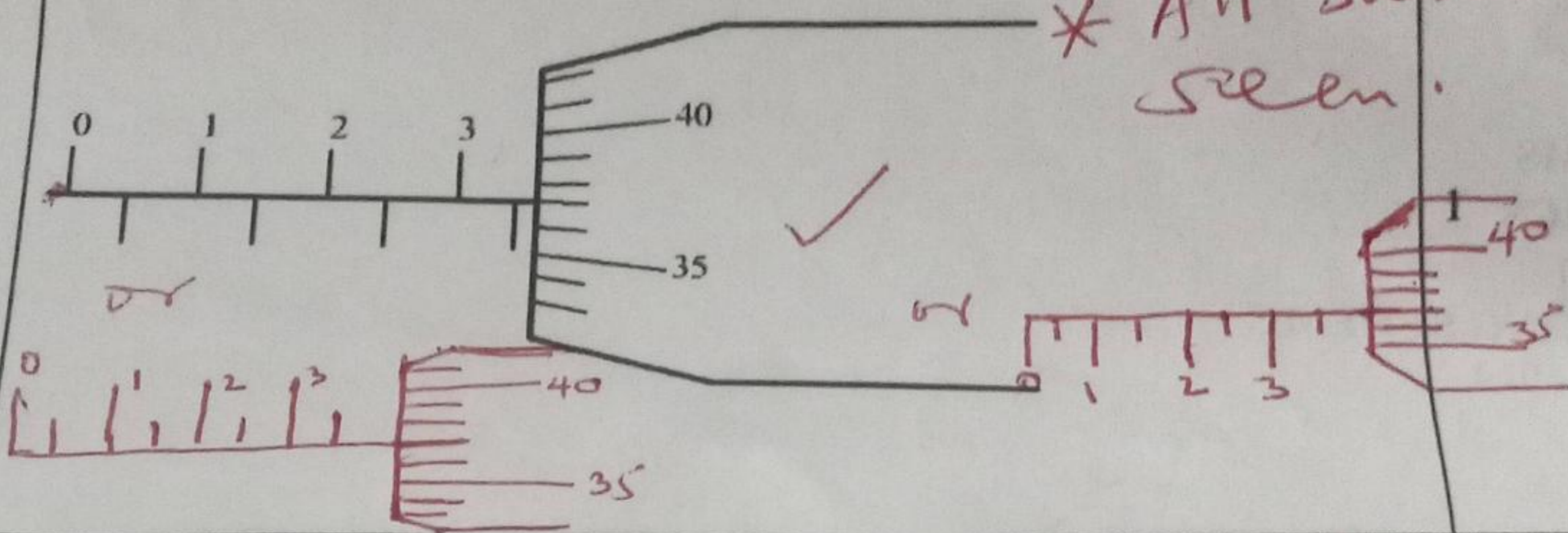


SECTION A (25 MARKS)

1.



* All subdivisions seen.

2.

- (a) For the liquid to be pulled downwards by cohesive forces.
 - (b) For point x to have a lower pressure than the liquid in the tank.
- Create pressure difference.

1
1

3.

(a) $P_1 l_1 = P_2 l_2$ / $P_1 V_1 = P_2 V_2$ / $P_1 A_1 l_1 = P_2 A_2 l_2$
 $76 \times 7.5 = (76 - 5) \times l_2$
 $l_2 = 8.028 \text{ cm}$

Accept 8.0 cm

at least 3 d.p.

- (b) Atmospheric pressure is greater than the pressure due to the mercury thread.

Pressure is less than the atmospheric pressure / Atmospheric pressure is equal to the pressure due to the mercury thread.

1

4.

Volume drained = $2 \times 3 = 6 \text{ cm}^3$
 Reading = $15 + 6 = 21 \text{ ml}$

$15 - 6 = 9 \text{ ml}$

2

- Radius

- Linear velocity / Speed.

