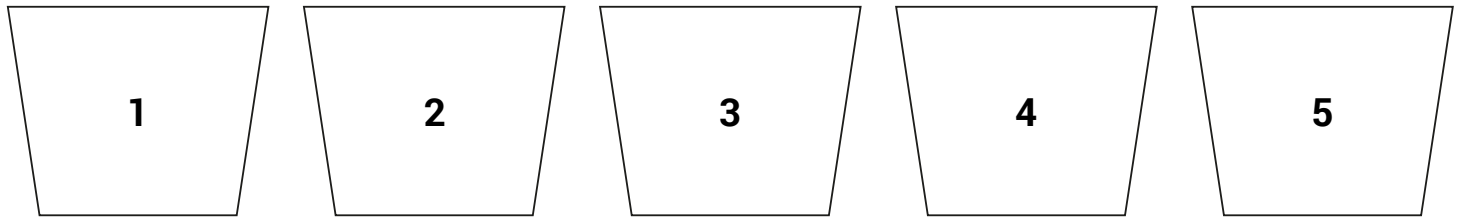


How Much is One Part in a Billion?

Procedures:

Label the 5 cups with numbers 1, 2, 3, 4, and 5 as shown below.

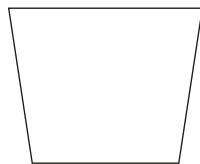


Working with Cup 1

- Using the eyedropper, place 99 drops of water in the graduated cylinder. Read the volume of the amount of water and record the volume below. Remember to read volume at the bottom of the meniscus (curve of the water). (See the image to the right.)

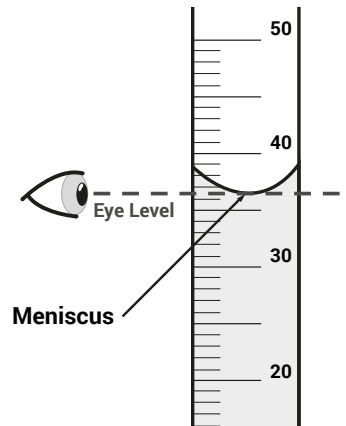
The volume of 99 drops of water is ____ mL.

- Pour the 99 drops of water into cup 1.
- Add one drop of food coloring dye to cup 1. Stir.
- Draw a particle representation of cup 1 below. This represents one part per hundred or 1/100.



Cup 1

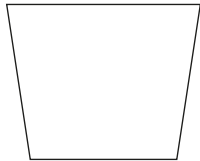
1 drop of dye + ____ drops of water = 1 part in 100 total parts.



How Much is One Part in a Billion? (continued)

Working with Cup 2

- Measure another 99 drops of water by pouring it to the same mark on the graduated cylinder as you did for cup 1.
- Transfer this water into cup 2.
- Take one drop of water from cup 1 and add it to cup 2. Stir.
- Draw a particle representation of cup 2 below.
This represents one part in ten thousand ($1/10,000$ or $1/100$ divided by 100).

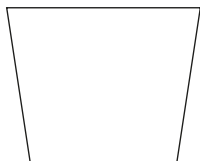


Cup 2

1 drop from cup 1 + ____ drops of water = 1 part in 10,000 total parts.

Working with Cup 3

- Measure another 99 drops of water by pouring it to the same mark on the graduated cylinder.
- Transfer this water into cup 3.
- Take one drop of water from cup 2 and add it to cup 3. Stir.
- Draw a particle representation of cup 3 below.
This represents one part in one million ($1/1,000,000$ or $1/10,000$ divided by 100).



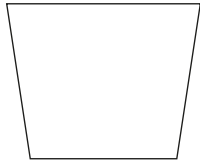
Cup 3

1 drop from cup 2 + ____ drops of water = 1 part in 1,000,000 total parts.

How Much is One Part in a Billion? (continued)

Working with Cup 4

- Measure another 99 drops of water by pouring it to the same mark on the graduated cylinder.
- Transfer this water into cup 4.
- Take one drop of water from cup 3 and add it to cup 4. Stir.
- Draw a particle representation of cup 4 below.
This represents one part in one-hundred million ($1/100,000,000$ or $1/1,000,000$ divided by 100).

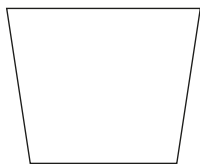


Cup 4

1 drop from cup 3 + ____ drops of water = 1 part in 100,000,000 total parts.

Use Cups 4 and 5 to Make 1 Part Per Billion

- To make one part per billion, place 9 drops of water in cup 5.
- Take one drop from cup 4 and add it to cup 5. Stir.
- Draw a particle representation of cup 5 below.
This represents one part in one billion ($1,000,000,000$ or $1/100,000,000$ divided by 10).



Cup 5

1 drop from cup 4 + ____ drops of water = 1 part in 1,000,000,000 total parts.

Compare and contrast your cup results and model representations with two other groups. Discuss with the other groups and then answer the following questions.

How Much is One Part in a Billion? (continued)

1. Our group results are similar to _____ because _____

2. Our group results are different from _____ because _____

3. What are some reasons for similarities and differences in data?
