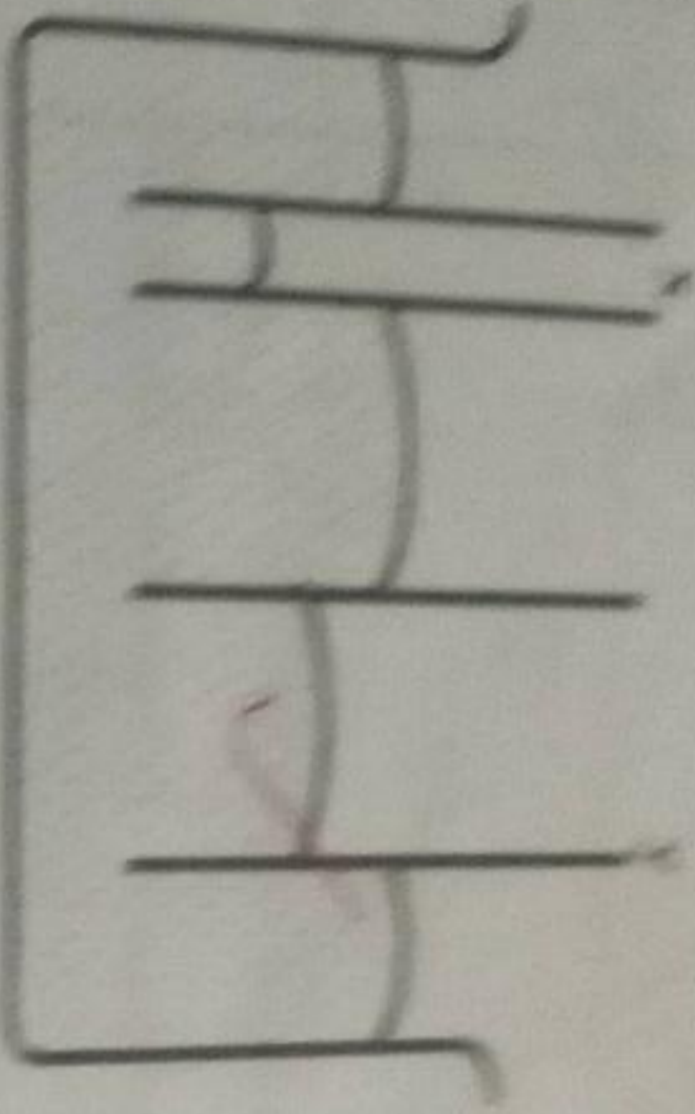


SECTION A (25 MARKS)

1.		<p>* All Subdivisions seen.</p>
2.	<p>(a) For the liquid to be pulled downwards by cohesive forces. ✓ (b) For point x to have a lower pressure than the liquid. ✓ Create Pressure difference.</p>	<p>1 1</p>
3.	<p>(a) $P_1 l_1 = P_2 l_2$ ✓ $76 \times 7.5 = (76 - 5) \times l_2$ ✓ $l_2 = 8.028 \text{ cm}$ ✓ Accept 8.0 cm ✓ (b) Atmospheric pressure is greater than the pressure due to the mercury thread. ✓ the atmospheric pressure is greater than the atmospheric pressure. ✓</p>	<p>3 ✓ 1 ✓</p>
4.	<p>Volume drained = $2 \times 3 = 6 \text{ cm}^3$ ✓ Reading = $15 + 6 = 21 \text{ ml}$ ✓</p>	<p>2</p>
-	<p>Radius ✓ Linear velocity / speed. ✓ Change in displacement ✓ Time (change) / frequency / Periodic time. ✓</p>	<p>Any 2 x 1 correct ✓ change in linear displacement ✓ Periodic time. ✓ (Any 2)</p>

