NAME.....Marking Scheme.....INDEX NO.....CLASS.....

CANDIDATES SIGNATURE.....DATE.....

232/1
PHYSICS
PAPER 1
SEPTEMBER, 2021
TIME: 2HOURS

MOMALICHE 2 CYCLE 8

INSTRUCTION TO CANDIDATES

- Write your name and index number in the spaces provided above.
- Answer all the questions both in Section **A** and **B** in the spaces provided below each question.
- All working **must be clearly shown**; marks may be awarded for correct steps even the answers are wrong.
- Mathematical tables and non programmable silent electronic calculators may be used. (Take acceleration due to gravity - 10m/s. Density of water -1g/cm)

For examiners use only

SECTION	QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
A	1-11	25	
B	12	8	
	13	9	
	14	9	
	15	9	
	16	10	
	17	10	

SECTION A (25 marks)

Answer ALL the questions in the spaces provided.

1. The water level in a burette is 30.6cm³, 50 drops of water each of volume 0.2cm³ are added to the water in the burette. What is the final reading of the burette. (2 marks)

Vol in = 50 × 0.2
= 10 cm³
Reading = 30.6 − 10
= 20.6 cm³.

2. Figure 1 shows a graph showing the behaviour of a helical spring.

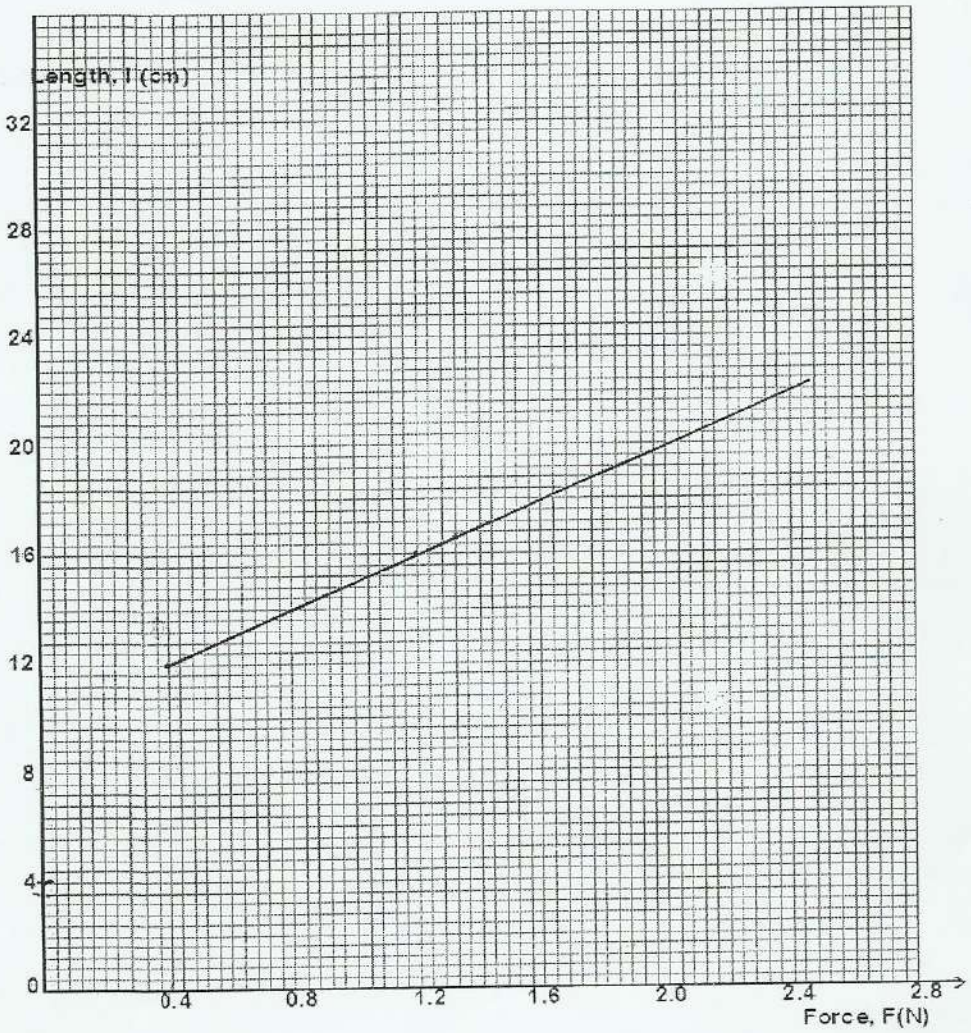


Fig 1

Determine the spring constant in SI units. (3 marks)

F = Ke
K = F/e ∴ = 1/Gradient
= (1.2 − 0.4)/(16 − 12) = 0.8/4 = 0.2 N/cm
= 20 N/m

3. Two forces are acting on a body as shown in figure 2.

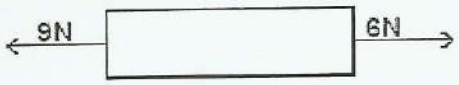
