TERM 2 - 2023

PHYSICS (232)

FORM TWO (2)

Time - 2 Hours

MARKING SCHEME

SECTION A (25 MARKS)

1. Two metallic spheres **A, B** stand in contact as shown. A positively charged rod is held near sphere **A**.

Figure 1

a. Show the charge on each sphere when the metallic balls are separated and the rod is removed. (2 Marks)

-Showing even negative charge distribution around sphere A.✓
-Showing even positive charge distribution around sphere B✓

b. Why are the balls supported on insulated stands? (1 Mark)

-To prevent charge from leaking out of the spheres✓

2. A density bottle has a mass of **45g** when full of paraffin and a mass of **50g** when full of water if the empty bottle weighs **25g**, calculate the density of paraffin. (2 Marks)

$$Mass\ of\ parafin = 45 - 25 = 20g$$
$$Mass\ of\ water = 50 - 25 = 25g$$
$volume\ of\ water = 25cm^3 = volume\ of\ bottle = volume\ of\ parafin$✓
$\rho\ of\ parafin = \frac{m}{v} = \frac{20}{25} = 0.8\ g/cm^3$✓

3. State the reason why thermal conductivity of a metal increases with the increase in the cross-section area of the conductor? (1 mark)

The thicker the conductor, the faster the heat flow as more particles per unit area vibrate✓

4. Describe how you would charge a gold leaf electroscope **negatively** by induction method. (3 marks)

Touch the cap of the electroscope with your finger to ensure that it is fully discharged.
Bring a charged rod (+) close to the cap of the uncharged electroscope.✓
While the rod remains in its position, touch the cap.✓
Withdraw the finger and subsequently remove the rod.✓

5. An airtight flask containing a gas is connected to a mercury manometer. The levels of mercury in the two limbs of the manometer are as shown in the diagram below.

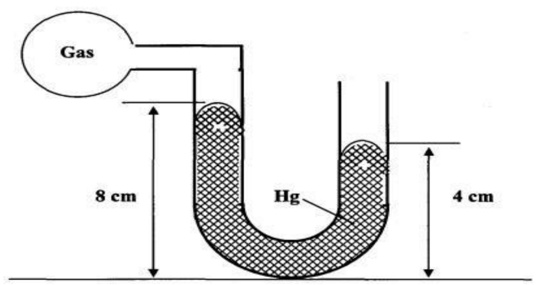


Figure 2

Calculate the pressure of the gas (Density of mercury = 1.36 x 10^4 kg/m^3 and atmospheric pressure = 1.0 x10^5 N/m^2) . (3 marks)

$P_{GAS} = P_{Atmospheric} - P_{Hg}$✓

$P_{GAS} = 100000 - (13600 \times 0.04m \times 10)$✓

$94560\ N/m^2$✓

6. Figure below shows a ray of light incident on a mirror at an angle of $\mathbf{45^0}$. Another mirror is placed at an angle of $\mathbf{60^0}$ to the first one as shown.

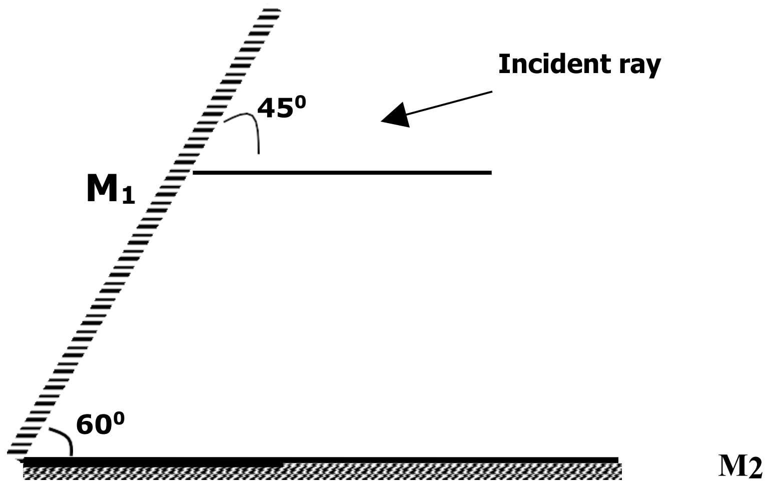


Figure 3

Calculate the number of images formed when an object is placed between the two mirrors. (2mks)

$$n = \frac{360}{\theta} - 1 = \frac{360}{60} - 1 ✓ = 5 images ✓$$

7. A highly inflated balloon bursts when transferred to a hotter environment. Explain this observation using kinetic theory of gases. (2marks)

