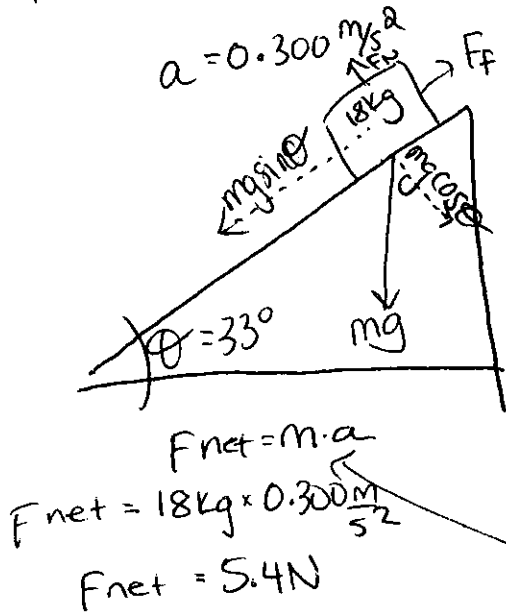


# Inclined plane Problems Answer key.

①



$\mu_k = ?$

$F_f = \mu_k \cdot F_N$

\* 1<sup>st</sup> find  $F_N$  using  $mg \cos \theta$

$F_N = 18kg \times 9.8 \frac{m}{s^2} \cos 33^\circ = 147.9N$

\* Next, find  $F_f$  which opposes the forward motion

\* BUT before  $F_f$  can be found, we must find  $F_{net}$  b/c  $F_{net} = F_{g\parallel} - F_f$

$5.4N = F_{g\parallel} - F_f$  where  $F_{g\parallel} = mgsin\theta$

$5.4N = 18kg \times 9.8 \frac{m}{s^2} \times \sin 33^\circ - F_f$

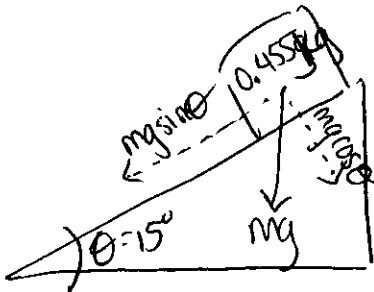
$5.4N = 96 - F_f \quad \therefore F_f = 96 - 5.4N = 90.67N$

now plug into  $F_f = \mu_k \cdot F_N$

$90.67N = \mu_k \cdot 147.9N$

$\mu_k = 0.6$

②



\* mass = 455g but we need it in  $kg$   
 b/c  $1 \text{ newton} = 1 \text{ kg} \cdot \frac{m}{s^2} \quad \therefore M = 0.455kg$

a)  $F_f = 0 \quad a = ? \quad F = ma$

where  $F_{net} = mgsin\theta$  b/c  $F_f = 0$

$0.455kg \times 9.8 \frac{m}{s^2} \sin 15^\circ = 0.455kg \cdot a$

$1.154N = 0.455kg \cdot a$

$a = 2.5 \frac{m}{s^2}$

b)  $\mu_k = 0.2 \quad a = ?$

$F_f = \mu_k \cdot F_N$  Find  $F_N = mg \cos \theta = 0.455kg \times 9.8 \frac{m}{s^2} \cos 15^\circ = 4.3N$

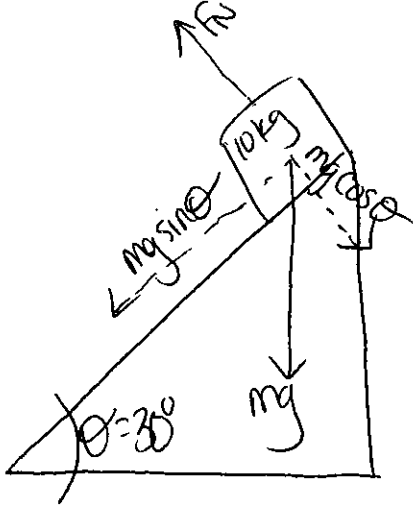
$F_f = 0.2 \times 4.3N = 0.86N$

$F_{net} = ma$  &  $F_{net} = F_{g\parallel} - F_f = mgsin\theta - 0.86N$

$0.29N = 0.455kg \cdot a \quad 1.154N - 0.86N = 0.29N$

$a = 0.64 \frac{m}{s^2}$

3



$$F_f = 0 \text{ N}$$

$$a) F_{g\perp} = mg \cos \theta = 10 \text{ kg} \cdot \frac{9.8 \text{ m}}{\text{s}^2} \cos 30^\circ = \boxed{85 \text{ N}}$$

$$b) F_{g\parallel} = mg \sin \theta = 10 \text{ kg} \cdot \frac{9.8 \text{ m}}{\text{s}^2} \sin 30^\circ = \boxed{49 \text{ N}}$$

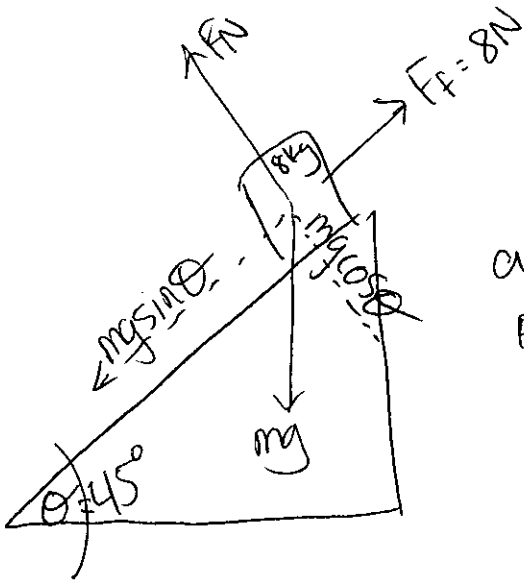
$$c) a = ? \quad F_{\text{net}} = m \cdot a \quad \& \quad F_f = 0 \therefore$$

$$F_{\text{net}} = mg \sin \theta$$

$$\frac{49 \text{ N}}{10 \text{ kg}} = \frac{10 \text{ kg} \cdot a}{10 \text{ kg}}$$

$$a = \boxed{4.9 \frac{\text{m}}{\text{s}^2}}$$

4



$$a) F_{\text{net}} = F_{g\parallel} - F_f$$

$$F_{g\parallel} = mg \sin \theta = 8 \text{ kg} \cdot \frac{9.8 \text{ m}}{\text{s}^2} \sin 45^\circ = 55.44 \text{ N}$$

$$F_{\text{net}} = 55.44 \text{ N} - 8 \text{ N} = \boxed{47 \text{ N}}$$

$$b) a = ?$$

$$F_{\text{net}} = m \cdot a$$

$$\frac{47 \text{ N}}{8 \text{ kg}} = \frac{8 \text{ kg} \cdot a}{8 \text{ kg}}$$

$$a = \boxed{5.9 \frac{\text{m}}{\text{s}^2}}$$