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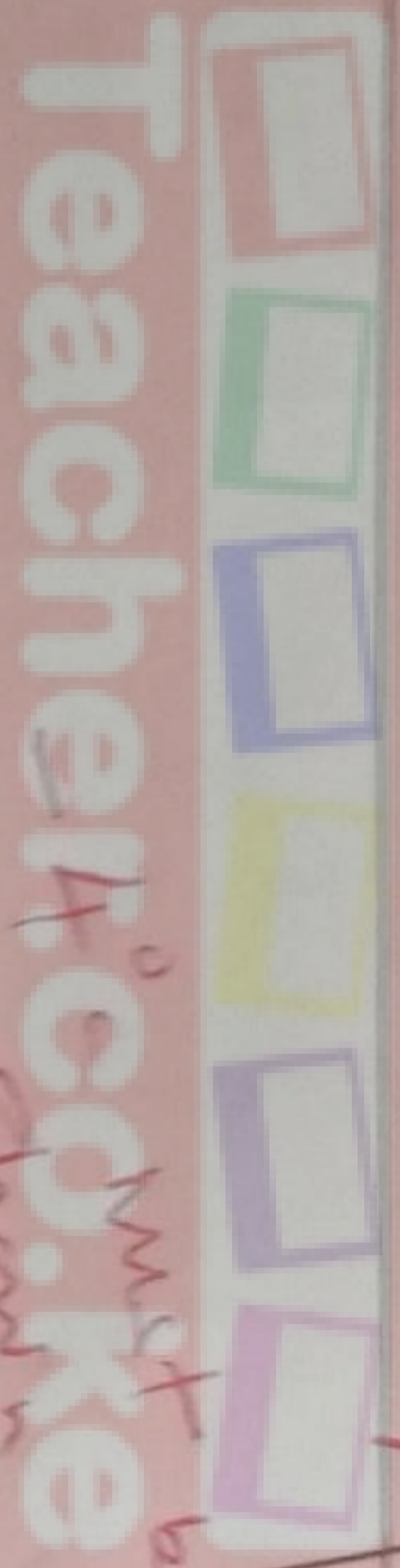
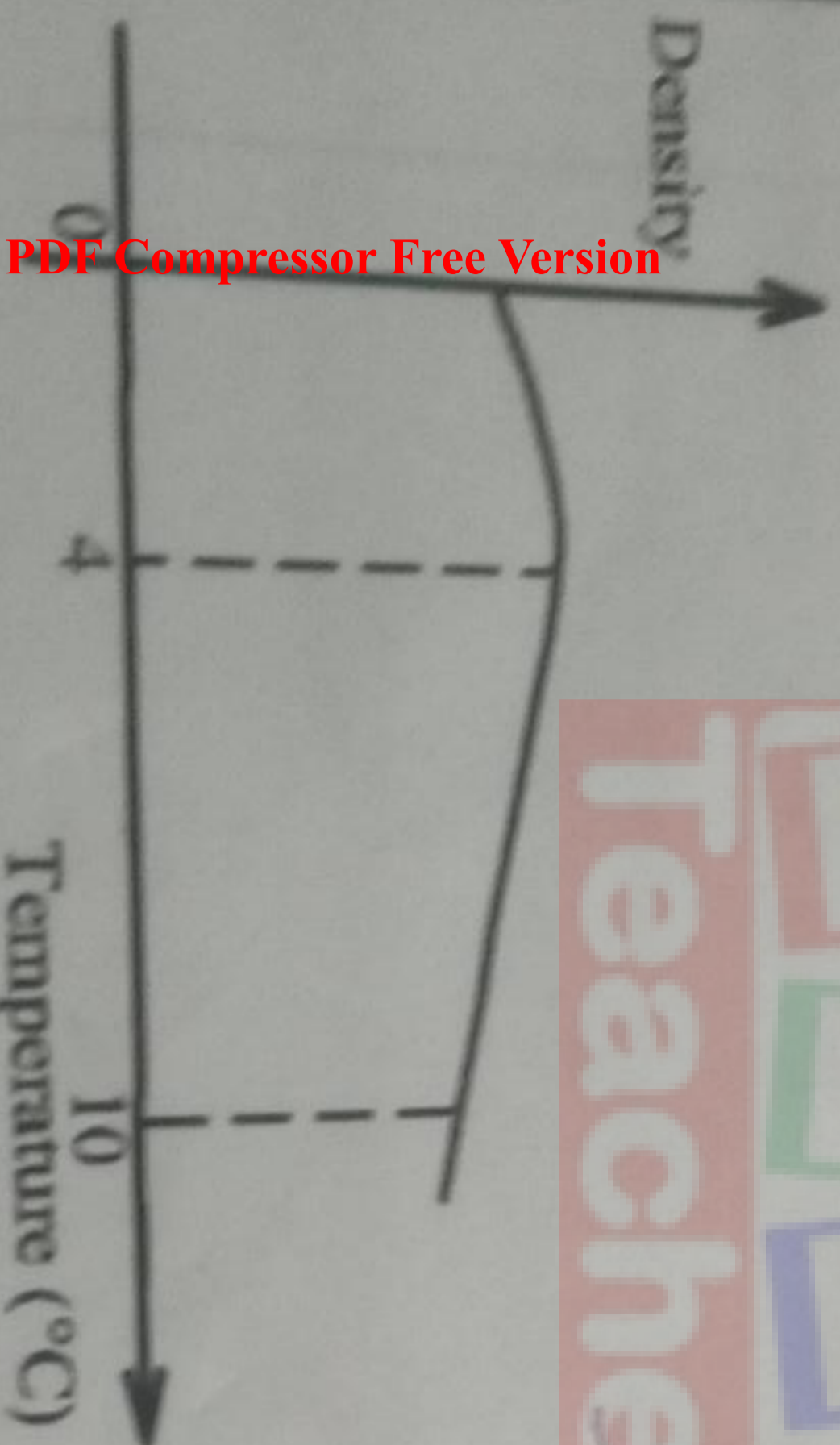
Handwritten notes on the right side of the page, including the phrase 'Rate at which the water turns black decreases' and 'Reason for this is that rate of diffusion is slow'. There are also some illegible scribbles and other notes.

