Problem Set 7 – work & power

All forces are parallel to the direction of motion unless I tell you differently.

1. A force moves a 50 kg object for 20 seconds. How much work does the force do in each case and what is the power output of the force?

(a) The object moves 30 meters and the force is 1000 N.

(b) The object moves 30 meters and the force is 1000 N, 37o up from the direction of motion?

2. A person pulls a 50-kg crate 10 meters across a surface. The person pulls with a force of 120 N.

The surface exerts a constant friction of 90 N on the crate.

(a) How much work does the person do?

(b) How much work does friction do?

(c) How much work is done on the crate?

(d) How much work does the force do against friction?

(e) If the crate starts from rest, what is the speed of the crate after the person pulls for the 10 meters?

3. A motor pulls a 200-kg object from rest to a speed of 6 m/s in 20 seconds.

(a) How much work does the motor do?

(b) What is the power output of the motor?

4. A crane lowers a 2000-kg beam at constant speed a distance of 30 meters in 60 s. **Use *g =* 10 m/s2**.

(a) What force does the crane exert on the beam? (d) How much work does gravity do?

(b) How much work does the crane do? (e) How much work is done on the beam?

(c) What is the power output of the crane? (f) How much work does the crane do against gravity?

5. A person does 1000 J of work with a power output of 50 W.

(a) How much time did the person require to do this work?

(b) What was the magnitude of the force the person exerted to do this work?

6. A person pushes a box across a surface at constant speed. The person pushes with a force of 200 N and develops a constant power of 100 W.

(a) What is the force of friction on the object?

(b) What was the speed of the box?

7. Two forces act on a 100 kg object. Force A is 300 N in the direction of motion. Force B is 500 N, 37o up from

the direction of motion. The two forces pull the object for 3 meters.

(a) How much work does force A do?

(b) How much work does force B do?

(c) How much work is done on the object?

8. A 4-kg object is moving at +10 m/s when it moves onto a rough surface. Friction stops the object after the object slides 2 meters.

(a) How much work did friction do on the object?

(b) What was the size of the friction on the object?

(c) What was the acceleration of the object while the friction stopped the object?

(d) Where did the original kinetic energy of the object go?

ANSWERS

1. (a) 30,000 J & 1500 W 3. (a) 3600 J 5. (a) 20 seconds 7. (a) 900 J

(b) 24,000 J & 1200 W (b) 180 W (b) ? (b) 1200 J

(c) +2100 J

2. (a) 1200 J 4. (a) 20,000 upward 6. (a) 200 N

(b) 900 J (b) 600,000 J (b) 0.5 m/s 8. (a) 200 J

(c) +300 J (c) 10,000 W (b) 100 N

(d) 900 J (d) 600,000 J (c) -25 m/s2

(e) 3.5 m/s (e) 0 J (d)

(f) 600,000 J