Increased heat increases the kinetic energy of the gas particles which move more randomly and collide with walls of the balloon.✓ This increases the pressure on the balloon causing it to burst.✓

8. In a ball and ring experiment, the ball goes through the rings at room temperature. When it is heated it does not go through the ring, but when left on the ring for some time, it goes through. Explain this observation. (2marks)

When heated, the ball expands and so cannot go through the ring. When it is left on the ring for some time the temperature of the ball decreases and the ball contracts. ✓At the same time the ring absorbs some heat from the ball its temperature increases and so it expands allowing the ball to pass through.✓

9. A piece of metal weighs 3N in air and 2N when totally immersed in water.
   i. Identify the force responsible for the difference in weight of the metal. (1mark)

      Upthrust force✓

   ii. Determine the value of the force in (i) above. (2 marks)

$$Upthrust = Weight\ in\ air - Weight\ in\ water \checkmark$$

$$Upthurst = 3N - 2N = 1N \checkmark$$

10. Explain how a person is able to drink a soda using a drinking straw. (2marks)

When water is sucked up a straw the air pressure inside the straw reduces. ✓The atmospheric pressure acting on the water surface is now greater than the pressure inside the straw. Water is thus pushed up the straw by the atmospheric pressure.✓

11. Give a reason why air is not commonly used as the fluid in a hydraulic lift. (1mark)

Air is compressible hence it will not transmit pressure in a hydraulic lift.✓

12. State **one** assumption made when estimating the size of an oil molecule in the oil drop experiment. (1mark)

The oil drop is perfectly spherical.✓The oil patch is perfectly cylindrical.✓The oil patch is one molecule thick.✓

SECTION B (55 MARKS)

13. (a) State the law of moment (1 mark)

For a system in equilibrium the sum of clockwise moments about a point must be equal to the sum of anti-clockwise moments about the same point✓

(b) The figure 4 below shows a uniform metre rule of mass 200g balanced at 40 cm mark by a number of forces. Calculate,

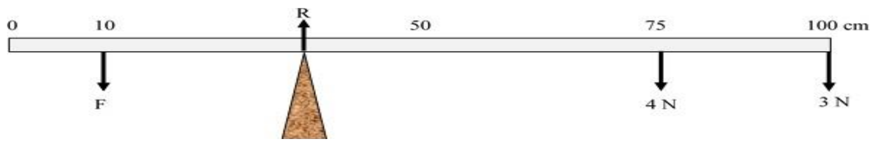


Figure 4

(i) The force F (3 marks)

$At\ equillibrium, sum\ of\ clockwise\ moments = sum\ of\ anticlockwise\ moments$✓

$(0.6 \times 3) + (0.35 \times 4) = F \times 0.3$✓

$F = \frac{3.2}{0.3} = 10.6667N$✓

(ii) the reaction at R (2 marks)

$Sum\ of\ uprard\ forces = sum\ of\ downward\ foces$✓

$R = 10.6667N + 4N + 3N = 17.6667N$✓

(c) A spherical ball bearing of mass 0.0024kg is held between the anvil and spindle of a micrometer screw gauge. Use this information and the position of the scale in the figure 5 below to answer the questions (a) and (b) below:

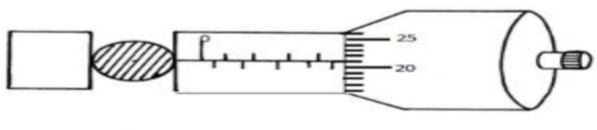


Figure 5

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

$4.71mm$✓

II. Find the density of the ball bearing correct to 3 significant figures. (3marks)

$Volume\ of\ sphere = \frac{4}{3}\pi 2.355^3 = 54.7093cm^3$✓

$\rho = \frac{m}{v} = \frac{2.4g}{54.7093cm^3} = 0.043868227\ g/cm^3$✓

$To\ 3\ significant\ figures = 0.0439\ g/cm^3$✓

14. In an experiment to estimate the diameter of an oil molecule, an oil drop of diameter **0.05 cm** spread over a circular patch whose diameter is **20cm**