Rate at which the water turns black decreases.
Reason for this is that rate of diffusion is slow.

$K = \frac{F}{A}$
 $= \frac{50}{1}$
 $= 50 \text{ Nem}^{-1}$
 effective $K = 2 \times 50 \text{ Nem}^{-1}$
 $= 100 \text{ Nem}^{-1}$

$F = K_e V$
 $K = \frac{50}{1} = 50 \text{ Nem}^{-1}$
 $K_p = K_1 + K_2$
 $= 50 + 50$
 $= 100 \text{ Nem}^{-1}$

$F = K_e V$
 $e_g = \frac{1}{2} \times \frac{1}{2} = 0.25 \text{ cm}$
 $= \frac{50}{0.25} = 200 \text{ Nem}^{-1}$



Handwritten notes at the bottom of the page: 'should have a curve or not a straight line'.

Vertical line of stability
To maintain stability
from through e.i.o.s (shifts) to fall
within the base / lower the
center of gravity
within the

11.	<p>At BC the molten substance solidifies. ✓ Because it is losing latent heat. ✓ ✓ Freezes / changes to solid ✓ latent heat of fusion / ✓ loss of heat / latent change in temperature.</p>	1
12.	<p>$10 \times 0.5 = T \times 1.4$ ✓ $T = 3.571N$ ✓ Sum of currents = Sum of distances $F_1 d_1 = F_2 d_2$ ✓</p>	2
13.	<p>Hot water rises up due to lower density to heat ice B before A. ✓ ✓ It's due to convection. ✓ ✓ B has A. ✓ ✓ more heat reach</p>	1
14.	<p>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. ✓</p>	2

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SECTION B (55 MARKS)

15. (a)	(i) Weight of block = weight of displaced water $= \frac{1}{3} \rho_w V_w g.$ $= \frac{1}{3} \times 1000 \times 90 \times 10^{-6} \times 10$ $= 0.3 \text{ N}$	$V = \frac{1}{3} \times 90 = 30 \text{ cm}^3$ $m = \rho \times V = 3 \times 30$ $m = 90 \text{ g}$ $W = m \times g$ $= 0.3 \text{ N}$	✓
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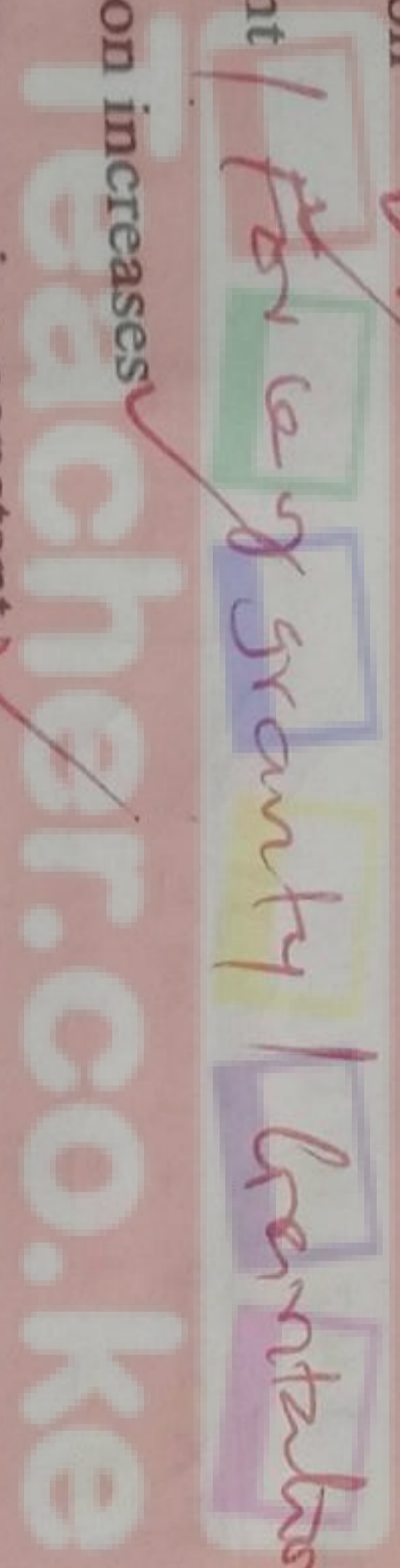
(ii) Weight of metal block = weight of extra water to be displaced	$V_{\text{metal}} = V_{\text{PS}}$ $= \frac{2}{3} \rho_w V_w g$ $= \frac{2}{3} \times 1000 \times 90 \times 10^{-6} \times 10$ $= 0.6 \text{ N}$	$V = \frac{2}{3} \times 90 = 60 \text{ cm}^3$ $\rho M = \rho \times V = 1 \times 60 = 60 \text{ g}$ $M = 2M \times g = \frac{60}{1000} \times 10 = 0.6 \text{ N}$	✓
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(b) (i) - Tension	✓	✓	✓
- Weight	✓	✓	✓
(ii) - Tension increases	✓	✓	✓
- Weight remains constant	✓	✓	✓

