Name: MARKING SCHEME.....Class: ..... Adm.No. .....

Index No..... Candidate's Signature.....Date.....

232/1
PHYSICS
THEORY
Paper 1
AUGUST 2022
Time: 2 hours

MANGU HIGH SCHOOL

MOCK EXAM 2022

PAPER 1

Instructions to Candidates

- *Write your name, admission number, class, Index no. 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.*
- *Non-programmable silent electronic calculator and KNEC mathematical table may be used*
- *ALL working MUST be shown clearly*
- *Candidates should answer the questions in English.*

This paper consists of 12 printed pages. ***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing***

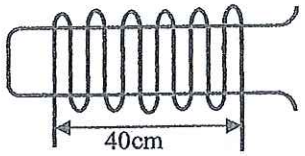
Where necessary use g = 10 N/kg, or10 m/s²

FOR EXAMINER'S USE ONLY

SECTION	QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
A	1 – 9	25	
B	10	7	
	11	7	
	12	7	
	13	6	
	14	8	
	15	9	
	16	11	
		80	

SECTION A (25 MARKS)

1. The figure below shows a wire wound on a test tube. The windings just touch each other. If the total number of complete loops was found to be 30, and the distance covered by the windings on the test tube is 40cm; find the radius of the wire. ~~test tube wire~~ (2 marks)



$d = \frac{40\,cm}{30}$ ✓

$d = 1.333\,cm$

$= 0.6665\,cm$ ✓

2. Explain why the level of a liquid in a glass thermometer slightly rises before falling when put in ice cold water. (2 marks)

The glass contracts earlier first making the liquid level to rise. The water then cools and contracts faster (more) than glass thus level falls.

3. A boy standing at the back of a lorry which is moving at a constant speed throws a tennis ball upwards. It is observed that the ball fell back at the point of projection inside the lorry.

a) Explain this observation (2 marks)

The ball does not have horizontal acceleration. Its horizontal velocity is the same as that of the lorry. (deny $a = 0$)

b) If the initial velocity of the ball was 20 m/s, determine how high the ball rose. (3mks)

$H = \frac{u^2}{2g} = \frac{20 \times 20}{2 \times 10} = 20m$ ✓

Follow SS working

4. Water flows through a horizontal pipe of varying diameter. The inlet diameter is 6cm and the water leaves the pipe at the rate of 0.5 m^3/s. determine the inlet velocity of the water. (3mks)

$r_1 = 3cm$

flow rate $= AV$ ✓

$= \pi r^2 V$

$0.5 = 3.142 \times (0.03)^2 \times V$ ✓

$V = 176.8\,m/s$ ✓

or $1.768 \times 10^4\,cm/s$.

5. Explain why deflating the tyres of a motor vehicle reduces extend of sinking of the wheels into a soft ground. (2 marks)

Deflating a tyre makes the surface area (area of contact) to be bigger / larger. This in turn reduces the pressure exerted by tyre on the soft ground thus reducing the extent of sinking.

6. The figure below shows a uniform wooden plank which weighs 10N. The plank is balanced at 0.8m from one end by a mass of 2.5 kg.

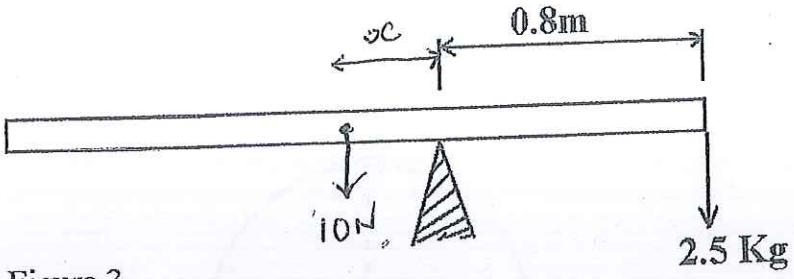


Figure 3

Determine the length of the wooden plank in metres. (3 marks)

