Name: _____

Class Period: _____

**AP Physics 1: Simple Harmonic Motion**
**Simple Pendulum**

**Multiple Choice:**

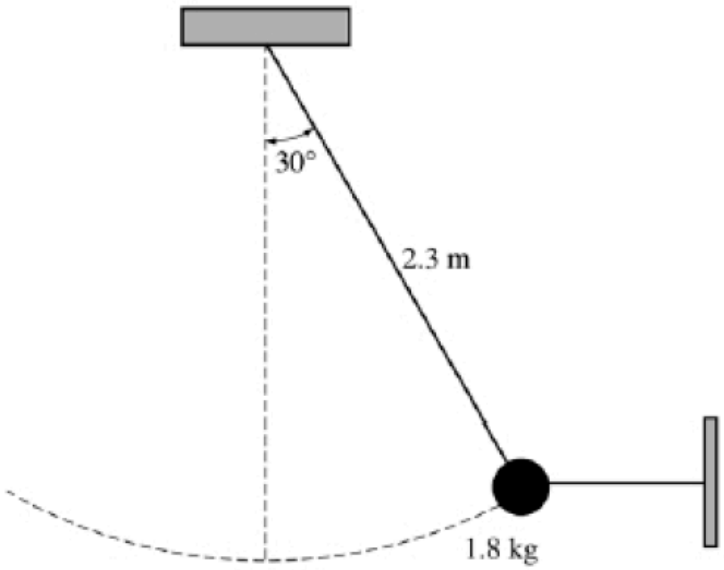
1. A simple pendulum and a mass hanging on a spring both have a period of 1 s when set into small oscillatory motion on Earth. They are taken to Planet X, which has the same diameter as Earth but twice the mass. Which of the following statements is true about the periods of the two objects on Planet X compared to their periods on Earth?
   A. Both are shorter.
   B. Both are the same.
   C. Both are longer.
   D. The period of the mass on the spring is shorter; that of the pendulum is the same.
   E. The period of the pendulum is shorter; that of the mass on the spring is the same.

2. A pendulum with a period of 1 s on Earth, where the acceleration due to gravity is g, is taken to another planet, where its period is 2 s. The acceleration due to gravity on the other planet is most nearly
   A. g/4
   B. g/2
   C. g
   D. 2g
   E. 4g

3. A mass M suspended on a string of length L has a period T when set into oscillatory motion on Earth. Its period on Mars, whose mass is 1/9 and radius ½ that of Earth, is most nearly….
   **This one is a little tricky – consider looking back at Newton's Law of Universal Gravitation to see how the acceleration of gravity might be affected. See section 5.7*
   A. T/3
   B. 2T/3
   C. T
   D. 3T/2
   E. 3T

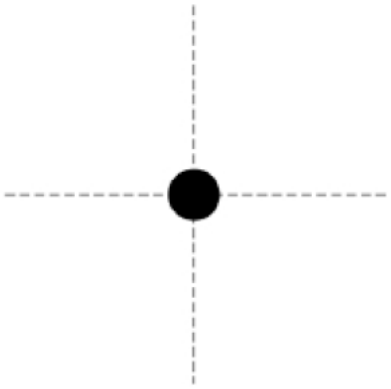
**Free Response:**

4. Show that the formula for the maximum speed of a pendulum can be expressed as $v_{max} = \sqrt{2gL(1 - cos\theta)}$
   Show all substitutions and manipulations.




5. A pendulum (created with a 2.30 m string) has a 1.80 kg mass attached to the end. The mass is held at an angle of 30.0° by a horizontal string connected to a wall as shown.

   A. On the figure below, draw a free-body diagram showing and labeling the forces on the bob in the position shown above.



   B. Calculate the tension in the horizontal string.
   C. The horizontal string is now cut close to the bob, and the pendulum swings down. Calculate the speed of the bob at its lowest position. (*Consider what you've learned back in question #4)*
   D. How long will it take the bob to reach the lowest position for the first time?