{atm}$

$P_{atm} = (150/2)\ cmHg$ (2)

$= 75cmHg$

Determine the value of the atmospheric pressure in mmHg (2 mks)

d) In an experiment to determine the specific heat capacity of a ~~0.5~~ 2.0 kg aluminium block, a potential difference of 12V is used to supply a constant current of 2A through a heater coil for 5 minutes. The block is well lagged and its temperature rises from 21°C to 37.1°C within this period. Using the values given, determine:

i) The total electrical energy supplied by the heater (2 mks)

$E = IVt$

$= 2 \times 12 \times 5 \times 60$

$= 7200\ J$ (2)

ii) The specific heat capacity of aluminium (2 mks)

Temperature rise $(37.1 - 21)^\circ C = 6.1^\circ C$

$IVt = mc\Delta\theta$

$7200 = \underset{2.0}{\cancel{0.5}} \times c \times 6.1$ (2)

$c = \dfrac{7200}{\underset{2.0}{\cancel{0.5}} \times 6.1} = \cancel{2285}\ 590.2\ Jkg^{-1}K^{-1}$

**16.** a) A garden sprinkler of **x** holes each of cross-sectional area $3.0\times10^{-6}m^2$ and is connected to a horse-pipe of cross-sectional area of $2\times10^{-4}m^2$. If the speed of the water in the horse pipe is 1.35 m/s, calculate;

i) The mass flow rate of water in kg/s (3 mks)

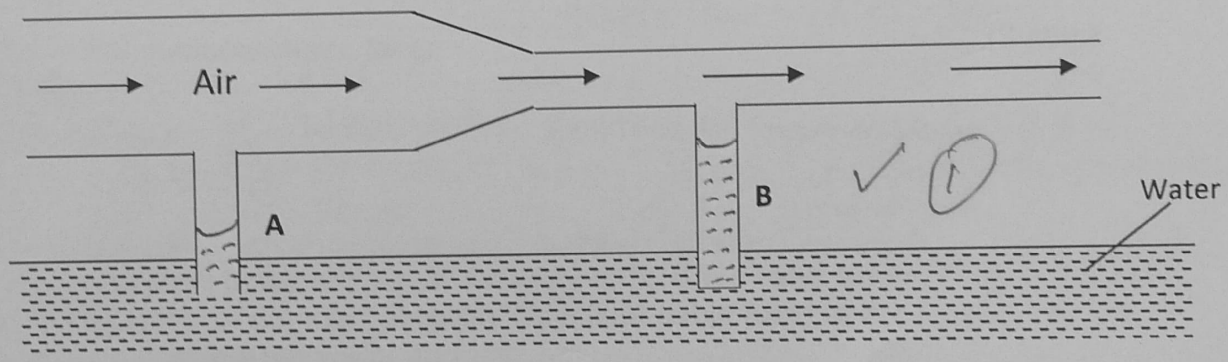
Vol. rate $= AV$
$= 2.0\times10^{-4}\times1.35$
$= 2.7\times10^{-4}\ m^3/s$ ✓

Mass flow rate = Vol. rate × density
$= 2.7\times10^{-4}\times1000$ ✓
$= 0.27\ kgs^{-1}$ ✓ (3)

ii) The number of holes, x if the speed of water as it emerges from the holes is 3m/s. (3 mks)

$R = AV$ ✓
$2.7\times10^{-4} = 3\times10^{-6}\times x\times3$
$x = \frac{2.7\times10^{-4}}{9\times10^{-6}}$ ✓ $= 30$ holes ✓ (3)

b) The figure below shows air flowing through a pipe of different cross sectional areas. The two pipes A and B are dipped into water.




i) Indicate on the figure the levels of water A and B (1 mk)

✓ (1)

ii) Explain the cause of the difference in the levels of water in the pipes A and B (2 mks)

At pipe A – low speed high pressure ✓
At pipe B – high speed low pressure ✓ (2)
Pressure difference $\Delta P$ is higher in B than in A hence water level at B higher than at A. ✓

iii) Explain why a lorry loaded with bags of maize packed high up is likely to topple when negotiating a sharp bend (2 mks)