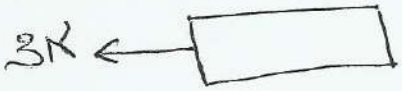


Fig 2

By use of a vector, draw the body and show the resultant force. (1 mark)



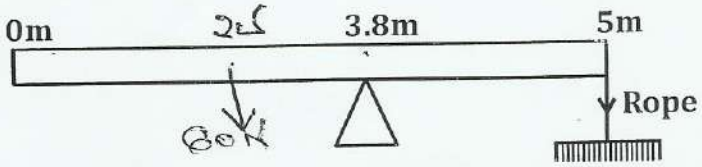
4. Two identical beakers A and B containing equal volumes of water are placed on a bench. The water in A is cold while in B is warm. Identical pieces of potassium permanganate are placed gently at the bottom of each beaker inside the water. It is observed that the spread of colour in B is faster than in A. Explain this observation. (2 marks)

Water in beaker B has higher K.E ⇒ Molecules are moving faster hastening the spread

5. A dropping dust particle in a still room does not trace a straight vertical path. Explain. (1 mark)

Due to collision with invisible air particles

6. A uniform rod of length of 5m and a mass of 6kg is pivoted at 3.8m mark. The rod is held horizontally by a vertical rope at 5m mark as shown in figure 3 below.



Calculate tension on the rope. (3 marks)

$F_1 d_1 = F_2 d_2$

$60 \times 1.3 = 1.2T$

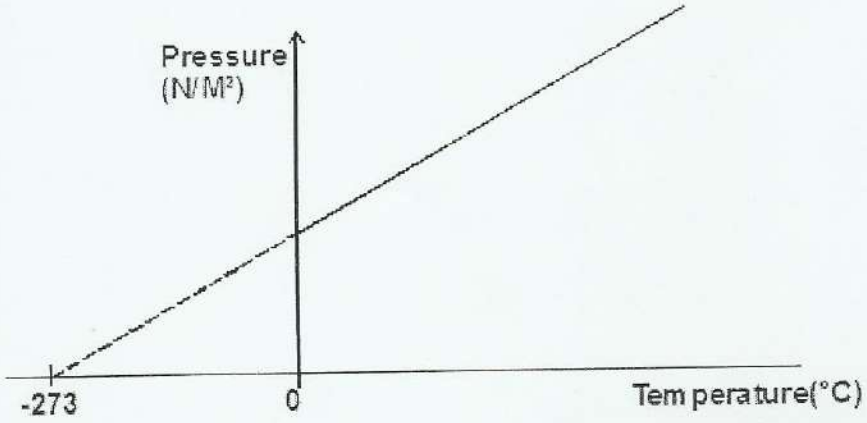
$T = \frac{60 \times 1.3}{1.2} = 65N$

7. When floating in a liquid of relative density 0.8 a rod displaces $90cm^3$; what volume will it displace when it floats in a liquid of relative density 1.2? (3marks)

wt of hydrometer = wt of fluid disp.
$= 90 \times 10^{-6} \times 800 \times 10$
$= 0.72N$

ρ of Liquid $= 1.2 \times 1000 = 1200 kgm^{-3}$
wt disp $= 0.72N$
$V = m/\rho = \frac{0.072}{1200} = 0.00006m^3$

8.



