Conservation of Energy

And Simple Machines

Name_____

Concept:

1) What does conservation of energy mean?

2) Give the equations for five types of work that you know?

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3) Is work and energy a scalar or a vector?

Exercises: (show all work including equation, substitution and answers with units)

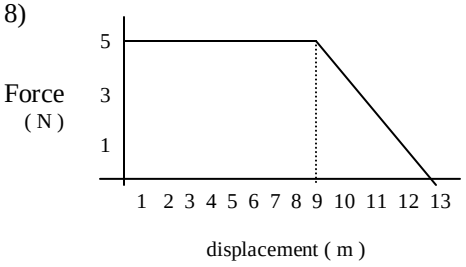
4) h = 10m, m = 5 kg, find the work.

5) v = 15 m/s, m = 20 kg, find the work.

6) F = 23 N, Δs = 3.2 m, find the work.

7) k = 3500 kg/s^2, x = .4 m, find the work.

8) Find the work.



Problems: (show all work including equation, substitution and answers with units)

Springs…..

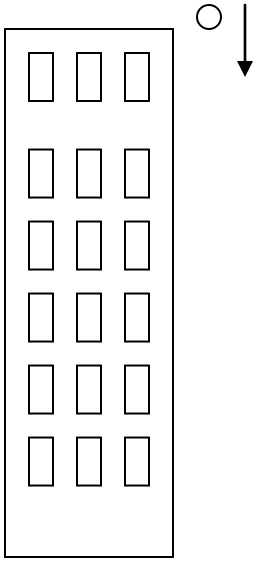
9) If a spring with a spring constant of 2400 kg/s^2 is pulled .2 meters, what is its maximum speed?

10) If a force of 35 N is applied to a spring and it is displaced 2 m, how much energy can be stored in the spring? What is its spring constant? What will the displacement of the spring be when it reaches its maximum speed and what is the maximum speed the spring will have?

Pendulums…..

11) A pendulum (m = 7 kg) is raised to a height of 2.5 meters above its lowest point. What is the potential energy due to gravity at that height? What is its total energy? What is the kinetic energy at the top? What is the kinetic energy of the pendulum at the bottom when released? When does the maximum speed occur? When does the minimum speed occur? What is the maximum speed of the pendulum?

12) Find all values. (mass = 50 kg)



height	total energy	PE_g	KE	velocity
200 m				
150 m				
100m				
50 m				
0 m				

13) A roller coaster starts from a height of 47 m. and ends at a height of 2.0 m. What is the speed of the rider's at the bottom of their ride?

14) You throw a ball (mass = .247 kg) straight up into the air. If the ball goes to a height of 38.0 meters. How much Potential Energy does the ball have at it's maximum height. How much Kinetic Energy did you use in throwing the ball and what velocity was the ball going as you caught it?

15) Your parents have asked you to move a 1000 Newton rock. If you can get a rod to fit .1 meters under the rock, how long must the rod be in order for you to lift it if you apply a 100 Newtons of force? (type one lever)

16) How much dirt can you lift in Newtons in a wheelbarrow if you can lift 200 Newtons without a wheelbarrow. This is a type 2 lever. Assume the center of mass of the dirt is .25 meters from the ground and the handles are 1.5 meters from the ground.

17) Your arm is a very inefficient lever (type 3). If you can lift a barbell that has a weight of 100 N with one arm, how much force does your bicep have to apply to do the job. Your bicep is attached to your arm about 8 cm from your elbow (the fulcrum). Use a meter stick to measure from your elbow to the center of your fist. This is the distance to the 100 N force.

18) A pen is a type one lever. Your middle finger acts as the fulcrum while your thumb and index finger apply a force to the pen. If the force applied to the pen by these two fingers is 5 Newtons and they are .01 meters from the fulcrum. What force is applied to the paper by the pen, which is .02 meters from the fulcrum?

19) You climb a flight of stairs that are 6 meters long. If the height of the story of the building is 3 meters and you weigh 750 N, how much force did you apply to walk up the flight of steps? (assume there is no friction, $Work_{input} = Work_{output}$)

20) If in the problem above it actually took you 500 N worth of force to climb the stairs, what is your efficiency?

21) Clyde, a stubborn 3000 Newton bull, refuses to walk into the barn, so the rancher must drag him up a 5 meter ramp to his stall, which stands .5 meters above the ground. a) What is the theoretical mechanical advantage? b) If the farmer needs a 450 Newton force on the mule to drag him up the ramp with a constant speed, what is the actual mechanical advantage of the ramp? c) What is the efficiency of the ramp?

22) You are moving to a new home and have to move a 2200 Newton china cabinet up a 6 meter long ramp to the moving van. The height of the moving van is 1 meter. a) What is the theoretical mechanical advantage? b) If you need a 500 Newton force on the cabinet to drag it up the ramp with a constant speed, what is the actual mechanical advantage of the ramp? c) What is the efficiency of the ramp?

23) Mary, a 460 Newton actress playing Peter Pan, is hoisted above the stage in order to "fly" by a stagehand pulling with a force of 60 Newtons on a rope wrapped around a pulley system. What is the actual mechanical advantage of the system? If the pulleys are relatively frictionless, what is the maximum number of pulleys being used in the system?

24) You are hoisting the engine out of your car. If the engine weighs 1350 Newtons and your hoist has a pulley system with 6 pulleys supporting the load, what is the minimum force that you must apply? (assume the pulleys are frictionless) If you have to raise the engine 1.5 meters how much rope will you have to pull?