

Mass and Weight

- Mass \rightarrow property of an object
- Weight is a force!

$$F_g = ma_g$$

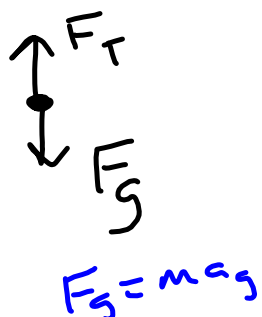
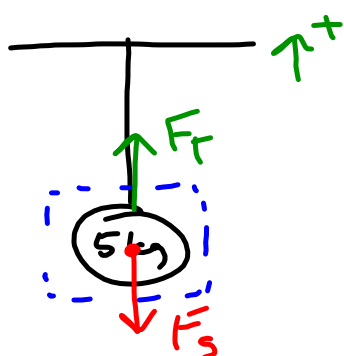
UNITS OF FORCE:

$$F = ma_g$$

$$(kg) \left(\frac{m}{s^2} \right) = \frac{kg \cdot m}{s^2} = N \text{ (Newtons)}$$

WORKSHEET 3

1)



$$\sum F_y = 0$$

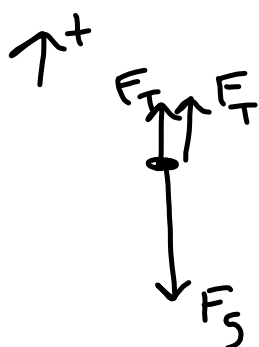
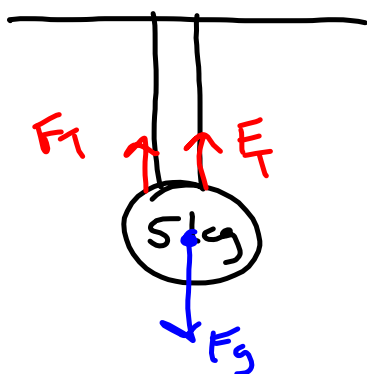
$$F_T - F_g = 0$$

$$F_T = F_g$$

$$F_T = ma_g$$

$$= (5 \text{ kg})(9.8 \text{ m/s}^2)$$

$$= 49 \text{ N}$$



$$\Sigma F_y = 0$$

$$F_T + F_T - F_g = 0$$

$$2F_T = F_g$$

$$F_T = \frac{F_g}{2}$$

$$F_T = \frac{m a_g}{2}$$

$$= \frac{(5 \text{ kg})(9.8 \text{ m/s}^2)}{2}$$

$$= 24.5 \text{ N}$$

2)

Diagram showing two masses, A and B, connected by a string. Mass A is 4 kg and mass B is 5 kg. The forces acting on mass A are tension F_{TA} (up), gravity F_{gA} (down), and tension F_T (up). The forces acting on mass B are tension F_{TB} (up), gravity F_{gB} (down), tension F_{TA} (down), and tension F_T (down). The total tension $F_{T-total}$ is shown acting on mass B.

For mass A:

$$\sum F_{yA} = 0$$

$$F_{TA} - F_{gA} = 0$$

$$F_{TA} = F_{gA}$$

$$= (4 \text{ kg})(9.8 \text{ m/s}^2)$$

$$= 39.2 \text{ N}$$

For mass B:

$$\sum F_{yB} = 0$$

$$F_{TB} - F_{TA} - F_{gB} = 0$$

$$F_{TB} = F_{TA} + F_{gB}$$

$$= 39.2 \text{ N} + 49 \text{ N}$$

$$= 88.2 \text{ N}$$

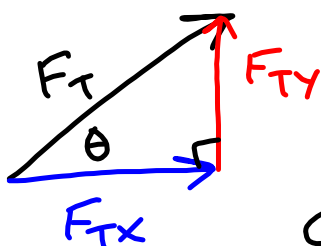
Calculation for F_{gB} :

$$F_{gB} = m_B a_g$$

$$= (5 \text{ kg})(9.8 \text{ m/s}^2)$$

$$= 49 \text{ N}$$

3)



$$\cos(55^\circ) = \frac{F_{Tx}}{F_T}$$

$$\theta = 55^\circ$$

$$F_T = 38 \text{ N}$$

$$F_{Tx} = F_T \cos(55^\circ)$$
$$= (38 \text{ N}) [\cos(55^\circ)]$$

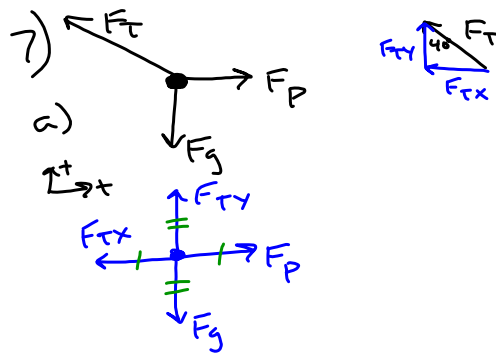
$$= 21.8 \text{ N}$$

$$\sin(55^\circ) = \frac{F_{Ty}}{F_T}$$

$$F_{Ty} = F_T \sin(55^\circ)$$

$$= (38 \text{ N}) [\sin(55^\circ)]$$

$$= 31.1 \text{ N}$$



b) $\Sigma F_y = 0$
 $F_{Ty} - F_g = 0$
 $F_{Ty} = F_g$

c) $\Sigma F_x = 0$
 $-F_{Tx} + F_P = 0$
 $F_P = F_{Tx}$

d) $F_g = ma_g$
 $= (75 \text{ kg})(9.8 \text{ m/s}^2)$
 $= 735 \text{ N}$

e) $F_{Ty} = F_g$
 $= 735 \text{ N}$

$F_T \cos(40^\circ) = \frac{F_{Ty}}{F_T} F_T$
 $F_T \frac{\cos(40^\circ)}{\cos(40^\circ)} = \frac{F_{Ty}}{\cos(40^\circ)}$
 $F_T = \frac{F_{Ty}}{\cos(40^\circ)}$
 $= \frac{735 \text{ N}}{\cos(40^\circ)}$
 $= 959 \text{ N}$

f) $F_{Tx} = F_P$

$\tan(40^\circ) = \frac{F_{Tx}}{F_{Ty}}$
 $F_{Tx} = F_{Ty} \tan(40^\circ)$
 $= (735 \text{ N}) \tan(40^\circ)$
 $= 617 \text{ N}$
 $F_P = 617 \text{ N}$