

Viscosity Review

1. *Define the term "fluid."*

A fluid is any substance that flows. It may be a liquid or a gas.

2. *Use the particle theory to explain why liquids and gases are fluids, but solids are not.*

The particle theory says that solids are composed of particles that are tightly packed together. It also says that these particles are highly attracted to one another. As this is the case, the particles in a solid do not move relative to one another, and thus can not be poured, so they do not flow. On the other hand, the particle theory tells us that the particles in both liquids and gases are free to move around one another, and thus they are free to flow, making them fluids.

3. *Give some characteristics of liquids and solids that are the same. What are some characteristics that are different?*

Both liquids and solids have a defined volume. Their particles hold an attraction to one another that keeps them relatively close.

Solids have a defined shape and their particles can not move freely.

Liquids do not have a defined shape, and their particles can move freely.

4. *Explain how liquids and gases are similar. How are they different?*

Both liquids and gases have indefinite shape and take the shape of their container. The particles in both are also spread out such that they are free to move (which is untrue for solids, which can only vibrate). Liquids and gases can both also flow.

Gases have extremely large empty spaces between them and will move about to completely fill any container they are in, thus a gas has no definite volume.

The particles in liquids will fill the lowest point of a container because they have a defined volume. Also, the spaces between particles in a liquid are small in comparison to a gas.

5. *Describe how to measure viscosity.*

Viscosity is difficult to measure directly and thus flow rate is usually used as an indicator. This is done by allowing a fluid to travel through an opening, then the time taken for a set amount of fluid to travel is measured.

6. *Explain how to determine the flow rate of a liquid.*

Flow rate may be determined by the following equation:

$$\text{Flow Rate} = \frac{\text{volume}}{\text{time}} \rightarrow \frac{\text{ml}}{\text{s}}$$

7. *Name some industries in which measuring and controlling viscosity are important.*

Some examples are: Food processing, cosmetics, chemical and paint making, motor mechanic, petroleum.

8. *Name some jobs in which workers regulate the viscosity of substances.*

Some examples are: Cook, painter, doctor, and pharmacist.

9. *Summarize the main factors that affect the viscosity of liquids and gases.*

The main factors that affect viscosity of fluids are the size and shape of the particles and the temperature.

10. *Use the particle theory to explain how each factor affects viscosity.*

Liquids and gases that have large, bulky particles are more viscous because it is more difficult for the particles to move past each other. A rise in temperature in a liquid reduces its viscosity, because thermal energy is added, which moves the particles further apart.

11. *Explain why the effect of temperature on the viscosity of gases differs from the effect of temperature on the viscosity of liquids.*

In liquids particles are close together (relative to a gas), heat causes them to spread out, so they do not bump into each other as often. This results in less internal friction, which means a lower viscosity. In a gas, the particles are already far apart, meaning they do not bump into each other often. A rise in temperature causes the particles to bump into each other more often. This increases the internal friction and, therefore, the viscosity. When a gas is cooled, the particles lose energy and do not bump into each other as often, so the viscosity is lower.