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MARKING SCHEME

232/1
PHYSICS
PAPER 1
(THEORY)
END TERM 2 2025
JULY 2025

SECTION I (25 MARKS)

1. In an experiment to determine the density of liquid X a student obtained the following data:

- Mass of density bottle 55.0g
- Mass of the density bottle + water = 80.0g
- Mass of the density bottle + liquid x = 70.0g

Determine the density of liquid X (Take density of water = 1000kgm^-3). (3 mks)
Answer:
Mass of water = 80.0g - 55.0g = 25.0g
Mass of liquid X = 70.0g - 55.0g = 15.0g
Volume of the bottle = mass of water / density of water = 25.0g / 1000kg/m^3 = 25.0 x 10^-3 kg / 1000kg/m^3 = 25.0 x 10^-6 m^3
Density of X = mass / volume = 15.0g / 25.0cm^3 = 600kg/m^3

2. It is observed that when 20cm^3 of alcohol is mixed with 20cm^3 of water, the volume of the mixture is 39cm^3. State the reason why the volume of the mixture is not 40cm^3. (2 mks)
Answer:
Particles of alcohol fit into the spaces between the particles of water, leading to a decrease in total volume (intermolecular space reduction).

3. When a liquid is heated in a glass flask, it is observed that the level at first goes down and then rises. Explain this observation. (2 mks)
Answer:
Initially, the glass flask expands before the liquid absorbs enough heat to expand, hence the initial drop. Later, the liquid expands more and rises.

4. State the reason why the speed of water at the narrow section of a river is higher than at the wider section. (1 mk)
Answer:
According to the principle of continuity, the velocity increases where the cross-sectional area decreases.

5. i) Write expression for the velocity ratio of the above system in terms of r and R. (1mk)
Answer:
Velocity Ratio (V.R.) = Radius of wheel / Radius of axle = R/r
ii) The diameter of the wheel is 30cm and that of axle is 3.0cm, determine the velocity ratio. (2 mks)
Answer:

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Radius of wheel = 15cm, radius of axle = 1.5cm
V.R. = 15 / 1.5 = 10

6. Using the definition of impulsive force, show that F=ma. (3 mks)
   Answer:
   Impulse = Change in momentum = Force x time = mv - mu
   F = (mv - mu)/t = m(v - u)/t = ma

7. A uniform metre rule is pivoted at its centre. Two weights of 20N and 10N are suspended at the 20cm and 100cm marks respectively. Determine the position at which a 10N weight should be suspended in order to balance the system. (3 mks)
   Answer:
   Let x be the position of 10N weight.
   Taking moments about the centre (50cm mark):
   20N x (50 - 20) = 10N x (100 - 50) + 10N x (x - 50)
   600 = 500 + 10(x - 50)
   10(x - 50) = 100 => x - 50 = 10 => x = 60cm

8. State what is meant by polarization in simple cells. (1 mk)
   Answer:
   It is the formation of hydrogen bubbles at the positive electrode, which reduces the cell's efficiency.

9. A stone of mass 1.5kg is in uniform motion in a vertical plane of radius 0.5m as in the figure below. The stone is whirled at a speed of 6m/s. Determine the tension in the string at point A. (3mks)
   Answer:
   T = mv^2/r + mg = (1.5 x 6^2)/0.5 + (1.5 x 9.8) = 108 + 14.7 = 122.7N

10. State a reason why B is more stable than A. (1 mk)
    Answer:
    Design B has a wider base, hence a lower centre of gravity increasing stability.

SECTION II (55 MARKS)

11. i) Determine the velocity of the trolley at:
I: Distance a. (4 mks)
Answer:
Time between two dots = 1/50 = 0.02s
Velocity = Distance / Time = 0.5cm / 0.02s = 25 cm/s = 0.25 m/s

II: Distance b (2 mks)
Answer:
Velocity = 1.5cm / 0.02s = 75 cm/s = 0.75 m/s

ii) Determine the acceleration of the trolley (2 mks)
Answer:
acceleration a = (v - u)/t = (0.75 - 0.25)/0.18 = 0.5/0.18 = 2.78 m/s^2

12. a) Steps to verify Hooke's law (5 mks)
    Answer:

- Suspend spring vertically on clamp.

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- Attach a pointer and scale.
- Add known mass and record extension.
- Repeat with increasing mass.
- Plot a graph of force vs extension; straight line confirms Hooke's law.

i) Spring constant K (3 mks)
Answer:
Gradient of force vs extension = k
Choose two points (e.g., 2N, 0.02m) and (4N, 0.04m)
k = (4 - 2)/(0.04 - 0.02) = 2 / 0.02 = 100 N/m

ii) Load for 3x10^-2m extension (1 mk)
Answer:
F = kx = 100 x 0.03 = 3N

c) Three identical springs constant 100Nm^-1 support 5N (3 mks)
Answer:
Two springs in parallel: k_eq1 = 100 + 100 = 200 N/m
In series with third spring: 1/k_total = 1/200 + 1/100 = 3/200
k_total = 66.67 N/m
Extension = F/k = 5 / 66.67 = 0.075m

13. i) Reasons for using oil (2 mks)
    Answer:

- Spreads into a thin film
- Has small molecules

ii) Function of lycopodium powder (1 mk)
Answer:
Makes the outline of oil spread visible

iii) Assumptions (2 mks)
Answer:

- The oil drop contains a single layer of molecules
- The patch is circular and uniform

iv) Why oil spreads on water (2 mks)
Answer:
Adhesive forces between oil and water are stronger than cohesive forces between oil molecules

b) Size of a palm oil molecule (3 mks)
Answer:
Volume of one drop = 15.0 / 100 = 0.15mm^3
Thickness = volume / area = 0.15 / (8 x 10^4) = 1.875 x 10^-6 mm = 1.875 x 10^-9 m

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