When the solar system was young, planets were built as huge numbers of smaller bodies like asteroids collided with each other. Over millions of years of collisions, planets like Earth grew to their present sizes.

To see how this happened, we will model the process using a ball of clay!

Problem 1 - Take one-half pound of clay and form it into a round ball. Slice this round ball exactly in half and measure its diameter using a millimeter ruler.

Problem 2 – Take the two halves of the clay ball and re-form them into a round ball again. Now divide this ball into ten equal pieces of clay and roll each of these into round balls of about equal sizes. Slice one of these balls in half and measure its diameter.

Problem 3 – On a piece of graph paper, mark the horizontal axis with the number of small balls used from one to ten and the vertical axis with the diameter of the finished ball from 1 centimeter to 20 centimeters. Plot the diameter of one of these small balls on the graph.

Problem 4 – Take two of the small balls and roll them together into a single ball. Cut this new ball in half and measure its diameter. Mark the finished ball on the graph by its size in centimeters and the number of small balls '2'. Continue this process until you have collected all ten balls into one large ball and plot the diameter of the large ball and the number of small balls used '10'.

Problem 5 – Connect the ten points on the graph. What do you notice about the curve you plotted?

Problem 6 – If the large ball represented the final size of our Earth with a diameter of 12,000 kilometers, on this scale of the clay balls, how big would each of the ten 'planetessimals' have been that collided to form the final planet?

Problem 7 – Suppose you started with 100 equal-sized small clay balls. Would you get the same kind of plotted curve?

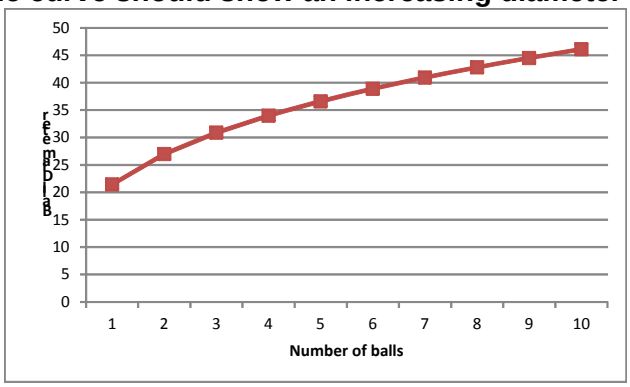
Problem 1 - Take one-half pound of clay and form it into a round ball. Slice this round ball exactly in half and measure its diameter using a millimeter ruler. **Answer will depend on how the students make the ball and how much clay is used.**

Problem 2 – Take the two halves of the clay ball and re-form them into a round ball again. Now divide this ball into ten equal pieces of clay and roll each of these into round balls of about equal sizes. Slice one of these balls in half and measure its diameter. **Answer will depend on how the students make the ball and how much clay is used.**

Problem 3 – On a piece of graph paper, mark the horizontal axis with the number of small balls used from one to ten and the vertical axis with the diameter of the finished ball from 1 centimeter to 20 centimeters. Plot the diameter of one of these small balls on the graph. **Answer will depend on how the students make the ball and how much clay is used.**

Problem 4 – Take two of the small balls and roll them together into a single ball. Cut this new ball in half and measure its diameter. Mark the finished ball on the graph by its size in centimeters and the number of small balls '2'. Continue this process until you have collected all ten balls into one large ball and plot the diameter of the large ball and the number of small balls used '10'. **Answer will depend on how the students make the ball and how much clay is used.**

Problem 5 – Connect the ten points on the graph. What do you notice about the curve you plotted? **Answer: The curve should show an increasing diameter from left to right.**



Problem 6 – If the large ball represented the final size of our Earth with a diameter of 12,000 kilometers, on this scale of the clay balls, how big would each of the ten 'planetessimals' have been that collided to form the final planet? Answer: Suppose the big balls final diameter is 45 millimeters and the small balls diameter is 20 mm. Use a simple proportion to find 12,000/45 = X/20 and so **X = 5300 km**. This is a bit larger than the diameter of our moon (3,500 km).

Problem 7 – Suppose you started with 100 equal-sized small clay balls. Would you get the same kind of plotted curve? **Answer: The curve would look the same but the scale on the horizontal axis would be changed. Each of the small balls would have a diameter of about 10 mm and represent a planetessimal with a diameter of about 12000/45 = X/10 so X = 2700 kilometers or slightly smaller than the diameter of our moon!**