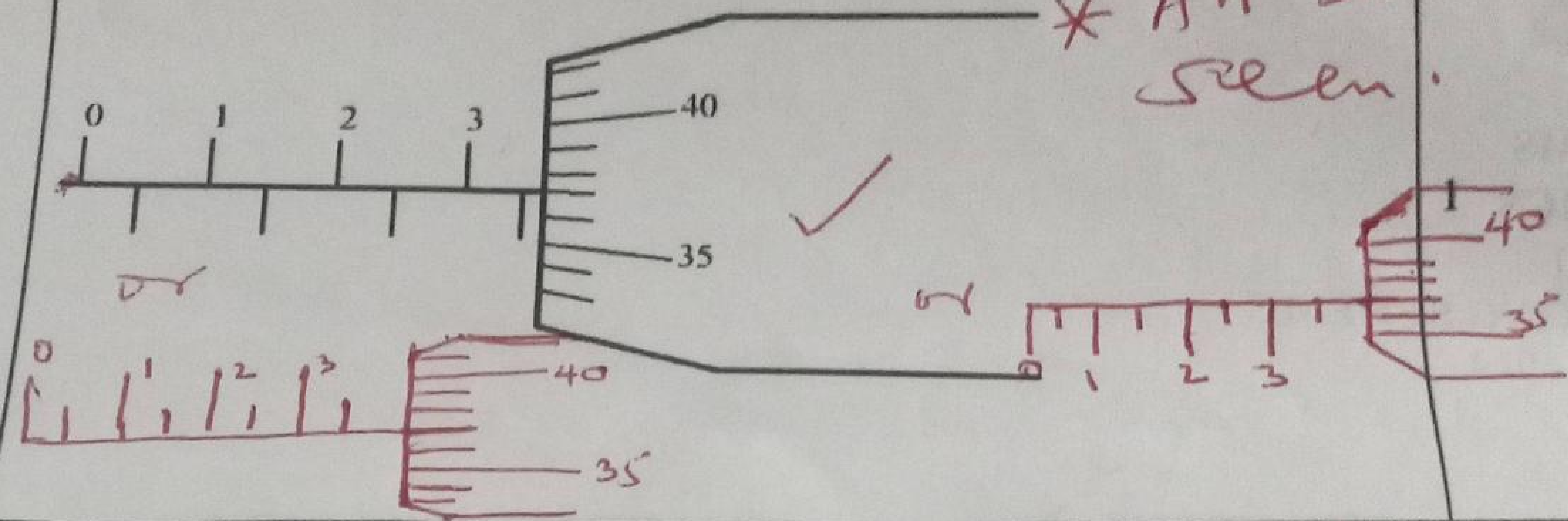
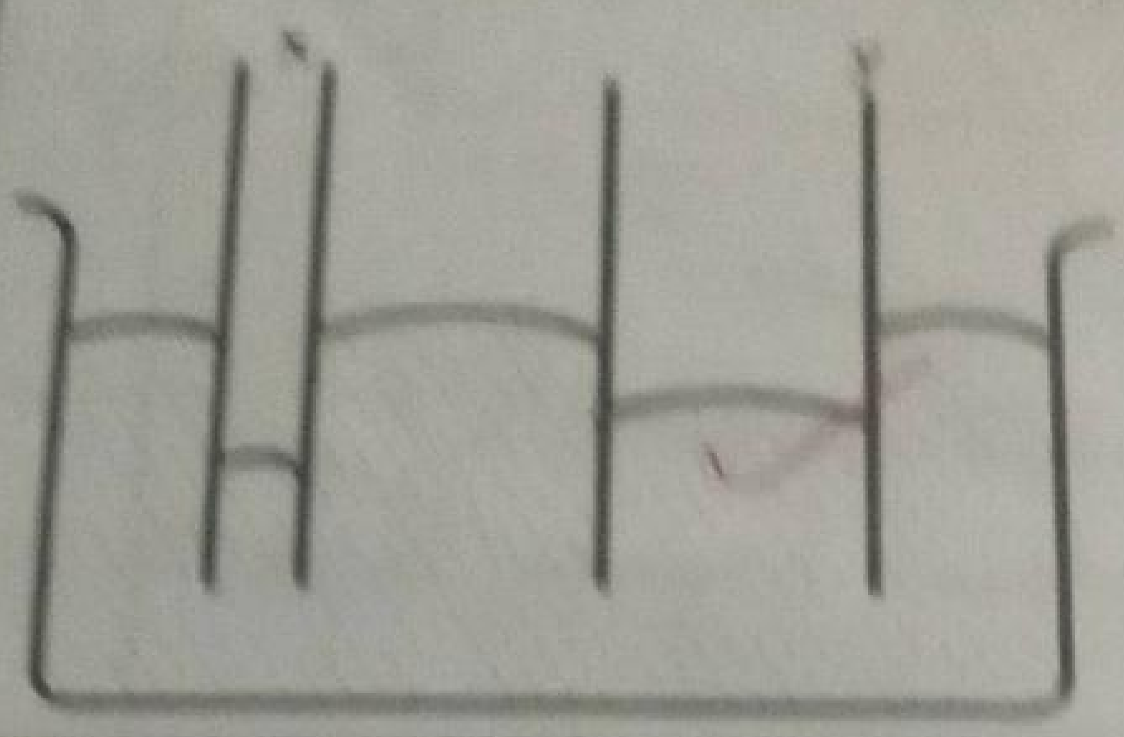
SECTION A (25 MARKS)

