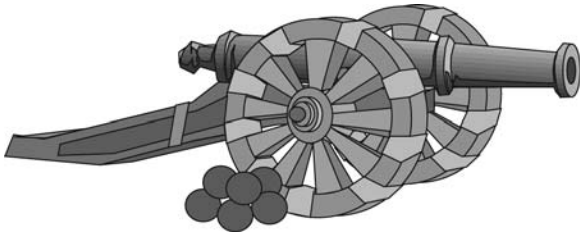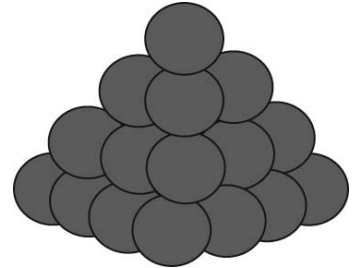Name: _____ Date: _____

What Was Kepler's Guess?

In 1611, Sir Walter Raleigh asked his assistant, Thomas Harriot, to give him a simple mathematical formula for calculating the number of cannonballs he had in the piles on the deck of his ship.

Harriot gave Raleigh his formula, but realized that he did not know whether the cannonballs were being stacked in the most efficient fashion. He passed the problem on to German mathematician Johannes Kepler, who made a theory about the best arrangement. It was not until 1998 that an American mathematician named Thomas Hales proved mathematically that Kepler's theory was correct.

What was Kepler's theory?

Materials
• six identical circular objects
• compass
• ruler

1. **a)** Arrange sets of 3, 4, 5, and 6 identical circular objects in one layer so that they are as densely packed as possible. Sketch each arrangement.
   b) Describe the arrangement you think is the densest. Show mathematically why you think this arrangement is the densest.

2. Based on your results, what arrangement of spheres would you use to fill the bottom of a rectangular box? Illustrate your arrangement. Explain.

3. What arrangement of spheres would you use to pack the entire box? Why did you arrange the spheres this way? Would you arrange spheres differently in a cylindrical bin? Explain.

4. What do you think Kepler's theory was?