

Name _____

Work and Power

1. Agatha lifts her toys into a tree house in a homemade elevator the mass of which is 2.5 kg. The tree house is 8.0 meters above the ground. How much work does she do when she lifts 5.0 kg of toys into the house? When she lifts 20.0 kg?
2. Suppose Agatha raises the 5.0 kg load in 5 sec. How much power did she use doing this work? How much power was needed to raise the 20.0 kg mass in 12.0 sec?
3. A student's job requires that she carry 25 kg masses up three flights of stairs that are each 5.0 meters high. Timing herself one day, she finds that she can climb the stairs in 12.4 sec at 9 am, 15.8 sec at noon, and 24.3 sec at 5 pm. How much work does she do in each case? How much power does she produce in each case?
4. In a record breaking lift, a weight lifter presses 222.2 kg. In doing so, he raised the weights 2.2 meters from the floor to a position above his head. How much work did he perform in this event?
5. During a major downtown fire, the Bellmore Fire Department pumped 400,000 liters of water to the 27th floor of a building 96 meters above the street. How much work was done in the process? (1 liter of water = 1 kg mass).
6. A crane lifts a marble block with a mass of 500 kg to a height of 50 meters in 2.5 minutes. What is the power output of the crane?
7. A pile driver drops a mass of 1,250 kg from a height of 12.8 meters each time it falls on a steel column. The resistance offered against this force by the ground is 2.5×10^5 N. How far is the column driven into the ground each time?
8. A 3.0 hp motor is used to raise iron ore from a mine. In each trip, a bucket of ore whose total mass is 150 kg is raised a distance of 10 meters. How long does it take to raise the bucket?
9. Tom and Jerry are using a pulley system to lift their new 420 kg piano to the third floor of their house, 28.4 meters above the ground. Each of them is able to develop a sustained power of .25 hp. How long will the job take? (1 hp = 746 watts)
10. The power output of a new truck is being tested. The truck manages exert a steady pull of 15,522 N as it travels at a speed of 14 km/hr. How much power is the truck developing?

Forms of Energy – K.E., P_g.E., P_s.E

11. Find the kinetic energy of a 2 kg mass traveling at a speed 4 m/s?
12. If the kinetic energy of an object is 25 joules when its speed is 5 m/s. What is the mass of the object?
13. As an object is thrown vertically upward describe what happens to its kinetic energy. Why?
14. How much gravitational potential energy does a 10 kg box have 4 meters above the earth's surface?
15. A 70 kg student has 2,100 J of potential energy. How high above the earth's surface is she located?
16. When a spring is stretched .20 meters from its equilibrium position, it possesses a potential energy of 10 joules. What is the spring constant?
17. A 20 N weight is attached to a spring which stretches a distance of .5 meters. Determine the spring constant of this spring?
18. A toy spring is compressed a distance of .02 meters. If the spring constant of the spring is 340 N/m, how much energy is being stored in the spring?
19. A spring has a spring constant of 120 N/m. How much work was needed to stretch the spring a distance of .2 meters?

Conservation of Energy

20. An object has 100 J of gravitational energy while sitting atop of a table (relative to the floor). If a student knocks the object off the table how much kinetic energy does the object have right before it hits the floor?
21. If the object mentioned above has a mass of 2 kg, what is its speed right before it hits the ground?
22. A 250 kg roller coaster goes over the first hill 30 meters high. How fast is it moving at the bottom of this hill (neglect friction)?
23. In the problem above how fast would the roller coaster be moving if it was pushed with a 5 N force for .25 meters at the top of the hill?
24. A 20 kg cart is moving at 10 m/s rolls up an incline. Neglecting friction, how high up the incline is the cart going to rise?
25. A 10 kg wood crate is slide across a wood floor with an initial velocity of 2 m/s. How far along the floor is the crate going to travel?
26. A 5 kg mass, starting 3 meters vertically above the ground, slides down an incline and compresses a spring a distance of .2 meters. Determine the spring constant of the spring.
27. A 2 kg mass, starting 5 meters vertically above the ground, slides down a frictionless incline. It hits a spring with a spring constant 2,000 N/m. Determine the maximum compression of the spring?