Physics 17 Practice Problems Parts E

1. A block being pulled to the right across a tabletop by a 50-N force also experiences a 12 N frictional force to the left. What total work will have been done by these two forces after the object has moved seven meters?

2. A machine is lowering a 5000-N object at constant speed from the top of a 30-m building to the ground. By the time the object reaches the ground, how much work will it have done?

3. A 200-N force acts on an object as it moves 30 meters in 5 seconds. (a) What was the power output of this force during this time, in watts? (b) In horsepower?

4. A 40-kg object has a speed of 4 m/s. What is its kinetic energy?

5. The kinetic energy of an object is 400 J. What multiple of the its initial speed would the speed have to be to make the new kinetic energy 3600 J?

6. The kinetic energy of an object is 5000 J. A force is then applied to the moving object and quadruples its speed. How much work did this force do?

7. The speed of a 3-kg object is 20 m/s. Later, the object's speed has been reduced to 4 m/s. What was the total work done on the object?

8. A 12 kg block is sliding to the right across the floor at a speed of 20 m/s. Opposing the motion is a 60 N force acting to the left. How far will the object travel before its speed decreases to 5 m/s?

9. A 20-kg object is thrown upward at an initial speed of 39.2 m/s. How much work will Earth (gravity) do on the object by the time it reaches its maximum height?

10. A 1.0-kg arrow fired upward initially has a speed of 80 m/s. Later, its speed is 30 m/s. How much work did Earth do during this time?

11. A bullet having a mass of 0.030 kg and moving at 500 m/s is about to strike a thick concrete wall. How much work can the bullet do on the wall?

Solutions

1.
50-N force:
$W = 50\ (7)$
$= 350$ J

12-N force:
$W = -(12)(7)$
$= -84$ J
Total Work = 350 - 84
$= 266$ J

2. Machine pulls up with F = 5000 N to counter -5000 N Earth's pull down.

$x = -30$ m
$W = Fx$
$= 5000(-30)$
$= -150{,}000$ J

3. $W = (200)(30)$
$= 6000$ J
(a) $P = W/t$
$= 6000/5$
$= 1200$ W
(b) $1200/746 = 1.61$ hp

4. $\frac{1}{2}\ (40)4^2 = 320$ J

5. $K_2 = \frac{1}{2}\ mv_2^2$
$K_1 = \frac{1}{2}\ mv_1^2$

$K_2/K_1 = v_2^2/v_1^2$
$= (v_2/v_1)^2$
also

$K_2/K_1 = 3600/400$
$= 9$

$(v_2/v_1)^2 = 9$
$v_2/v_1 = 3$

$v_2 = 3v_1$ (triple the speed)

6. Quadrupling the speed v makes v^2 sixteen times its previous value. Therefore, the new kinetic energy is 16 times its previous value of 5000 J:

$K = 16\ (5000)$
$= 80{,}000$ J

$W = K - K_o$
$= 80{,}000 - 5{,}000$
$= 75{,}000$ J

7. $W = K - K_o$
$= \frac{1}{2}\ (3)4^2 - \frac{1}{2}\ (3)20^2$
$= -576$ J

8. $W = \Delta K$
$-60x = \frac{1}{2}\ (12)(5)^2 - \frac{1}{2}\ (12)(20)^2$
$x = 37.50$ m

9. $K_o = \frac{1}{2}\ (20)\ 39.2^2$
$= 15{,}366$ J
$K = 0$
$W = K - K_o$
$= 0 - 15{,}366$
$= -15{,}366$ J

10. $K_o = \frac{1}{2}\ (1.0)80^2$
$K = \frac{1}{2}\ (1.0)30^2$
$W = K - K_o$
$= -2750$ J

11. Work done on bullet by the wall:
$W = K - K_o$
$= \frac{1}{2}\ (0.030)0^2 - \frac{1}{2}\ (0.030)500^2$
$= -3750$ J
By Newton's 3rd Law, whatever work one object does on another one, the other one does opposite work on the first one. If one work is negative, the other one is positive.

The work done on the wall by the bullet is 3750 J.