$F_1 d_1 = F_2 d_2$ ✓

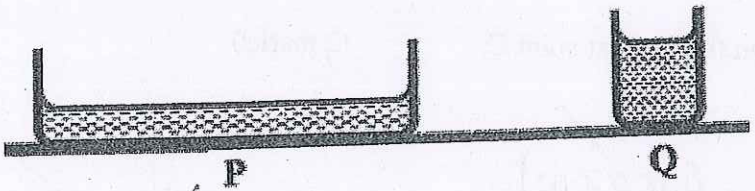
$2.5 \times 10 \times 0.8 = 10x$

$x = 2m$ ✓

$\frac{1}{2}d = 2 + 0.8 = 2.8$

$d = 5.6m$ ✓

7. The figure below shows two containers filled with equal volume of hot water.



State, with a reason, in which container will water cool faster. (2 marks)

Container P ✓ It has a larger liquid surface area than Q. Evaporation will be faster and heat loss is also faster ✓

8. The pointer of a spring loaded with a mass of 0.12kg reads 38cm. A pan in which a mass of 0.21kg is placed is suspended from the spring and the pointer reads 48cm. Determine the mass of the pan if the pointer of the unloaded spring is 22cm. (3 marks)

$e_1 = 38 - 22 = 16cm$

$F_1 = 0.12 \times 10 = 1.2N$

$K = F_1/e_1 = \frac{1.2}{16} = 0.075N/cm$ ✓

$e_2 = 48 - 22$

$= 26cm$

$F_2 = Ke_2$

$= 0.075 \times 26$

$= 4.635N$

$m_2 = 4.635kg$ ✓

But $m_2 = 0.12 + x$

$4.635 = 0.12 + x$

$x = 4.515$ ✓

9. A barometer has reading of 675mmHg at a certain place. The average density of air is $1.25kgm^{-3}$. Determine the altitude of the place. Take the atmosphere pressure at sea level to be 760mmHg. (3 marks)

$\left(\frac{760 - 675}{1000}\right) \times 13600 \times 10 = h \times 1.25 \times 10$ ✓

$h = 924.8m$ ✓

SECTION B (55 MARKS)

10. a) The figure below shows a body of mass 1000 kg which moves along a circular path in vertical plane. The radius of the circular path is 10m and the body moves with a velocity of 200ms^{-1}. (Take g = 10m/s^2).

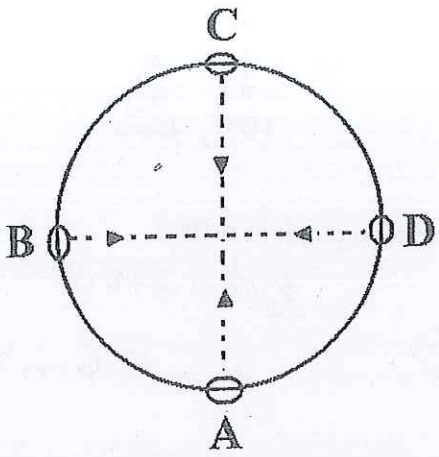


Figure 2

Calculate

I) the tension which acts on the body at point C. (2 marks)

$T = \frac{mv^2}{r} - mg$ ✓

$= \frac{1000 \times (200)^2}{10} - (1000 \times 10)$ ✓

$= 3.99 \times 10^6 N$ ✓

II) the tension which acts on the body at point A. (2 marks)

$T = \frac{mv^2}{r} + mg$ ✓

$= \frac{1000 \times (200)^2}{10} + (1000 \times 10)$ ✓

$= 4.01 \times 10^6 N$ ✓

b) A particle revolves at 4 Hz in a circle of radius 7cm. Calculate its linear speed. (3 marks)

$V = 2\pi r f$ ✓

$= 2 \times \pi \times 0.07 \times 4$ ✓

$= 1.75952 m/s \simeq 1.759 m/s$ ✓

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

11. a) State what is meant by the term specific latent heat of vaporization. (1 mark)

Quantity of heat required to change a unit mass of substance from liquid to gas without change in temperature. ✓

b) In an experiment to determine the specific latent heat of vaporization of water steam at 100°C was passed into water contained in a well lagged Calorimeter, the following measurements were made.

