QUESTION BANK 6

Q1. A 68.5 kg skater moving initially at 2.4 m/s on rough horizontal ice comes to rest uniformly in 3.52 s due to friction from the ice. What force does friction exert on the skater?

Solution:

$$v_f = v_0 + at, \quad v_f = 0, \quad thus \quad a = -\frac{v_0}{t} = -\frac{2.4}{3.52} = -0.68\, m/s^2$$
$$Force = ma = 68.5 * (-0.68) = -47\, N, \quad Friction = 47N$$

Q2. A box rests on a frozen pond, which serves as a frictionless horizontal surface. If a fisherman applies a horizontal force with magnitude 48.0 N to the box and produces an acceleration of magnitude 3 m/s^2, what is the mass of the box?

Solution:

$$F = ma \rightarrow \ m = \frac{F}{a} = \frac{48}{3} = 16\, Kg$$

Q3. A dock worker applies a constant horizontal force of 80.0 N to a block of ice on a smooth horizontal floor. The frictional force is negligible. The block starts from rest and moves 11.0 m in 5.00 s. What is the mass of the block of ice?

Solution:

$$F = ma \ \rightarrow m = \frac{F}{a} = \frac{F}{(\frac{x}{t^2})} = \frac{80}{\left(\frac{11}{25}\right)} = \frac{80}{0.44} = 182\, kg$$

Q4. Superman throws a 2400-N boulder at an adversary. What horizontal force must Superman apply to the boulder to give it a horizontal acceleration of 12 m/s^2.

Solution:

$$w = mg \ \rightarrow \ m = \frac{w}{g} = \frac{2400}{9.8} = 244.9\, kg$$
$$F = ma = 244.9 * 12 = 2938\, N$$

Q5. A stockroom worker pushes a box with mass 11.2 kg on a horizontal surface with a constant speed of 3.5 m/s. The coefficient of kinetic friction between the box and the surface is 0.20. (a) What horizontal force must the worker apply to maintain the motion? (b) Acceleration?

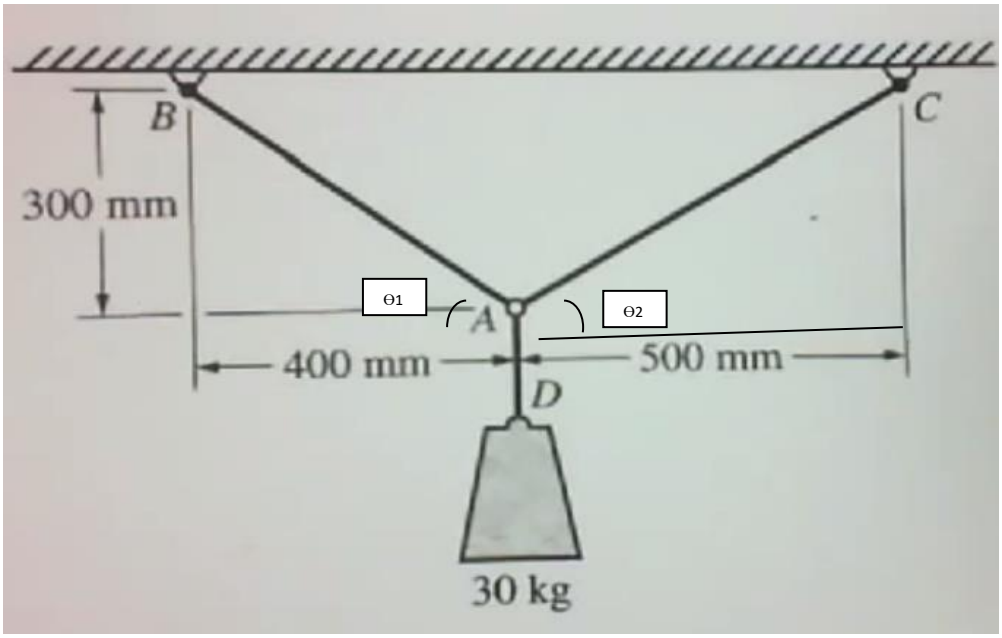
Solution:

a. Friction =μ_K n = μ_K mg =0.2 * 11.2 * 9.8= 22N

b. $F = ma \ \rightarrow a = \frac{F}{m} = \frac{22}{11.2} = 1.96\, m/s^2$

Q6: from the below diagram, determine the tension force produces between points AB and AC.

Solution:



F_{AD}=mg = 30* 9.8 =294 N

$$\theta_1 = \tan^{-1}\frac{300}{400} = 36.8^0$$

$$\theta_2 = \tan^{-1}\frac{300}{500} = 30.8^0$$

$$\sum fx = 0$$

$$-F_{AB}\cos 36.8 + F_{AC}\cos 30.8 = 0$$

$F_{AB} = 1.07\ F_{AC}$…… (1)

$$\sum fy = 0$$

$$-294 + F_{AB}\sin 36.8 + F_{AC}\sin 30.8 = 0$$

$-294 + 0.6\ F_{AB} + 0.514F_{AC} = 0$ …..(2)

By Substituting 1 in 2,

$$-294 + 0.6\ (1.07F_{AC}) + 0.514F_{AC} = 0$$

$$F_{AC} = 254.3N$$

$$F_{AB} = 272.1N$$