Any 2 x 1 correct

- Change in displacement

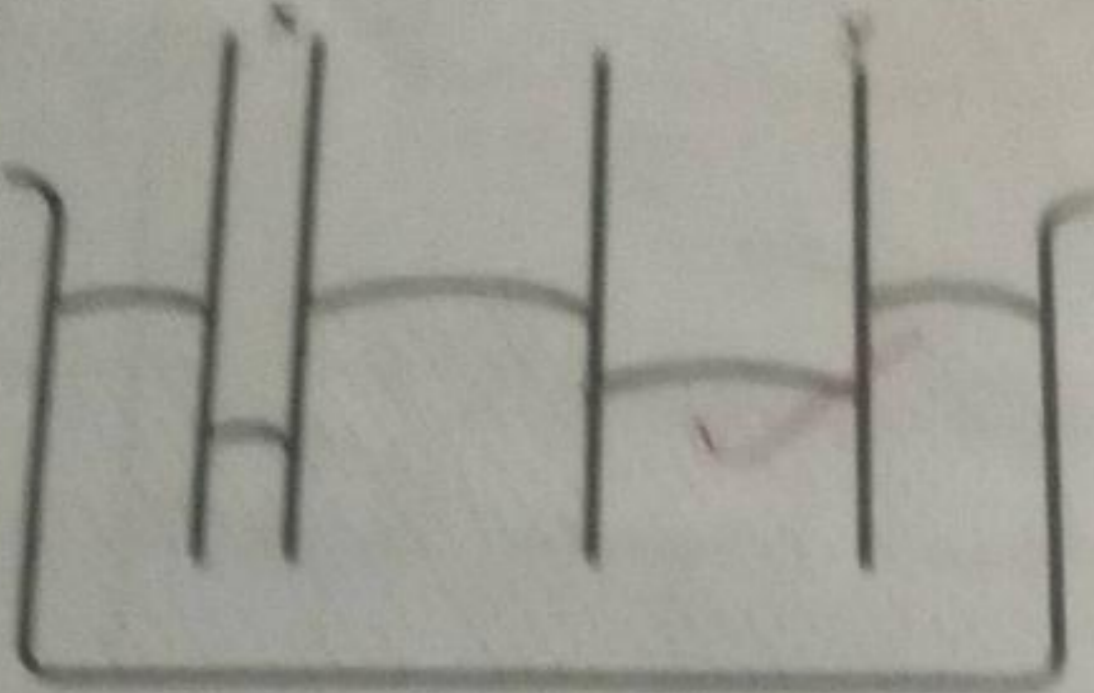
change in linear displacement

- Time (change)

frequency / Periodic time.

(Any 2)

* Don't accept



Level of water above the tube is the same. The level in the beaker is the same. Concentration of water is the same.

Rate at which the water turns black decreases.

larger to the black rate of diffusion decreases.