Mass of calorimeter	60g
Initial mass of water	80g
Final mass of calorimeter +condensed steam.	143g.
Initial temperature	17°C
Final temperature of mixture	32°C
Specific heat capacity of copper	390J/kgK

(i) Determine the mass of condensed steam. (1 mark)

$143 - 140 = 3g$

(ii) Determine the heat gained by calorimeter and water. (2 marks)

$Q = mc\Delta\theta$

$= \frac{80}{1000} \times 4200 \times (32-17) + \frac{60}{1000} \times 390 \times (32-17)$

$= 5040 + 351 = 5391\ J$

(iii) Determine the latent heat of vaporization of steam. (3 marks)

$mc\Delta\theta + ml_v = Q$

$\left(\frac{3}{1000} \times 4200 \times 68\right) + \frac{3}{1000} l_v = 5391$

$856.8 + 0.003 l_v = 5391$

$0.003 l_v = 4534.2$

$l_v = 1.5114 \times 10^6\ J/kg.$

12. (a) State Newton's second law of motion. (1 mark)

The rate of change of momentum is directly proportional to the resultant force producing the change and takes place in the direction of force.

(b) A trolley of mass 1kg moving at 1m/s collides head on with a stationary block of wood of mass 2kg. If the trolley and the block of wood are stuck together and moved a distance of 0.1m before coming to rest, find the;

(i) The velocity after collision. (2 marks)

$m_1u_1 + m_2u_2 = (m_1 + m_2)v$

$(1 \times 1) + (2 \times 0) = (1+2)v$ or

$3v = 1$

$v = 0.3333\ m/s$

(ii) Kinetic energy after collision. (2 marks)

$K.E = \frac{1}{2}mv^2$ or

$= \frac{1}{2} \times 3 \times (0.3333)^2$

$= 0.1667\ J$

Initial K.E = $\frac{1}{2} \times 1 \times 1^2 = 0.5J$ 5mks

(iii) The frictional force.

Work done against friction = change in K.E

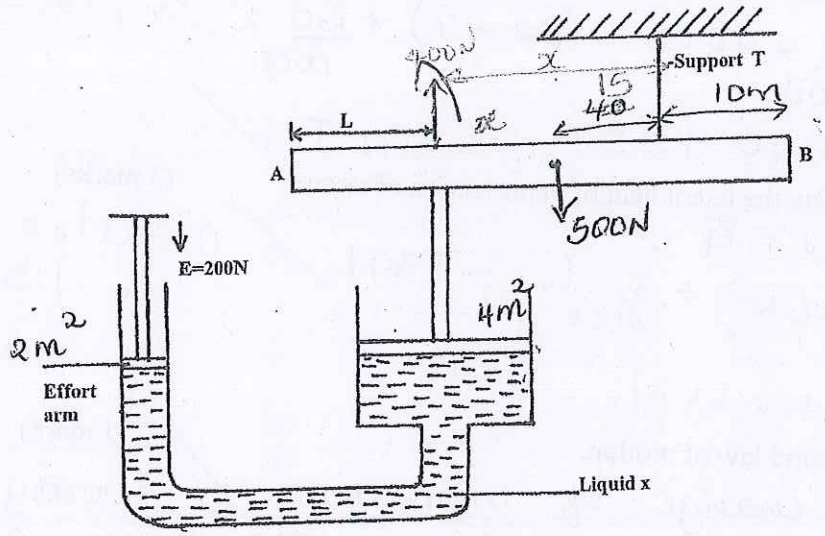
$F \times 0.1 = 0.1667 - 0.5J$

$0.1F = 0.3333$ $F = 3.333N$

13. a) Define the term efficiency as used in machines. (1mk)

Ratio of work done on load (work output) to the work done by effort (work input) usually expressed as a percentage

b) The hydraulic lift below was used to support a uniform metal rod horizontally in a construction size. The rod is 50m long and weighs 500N. If support T is 10m from B and cross-sectional area of effort arm is 2.0m^2 and the local arm 4.0m^2.