1.		
2.	(a) For the liquid to be pulled downwards by cohesive forces.	1
	(b) For point *x* to have a lower pressure than the liquid in the tank.	1
3.	(a) $P_1 l_1 = P_2 l_2$	3
	$76 \times 7.5 = (76-5) \times l_2$	
	$l_2 = 8.028$ cm	
	(b) Atmospheric pressure is greater than the pressure due to the mercury thread.	1
4.	Volume drained = 2 x 3 = 6 cm^3	2
	Reading = 15+6	
	= 21ml	
	- Radius	2
	- Linear velocity	
	- Change in displacement	
	- Time(change)	
	(Any 2)	

6.



Rate at which the water turns black decreases. | 1

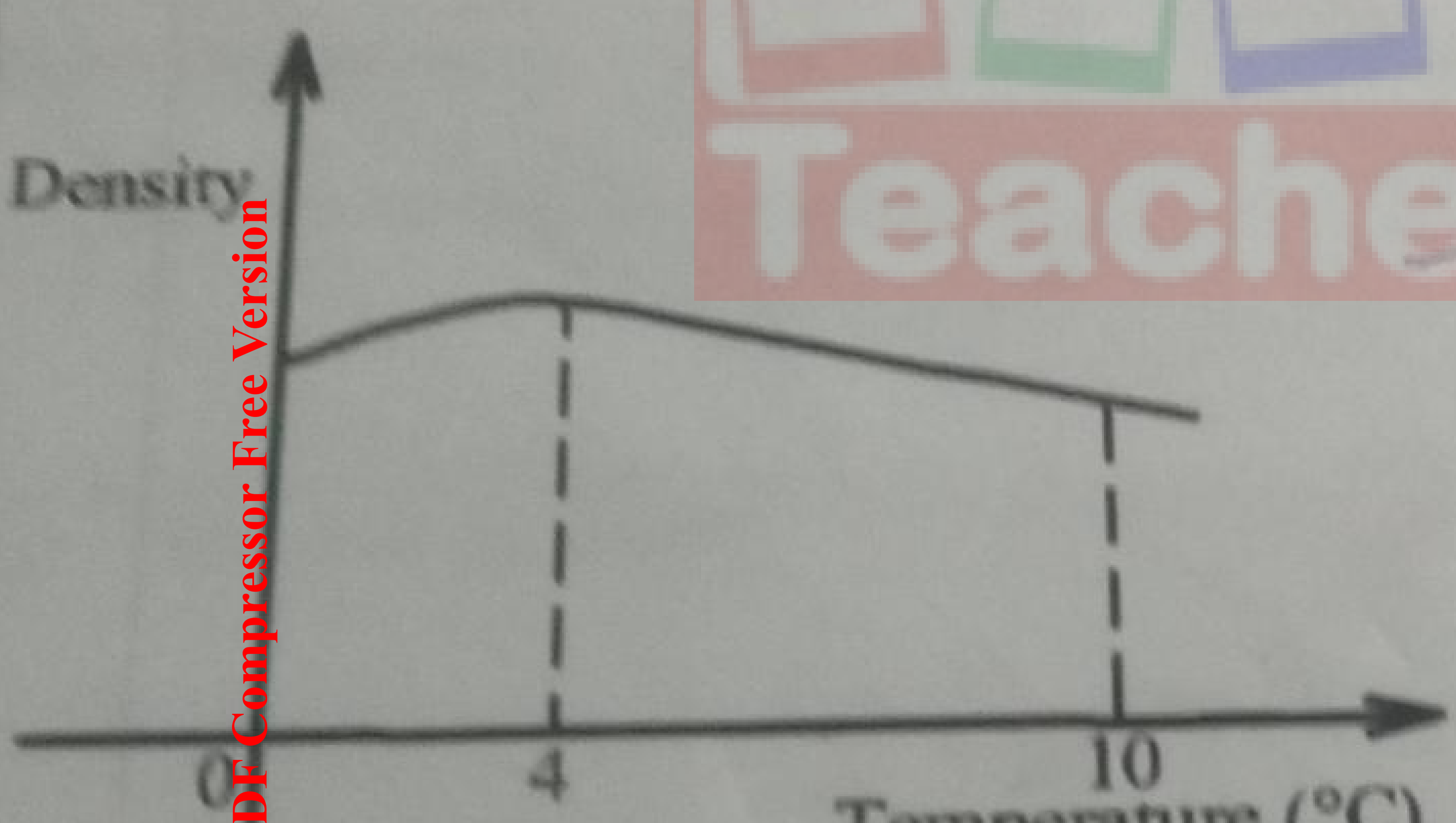
$K = \frac{F}{e}$

$= \frac{50}{1}$

$= 50\ Ncm^{-1}$

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

$= 100\ Ncm^{-1}$



1

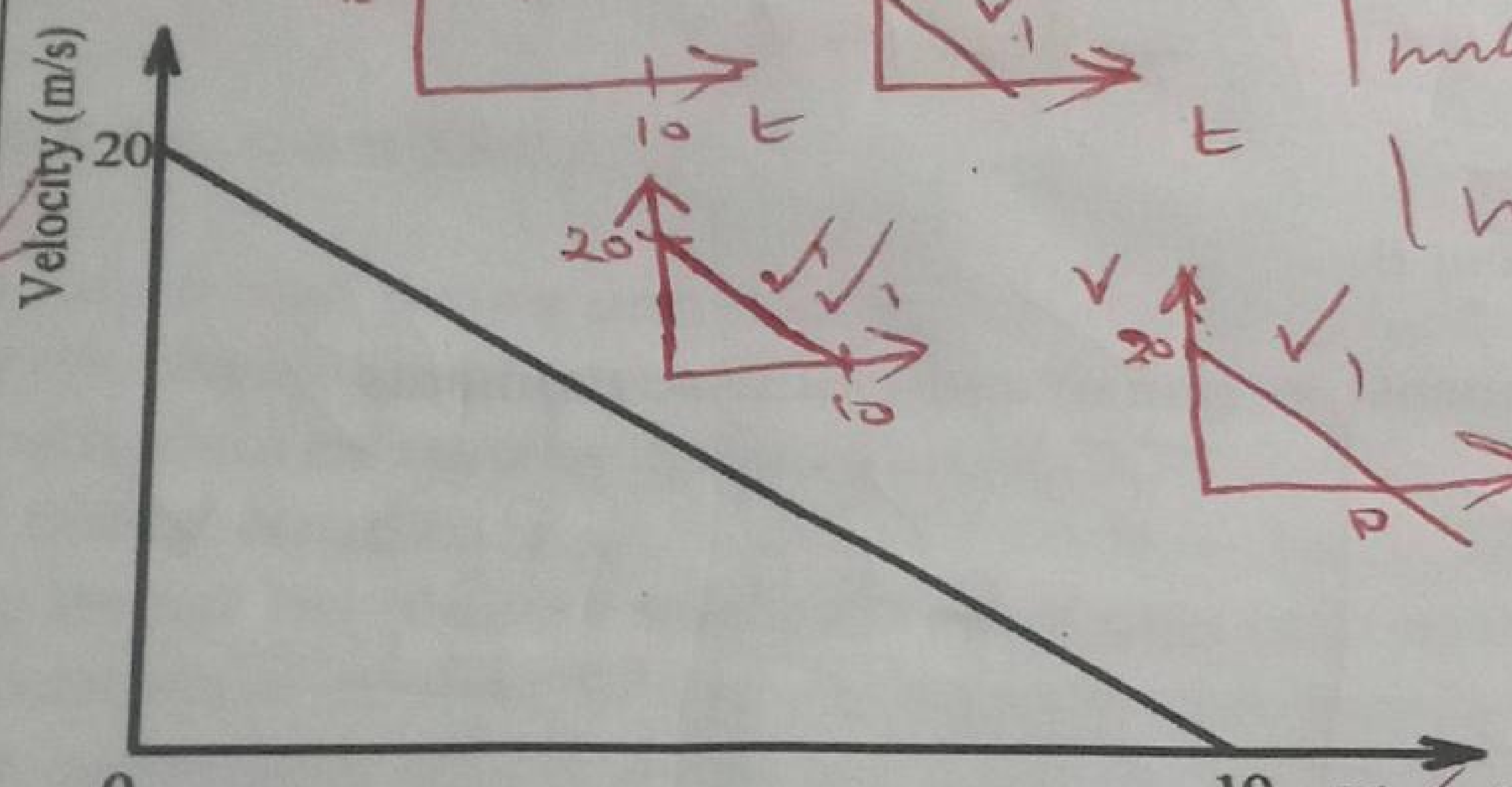
To maintain stability | 1

11.	At BC the molten substance solidifies. Because it is loosing latent heat.	1 1
12.	$10 \times 0.5 = T \times 1.4$ $T = 3.57N$	2
13.	Hot water rises up due to lower density to heat ice B before A.	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

