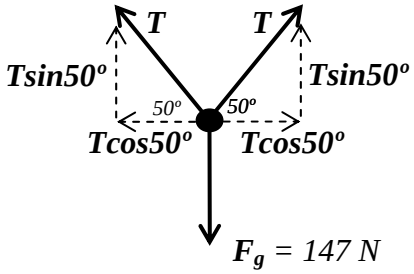
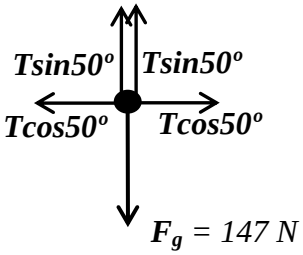
Answers to "Worksheet: Advanced Forces Part I"

1. This set-up is symmetrical.





$F_{net} = 0$

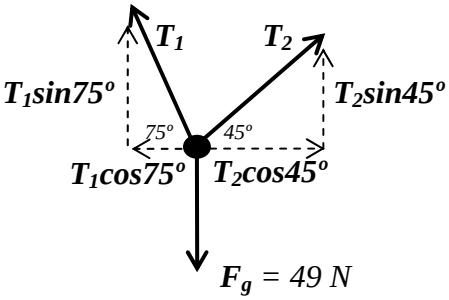
$0 = T\sin 50° + T\sin 50° - F_g$

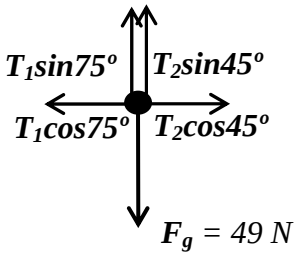
$F_g = 2T\sin 50°$

$$T = \frac{F_g}{2\sin 50°} = \frac{147N}{2\sin 50°} = 95.9N$$

Ans: The tension in each string is 95.9N

2.





Horizontally:

$F_{net} = 0$

$T_1\cos 75° = T_2\cos 45°$

$$T_1 = \frac{T_2\cos 45°}{\cos 75°}$$

$T_1 = 2.73T_2$

Vertically:

$F_{net} = 0$

$T_1\sin 75° + T_2\sin 45° = F_g$

$(2.73T_2)\sin 75° + T_2\sin 45° = 49N$

$2.637T_2 + 0.707T_2 = 49N$

$3.344T_2 = 49N$

$$T_2 = \frac{49N}{3.344} = 14.7N$$

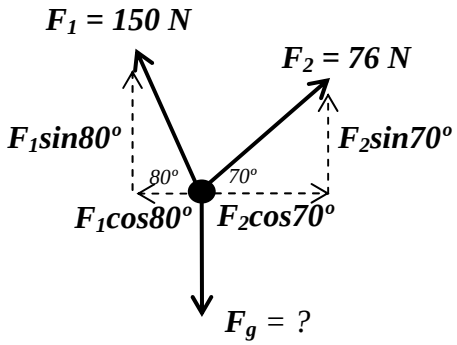
$T_1 = 2.73T_2$

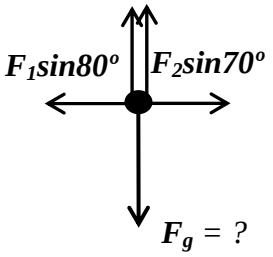
$T_1 = 2.73(14.7N)$

$T_1 = 40.1N$

Ans: T_1 = 40.1 N ; T_2 = 14.7 N

3.





Vertically:

$F_{net} = 0$

$F_1 \sin 80° + F_2 \sin 70° = F_g$

$F_g = (150N)(\sin 80°) + (76N)(\sin 70°)$

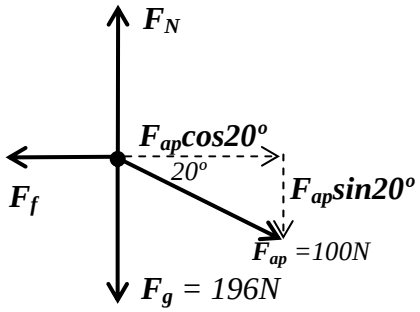
$F_g = 219N$

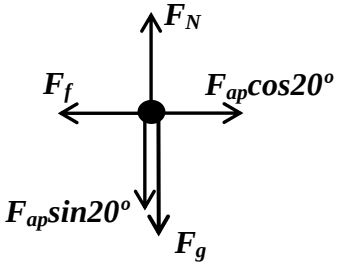
$F_g = mg$

$m = \frac{F_g}{g} = \frac{219N}{9.8 \frac{m}{s^2}} = 22.3kg$

Ans: m = 22.3 kg

4.





