**Practice Questions**

1. A toy rocket of mass 100g is launched straight up in the air using a compressed spring. The compressed spring has an initial elastic potential energy of 10J.
   1. Before the launch, with the rocket at rest, what is the total mechanical energy (Em) of the system? (Provide values for Ee, Ek,Eg, and Em)
   2. What is the velocity of the rocket just after launch? (Provide values for Ee, Ek,Eg, and Em)
   3. What is the maximum height that the rocket will reach? (Provide values for Ee, Ek,Eg, and Em)
2. A roller coaster designer wants the speed of the cars to be 80 km/h at the bottom of the first drop. How high must he make the top of first drop?
3. The roller coaster designer finds it more cost effective to build the first drop 30 m tall and slow the cars down to 80 Km/h using a spring at the bottom. Assume that the mass of a car is 800kg.
   1. How much work must be done by the spring to slow the cars down?
   2. How much energy will be stored in the spring?
   3. How does this demonstrate the conservation of energy in an isolated system?

**Lab Prep**

Refer to the figure on the right for all questions. The figure represents a   
pendulum bob (mass) swinging on a string attached to a fixed point.

1. If the pendulum is released from rest at point 1 at a height "h":
   1. What is its maximum height at point 3?   
      (*explain using conservation of energy*)
   2. What is its velocity at point 3?   
      (*explain using conservation of energy*)
2. If a pendulum of mass 200g has a velocity of 2 m/s at point 2:
   1. What is its kinetic energy at point 2?
   2. What is its total energy at point 2?
   3. What is its maximum height at point 3? (explain using conservation of energy)
   4. What was its release height at point 1? (explain using conservation of energy)
3. If a pendulum of mass 200g is released from point 1 at a height of 20 cm and with an initial velocity of 1.0 m/s [swinging down]:
   1. What is its total energy at point 1?
   2. What is its velocity at point 2?
   3. What is its maximum height at point 3?

**Answers:**

1a) 10J, 1b) 14.1 m/s, 1c) 10m, 2) 25 m, 3a) 3.8x104J, 3b) 3.8x104J

1a) Same "h" as point 1, 1b) 0 m/s, 2a) 0.4 J, 2b) 0.4 J, 2c) 0.2 m, 2d) 0.2 m,

3a) 0.14 J, 3b) 1.18 m/s, 3c) 71 cm