Determine

i) Force exerted on the rod by the load arm. (3 marks)

$\frac{F_1}{A_1} = \frac{F_2}{A_2}$ $F_2 = 400N$

$\frac{200}{2} = F_2/4$

ii) Distance of the load arm from point A. (2 marks)

$F_2 d_2 = F_1 d_1$

$500 \times 15 = 400 \times x$

$x = 18.75$

$L = 50 - (18.75 + 10)$

$L = 21.25m$

14. a) Distinguish between speed and velocity. (2 marks)

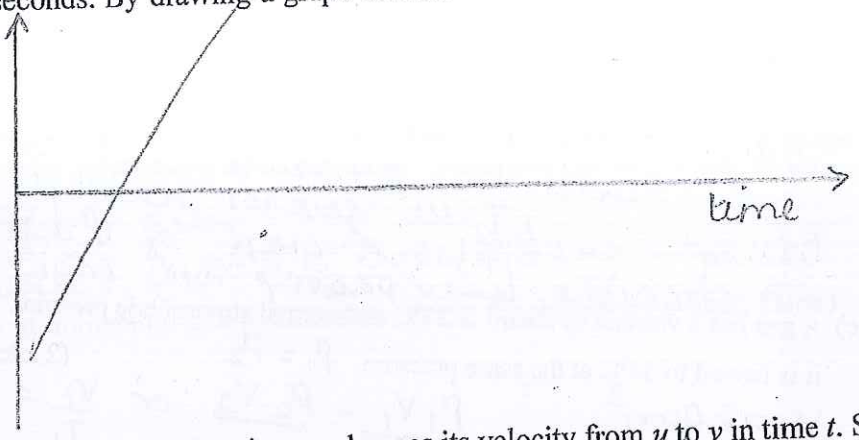
Speed is distance covered per unit time while velocity is change of displacement per unit time. or rate of change of displacement.

b) A car starts from rest and accelerates at $3m/s^2$ for 10seconds.It then moves at a constant velocity for 5 seconds. It accelerates at $2.5m/s^2$ till the final velocity is 4.5m/s. The car then retards uniformly and comes to rest after 10seconds. By drawing a graph determine the total distance travelled by the car.
(3 marks)

$u = 0$
$a = 3m/s^2$
$t = 10s$

$v = u + at$
$= 0 + 3 \times 10$
$= 30m/s$

$t = \frac{v-u}{a} = \frac{4.5-30}{2.5}$
$= 10.2s$



c) An object moving with uniform acceleration, a, changes its velocity from u to v in time t. Show that $v^2 = u^2 + 2as$ (3mks)

