***SPH3U****-Work & Energy* **Problems: Conservation of Mechanical Energy** Date:\_\_\_\_\_\_\_\_

*The Earth's gravitational field strength is g=9.80 N/kg. Assume air resistance can be ignored for all of the following problems.*

1. A rock of mass 6.5 kg is thrown down from a cliff 120 m high with an initial speed of 18 m/s.

Calculate:

a) The kinetic energy of the rock at the top of the cliff.

b) The potential energy of the rock, relative to the base of the cliff , when it is at the top of

the cliff.

c) The total mechanical energy at the top of the cliff.

d) The kinetic energy of the rock at a height of 60.0 m above the base.

e) The speed of the rock at a height of 60 m.

f) The speed of the rock just before it hits the ground.

2. A high school student shoots a 0.040 kg arrow straight up in the air at 30.0 m/s during

archery class in the school gym.

a) Assuming no air resistance, what is the maximum height that the arrow could reach?

b) What is the kinetic energy of the arrow when it strikes the ceiling at a height of 15.0 m?

c) How fast is the arrow going when it strikes the ceiling?

3. A ball of mass 240 g is moving through the air at 20.0 m/s with a gravitational potential

energy of 70.0 J relative to the ground. With what speed will the ball hit the ground?

4. A roller coaster with a mass of 1.00 x 103 kg moves along a frictionless track. The total

mechanical energy possessed by the roller coaster is 1.08 x 10 5 J. Assume gravitational

potential energy is measured relative to the lowest point of the roller coaster track.

a) What is the kinetic energy of the coaster when the gravitational potential energy is

1.96 x 104 J ?

b) What is the speed at that moment?

5. A pendulum bob of mass 5.50 kg is raised vertically by 6.25 m above its rest position and

released.

a) Find the maximum speed of the pendulum.

b) With the aid of a diagram, explain where in the pendulum cycle the maximum speed

will occur.

*Answers:*

*1. a)1.1 x 10 3 J 2. a) 46 m 3. 31 m/s 4. a) 8.84 x 104 J 5. a) 11.1 m/s*

*b)7.6 x 10 3 J b) 12 J b) 13.3 m/s*

*c)8.7 x 10 3 J c) 25 m/s*

*d)4.9 x 103 J*

*e) 39 m/s*

*f) 52 m/s*

*SPH3U* **Additional Conservation of Energy Problems** Date:\_\_\_\_\_\_\_\_\_\_

1. A ball is thrown down from the top of a building 12.0 m high, with an initial speed of

3.5 m/s. Find the speed of the ball just before it reaches the ground below.

2. A girl climbs to the top of a 2.3 m high superslide. After sitting at the top for a moment,

she begins to slide down starting from rest. Assuming the slide is frictionless, what will

her speed at the bottom be?

3. a) A physics student and her younger brother are playing at the park on the swings.

Holding the swing, the student climbs up the nearby jungle gym to a height of 1.5 m

above the lowest point of the swing so she can start swinging from rest. What is her

maximum speed as she swings through the lowest point of the swing?

b) How would the speed of her brother (half her mass) compare if he tries the same trick?

Answers: 1. 16 m/s 2. 6.7 m/s 3.a) 5.4 m/s