16. (a)	Quantity of heat required to change a unit mass of a material from solid to liquid at constant temperature.	1
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(b) (i)	Heat lost by water = $M C \Delta \theta$	3
	$= \frac{10.5}{1000} \times 4200 \times (100 - 40)$	✓
	$= 2646 \text{ J}$	✓

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(iii) Heat gained by ice = $MCA\theta$
 $= \frac{5}{1000} \times 2100 \times 10$
 $= 105 \text{ J}$

(iii) $Q = mL_f$
 $= \frac{5}{1000} \times L_f = 0.005 L_f$

(iv) $Q = MCA\theta$
 $= \frac{5}{1000} \times 4200 \times 40$
 $= 840 \text{ J}$

(v) Heat lost = heat gained
 $M_{\text{ice}} \Delta\theta_1 = M_{\text{ice}} \Delta\theta_2 + M_{\text{L}} + M_{\text{W}}$
 $2646 = 105 + 0.005 L_f + 840$

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

$F = 0.4$
 $F \times 0.14 = 100 \times 2$
 $F = \frac{200}{0.14} = 1428.57 \text{ N}$

$F = 500 \text{ N}$

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

$= \frac{500}{\pi(5.64 \times 10^{-2})^2}$
 $= 50033.61 \text{ Pa}$

$= 5.0033 \times 10^4 \text{ Pa}$

$L = P \cdot A \Rightarrow \text{Load} = P \times A$

$= 5.0033 \times 10^4 \times \pi(14.24 \times 10^{-2})^2$
 $= 3.187 \times 10^3 \text{ N} = 3187 \text{ N}$