Determine:

(i) The volume of the oil drop. (2 Marks)

$Volume\ of\ oil\ drop = Volume\ of\ sphere ✓ = \frac{4}{3}\pi 0.025^3 = 6.544984695 \times 10^{-5} cm^3 ✓$

(ii) The area of the patch covered by the oil (2 Marks)

$Area\ of\ oil\ patch = Area\ of\ a\ circle ✓ = \pi 10^2 = 314.2cm^2 ✓$

(iii) The thickness of the oil molecule. (3 Marks)

$$Thickness\ of\ oil\ molecule = \frac{Volume\ of\ oil\ drop}{Area\ of\ oil\ patch} ✓ = \frac{6.544984695 \times 10^{-5} cm^3}{314.2cm^2} ✓$$

$$= 2.08306 \times 10^{-7} cm ✓$$

(iv) State the importance of lycopodium powder in the above experiment. (1 Mark)

It breaks surface tension.✓

It clearly shows the extent of spread of the oil drop✓

(v) State two possible sources or errors in this experiment. (2 Marks)

Error in measuring the diameter (or volume) of oil drop.✓

Error in measuring diameter of oil patch✓

15. A concave mirror with a focal length of 8cm forms on upright image 15 cm from the mirror. If the object is 5 cm tall, calculate;

(i) The distance of the object from the mirror (3 marks)

$\frac{1}{U} = \frac{1}{f} - \frac{1}{V}$;✓

$\frac{1}{U} = \frac{1}{8} - \frac{1}{15} = \frac{17}{120}$✓

$U = 17.14Cm$✓

(ii) Magnification. (2 marks)

$m = \frac{v}{u} = \frac{15}{17.14}$ ✓=0.875✓

(iii) Image height (2 marks)

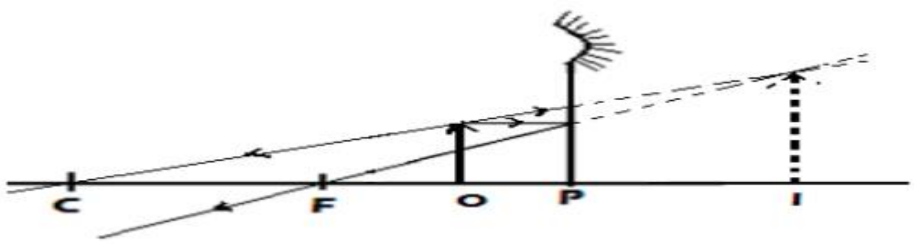
$h_{image} = m \times h_{object} = 0.875 \times 15 ✓ = 13.125cm ✓$

(iv) The figure 6 below shows an object placed 10cm in front of a concave mirror whose radius of curvature is 40cm.On the same figure, draw a ray diagram to show the position of the image formed. (3 Marks)

-Correct rays✓

-Correct image position✓

-A virtual image✓



The image formed is behind the mirror, virtual, upright and larger than the object

(v) Give a reason why convex mirror is preferred to plane mirror for use in supermarkets. (1 mark)

- It has a wider field of view.✓ It forms upright images for all object positions. ✓

16. a) Define magnetic field. (1 mark)

The space around a magnet where the magnetic influence (magnetic force of attraction and repulsion) is felt✓

b) The graph in the figure 7 below was obtained from an experiment.

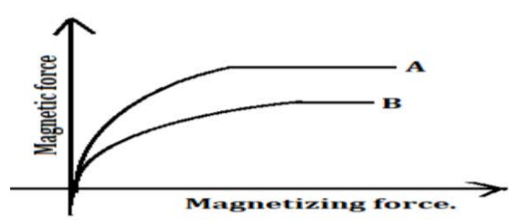


Figure 6

i) Which material is easy to magnetize. (1 mark)

A✓

ii) Using domain theory explain your answer (i) above. (2 marks)

