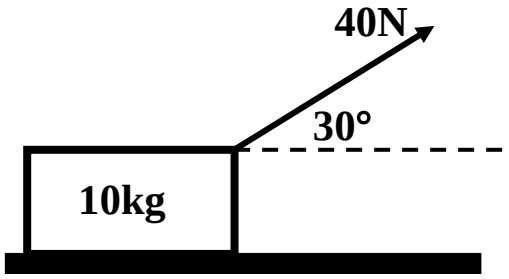
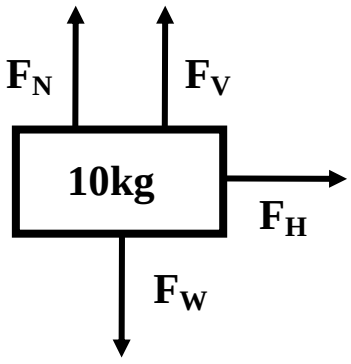
Problem Solving Process (Pg 91)

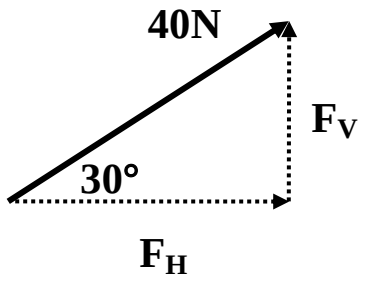
Example 4-11

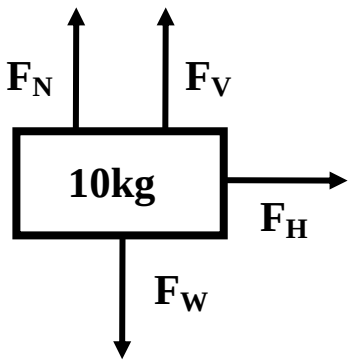
A person exerts 40.0N of force by pulling a rope which is at a 30.0° angle to the horizontal on a box with a mass of 10.0kg. Calculate:

a. the acceleration of the box

b. the magnitude of the upward force exerted by the table on the box

Process Step	Illustration
1. Draw a sketch	
2. Draw a free-body diagram	

3. Resolve vectors into components	 $$\sin 30° = \frac{F_V}{40N}$$ $$F_V = (40N)(\sin 30°)$$ $$F_V = 20.0N$$ $$\cos 30° = \frac{F_H}{40N}$$ $$F_H = (40N)(\cos 30°)$$ $$F_H = 34.6N$$

4. Apply Newton's second law to each component direction separately	 $F_V = 20.0N$ $F_H = 34.6N$ $F_W = mg = (10)(9.81)$ $F_W = 98.1N$ **Vertical** $\sum F = ma$ $a = 0$ $F_N + F_V - F_W = 0$ **Horizontal** $\sum F = ma$ $F_H = ma$
5. Solve equations for unknowns	**Vertical** $F_N + F_V - F_W = 0$ $F_N = F_{W-}F_V$ $F_N = 98.1 - 20.0 = 78.1N$ **Horizontal** $F_H = ma$ $\frac{F_H}{m} = a$

	$$\frac{34.6N}{10kg} = a$$ $$3.46\,m/s^2 = a$$