SECTION B (55 MARKS)

15. (a)	(i) Weight of block = weight of displaced water $= \frac{1}{3} \rho_w V_w g.$ $= \frac{1}{3} \times 1000 \times 90 \times 10^{-6} \times 10$ $= 0.3$ N	
	(ii) Weight of metal block = weight of extra water to be displaced $= \frac{2}{3} \rho_w . V_w g$ $= \frac{2}{3} \times 1000 \times 90 \times 10^{-6} \times 10$ $= 0.6$ N	3
(b)	(i) - Tension - Weight	2
	(ii) - Tension increases - Weight remains constant	2
16. (a)	Quantity of heat required to change a unit mass of a material from solid to liquid at constant temperature.	1
(b)	(i) Heat lost by water $= MC\Delta\theta$ $= \frac{10.5}{1000} \times 4200 \times (100-40)$ $= 2646$ J	3

	(ii) Heat gained by ice = MCΔΘ $= \frac{5}{1000} \times 2100 \times 10$ $= 105\ J$ (iii) $Q = mL_f$ $= \frac{5}{1000} \times L_f$ = 0.005 L_f = $\frac{1}{200}L_f$ (iv) $Q = M\ C\ \Delta\Theta$ $= \frac{5}{1000} \times 4200 \times 40$ $= 840\ J$ (v) Heat lost = heat gained $M_w C_w \Delta\theta_1 = M_i C_i \Delta\theta_2 + ML_f + M\ldots\Delta\theta_3$ $2646 = 105 + 0.005\ L_f + 840$ $L_f = 3.402 \times 10^5\ JKg^{-1}$ = 340200 J/kg Atleast 4 s.f.	2 1 2 3
7. (a)	~~F = 0.4~~ ~~= 100 x 2~~ F × 0.4 = 100 × 2 $F = \frac{200}{0.4} = 500N$ F = 500N $F_1 d_1 = F_2 d_2$ 0.4 × F = 1.6 × 100 $F = \frac{1.6 \times 100}{0.4} = 400N$ R = 400 + 100 = 500N $P = \frac{F}{A}$ $= \frac{500}{\pi x (5.64x10^{-2})^2}$ $= 50033.61Pa$ $= 5.003x\ 10^4\ Pa$ / 50033.61 Pa / Nm^{-2} Atleast	5
	L = P.A ⇒ Load = P × A $= 5.003x\ 10^4 \times \pi(14.24 \times 10^{-2})^2$ $= 3.187 \times 10^3\ N$ = 3187 N Allow T.E Atleast 4 SF.	
	M.A $= \frac{L}{E}$ $= \frac{3.187 \times 10^3}{100}$ ~~= 6.375 = 6.4~~ 3.187 × 10 = 31.87 Allow 1 d.p Allow T.E	

18. (a)	(i) $t = \frac{v-u}{a}$ $= \frac{0-20}{-2}$ $= 10s$		3
	(ii) 		
	(iii) S = Area under curve $= \frac{1}{2} \times 10 \times 20$ $= 100m$		
(b)	$m_1u_1+m_2u_2 = (m_1+m_2)V$ $(1000Kg)(40m/s) + 0 = (1000+800)V$ $\therefore V = 22.22$ m/s But $F = \frac{mv-mu}{t}$ $= \frac{1000(22.22)-1000(40)}{3}$ or $F = \frac{800(22.22)-800(0)}{3}$ $= -5.92x10^3N$ $F = 5.926x10^3N$ $= -5926N$ $= 5926N$		4

19. (a)	- The sum of forces in one direction is equal to the sum of the forces in the opposite direction. - The sum of clockwise moments about a point is equal to the sum of anticlockwise moments about the same point.	
(b)	(i) R = 80 + 120 = 200N	1
	(ii) Taking moments about B, Sum of clockwise moments = sum of anti-clokwise moments 200 x x = 80 x 4 $x = \frac{80x4}{200}$ = 1.6 m	3
(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.	2
	(ii) - With the rule balanced at c.o.g. place the mass M_1 on one side of the knife edge. - Adjust the position of the knife edge to balance the metre rule with the mass. - 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.	4

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