$K = \frac{F}{e \cdot p}$
 $= \frac{50}{1}$
 $= 50 \text{ Nm}^{-1}$

effective $K = 2 \times 50 \text{ Nm}^{-1}$

$= 100 \text{ Nm}^{-1} = 10000 \text{ N/m}$

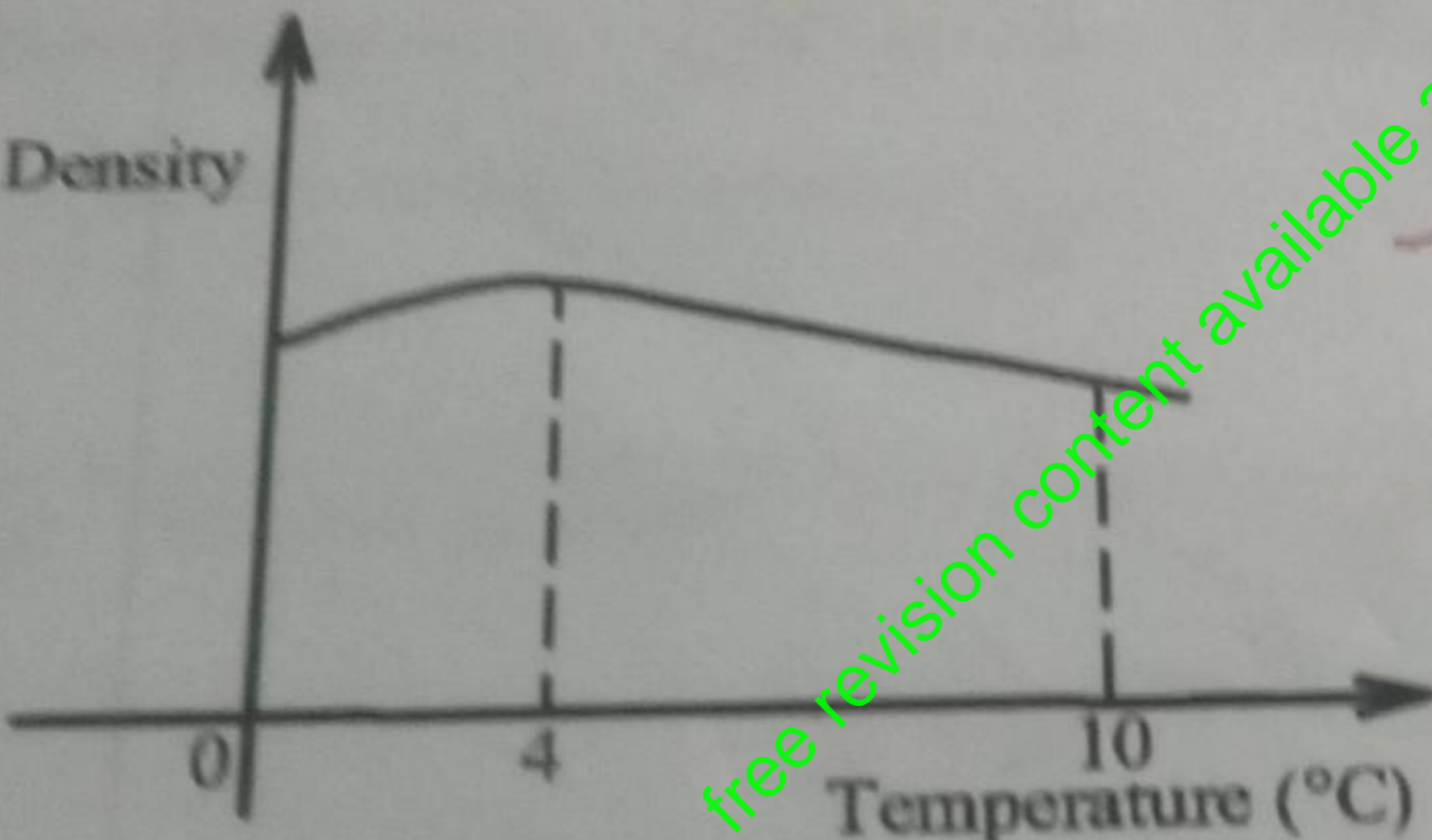
$F = Ke$
 $K = \frac{50}{1} = 50 \text{ Nm}^{-1}$
 $K_p = k_1 + k_2$
 $= 50 + 50$
 $= 100 \text{ Nm}^{-1}$

$F = Ke$

$e_2 = \frac{1}{2} e$

$= \frac{1}{2} \times 1 = 0.5 \text{ cm}$

$K_p = \frac{50}{0.5} = 100$



- 4°C must be shown

- should be a curve not a straight line

To maintain stability

vertical line of action through C.O.G (shifts) to fall within the base. Lower the C.O.G within the base.

11.	At BC the molten substance <u>solidifies</u> . Because it is losing latent heat.	<u>Freezes / changes to solid</u> <u>latent heat of fusion</u> <u>loses heat without change in temperature.</u>	1
12.	$10 \times 0.5 = T \times 1.4$ $T = 3.57 \text{ N}$	<u>Same distance</u> <u>Same pressure</u> $F_1 d_1 = F_2 d_2$	2
13.	Hot water rises up due to lower density to heat ice B before A.	<u>It is due to convection</u> <u>more heat reach B than A.</u>	1
14.	Velocity of the stream of air is higher under the folded paper than above the paper. Hence the pressure below is lower than above causing the paper to collapse.		2

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SECTION B (55 MARKS)