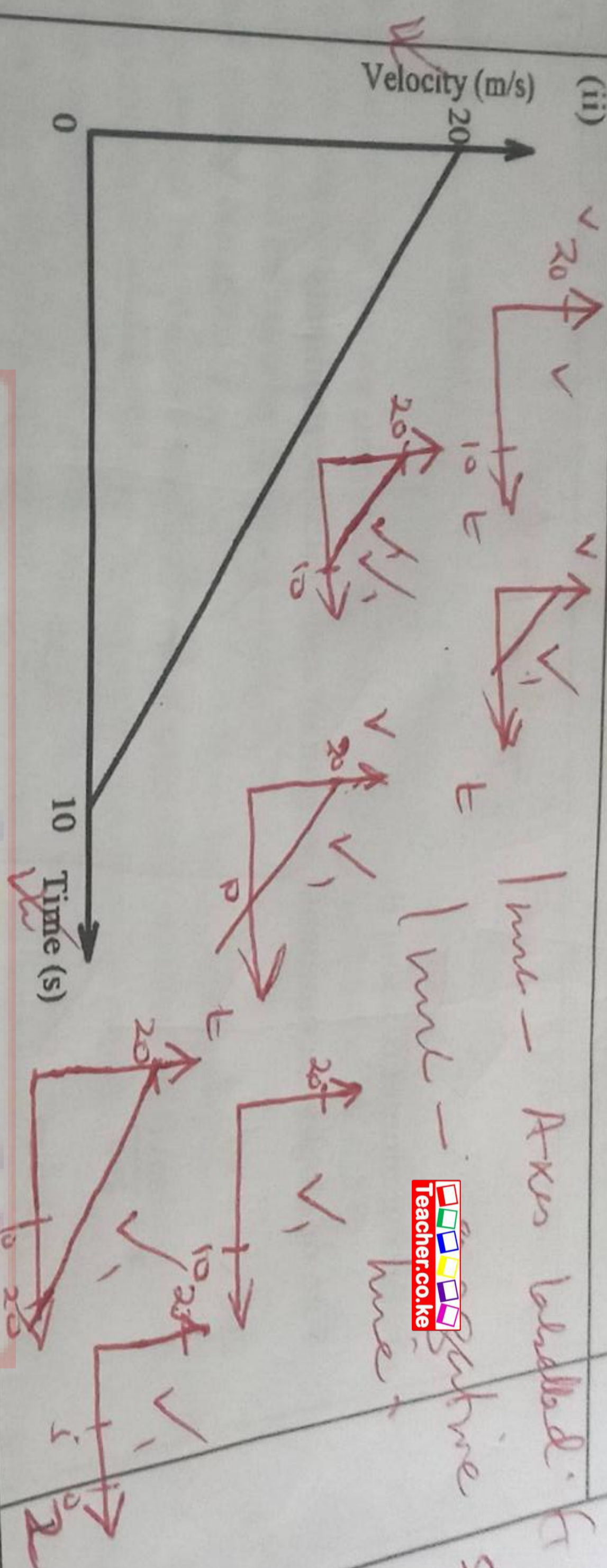
$M.A = \frac{L}{E}$

$= \frac{3.187 \times 10^3}{100}$

$= 31.87$

$3.187 \times 10^3 = 3187$

18. (a)	(i)	$v = \frac{v-u}{a}$ $= \frac{0-20}{-2}$ $= 10s$	$v = u + at$ $D = 20 - 2t$ $t = 10s$	3
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(iii) $S = \text{Area under curve}$
 $= \frac{1}{2} \times 10 \times 20$
 $= 100m$

(b)

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

$$(1000Kg)(40m/s) + 0 = (1000 + 800)V$$

$$\therefore V = 22.22 \text{ m/s}$$

But $F = \frac{mv - mu}{t}$

$$= \frac{1000(22.22) - 1000(40)}{3}$$

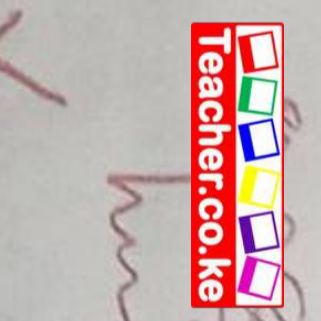
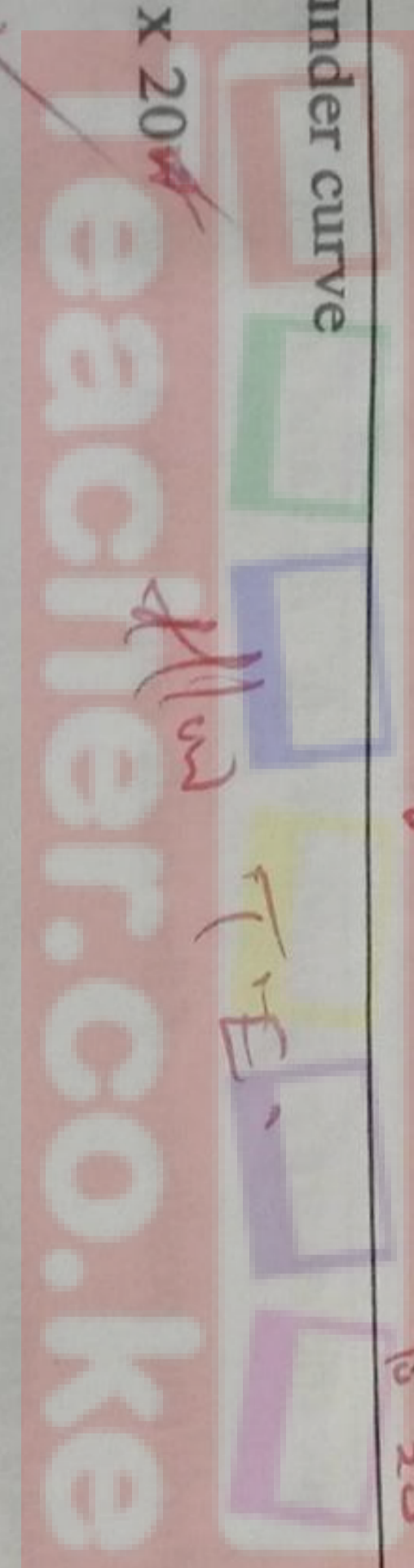
$$= -5.926 \times 10^3 N$$

