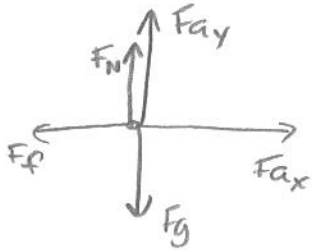
Review For Test - Advanced Forces

ANSWERS

1)

① $F_{ax} = 100N \cos 40°$
$= 76.6N$



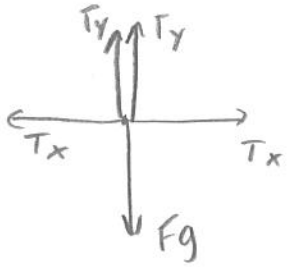
② $F_{net} = 0$

$F_{ax} = F_f$

$\boxed{F_f = 76.6\,N}$ ⟶ (B)

---

2)



① $F_g = mg$
$= (75\,kg)(9.8\,m/s^2)$
$= 735N$

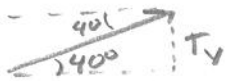
② $F_g = 2T_y$

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

$= \frac{735N}{2}$

$T_y = 367.5N$

③



$\sin 40° = \frac{T_y}{T}$

$T = \frac{T_y}{\sin 40°}$

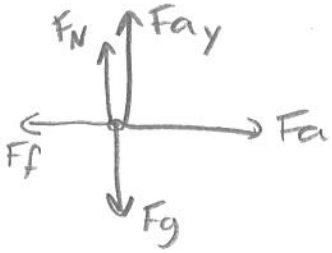
$T = \frac{367.5N}{\sin 40°}$

$\boxed{T = 572N}$

↳ (D)

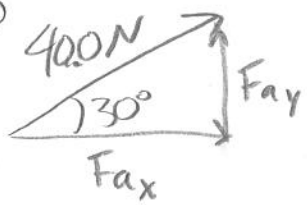
---

3)



$F_g = mg$
$= (6.0kg)(9.8\,m/s^2)$
$= 58.8N$

①



$F_{ax} = 40.0N \cos 30°$
$= 34.6N$

$F_{ay} = 40.0N \sin 30°$
$= 20.0N$

⟶

3) Continued

② $F_g = F_N + F_{ay}$

$F_N = F_g - F_{ay}$

$= 58.8\,N - 20.0\,N$

$= 38.8\,N$

③ $F_{net} = ma$

$= (6.0\,kg)(3.19\,m/s^2)$

$= 19.14\,N$

④ $F_{net} = F_{ax} - F_f$

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

$= 34.6\,N - 19.14\,N$

$= 15.46\,N$

⑤ $F_f = \mu F_N$

$\mu = \frac{F_f}{F_N}$

$= \frac{15.46\,N}{38.8\,N}$

$= 0.40$

4) ① $F_{g_{hang}} = mg$

$= (10kg)(9.8\ m/s^2)$

$= 98N$

② Find F_f (on 5kg mass)

$F_g = mg$

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

$= 49N = F_N$

$F_f = \mu F_N$

$= (0.5)(49N)$

$= 24.5N$

③ $F_{net} = F_{g_{hang}} - F_f$

$= 98N - 24.5N$

$= 73.5N$

④ $F_{net} = ma$

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

$= \frac{73.5N}{15kg}$

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

5) ① $F_{net} = ma$

$= (9.0\,kg)(1.8\,m/s^2)$

$= 16.2\,N$

② $F_{net} = F_{ghang} - F_f$

$F_{ghang} = F_{net} + F_f$

$= 16.2\,N + 6.3\,N$

$= 22.5\,N$

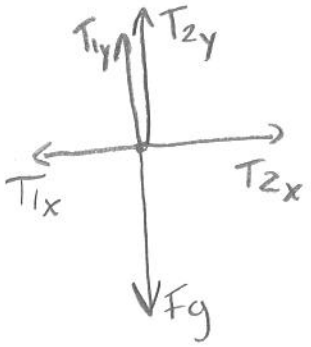
③ $F_{ghang} = mg$

$g = \frac{F_{ghang}}{m}$

$= \frac{22.5\,N}{3.0\,kg}$

$\boxed{g = 7.5\,m/s^2}$

6)