15. (a)	<p>(i) Weight of block = weight of displaced water ✓ $= \frac{1}{3} \rho_w V_w g$ ✓ $= \frac{1}{3} \times 1000 \times 90 \times 10^{-6} \times 10$ ✓ $= 0.3 \text{ N}$ ✓</p> <p>✓ $V_{\text{upthrust}} = V \rho g$ $V = \frac{1}{3} \times 90 = 30 \text{ cm}^3$ $\rho = 1 \text{ g/cm}^3$ $W = m \times g = 30 \times 10 = 0.3 \text{ N}$ ✓</p>	✓
	<p>(ii) Weight of metal block = weight of extra water to be displaced ✓</p> <p>Total Upthrust = $V \rho g$ $= 90 \times 10^{-6} \times 1000 \times 10$ $= 0.9 \text{ N}$</p> <p>Extra Weight = $0.9 - 0.3$ $= 0.6 \text{ N}$ ✓</p> <p>$= \frac{2}{3} \rho_w V_w g$ ✓ $= \frac{2}{3} \times 1000 \times 90 \times 10^{-6} \times 10$ ✓ $= 0.6 \text{ N}$ ✓</p> <p>✓ $V = \frac{2}{3} \times 90 = 60 \text{ cm}^3$ $\rho = 1 \text{ g/cm}^3$ $W = m \times g = 60 \times 10 = 0.6 \text{ N}$ ✓</p>	3
(b)	<p>(i) - Tension ✓ - Weight For e.g. gravity Gravitational pull (2)</p> <p>(ii) - Tension increases ✓ - Weight remains constant ✓</p>	2
16. (a)	<p>Quantity of heat required to change a unit mass of a material from solid to liquid at constant temperature. ✓</p>	1
(b)	<p>(i) Heat lost by water = $M C \Delta \theta$ ✓ $= \frac{10.5}{1000} \times 4200 \times (100 - 40)$ ✓ $= 2646 \text{ J}$ ✓</p> <p>✓ $M C \theta$ / $M C \Delta T$ (ΔT must)</p>	3

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Formula ✓
 Substitution ✓
 Correct ✓

(ii) Heat gained by ice = $MC\Delta\theta$

$= \frac{5}{1000} \times 2100 \times 10$
 $= 105 \text{ J}$

(iii) $Q = mL_f$

$= \frac{5}{1000} \times L_f$

(iv) $Q = MC\Delta\theta$

$= \frac{5}{1000} \times 4200 \times 40$

$= 840 \text{ J}$

(v) Heat lost = heat gained

$M_w C_w \Delta\theta_1 = M_i C_i \Delta\theta_2 + M L_f + M_w C_w \Delta\theta_3$
 $2646 = 105 + 0.005 L_f + 840$