$a = \frac{v-u}{t} \Rightarrow t = \frac{v-u}{a}$

$s = \left(\frac{u+v}{2}\right) \times t$

$s = \left(\frac{u+v}{2}\right)\left(\frac{v-u}{a}\right)$

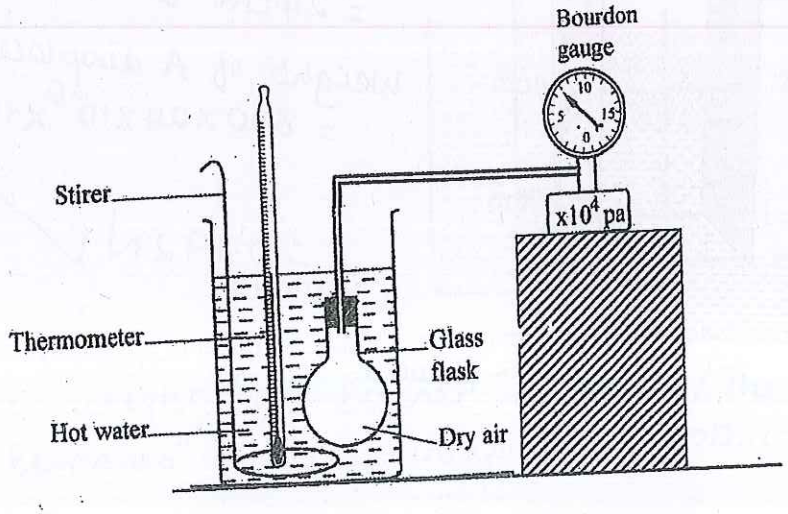
$s = \frac{v^2-u^2}{2a}$

$v^2 = u^2 + 2as$

15. a) State the Boyle's law. (1 mark)

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

b) The figure below shows a set up that may be used to verify one of the gas laws.



(i) State the measurements that may be taken in the experiment. (2 marks)

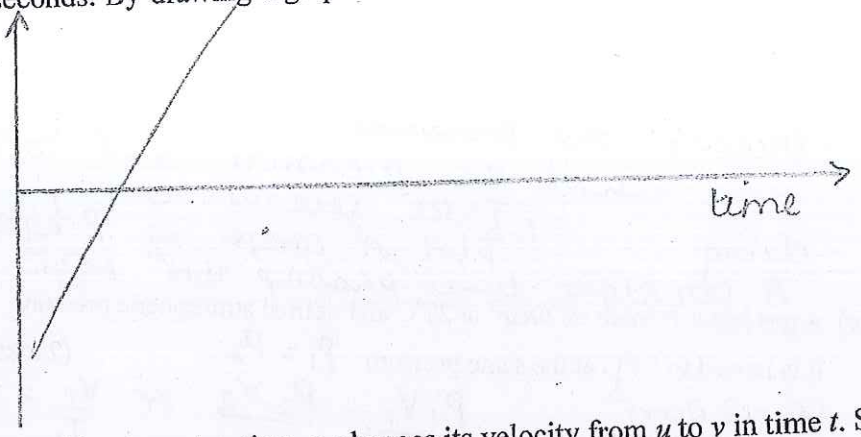
- pressure (of gas)
- Temperature

b) A car starts from rest and accelerates at $3m/s^2$ for 10seconds.It then moves at a constant velocity for 5 seconds. It accelerates at $2.5m/s^2$ till the final velocity is 4.5m/s. The car then retards uniformly and comes to rest after 10seconds. By drawing a graph determine the total distance travelled by the car. (3 marks)

$u = 0$
$a = 3m/s^2$
$t = 10s$

$v = u + at$
$= 0 + 3 \times 10$
$= 30m/s$

$t = \frac{v-u}{a} = \frac{4.5 - 30}{2.5}$
$= 10.25$



c) An object moving with uniform acceleration, a, changes its velocity from u to v in time t. Show that $v^2 = u^2 + 2as$ (3mks)