① $T_{1x} = T_{2x}$

$T_1 \cos 35° = T_2 \cos 70°$

$T_1 = T_2 \dfrac{\cos 70°}{\cos 35°}$

$T_1 = T_2 (0.418)$

$F_g = mg$

$= (50\text{kg})(9.8 \frac{\text{m}}{\text{s}^2})$

$= 490\text{N}$

② $F_g = T_{1y} + T_{2y}$

$490\text{N} = T_1 \sin 35° + T_2 \sin 70°$

$490\text{N} = (0.418) T_2 \sin 35° + T_2 \sin 70°$

$490\text{N} = 0.240 T_2 + 0.940 T_2$

$490\text{N} = 1.18 T_2$

$T_2 = \dfrac{490\text{N}}{1.18}$

$\boxed{T_2 = 415\text{N}}$

$T_1 = T_2 (0.418)$

$T_1 = (415\text{N})(0.418)$

$\boxed{T_1 = 173\text{N}}$

7) ① $F_{net} = F_{g\,hang} - F_f$

$= 19.6\text{N} - 5.0\text{N}$

$= 14.6\text{N}$

② $F_{net} = ma$

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

$= \dfrac{14.6\text{N}}{5.0\text{kg}}$

$= 2.92\,\text{M/s}^2$

③ isdate 3.0kg

$F_{net} = ma$

$= (3.0\text{kg})(2.92\,\text{M/s}^2)$

$= 8.76\text{N}$

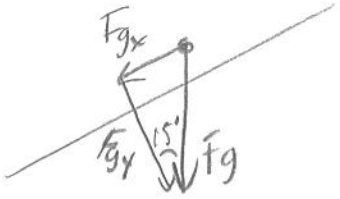
$F_{net} = T - F_f$

$T = F_{net} + T_f$

$= 8.76\text{N} + 5.0\text{N}$

$\boxed{T = 13.76\text{N}}$

8)



① $F_g = mg$

$= (125\,kg)(9.8\,m/s^2)$

$= 1225\,N$

$F_{gx} = F_g \sin 15°$

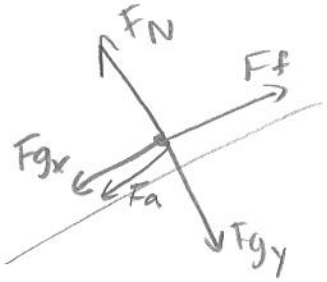
$= 1225\,N \sin 15°$

$= 317\,N$

$F_{gy} = F_g \cos 15°$

$= 1225\,N \cos 15°$

$= 1183\,N$



② $F_f = \mu F_N$ $\quad F_N = F_{gy}$

$= (0.40)(1183\,N)$ $\quad = 1183\,N$

$= 473\,N$

③ $F_{net} = F_{gx} + F_a - F_f$

$= 317\,N + 250\,N - 473\,N$

$= 94\,N$

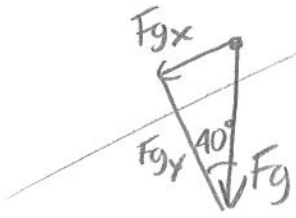
④ $F_{net} = ma$

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

$= \dfrac{94\,N}{125\,kg}$

$\boxed{a = 0.75\,m/s^2}$

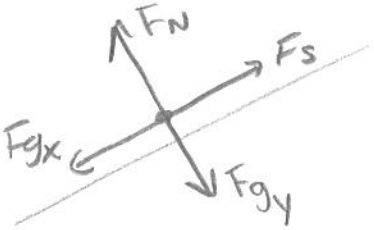
9)



① $F_g = mg = (50kg)(9.8 m/s^2) = 490N$

$F_{gx} = 490N \sin 40° = 315N$

$F_{gy} = 490N \cos 40° = 375N$



② $F_{gx} = F_s$ (equilibrium) $F_{net} = 0$

$F_s = 315N$

③ $F_s = kx$

$x = \frac{F_s}{k}$

$= \frac{315N}{250 N/m}$

$= 1.26m$

$\boxed{x = 126cm}$

10) $F_{net} = ma$

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

$= \frac{35N}{10kg}$

$a = 3.5 m/s^2$

Isolate 5.0kg

$F_{net} = ma$

$= (5.0kg)(3.5 m/s^2)$

$= 17.5N$

$F_{net} = F_a - T$

$T = F_a - F_{net}$

$= 35N - 17.5N$

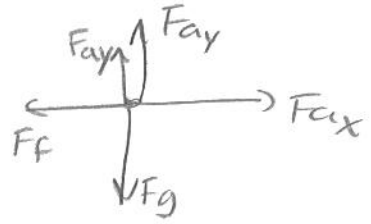
$\boxed{T = 17.5N}$

11) ① $F_{net} = ma$

$= (5.0kg)(4.0m/s^2)$

$= 20N$

②



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

$F_{ax} = F_{net} + F_f$

$= 20N + 45N$

$= 65N$

③

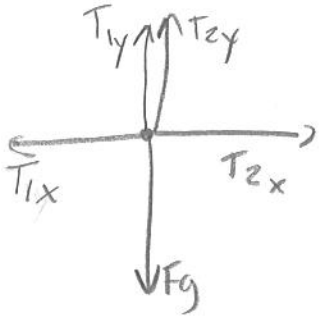
$\cos 40° = \frac{F_{ax}}{F}$

$F = \frac{F_{ax}}{\cos 40°}$

$= \frac{65N}{\cos 40°}$

$\boxed{F = 85N}$

12)