$L_f = 3.402 \times 10^5 \text{ JKg}^{-1}$

$= 340200 \text{ J/kg}$

7. (a) $F = 0.4$

$= 100 \times 2$

$F = 500 \text{ N}$

$P = \frac{F}{A}$

$= \frac{500}{\pi \times (5.64 \times 10^{-2})^2}$

$= 50033.61 \text{ Pa}$

$= 5.003 \times 10^4 \text{ Pa}$

$L = P \cdot A$

$= 5.003 \times 10^4 \times \pi (14.24 \times 10^{-2})^2$

$= 3.187 \times 10^3 \text{ N} = 3187 \text{ N}$

M.A

$= \frac{L}{E}$

$= \frac{3.187 \times 10^3}{500}$

$= 6.375 = 6.4$

$3.187 \times 10^1 = 31.87$

For Award formula or substitution

Award formula or substitution

At least 4 SF

$F d_1 = F_2 d_2$
 $0.4 \times F = 1.6 \times 100$

$F = \frac{1.6 \times 100}{0.4} = 400 \text{ N}$

$R = 400 + 100 = 500 \text{ N}$

50033.61 Pa / N m^{-2} ✓ At least 4 SF

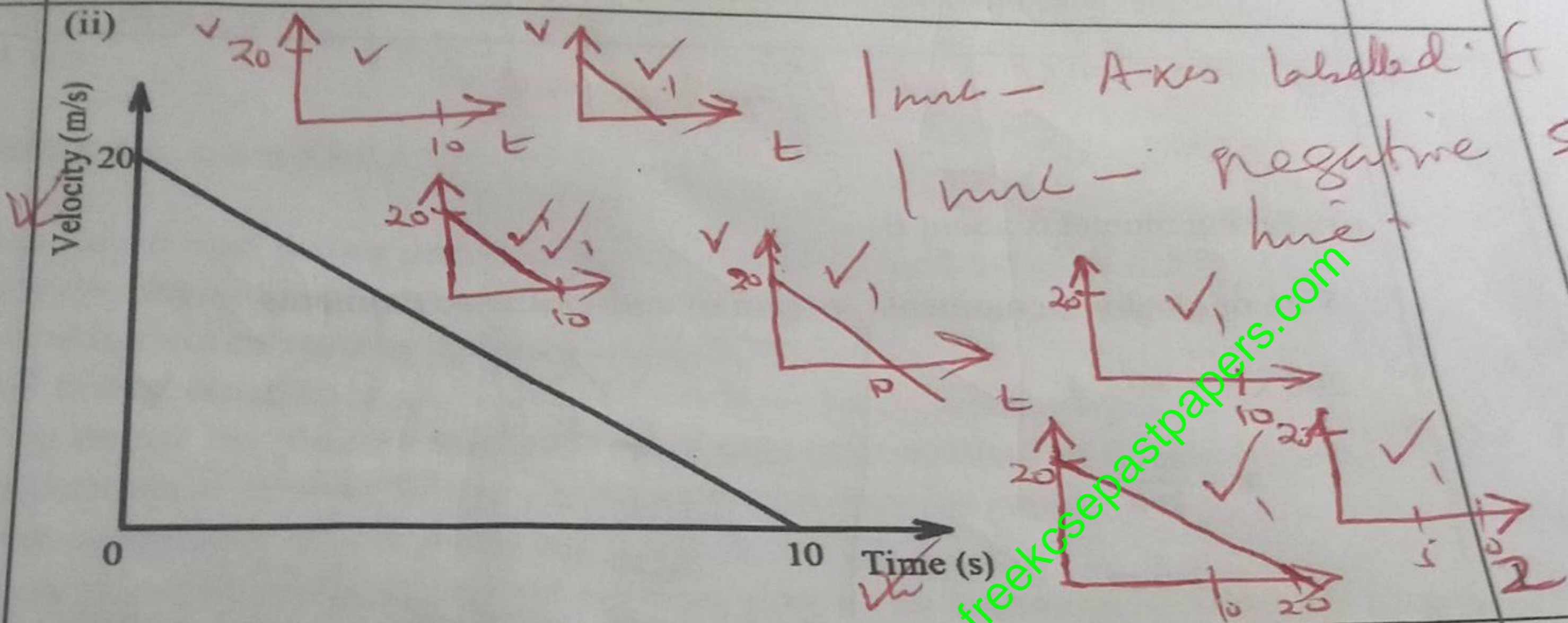
Allow T.E ✓ At least 4 SF

Allow 1 d.p ✓

Allow T.E

18. (a) (i) $t = \frac{v-u}{a}$ or $v = u + at$ ✓
 $= \frac{0-20}{-2}$ ✓ $D = 20 - 2t$
 $= 10s$ ✓ $t = 10s$

3



(iii) $S = \text{Area under curve}$

$= \frac{1}{2} \times 10 \times 20$ ✓
 $= 100m$ ✓

1

(b) $m_1u_1 + m_2u_2 = (m_1 + m_2)V$

$(1000\text{Kg})(40\text{m/s}) + 0 = (1000 + 800)V$

$\therefore V = 22.22 \text{ m/s}$ ✓

But $F = \frac{mv - mu}{t}$ ✓

$= \frac{1000(22.22) - 1000(40)}{3}$ or $F = \frac{800(22.22) - 800(0)}{3}$ ✓

$= -5.92 \times 10^3 \text{ N}$

$F = 5.926 \times 10^3 \text{ N}$

$= -5926 \text{ N}$

$= 5926 \text{ N}$ ✓

4

19. (a) The sum of forces in one direction is equal to the sum of the forces in the opposite direction. / Net force is zero / resultant force is zero
The sum of clockwise moments about a point is equal to the sum of anticlockwise moments about the same point. / Net Torque is zero / Net

(b) (i) $R = 80 + 120$
 $= 200\text{N}$ ✓ / or $R = 200 + W$.

(ii) Taking moments about B,

Sum of clockwise moments = sum of anti-clockwise moments ✓
 $F_1 d_1 = F_2 d_2$ ✓

$200 \times x = 80 \times 4$ ✓

$x = \frac{80 \times 4}{200}$

$= 1.6\text{ m}$ ✓

$80 \times x = (4 - x) \times 120$ ✓
 $80x = 480 - 120x$
 $200x = 480$
 $x = 2.4\text{ m}$
 $x = 2.4 = 1.6\text{ m}$ ✓

(c) (i) - Place the metre rule on the knife edge and adjust it until it balances. ✓
- Mark the position of the knife edge which gives the position of the centre of gravity.

(ii) - With the rule balanced at c.o.g. place the mass M_1 on one side of the knife edge. (Placing Mass M_1 on the Metre rule) ✓

- Adjust the position of the knife edge to balance the metre rule with the mass. Balances the Metre rule and ✓

- Measure the distance of the position of centre of gravity from the knife edge and the distance of the mass M_1 from the knife edge. ✓

- Use the principle of moments to determine M. ✓

$F_1 d_1 = F_2 d_2$