

A Study of the Particle Theory of Matter

Chemistry is the study of the composition, properties and structure of matter; however, describing the composition of matter is not easy since the actual composition can only be inferred rather than directly observed. Suppose you take a piece of charcoal and break it up into tiny pieces and then break these tiny pieces into dust. It is still charcoal. Then take the dust and further divide it until it is no longer visible. These invisible particles are still charcoal. As early as 400 B.C., the Greek philosopher Democritus thought that matter could be broken down until it could no longer be subdivided. He called these invisible particles **atoms** (from the Greek word meaning not divisible). By observing how particles behave in water and smoke scientists developed a model to identify the composition of matter.

The Particle Theory of Matter
<ul style="list-style-type: none">☞ All matter is made up of extremely tiny particles. There are spaces between the particles.☞ Each pure substance has its own kind of particle, different from the particles of other pure substances.☞ Particles attract each other.☞ Particles are always moving.☞ Particles at a higher temperature move faster on average than particles at a lower temperature.

In this experiment you will look at various aspects of the particle model by interpreting observations of matter. For each observation you must make a hypothesis (prediction). After you record your observations, you need identify and write out the part of the particle theory that you will then use to explain your observations.

A. Hot and Cold water

1. Predict what will happen when dye is added to hot and when dye is added to cold water.
2. Measure 20 ml of ice cold water and 20 ml of hot water in separate **glass** graduated cylinders.
3. Using an eye dropper, add 2 drops of dye to each water sample. **DO NOT** mix.
4. Compare the movement of the dye in the hot and cold water.
5. Identify the postulate (part) of the particle theory that mostly applies here.
6. Use this postulate to explain your observations.

B. The Shape of Water Droplets

1. Predict the shape of the water droplets on plastic.
2. Using an eye dropper, place several small droplets of tap water of different sizes on a flat piece of clean plastic.
3. Make sketches of the top and side views to indicate the shape of some of the droplets.
4. Identify the postulate (part) of the particle theory that mostly applies here.
5. Use this postulate to explain your observations.
6. Repeat steps 1-5, but this time place several small droplets of tap water of different sizes on a piece of clean glass.
7. Repeat steps 1-5, but this time place several small droplets of tap water of different sizes on a piece of paper towel.

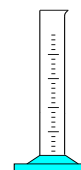


C. Interacting Droplets

1. Predict what will happen when two droplets of water on plastic touch each other.
2. Using an eye dropper, carefully place 2 small droplets of tap water close together on the piece of plastic. Keep placing droplets until 2 droplets are so close they just touch each other.
3. Explain what happens when the droplets interact.
4. Identify the postulate (part) of the particle theory that mostly applies here.
5. Use this postulate to explain why water droplets interact the way they did.
6. Repeat steps 1-5, but this time carefully place 2 droplets of tap water of nearly equal size on the piece of plastic. To one droplet add another droplet of water and to the other add a droplet of liquid soap.

D. Mixing Sand and Stones

1. Predict the final volume when 20 mL of stones are mixed with 20 mL of sand.
2. Pour 20 ml of stones in a **plastic** graduated cylinder and in another **plastic** graduated cylinder add 20 ml of sand. Carefully pour the sand into the cylinder with the stones.
3. Record the actual final volume. (Separate the stones from the sand when you are finished.)
4. Identify the postulate (part) of the particle theory that mostly applies here.
5. Use this postulate to explain the final volume resulting when sand and stones are mixed.



E. Mixing Water and Methanol

1. Predict the final volume when 5 mL of water is mixed with 5 mL of methanol.
2. Measure as accurately as possible 5 ml of tap water in a small **glass** graduated cylinder. In a second **glass** graduated cylinder measure as accurately as possible 5 ml of methanol. Carefully pour the methanol into the cylinder with the water.
3. Record the actual final volume.
4. Identify the postulate (part) of the particle theory that mostly applies here.
5. Use this postulate to explain the final volume resulting when methanol and water are mixed.