Vertically

$F_{net} = 0$

$F_N = F_g + F_{ap} \sin 20°$

$F_N = 196N + (100N)\sin 20°$

$F_N = 196N + 34.2N$

$F_N = 230.2N$

Horizontally:

$F_{net} = 0$

$F_f = F_{ap} \cos 20°$

$F_f = (100N)\cos 20°$

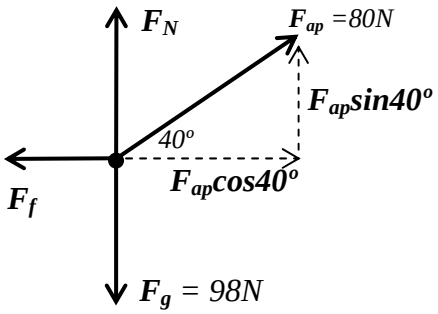
$F_f = 93.97N$

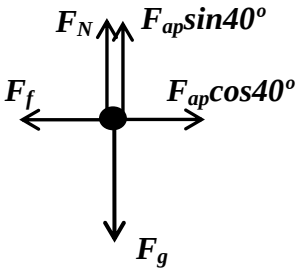
$F_f = \mu_k F_N$

$\mu_k = \frac{F_f}{F_N} = \frac{93.97N}{230.2N} = 0.41$

Ans: The coefficient of kinetic friction is 0.41.

5.





Vertically

$F_{net} = 0$

$F_N + F_{ap}\sin 40° = F_g$

$F_N = F_g - F_{ap}\sin 40°$

$F_N = 98N - (80N)\sin 40°$

$F_N = 46.6N$

$F_f = \mu_k F_N$

$F_f = (0.2)(46.6N)$

$F_f = 9.32N$

Horizontally:

$F_{net} = ma$

$F_{net} = F_{ap}\cos 40° - F_f$

$F_{net} = (80N)\cos 40° - 9.32N$

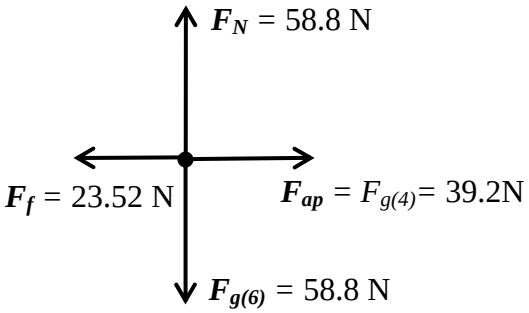
$F_{net} = 51.96N$

$F_{net} = ma$

$a = \frac{F_{net}}{m} = \frac{51.96N}{10kg} = 5.2\,\frac{m}{s^2}$

Ans: 5.2 m/s^2

6. On the system:



$F_f = \mu_k F_N$

$F_f = (0.4)(58.8N)$

$F_f = 23.52N$

$F_{net} = F_{ap} - F_f$

$F_{net} = 39.2N - 23.52N$

$F_{net} = 15.68N$

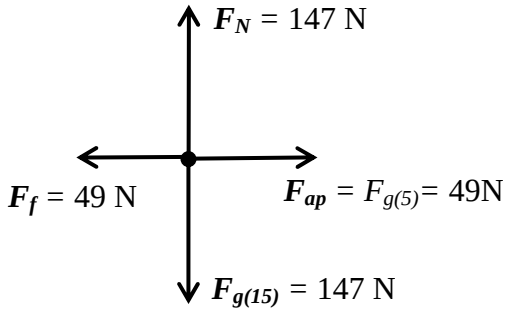
$F_{net} = ma$

$a = \frac{F_{net}}{m}$

$a = \frac{15.68N}{(4kg + 6kg)} = 1.57\,\frac{m}{s^2}$

Ans: 1.57 m/s^2

7.



$$F_{net} = 0$$
$$F_{ap} = F_f$$
$$F_f = 49N$$

$$F_f = \mu_k F_N$$
$$\mu_k = \frac{F_f}{F_N} = \frac{49N}{147N} = 0.33$$

Ans: 0.33