PRACTICE PROBLEMS FOR FORCE/FRICTION

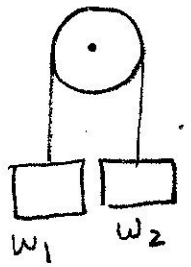
1. Convert 211 kg mass to newtons.

$F = ma = 211\,kg \times 9.8\,m/s^2 = \boxed{2,068\,N}$

2. How many kilograms is a 4500N weight?

$m = \frac{F}{a} = \frac{4500\,N}{9.8\,m/s^2} = \boxed{459\,kg}$

3. What is the direction and acceleration of this Atwood system? →



$F_1 = W_1(9.8\,m/s^2) = 25\,kg(9.8\,m/s^2) = 245\,N$ CCW

$F_2 = W_2(9.8\,m/s^2) = 10\,kg(9.8\,m/s^2) = 98\,N$

$a = \frac{F_n}{M_T} = \frac{245\,N - 98\,N}{35\,kg} = \frac{147\,N}{35\,kg} = \boxed{4.2\,m/s^2}$

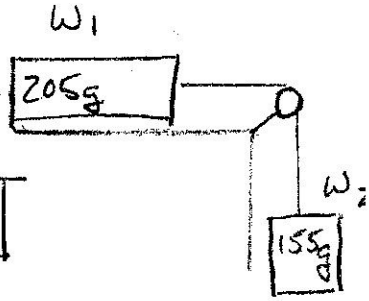
$W_1 = 25\,kg$

$W_2 = 10\,kg$

4. What force is needed to accelerate a 12-kg cannonball 2 m/s/s?

$F = ma = (12\,kg)(2\,m/s^2) = \boxed{24\,N}$

5. Find the acceleration of this system with no friction. →



$F_f = 0$

$F_n = ma = 0.155\,kg \times 9.8\,m/s^2 = 1.52\,N$

$M_T = 0.36\,kg$ (205g + 155g)

So: $a = \frac{F_n}{M_T} = \frac{1.52\,N}{0.36\,kg} = \boxed{4.22\,m/s^2}$

6. If the above situation has a coefficient of friction of 0.4 between the horizonal surface and the box, what is the new acceleration?

$F_f = \mu F_n = 0.4(0.205\,kg \times 9.8\,m/s^2) = 0.80\,N$

$a = \frac{1.52\,N - 0.80\,N}{0.36\,kg} = \frac{0.72\,N}{0.36\,kg} = \boxed{2.0\,m/s^2}$

$F_f = F_a$ AND $F_n = W$

7. A 72-kg cross country skier travels at a constant velocity with a force of 100N. What is the coefficient of friction between the skies and the snow?

$$\mu = \frac{F_f}{F_n} = \frac{100N}{72kg(9.8m/s^2)} = \frac{100N}{706N} = \boxed{0.14}$$

8. A skateboarder uses 220N of force to accelerate his 440N body and his 20N skateboard 2.6 m/s/s. What is the frictional force?

$F_a = 220N$

$M = \frac{F}{a} = \frac{460N}{9.8} = 47kg$

$F_f = F_{App} - ma$

$= 220N - 47kg(2.6m/s^2) = \boxed{98N}$

9. A helicopter has a weight of 4100N and accelerates upward at 2.5 m/s/s. What force is exerted by the air to lift the helicopter up?

$W = 4100N$

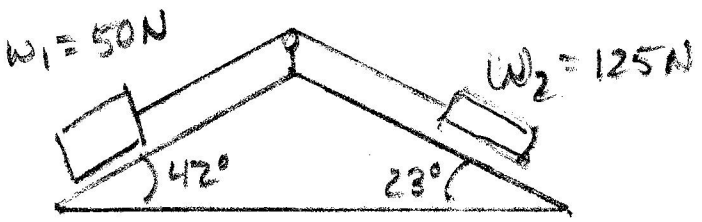
$a = 2.5m/s^2$

$M = \frac{F}{a} \quad \frac{4100}{9.8} = 418kg$

$F_{appl} = M(a-g) = 418[2.5m/s^2 - (-9.8m/s^2)] = 5141N$

OR $\boxed{5.14 \times 10^3 N}$

10. What is the direction and acceleration of the system below?



$F_1 = W_1 \sin\theta$

$50N(\sin 42°) = 33.5N$

$F_2 \; W_2 \sin\theta$

$125N(\sin 23°) = 49N$

$49N > 33.5N$ so $\boxed{\text{RIGHT}}$

$M_T = \frac{175N}{9.8m/s^2} = 18kg$

$$a = \frac{F_n}{M_T} = \frac{49N - 33.5N}{18kg} = \frac{15.5N}{18kg}$$

$$= \boxed{0.86m/s^2}$$

Answers: 1. 2068N 2. 459-kg 3. 4.2 m/s/s, ccw 4. 24N 5. 4.22 m/s/s

6. 2.0 m/s/s 7. 0.14 8. 98N 9. $5.14 \times 10^3 N$ 10. right, 0.86 m/s/s