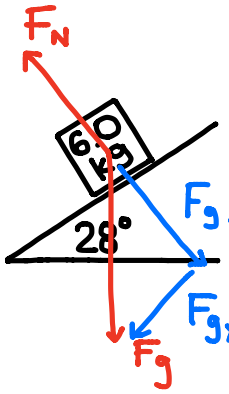
FORCES AT ANGLES - SOLUTIONS

1.

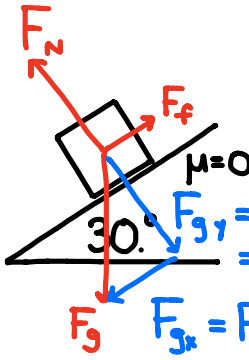


$F_{gy} = F_g \cos 28°$
$= mg \cos 28°$

$F_{gx} = F_g \sin 28°$
$= mg \sin 28°$

$F_{NET} = ma$
$F_{gx} = ma$
$mg \sin 28° = ma$
$a = g \sin 28°$
$= 9.8 \sin 28°$
$= 4.6 \frac{m}{s^2}$ DOWN THE RAMP

2.



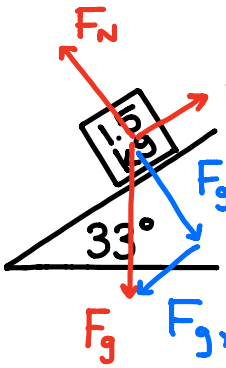
$F_{gy} = F_g \cos 30.°$
$= mg \cos 30.°$

$F_{gx} = F_g \sin 30.°$
$= mg \sin 30.°$

$F_N = F_{gy}$
$= mg \cos 30.°$

$F_{NET} = ma$
$F_{gx} - F_f = ma$
$mg \sin 30.° - \mu F_N = ma$
$mg \sin 30.° - \mu mg \cos 30.° = ma$
$a = g(\sin 30.° - \mu \cos 30.°)$
$= 9.8(\sin 30.° - 0.40 \cos 30.°)$
$= 1.5 \frac{m}{s^2}$ DOWN THE RAMP

3.



$F_N = F_{g_y}$
$= mg\cos 33°$

$F_{g_x} - F_f = ma$

$mg\sin 33° - \mu F_N = ma$

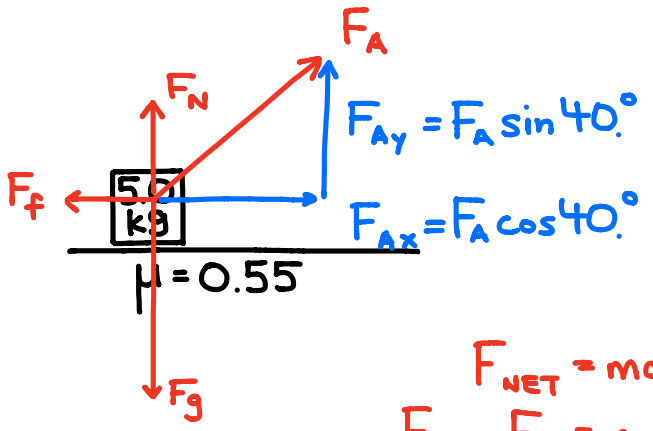
$mg\sin 33° - \mu mg\cos 33° = ma$

$$\mu = \frac{g\sin 33° - a}{g\cos 33}$$

$$= \frac{9.8\sin 33° - 3.0}{9.8\cos 33°}$$

$= 0.28$

4.



$F_N + F_{A_y} = F_g$

$F_N = F_g - F_{A_y}$

$= mg - F_A \sin 40°$

$F_{NET} = ma$

$F_{A_x} - F_f = ma$

$F_A \cos 40° - \mu F_N = ma$

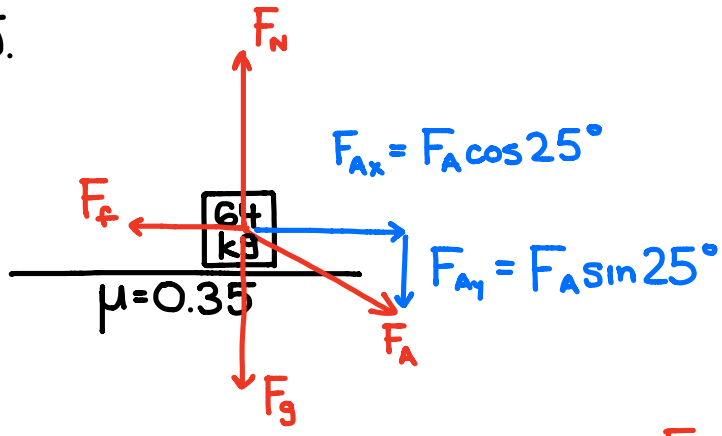
$F_A \cos 40° - \mu(mg - F_A \sin 40°) = ma$

$$a = \frac{F_A \cos 40° - \mu(mg - F_A \sin 40°)}{m}$$

$$= \frac{45\cos 40° - 0.55\left[(5.0)(9.8) - 45\sin 40°\right]}{5.0}$$

$$= 4.7 \ \frac{m}{s^2} \ \text{RIGHT}$$

5.



$$F_N = F_g + F_{Ay}$$
$$= mg + F_A \sin 25°$$

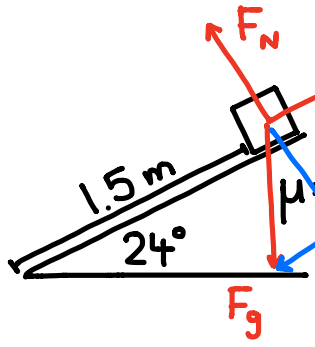
$$F_{NET} = ma$$
$$F_{Ax} - F_f = ma$$
$$F_A \cos 25° - \mu F_N = ma$$
$$F_A \cos 25° - \mu(mg + F_A \sin 25°) = ma$$

$$a = \frac{F_A \cos 25° - \mu(mg + F_A \sin 25°)}{m}$$

$$= \frac{450\cos 25° - 0.35\left[(64)(9.8) + 450\sin 25°\right]}{64}$$

$$= 1.9 \ \frac{m}{s^2} \ \text{RIGHT}$$

6.