$$= -5926 N$$

OR $F = \frac{800(22.22) - 800(0)}{3}$

$$= 5.926 \times 10^3 N$$

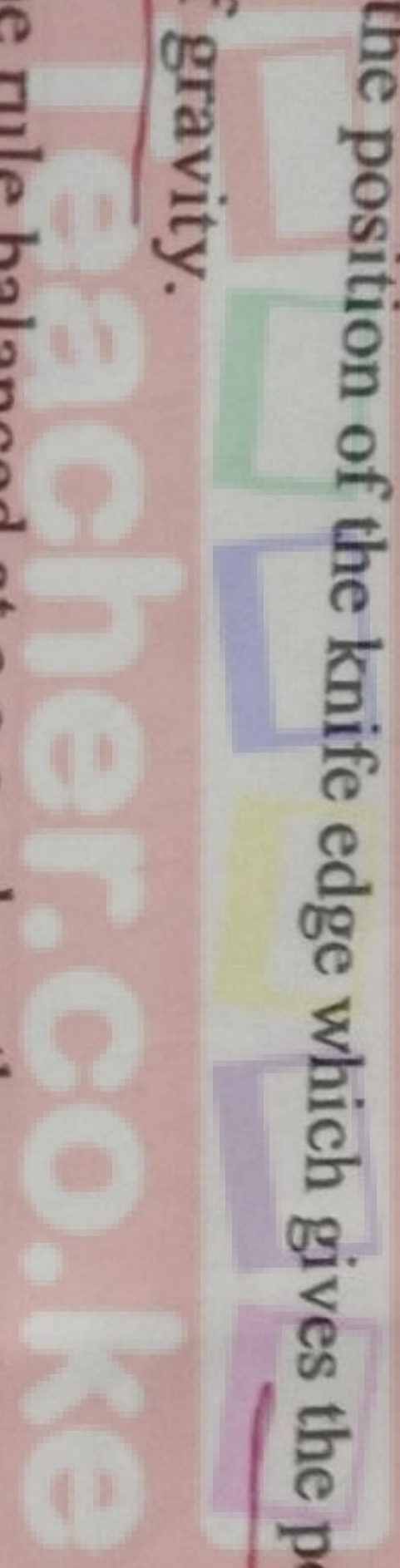
$$= 5926 N$$



Handwritten notes at the bottom right: $F = \frac{mv - mu}{t}$, $F = \frac{800(22.22) - 800(0)}{3}$, $F = 5.926 \times 10^3 N$, $F = 5926 N$.

19. (a)	<p>The sum of forces in one direction is equal to the sum of the forces in the opposite direction. <i>Net force is zero / resultant force is zero</i></p> <p>The sum of clockwise moments about a point is equal to the sum of anticlockwise moments about the same point. <i>Net torque is zero / resultant torque is zero</i></p>	
(b)	<p>(i) $R = 80 + 120$ $= 200\text{N}$ ✓</p> <p>(ii) Taking moments about B, Sum of clockwise moments = sum of anti-clockwise moments $200 \times x = 80 \times 4$ ✓ $x = \frac{80 \times 4}{200}$ $= 1.6\text{m}$ ✓</p> <p><i>Handwritten notes:</i> $80 \times x = 480 - 120x$ $200x = 480$ $x = 2.4\text{m}$ $F = 2.4 = 1.6\text{m}$</p>	1
(c)	<p>(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. ✓</p> <p>(ii) - With the rule balanced at c.o.g. place the mass M_1 on one side of the knife edge. <i>Placing Mass M_1 on the Metre rule</i></p> <p>- Adjust the position of the knife edge to balance the metre rule with the mass. <i>Balances the Metre rule and</i></p> <p>- 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. ✓</p> <p>- Use the principle of moments to determine M. ✓ <i>Handwritten note: $F_1 d_1 = F_2 d_2$</i></p>	2

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