

# Mechanics 5 Inclined Planes SOLUTIONS

## SECTION 1

1)  $\vec{u}$   $7\text{ m/s}$   $\rightarrow$   $30\text{ cm}$   $\rightarrow$   $a$   $\vec{AB}$   $u$   $v=7$   $v=u+at$   
 $A$   $B$   $C$   $a$   $7=7+2a$  ①  
 $t=0$   $t=2$   $t=5$   $t=2$

$\vec{BC}$   $u=7$   $s=ut + \frac{1}{2}at^2$   
 $a$   $0.3 = 7 \times 3 + \frac{1}{2}a \times 9$   
 $t=3$   $0.3 = 21 + 4.5a \Rightarrow a = -4.6\text{ m/s}^2$   
 $s=0.3$

$\Rightarrow u = 16.2\text{ m/s}$

2) a) 18, 6 b)  $0.4 \rightarrow \downarrow 10 \times \frac{15}{4} = 37.5$  c) i) 27, ii)  $\frac{2.5}{4} \times 15 + 12 = 21.3$

3)  $350$   $\rightarrow$   $a$   $\left[ \begin{array}{c} \rightarrow \\ \leftarrow \end{array} \right] 600 \rightarrow F$   
 $u=0$   $v=u+at$   
 $v=25$   $25=0+12t$   
 $t=12$   $a = \frac{25}{12}\text{ m/s}^2$   
 $a$

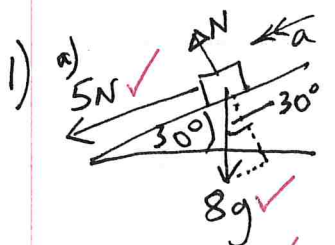
So i)  $\frac{27}{69} \times 100 = 39\%$   
 ii)  $\frac{21.3}{69} \times 100 = 31\%$

$F=ma: F-350 = \frac{25}{12} \times 600$

$\Rightarrow F = 1600\text{ N}$

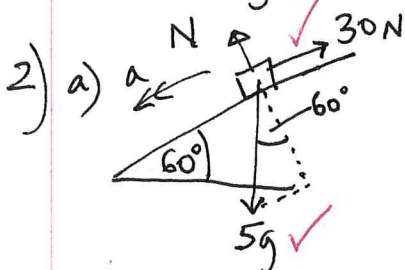
4)  $\downarrow 10 \sin 20^\circ + P \sin \theta = 10 \cos 20^\circ$   
 ①  $P \sin \theta = 5.9767\dots$   
 $\leftrightarrow 10 \cos 20^\circ + 10 \sin 20^\circ = 5 + P \cos \theta$   
 ②  $P \cos \theta = 7.8171\dots$   
 $\frac{①}{②} \Rightarrow \tan \theta = \frac{5.9767\dots}{7.8171\dots}$   
 ①  $\Rightarrow P = \frac{5.9767\dots}{\sin(37.4^\circ)} = 9.84\text{ N}$   $\theta = 37.4^\circ$

## SECTION 2



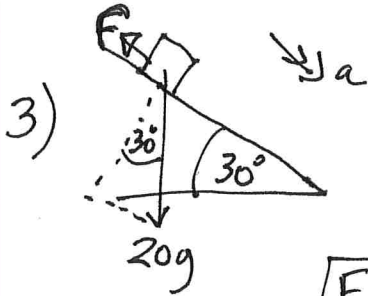
b)  $N = 8g \cos 30^\circ = 67.9\text{ N}$

c)  $5 + 8g \sin 30^\circ = 8a \Rightarrow a = 5.5\text{ m/s}^2$



b)  $N = 5g \cos 60^\circ = 24.5\text{ N}$

c)  $5g \sin 60^\circ - 30 = 5a \Rightarrow a = 2.5\text{ m/s}^2$



$$u = 0 \quad v = u + at \quad \checkmark$$

$$v = 21 \quad 21 = 0 + 6a$$

$$t = 6$$

$$a = \underline{3.5 \text{ m/s}^2} \quad \checkmark$$

$$\boxed{F = ma}$$

$$20g \sin 30^\circ - F = 20 \times 3.5 \quad \Rightarrow \quad f = 98 - 70 = \underline{28 \text{ N}} \quad \checkmark$$

4) i) a)  $R = 10g \cos 30^\circ \Rightarrow R = \underline{84.9 \text{ N}} \quad \checkmark$

b)  $10g \sin 30^\circ = 10a \Rightarrow \underline{a = 4.9 \text{ m/s}^2} \quad \checkmark$

ii) a)  $R = 10g \cos 30^\circ$

c)  $\Rightarrow R = \underline{84.9 \text{ N}} \quad \checkmark$

b)  $P - 10g \sin 30^\circ = 10 \times 2$

$\Rightarrow \underline{P = 69 \text{ N}} \quad \checkmark$

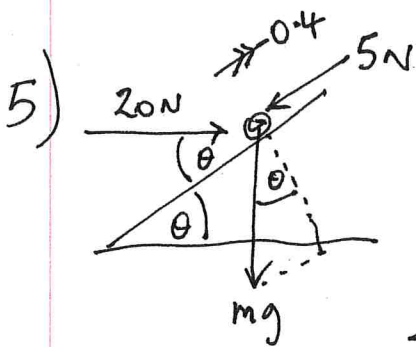
iii) a)  $49 = 10g \cos \theta$

c)  $\Rightarrow \cos \theta = \frac{1}{2} \Rightarrow \underline{\theta = 60^\circ} \quad \checkmark$

b)  $10g \sin \theta - 50 = 10a$

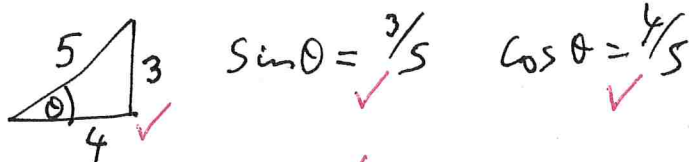
$\Rightarrow a = (10g \sin 60^\circ - 50) / 10 \quad \checkmark$

$\underline{a = 3.5 \text{ m/s}^2} \quad \checkmark$



// to slope  $\underline{F = ma} \quad \checkmark$

$$20 \cos \theta - 5 - mg \sin \theta = m \times 0.4$$



$$\Rightarrow 20 \times \frac{4}{5} - 5 - m \times 9.8 \times \frac{3}{5} = m \times 0.4$$

$$\Rightarrow 11 - 5.88m = 0.4m \quad \checkmark$$

$$\Rightarrow 11 = 6.28m \quad \checkmark$$

$$\Rightarrow \underline{m = 1.75 \text{ kg}} \quad \checkmark$$