$F_{g_y} = F_g \cos 24°$
$= mg\cos 24°$

$F_N = F_{g_y}$
$= mg\cos 24°$

$F_{g_x} = F_g \sin 24°$
$= mg \sin 24°$

$$F_{NET} = ma$$
$$F_{g_x} - F_f = ma$$
$$mg\sin 24° - \mu F_N = ma$$
$$mg\sin 24° - \mu mg\cos 24° = ma$$
$$a = g(\sin 24° - \mu\cos 24°)$$
$$= 9.8(\sin 24° - 0.30\cos 24°)$$
$$= 1.3002 \frac{m}{s^2}$$

GIVEN:

$a = 1.3002 \frac{m}{s^2}$

$d = 1.5$ m

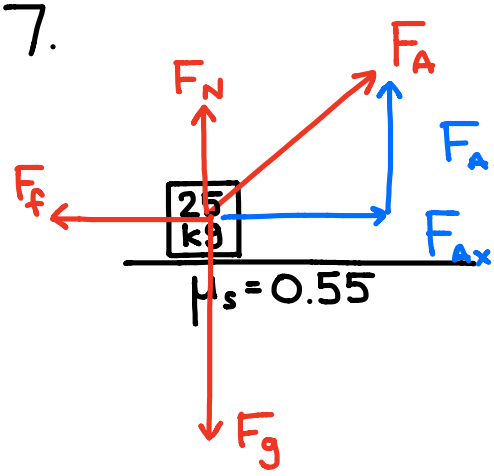
$v_i = 0$

$t = ?$

$v_i = 0$

$$d = v_i t + \frac{1}{2}at^2$$
$$d = \frac{1}{2}at^2$$
$$t^2 = \frac{2d}{a}$$
$$t = \sqrt{\frac{2d}{a}}$$
$$= \sqrt{\frac{2(1.5)}{1.3002}}$$
$$= 1.5 \text{ s}$$

7.



$F_{A_y} = F_A \sin 35°$

$F_{A_x} = F_A \cos 35°$

$F_N + F_{A_y} = F_g$

$F_N = F_g - F_{A_y}$

$= mg - F_A \sin 45°$

$a = 0$ (MINIMUM FORCE)

$F_{NET} = ma$

$F_{A_x} - F_f = 0$

$F_A \cos 35° - \mu F_N = 0$

$F_A \cos 35° - \mu(mg - F_A \sin 35°) = 0$

$F_A \cos 35° - \mu mg + \mu F_A \sin 35° = 0$

$F_A \cos 35° + \mu F_A \sin 35° = \mu mg$

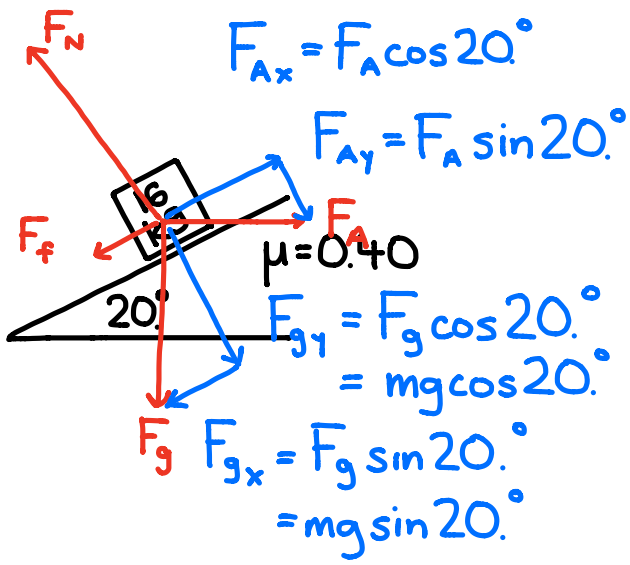
$F_A(\cos 35° + \mu \sin 35°) = \mu mg$

$$F_A = \frac{\mu mg}{\cos 35° + \mu \sin 35°}$$

$$= \frac{(0.55)(25)(9.8)}{\cos 35° + 0.55 \sin 35°}$$

$= 120 \text{ N}$

8.



$$F_N = F_{gy} + F_{Ay}$$
$$= mg\cos 20.° + F_A \sin 20.°$$

$$F_{NET} = ma$$
$$F_{Ax} - F_{gx} - F_f = ma$$
$$F_A \cos 20.° - mg \sin 20.° - \mu F_N = ma$$
$$F_A \cos 20.° - mg \sin 20.° - \mu(mg\cos 20.° + F_A \sin 20.°) = ma$$

$$a = \frac{F_A \cos 20.° - mg \sin 20.° - \mu(mg\cos 20.° + F_A \sin 20.°)}{m}$$

$$= \frac{150\cos 20° - (16)(9.8)\sin 20° - 0.40[(16)(9.8)\cos 20.° + 150 \sin 20°]}{16}$$

$= 0.49 \frac{m}{s^2}$ UP THE RAMP