State the law represented in figure above. (1 mark)

Charles' Law.

9. Alcohol was placed in a flask fitted with an air tight cork as shown in figure 5.

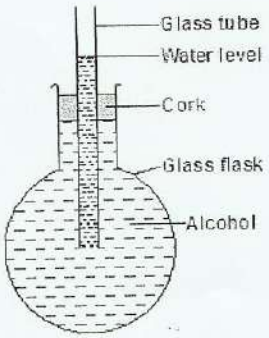


Fig 5

State and explain what would be observed if the flask was cooled. (3 marks)

- The water level rises then falls.
- The flask contracts causing the rise
- Later the water contracts dropping the

10. A boy poured some boiling water into a plastic can and placed an air-tight cork on its open end. He then ran some cold water on it for about 20 seconds after which he shook the can vigorously. State and explain what he observed. (2 marks)

- Pressure in the can increases and the can bulges.
- When cold water is poured on it the vapour condenses and the bottle shrinks

11. Water flows along a horizontal pipe of cross-sectional area 30cm². The speed of the water is 4m/s but it reaches 7.5m/s in a constriction in the pipe. Calculate the area of the constriction in m² (2 marks)

$$A_1V_1 = A_2V_2$$
$$30 \times 4 = 7.5A_2$$
$$A_2 = \frac{1200}{75} = 16\,cm$$
$$= 1.6 \times 10^{-3}\,m^2$$

12. A 240V television set is switched on for five minutes. If a current of 0.25A flows in it, determine the amount of energy supplied to it. (2 marks)

$$E = VIt$$
$$= 20 \times 0.25 \times 5 \times 60$$
$$= 1500\,J.$$

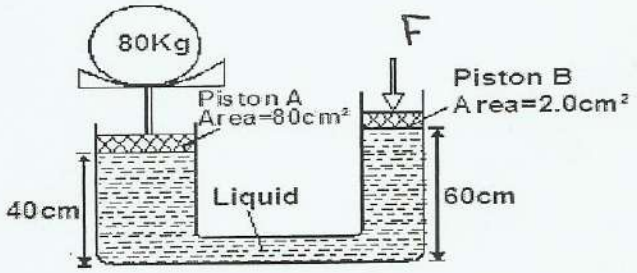
SECTION B (55 MARKS)

Answer ALL questions in this section.

13 a) State the principle of transmission of pressure in liquids. (1 mark)

Pressure exerted at one point in an enclosed container is transmitted equally to all parts.

b) A mass of 80kg is being lifted by a force F applied on the other piston of the machine as shown in figure below



Determine the value of F needed to just lift the 80kg mass given the density of the liquid is 1.2g/cm³. (4 marks)

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

$\frac{800}{80} = \frac{F_2}{2.0}$

$F_2 = 20N$

Mass of liquid $= (2.0 \times 20) \times 1.2$

$= 48g = 0.048kg$

Wt of liq. $= 0.48N$

$F = 20 - 0.48$

$= 19.52N$

c) Give one reason why a lift pump raises water to heights less than 10m. (1 mark)

Fear for density

d) In an experiment, it was observed that soapy water placed on a wet smooth surface displaced the particles of non-soapy water. State and explain this observation. (2 marks)

Soapy water lowers the surface tension of non-soapy water drawing the non-soapy water towards itself.