① $T_{1x} = T_{2x}$

$= T_2 \cos 30°$

$= (15.0N) \cos 30°$

$T_{1x} = 12.99N$

② $T_{1y} + T_{2y} = F_g$

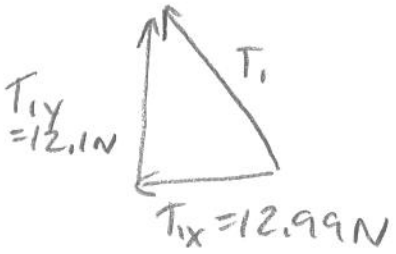
$T_{1y} + T_2 \sin 30° = (2kg)(9.8m/s^2)$

$T_{1y} + (15.0N) \sin 30° = 19.6N$

$T_{1y} + 7.5N = 19.6N$

$T_{1y} = 12.1N$

③



$T_1 = \sqrt{T_{1x}^2 + T_{1y}^2}$

$= \sqrt{(12.99N)^2 + (12.1N)^2}$

$\boxed{T_1 = 17.8N}$

13) ① $\Delta d = 8.0\,m$

$a = ?$

$v_i = 0$

$\Delta t = 3.0\,s$

$\Delta d = v_i \Delta t + \frac{1}{2} a (\Delta t)^2$ ($v_i = 0$)

$a = \frac{2\Delta d}{(\Delta t)^2}$

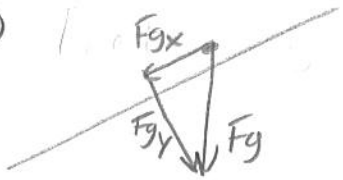
$= \frac{2(8.0\,m)}{(3.0\,s)^2}$

$a = 1.78\,m/s^2$

② $F_{net} = ma$

$= (10.0\,kg)(1.78\,m/s^2)$

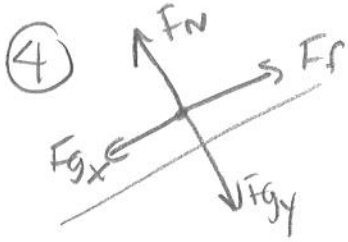
$= 17.8\,N$

③ 

$F_g = mg = (10.0\,kg)(9.8\,m/s^2) = 98\,N$

$F_{gx} = 98\,N \sin 28° = 46\,N$

$F_{gy} = 98\,N \cos 28° = 86.5\,N$

④ 

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

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

$= 46\,N - 17.8\,N$

$= 28.2\,N$

$F_{gy} = F_N$

⑤ $F_f = \mu F_N$

$\mu = \frac{F_f}{F_N}$

$= \frac{28.2\,N}{86.5\,N}$

$\boxed{\mu = 0.33}$

14) ① From graph $g = \text{Slope}$

$$= \frac{20N - 4N}{10kg - 2kg}$$

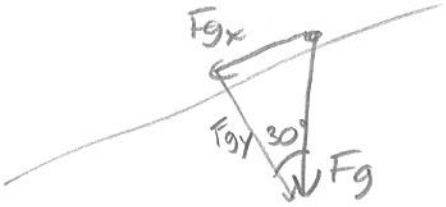
$$= \frac{16N}{8kg}$$

$$g = 2\ m/s^2$$

② $F_g = mg$

$= (80kg)(2.0\ m/s^2)$

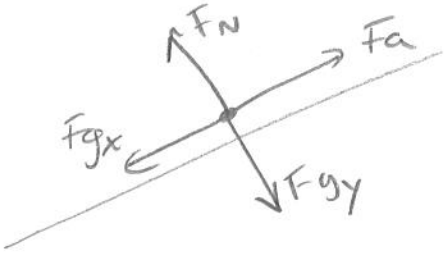
$= 160N$



$F_{gx} = 160N \sin 30°$

$= 80N$

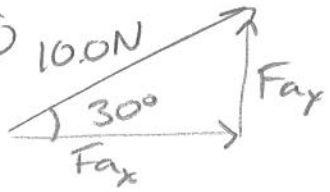
③



Equilibrium (constant speed)

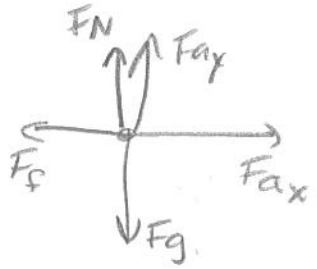
$\rightarrow F_{gx} = F_a$

$\boxed{F_a = 80N}$

15) ① 

$F_{ax} = 10.0N \cos 30°$
$= 8.66N$

$F_{ay} = 10.0N \sin 30°$
$= 5.0N$

② 

$F_g = F_N + F_{ay}$
$F_N = F_g - F_{ay}$
$= 19.6N - 5.0N$
$F_N = 14.6N$

③ $F_f = \mu F_N$
$= (0.15)(14.6N)$
$= 2.19N$

④ $F_{net} = F_{ax} - F_f$
$= 8.66N - 2.19N$
$F_{net} = 6.47N$

⑤ $F_{net} = ma$
$a = \frac{F_{net}}{m}$
$= \frac{6.47N}{2.0kg}$
$\boxed{a = 3.2 m/s^2}$