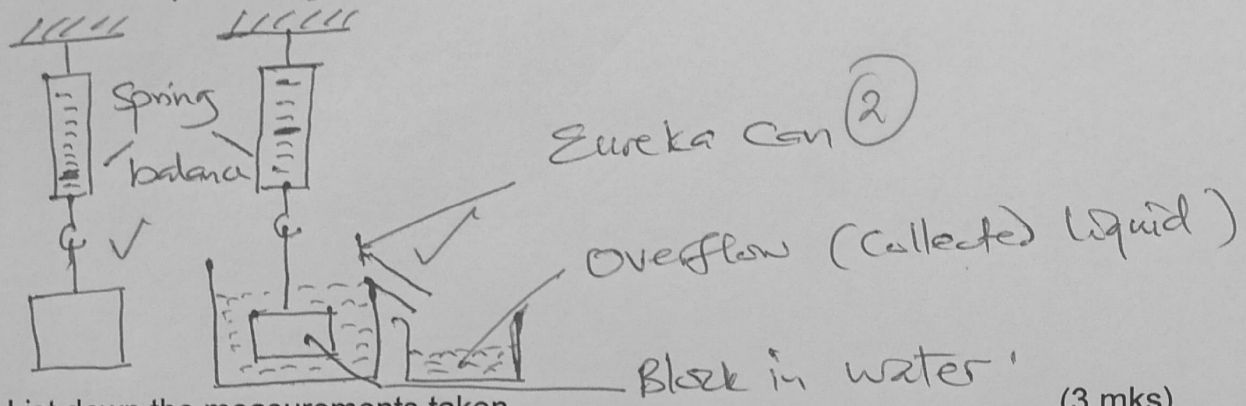
Bags of maize packed high up raise the position of the c.o.g when negotiating a corner the vertical line drawn vertically downwards from its c.o.g may fall outside the base ✓ (2) hence the lorry topples. ✓

17. a) State Archimedes's principle (1 mk)

When an object is partially or fully immersed in a fluid it experiences an upthrust force equal to the weight of fluid it displaces. (1)

b) You are provided with the following apparatus to carry out an experiment to verify Archimedes's principle: a spring balance, a eureka can, a beaker, a weighing balance, water in a container and a 50g metal block

i) Draw a set up showing how the apparatus are used in the experiment (2 mks)



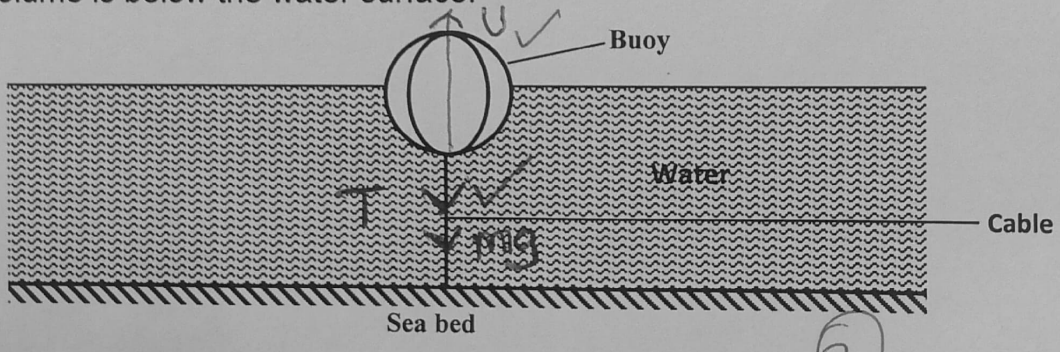

(2)

ii) List down the measurements taken (3 mks)

i) Weight of block in air
ii) Weight of block when partially immersed
iii) Weight of overflow when block is partially immersed
iv) " " block when fully immersed
v) Weight of overflow when block is fully immersed

(3)

(c) Figure below shows a buoy of capacity $4.0 \times 10^4 cm^3$ and mass 10kg. It is held in position in sea water of density $1.04 g/cm^3$ by a light cable fixed to the bottom so that ¾ of its volume is below the water surface.




(2)

i) Indicate on the diagram the forces acting on the buoy (2mks)

ii) Determine the tension in the cable. (3 mks)

$T + mg = U$

$T = U - mg$

$= 4.0 \times 10^{+4} \times 10^{-6} \times 1040 \times 10 - 10 \times 10$

$= (1 \times 10^{-2} \times 10400) - 100$

$= 104 - 100$

$= 4\ N$

(3)