14 a) A block of metal of mass 250g at 100°C is dropped into a lagged calorimeter of heat capacity $40JK^{-1}$ containing 100g of water at 25°C. The temperature of the resulting mixture was found to be 40°C. Determine; ($C_w = 4200J/kgk$)

i) Heat gained by calorimeter. (2 marks)

$Q = MC\Delta\theta$

$= 40 \times 15$

$= 600J.$

ii) Heat gained by water. (2 marks)

$Q = MC\Delta\theta$

$= 0.1 \times 4200 \times 1.5 = 630\text{J}$.

iii) Heat lost by the block. (2 marks)

$Q = 6300 + 600$

$= 6900\text{ J}$.

iv) Specific heat capacity of the metal block. (3 marks)

$0.25 \times c \times 60 = 6900$

$15c = 6900$

$c = 400\text{J kg}^{-1}\text{K}^{-1}$.

15a) State Newton's third law of motion. (1mk)

Action and reaction are equal and opposite

b) Distinguish between elastic and inelastic collision. (2mks)

- Elastic collision – Both K.E and momentum are conserved
- Inelastic collision – Only momentum is conserved

c) A mini bus of mass 2000kg travelling at a constant velocity of 36km/hr collides with a stationary car of mass 1000kg. The impact takes 2 seconds before the two move together at a constant velocity for 20 seconds. Calculate.

i) The common velocity (2mks)

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

$2000 \times 10 + 1000 \times 0 = 3000v$

$v = 20000/3000 = 6.667\text{ms}^{-1}$.

ii) The distance moved after impact. (2mks)

$d = vt$

$= \frac{20}{3} \times 20 = 133.3\text{m}$.

iii) The change in Kinetic energy. (2mks)

$K.E_B = \frac{1}{2} \times 2000 \times 10^2 = 100000\text{J}$.

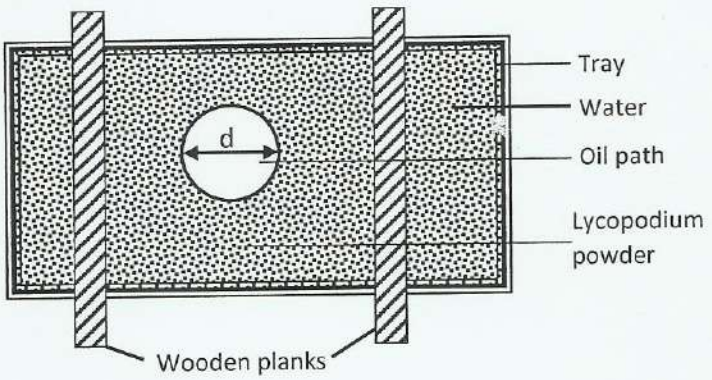
$K.E_A = \frac{1}{2} \times 3000 \times 6.667^2 = 66673$

Change $= 100000 - 66673$

$= 33327\text{J}$.

16 The figure 8 below shows an experimental set up for estimating the diameter of an oil molecule.

Figure 8



a) Describe how the oil patch is formed (3 Marks)

- Introduce the oil drop on the water surface.
- The surface tension of water reduces and the net force of the surrounding water pulls oil molecules outward hence spreading

b) i)In this experiment the diameter 'd' of the oil patch was measured to be 21cm for an oil drop of radius 0.28mm. Determine the diameter of the oil molecule. (3Marks)

$\pi r^2 h = \frac{4}{3}\pi R^3$

$\left(\frac{21}{2}\right)^2 h = \frac{4}{3}(0.25)^3$

$h = \frac{2.9269}{110.25}$

$= 2.655 \times 10^{-7} m$

ii)State any two assumptions made in calculating the diameter of the oil molecule (2Marks)

- Oil drops is monolayer
- Oil patch is a perfect circle
- Oil drop is a perfect sphere.

c) What is the role of the lycopodium powder in this experiment? (1Mark)

To make boundary of oil visible.

17 a)State two ways in which the centripetal force on a body of mass M can be increased. (2 marks)

- Increase the angular velocity
- Reduce the radius of rotation

b)Figure 9 shows an object of mass 200g at the end of a string 120cm long being whirled round a vertical circle in the direction shown.

