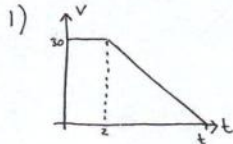


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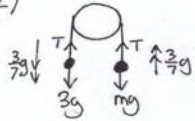
(1)



$$\text{Area} = \frac{(2+t) \times 30}{2} = 300$$

$$2+t = 20 \Rightarrow t = 18 \text{ sec}$$

2)



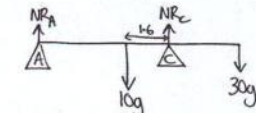
a) $3g - T = 3 \times \frac{3}{7}g \Rightarrow T = 3g - \frac{9}{7}g = \frac{12}{7}g$

b) $T - mg = m \times \frac{3}{7}g$

$$\frac{12}{7}g = \frac{3}{7}mg + mg \Rightarrow \frac{12}{7}g = \frac{10}{7}mg$$

$$m = 1.2 \text{ kg}$$

3)



$\sum \tau = 0$

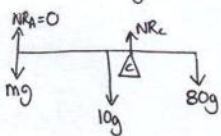
$$30g \times 0.4 + NR_A \times 3.6 = 16g \times 1.6$$

$$12g + 3.6NR_A = 16g$$

$$3.6NR_A = 4g$$

$$NR_A = 10.89 \text{ N}$$

b)



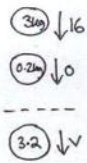
$\sum \tau = 0$

$$80g \times 0.4 = 10g \times 1.6 + mg \times 3.6$$

$$32g = 16g + 3.6mg$$

$$16g = 3.6mg \Rightarrow m = \frac{16}{3.6} = 4.4$$

4)



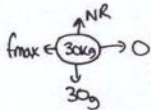
total momentum before = 48Ns
total momentum after = 3.2v Ns

$$48 = 3.2v \Rightarrow v = 15 \text{ m/s}$$

Mom before = 48Ns Mom after = 0Ns Impulse = 48

$$\text{Impulse} = f \times t \Rightarrow 48 = f \times 0.05 \Rightarrow f = 960 \text{ N}$$

c)



$NR = 30g \Rightarrow f_{\text{max}} = \mu NR$

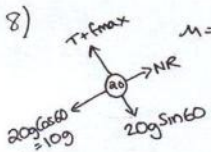
$$f_{\text{max}} = 0.2 \times 30g = 6g$$

$$\vec{R}F = ma \Rightarrow -6g = 30a \Rightarrow a = -1.96$$

$U = 12 \quad a = -1.96 \quad v = 0$

$$v^2 = U^2 + 2as \Rightarrow 0 = 144 - 3.92s \Rightarrow s = \frac{144}{3.92} = 36.7 \text{ m}$$

8)



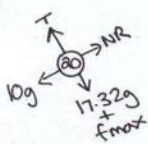
$m = 0.4 \quad RF \uparrow = 0 \Rightarrow NR = 10g \text{ N}$

$$f_{\text{max}} = \mu NR = 0.4 \times 10g = 4g \text{ N}$$

$RF \uparrow = 0 \quad T + 4g = 17.32g$

$$T = 13.32g = 130.5 \text{ N}$$

b)



$NR = 10g \Rightarrow f_{\text{max}} = 4g \text{ N}$

$RF \uparrow = 0$ (no acceleration)

$$T = 21.32g = 208.9 \text{ N}$$

- c) i) f_{max} acts down the slope when the package moves up the slope
- ii) Constant speed \Rightarrow no acceleration $\Rightarrow RF \uparrow = 0$

* 4b)

$RF \uparrow = 960$

$$Res - 3.2g = 960$$

$$Res = 991 \text{ N}$$

(2)

5)



$A = \tan^{-1}(\frac{3}{2}) = 56.3^\circ$

Angle from j = 146.3°

b) $Vel = (2i - 3j) + t(-i + 2j) = (2-t)i + (-3+2t)j$

c) $t = 3 \Rightarrow Vel = -i + 3j \text{ m/s}^{-1}$ Speed = $\sqrt{1+3^2} = 3.16$

d) parallel to i when j value is zero

$$(-3+2t) = 0 \Rightarrow 2t = 3 \Rightarrow t = 1.5 \text{ sec}$$

6) $U = 20 \quad a = 4 \quad S = 78$

$$v^2 = U^2 + 2as \Rightarrow v^2 = 400 + 624 \Rightarrow v = 32 \text{ m/s}$$

b) $v = u + at \Rightarrow 32 = 20 + 4t \Rightarrow 4t = 12 \Rightarrow t = 3 \text{ sec}$

In 3 sec A travels 90m

c) $S = ut + \frac{1}{2}at^2 \quad S = 20t + 2t^2 \quad S = 30t$

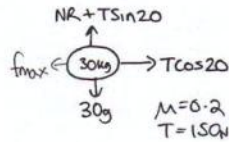
Overtakes when $S_B = S_A$

$$\Rightarrow 20t + 2t^2 = 30t \Rightarrow 2t^2 - 10t = 0$$

$$\Rightarrow 2t(t-5) = 0$$

$$t = 0 \quad t = 5$$

7)



$NR + 150 \sin 20 = 30g$

$NR = 24.2 \cdot 7 \text{ N} \quad f_{\text{max}} = 0$

$\vec{R}F = ma$

$$150 \cos 20 - f_{\text{max}} = 30a$$

$$92.4 = 30a \quad a = 3$$