$a = \frac{v-u}{t} \Rightarrow t = \frac{v-u}{a}$

$s = \left(\frac{u+v}{2}\right) \times t$

$s = \left(\frac{u+v}{2}\right)\left(\frac{v-u}{a}\right)$

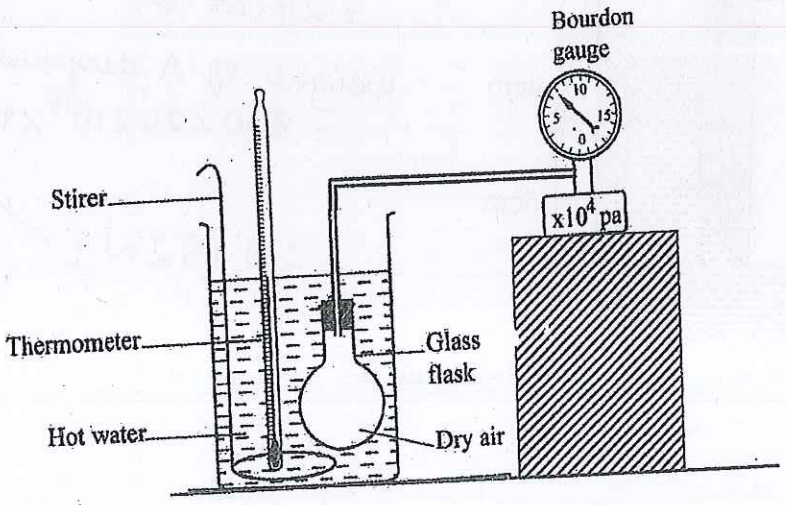
$s = \frac{v^2 - u^2}{2a}$

$v^2 = u^2 + 2as$

15. a) State the Boyle's law. (1 mark)

The ~~volume~~ Pressure of a fixed mass of a gas is inversely proportional to its volume provided the temperature is kept constant

b) The figure below shows a set up that may be used to verify one of the gas laws.



(i) State the measurements that may be taken in the experiment. (2 marks)

- pressure (of gas)
- Temperature

(ii) Explain how the measurement in (i) above may be used to verify the above law (4 marks)

- Record the initial pressure of gas and temp
- Increase the pressure.
- Record the pressure and corresponding temp
- Take several readings of pressure and corresp temp during
- Plot a graph of P against T - absolute temp
- A straight line passing thro' origin is sketched

c) A gas has a volume of $20cm^3$ at 27^0C and normal atmospheric pressure. Calculate the new volume of the gas if it is heated to 54^0C at the same pressure. (2 mks)

$P_1 = P_2$

$V_1 = 20cm^3$

$T_1 = 300K$

$V_2 = 327K$

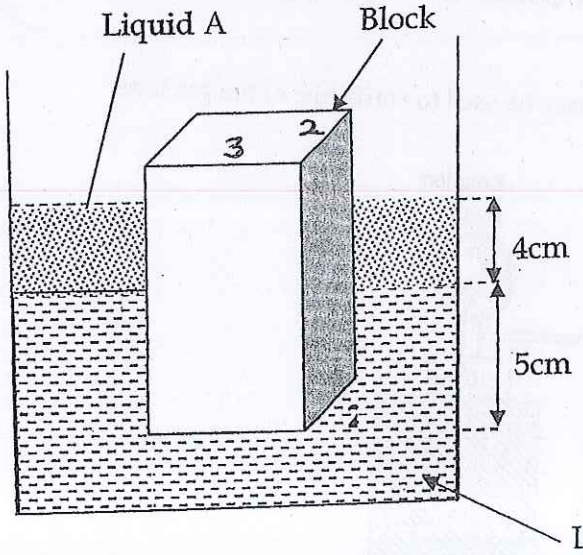
$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ or $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ ✓

$= \frac{20}{300} = \frac{x}{327}$ or $x = 21.8cm^3$ ✓

16. (a) State Archimedes Principle. (1mk)

When a body is partially or fully immersed in a fluid, it experiences an upthrust that is equal to the weight of the fluid displaced ✓

(b)The figure below shows a rectangular block of height 10cm floating vertically in a beaker containing two immiscible liquids A and B. The densities of the liquids are $0.8g/cm^3$ and $1.2g/cm^3$ respectively. The block is of dimensions 2cm by 3cm by 10cm.



Vol. of A displaced = Vol of block in Liquid A

$= 3cm \times 2cm \times 4cm$

$= 24cm^3$ ✓

Weight of A displaced = ρVg

$= 800 \times 24 \times 10^{-6} \times 10$

$= 0.192N$ ✓

Determine;

(i) the weight of liquid A displaced by the block. (2mks)