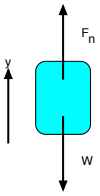
Your Name: _____

PHY203
Exam #2
Chapters 4,5,11
Fri., 3/7/13

Solutions



1. A block of mass 6.50 kg is placed on a bathroom scale on the floor of a 3500 kg elevator which is sitting initially at rest on the 30th floor of a building.
a. Find the scale reading.

scale reading = magnitude of normal force

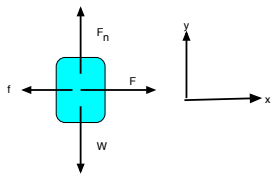
$$F_n - mg = 0$$
$$F_n = mg$$ **5**
$$F_n = (6.50)(9.81) = 63.8\,\text{N}$$

b. The elevator starts moving down with an acceleration of 3.00 m/s^2. Find the scale reading.

$$F_n - mg = ma$$
$$F_n = m(g + a)$$ **10**
$$F_n = (6.50)(9.81 - 3.00) = 44.3\,\text{N}$$

c. After 5.00 seconds of acceleration the elevator continues to move down with a constant velocity. Find the scale reading.

same as a. F_n = 63.8 N **5**



2. A force, F, pushes on a block of mass, m=6.00 kg, which is on a horizontal table as shown above. The coefficients of friction between block and table are: $\mu_s = 0.500 \; and \; \mu_k = 0.300$.

a. On the figure to the right above, draw a free-body diagram. **5**

b. Find the magnitude of the normal force on the block.

$$F_n - mg = 0$$
$$F_n = mg$$ **5**
$$F_n = (6.00)(9.81) = 58.9\,\text{N}$$

c. If the pushing force is 25.0 N, is the frictional force static or kinetic? Justify your answer.

$$f_{s\max} = \mu_s F_n = (0.500)(58.9) = 29.4N$$ **10**

since this is greater than 25.0 N, the block does not move-static friction.

d. Find the magnitude of the frictional force in this case.
static friction = pushing force = 25.0 N **5**

e. Find the magnitude of the acceleration of the block.
0

5

f. If the pushing force is 50.0 N, is the frictional force static or kinetic?

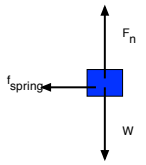
kinetic **5**

g. Find the magnitude of the frictional force.

$$f_k = \mu_k F_n$$ **5**
$$= (0.300)(58.9N) = 17.7N$$

h. Find the magnitude of the acceleration of the block.

$$F - f_k = ma$$
$$a = \frac{F - f_k}{m} = \frac{50.0 - 17.7}{6.00} = 5.38 m/s^2$$ **5**



3. A 5.50 kg block is traveling in a circle of radius 0.850 m on a horizontal frictionless table. The block is attached to a spring which has an unstretched length of 0.500 m.

a. On the figure to the right above (side view), draw a free-body diagram. **5**

b. Write out Newton's 2nd Law in both directions using the coordinate system in the sketch.

$x : f_{spring} = ma$ **10**

$y : \mathrm{F_n} - \mathrm{mg} = 0$

c. Find the magnitude of the force of the spring on the block if the spring force constant is 50.0N/m.

$f_{spring} = kx = (50.0)(0.350) = 17.5\ \mathrm{N}$ **5**

d. Find the magnitude of the acceleration of the block.

$f_{spring} = ma$

$a = \dfrac{17.5}{5.50} = 3.18 m/s^2$ **5**

e. Find the magnitude of the velocity of the block.

$a = \dfrac{v^2}{r}$

$v = \sqrt{ar} = \sqrt{(3.18)(0.850)} = 1.64 m/s$ **5**

f. Find the period of the block's motion.

$T = \dfrac{2\pi r}{v} = \dfrac{2\pi(0.850)}{(1.64)} = 3.25 s$ **5**