Physics 1 Unit 4 – Work and Energy Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

IB 2.3 Work, Energy and Power – Conservation of Energy

**Conservation of Energy: (use energy methods)**

1. A 35 kg girl is bouncing on a trampoline. During a certain interval after she leaves the surface of the trampoline her kinetic energy decreases to 210 J from 440 J. How high does she rise during this interval?
2. This same 35 kg girl can bounce to a height of 2.1 m when the trampoline is depressed by 6.5 cm. What is the effective spring constant for the trampoline?
3. A slingshot fires a pebble from the top of a building at a speed of 14.0 m/s. The building is 31.0 m tall. Ignoring air resistance, find the speed with which the pebble strikes the ground when the pebble is fired a) horizontally, b) vertically straight up, and c) vertically straight down.
4. A wrecking ball swings at the end of a 12.0 m cable on a vertical circular arc. The crane operator manages to give the ball a speed of 5.00 m/s as the ball passes through the lowest point of its swing, and then give s the ball no further assistance. Friction and air resistance are negligible. What speed doe sht ball have when the cable makes an angle of 20.0° with respect to the vertical?
5. A 375 g mass is held down on vertical spring that is compressed 2.35 cm from its equilibrium position. When the mass is released and launched vertically above the spring, it rises to a height of 1.14 m. a) What is the speed of the mass when it leaves the spring? b) What is the spring constant of the spring?
6. A 47.0 g golf ball is driven from the tee with an initial speed of 52.0 m/s and rises to a height of 24.6 m. a) neglect air resistance and determine the kinetic energy of the ball at its highest point? b) What is its speed when it is 8.0 m below its highest point?
7. A surfer starts at the top of a wave with a speed of 1.4 m/s and moves down the wave until her speed increases to 9.5 m/s. The drop in her vertical height is 2.7 m. If her mass is 59 kg, how much work is done by the nonconservative force of the wave?
8. A student, starting from rest, slides doenw a water slide. On the way down a kinetic frictional force acts on her. The student has a mass of 83.0 kg and the height of the water slide is 11.8 m. If the kinetic frictional force does -6.50 kJ of work, how fast is the student going at the bottom of the slide?

**Power and Efficiency:**

1. An 810 kg helicopter, starting from rest, accelerates straight up from the roof of a hospital from rest to a speed of 7.0 m/s in 3.5 seconds. The lift force does work in raising the helicopter. During this time, it climbs to a height of 8.2 m. What is the average power generated by the lift force?
2. A student pulls a 5.3 kg object along a horizontal surface at a constant speed of 2.1 m/s by a 15 N force   
   acting 30° above the horizontal. Find the power dissipated by the student.
3. What is the efficiency of a rope and pulley system if a painter uses 1.93 kJ of mechanical energy to pull on the rope and lift a 20.0 kg paint barrel at constant speed to a height of 7.5 m above the ground?

