Work, Energy & Power – Review

Name: _____ Date: _____

1. Define the following terms: Matter, Energy, Work, Potential Energy, Kinetic Energy, Efficiency, Heat Energy

Work

1. Write the equation for the Work done by a force pushing or pulling an object.
2. Jon pushes his snowboard across the snow with a force of 30 N for a distance of 25 m, calculate the amount of work that Jon does on the snowboard.
3. Matt does 400 J of work on his school bag while dragging it through a distance of 15m, calculate the force that Matt applied to the bag.
4. A 3 kg block is Matt from the ground to a shelf 1.5 m above the ground. Calculate the work done to lift the book in this case.

Kinetic & Potential Energy

1. Write the equation for kinetic energy (including the rearranged forms) and gravitational potential energy.
2. Rebecca is driving a 2000 kg car at a speed of 45 m/s. Calculate the amount of kinetic energy of the car.
3. Tyler is riding a snowmobile that has a mass of 200 kg. His kinetic energy is 40,000 J. Calculate the speed that Tyler is driving (convert it to km/h).
4. Cori is riding her bike at a speed of 10 m/s and has a kinetic energy of 3500 J. Calculate the mass of the bike and Cori. If the bike has a mass of 8 kg, calculate Cori's mass.
5. A book with a mass of 0.98 kg is resting on a desk that is 1.2 m above the ground. Calculate the potential energy of the book
   a) With respect to the top of the desk.
   b) With respect to the floor.
6. A cat with a mass of 11 kg is sitting in a tree. The gravitational potential energy of the cat is 1040 J. Calculate how high the cat is in the tree.

Work & Power (related to kinetic and potential energy)

1. Write the equation for power.
2. Calculate the amount work is done by the engine of a 9000 kg truck if it accelerates from 5 m/s to 18 m/s? If the engine performs this acceleration in 8 seconds, calculate the power that the engine delivers.

3. Calculate the work done by a person by lifting a 7 kg bowling ball from the rack 0.45 m above the ground above their head 2.6 m above the ground. If the person does this work in 3 seconds, calculate the amount of power.
4. What factors and how can you change in the power equation so that you get a high amount of power?

Conservation of Energy

1. State the law of conservation of energy.
2. A roller coaster cart with a mass of 300 kg is at rest at the top of a tall 30 m hill. The cart then begins to fall down the first hill.
   a) Calculate the potential and kinetic energy at the top of the hill before it begins to fall. Also, calculate the total energy at this point. What happens to the total energy during the ride?
   b) Calculate the potential and kinetic energy of the cart after it has fallen 10 m down the hill (i.e. it is now 20 m above the ground). Also, calculate the speed of the cart at this point.
   c) Calculate the speed of the cart at the bottom of the hill.
3. A skateboarder with a mass of 90 kg is skating towards a ramp at 5 m/s. The skater begins to move up the ramp
   a) Calculate the speed of the skater when he is 0.5 m (vertical height) up the ramp.
   b) Calculate the maximum height up the ramp that the skater will reach.
4. An ancient warrior is using a bow and arrow attack system to fight is enemies. The warrior pulls back his bow storing up 70 J of spring potential energy. Calculate the speed of the 0.2 kg arrow that he releases (note: the energy transfer is 100% efficient). What would happen to the speed of the arrow if the transfer was not 100% efficient?

Thermal Energy

1. The initial temperature of a 1.2 kg bar of gold is 22°C. If 350 J of energy is supplied to the bar of gold calculate the final temperature. ($c_{gold} = 1.3 \times 10^2$ J/kg°C)
2. Calculate the mass of water that when heated with 2000 KJ of energy causes its temperature to rise from 20°C to 75°C.
3. 0.68 kg of unknown metal that was found inside of an extraterrestrial meteorite is heated with 9000 KJ of energy. Scientists measure a temperature change of 8°C. Calculate the specific heat capacity of this metal. Compare this value to the value of the specific heat capacity of water (i.e. which has a greater thermal inertia and by how much?).
4. A piece of metal with a mass of 15.3 grams has a temperature of 50.0 °C. When the metal is placed in 80.2 grams of water at 21.0 °C, the temperature rises by 4.3 °C. What is the specific heat capacity of the metal?
5. A piece of copper has a temperature of 73.6 °C. When the metal is placed in 96.2 grams of water at 17.1 °C, the temperature rises by 5.1 °C. What is the mass of the metal?