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 gives the ball no further assistance. Friction and air resistance are negligible. What speed does the 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 down 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?