During magnetization process, dipoles get aligned.✓ In a partially magnetized material most but not all domains are aligned in one direction. Soft magnetic materials magnetized easily but do not retain their magnetism for long.✓

iii) State one application of hard magnetic materials. (1 mark)

Making permanent magnets. ✓Making magnetic compass.✓

c) State two methods of magnetization. (2 marks)

1. Induction✓ 2. Stroking✓ 3. Hammering in north-south direction✓ 4. Electrical method using direct current✓

d) Why is repulsion the surest way of identifying a magnet? (2 marks)

Repulsion is the only sure test for polarity of magnet because repulsion can only occur between like poles of magnets. ✓Attraction is not sure test because it can occur between unlike poles of magnets or between a magnet and unmagnified magnetic material✓

e) Figure 8 shows a magnetic material being magnetized

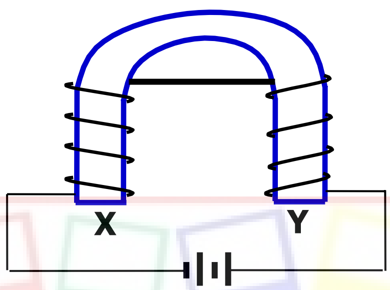


Figure 7

Identify the polarities of X and Y (2 Marks)

X: South✓

Y: South✓

f) Suggest three ways that can be done to make the electromagnet stronger. (3 Marks)

Increase the amount of current in the solenoid –the large the current the strong the electromagnet. ✓

Increase number of turns in the solenoid –the more the number of turns the strong the electromagnet.✓

Increase the length of the solenoid- the longer the solenoid the stronger the electromagnet. ✓

The shape of the core -horse - shoe shaped core produces a stronger electromagnet than u- shaped core while a u-shaped core produces a stronger electromagnet than a straight core.✓

17. a) Fig. 8 shows a cylindrical can filled with a liquid of density 0.8 gcm^{-3}. A hole of diameter

2.0 cm is drilled at a depth of 2.8 m from the top of the can.

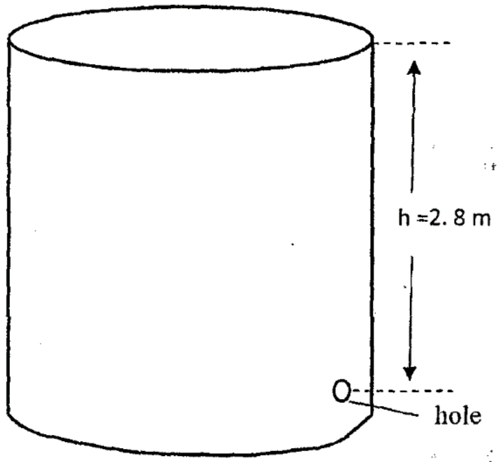


Fig. 8

Determine:

i. The cross-sectional area of the hole. (2marks)

$Area = \pi r^2 = \pi \times 0.01 \times 0.01 \checkmark = 3.142 \times 10^{-4} m^2 \checkmark$

ii. The maximum pressure exerted by the liquid at the hole. (2marks)

$P = h\rho g = 2.8 \times 800 \times 10 \checkmark = 22400\ N/m^2 \checkmark$

iii. The maximum force exerted on a jet of liquid through the hole. (2marks)

$Force = Pressure \times Area = 22400\ N/m^2 \times (3.142 \times 10^{-4} m^2) \checkmark = 7.03808 N \checkmark$

b) Name the states of equilibrium in the following diagrams. (2 marks)

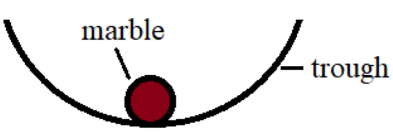
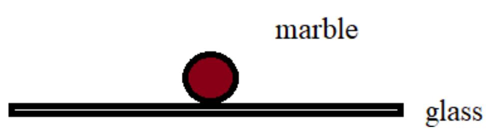


Figure 8



(i) Stable equilibrium✓ (ii) Neutral✓

c) State two ways to increase the stability of a body. (2 marks)

Lowering the position of COG of the body - the lower the position of the center of gravity the more stable a body is.✓

Widening/ increasing base area of the body- a body is more stable when the base is wide. A narrow base makes the body to be less stable.✓

#END