LIZARDI BHI	2008-09	Topics:	MARKS:
Physics-Chem	2nd term	Dynamics	
2009-03-26		Circular motion	
Name:			

(1) a) The normal force has to compensate both the weight and the vertical component of F:

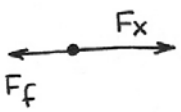
$N = W + F_y$

$W = 12\,Kg \times 10\frac{m}{s^2} = 120\,N$

$F_y = F \times \sin 30° = 60\,N$

$\boxed{N = 180\,N}$

b) First, we need to know the net force:



$F_{net} = F_x - F_f$

$F_x = F \times \cos 30° = 103.92\,N$

$F_f = \mu N = 27\,N$

$F_{net} = 76.92\,N$

The acceleration will be:

$$a = \frac{F_{net}}{m} = \frac{76.92\,N}{12\,Kg} \rightarrow \boxed{a = 6.41\,m/s^2}$$

c) By using the equation of displacement we will calculate the time needed to reach point "A"

$$x = x_0 + v_0 t + \frac{1}{2} a t^2 \longrightarrow 18\,m = \frac{1}{2} \times 6.41\frac{m}{s^2} \times t^2$$

$$\rightarrow t = \sqrt{\frac{2 \times 18\,m}{6.41\,m/s^2}} \rightarrow t = 2.37\,s$$

Then, we will know the final velocity:

$$v = v_0 + a t \longrightarrow v = 6.41\frac{m}{s^2} \times 2.37s \longrightarrow \boxed{v = 15.19\frac{m}{s}}$$

② a) The strategy is as follows:

$$\left.\begin{matrix} a \\ \text{mass} \end{matrix}\right\} \longrightarrow F_{net} \longrightarrow F_f \longrightarrow \mu$$

The net force is:

$$F_{net} = m \times a \longrightarrow F_{net} = (20\,kg + 12\,kg) \times 2.4\ m/s^2$$

$$F_{net} = 76.8\,N$$

From the net force we can get the friction force:

$$F_{net} = W_1 - F_f \longrightarrow 76.8\,N = 120\,N - F_f$$

$$\boxed{F_f = 43.2\,N}$$

The friction coefficient will be:

$$F_f = \mu N \longrightarrow \mu = \frac{F_f}{N} = \frac{43.2\,N}{200\,N} \longrightarrow \boxed{\mu = 0.22}$$

b) To calculate the tension a body (any) needs to be isolated:

$$F_{net} = m \times a \longrightarrow W_1 - T = m \times a \longrightarrow$$

$$\longrightarrow 120\,N - T = 12\,kg \times 2.4\ \frac{m}{s^2} \longrightarrow$$

$$\longrightarrow 120\,N - T = 28.8\,N \longrightarrow \boxed{T = 91.2\,N}$$

(3) a) We can know the angular velocity from the period:

$$\omega = \frac{2\pi}{T} \rightarrow \omega = \frac{2\pi}{0.1s} \rightarrow \boxed{\omega = 62.83 \frac{rad}{s}}$$

By converting units:

$$\omega = 62.83 \frac{rad}{s} \times \frac{60\,s}{1\,min} \times \frac{1\,rev}{2\pi\,rad} \rightarrow \boxed{\omega = 600\,rpm}$$

The linear velocity:

$$v = \omega \times R \rightarrow v = 62.83 \frac{rad}{s} \times 2.5\,m \rightarrow \boxed{v = 157.08 \frac{m}{s}}$$

b) The centripetal (normal) acceleration:

$$a_c = \frac{v^2}{R} \rightarrow \boxed{a_c = 9869.65 \frac{m}{s^2}}$$

c) The mass of the body:

$$F = m \times a_c \rightarrow m = \frac{F}{a_c} \rightarrow m = \frac{280N}{9869.65\,m/s^2} \rightarrow \boxed{m = 28.37\,g}$$

d) The frequency of motion:

$$f = \frac{1}{T} \rightarrow f = \frac{1}{0.1s} \rightarrow \boxed{f = 10\,Hz}$$

(4) a) We have to compare W_1 and W_{2x}

$W_1 = m_1 \times g = 80\ N$

$W_{2x} = W_2 \times \sin 30^\circ = 50N$

} Therefore, the system will move in this direction:

b) The normal is:

$N = W_{2y} \longrightarrow W_{2y} = W_2 \times \cos 30^\circ \longrightarrow \boxed{N = 86.6\,N}$

The friction force:

$F_f = \mu N = 0.05 \times 86.6N \longrightarrow \boxed{F_f = 4.33\,N}$

c) The acceleration:

$F_{net} = m \times a \longrightarrow F_{net} = W_1 - W_{2x} - F_f = 25.67\,N$

$a = \frac{F_{net}}{m} \rightarrow a = \frac{25.67\,N}{18\ Kg} \rightarrow \boxed{a = 1.43\ m/s^2}$

d) The tension

$F_{net} = m \times a \rightarrow W_1 - T = m \times a \rightarrow$

$\rightarrow 80\,N - T = 8\ Kg \times 1.43\ m/s^2 \rightarrow$

$\rightarrow 80N - T = 11.44\,N \rightarrow \boxed{T = 68.56\,N}$