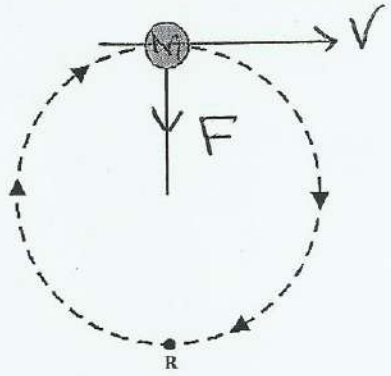


Fig 9

i) State two forces acting on the object at any instant as it continues to move in the vertical circle. (2 marks)

- Tension
- Weight

ii)Indicate with an arrow on the figure the direction of ;

I) Centripetal force. (1 mark)

II) Velocity at the position shown

It keeps on changing velocity. (1 mark)

iii) State the reason why the object is accelerating while its speed remains constant.

It keeps on changing velocity. (1 mark)

iv) Given that the angular velocity of the body is 5 rad s^{-1}, find the tension of the string at point R, the lowest point. (3 marks)

$T = Mw^2 x + Mg$

$= 0.2 \times 5^2 \times 1.2 + 0.2 \times 10$

$= 6.0 N$.

18a)i)State the pressure law of gases. (1 mark)

Pressure of a fixed mass of a gas is directly proportional to its absolute temp. provided the volume is kept constant

ii)Using the kinetic theory of gases, explain how rise in temperature of a gas causes a rise in pressure of the gas if volume is kept constant. (2 marks)

Increase in temp. increases the K.E. of particle increasing the rate of collision between air molecules and walls of the container which in turn increases the pressure.

b) A certain mass of hydrogen gas occupies a volume of $1.6m^3$ at a pressure of 160Kpa and the temperature of 16°C. Determine its volume when the temperature is 0°C at a pressure of 160KPa. (3 marks)

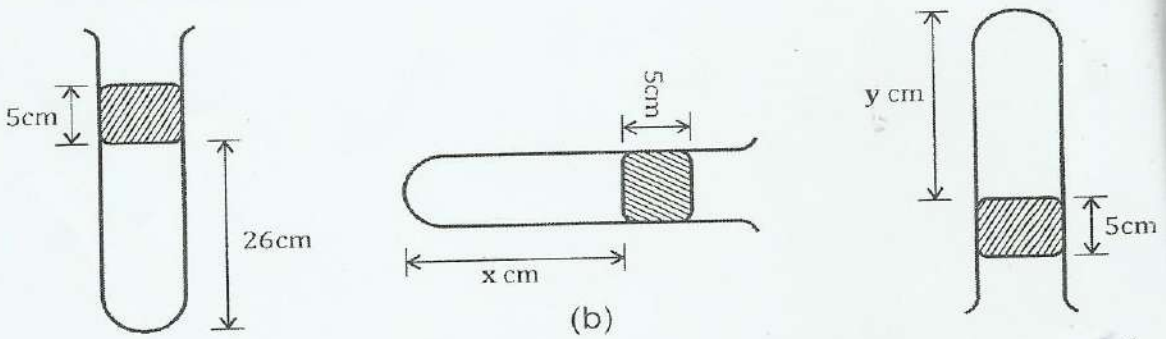
$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{160 \times 1.6}{289} = \frac{160 \times V_2}{273}$$

$$V_2 = \frac{160 \times 1.6 \times 273}{289 \times 160}$$

$$= 1.514 m^3$$

c) A column of air 26cm is trapped by mercury thread 5cm long as shown in diagram (a) below. When the tube is layed horizontally as in (b) the air column is now xcm long. When inverted as shown in (c) the length of the column is ycm. Find the values of x and y. (Take atmospheric pressure to be 70cmHg) (4 marks)



Getting x

$$P_1V_1 = P_2V_2$$

$$(70+5)26 = 70x$$

$$70x = 1950$$

$$x = 27.86 cm$$

Getting y

$$P_1V_1 = P_2V_2$$

$$(70+5)26 = (70-5)y$$

$$65y = 1950$$

$$y = 30 cm.$$