

**Science 8**  
**Unit 2: FLUIDS**  
**Topic 3: Viscosity and Flow Rate**



Student Name: \_\_\_\_\_

**Viscosity** is a measure of a liquid's resistance to flow.

-A thick liquid has a greater viscosity than a thin liquid. The thicker liquid is more resistant to flow. Therefore, it flows more slowly than a thinner liquid.

Example:

- Molasses and syrup have high viscosity
- Water and milk and low viscosity



**Flow Rate** refers to the speed at which a fluid flows from one position to another. It is a method of measuring viscosity because fluids with a high viscosity have a low flow rate

**STUDENT ACTIVITY: THE FLOW RATE OF LIQUIDS**

Viscosity is a difficult property to measure directly. The flow rate of a liquid, however, is a good indicator of viscosity. You can determine how fast a fluid flows by measuring the amount of time it takes for a certain amount of the fluid to flow past a specific point.

Liquid	Distance (cm)	Time (s)	Flow Rate (cm/s)	Rank Flow rate	Rank Viscosity
Water					

1. Determine the flow rate (in cm/s) for each substance. Do this by dividing the distance travelled (10 cm) by the time recorded for each substance (in seconds). Record each result in your data table.
2. Rank the liquids from fastest flow rate (1) to slowest flow rate (3). Record these rankings in the fourth column of your data table ("Ranked Flow Rate"). Was your hypothesis correct?
3. Rank the viscosities in the table from lowest (1) to highest (3). Record these values in your data table under "Ranked Viscosity."

Questions:

1. How is the flow rate of a liquid related to its viscosity?
2. (A) Which liquids were more difficult to measure with the viscosity ramp?  
  
(B) What could you have done to the ramp to make it easier to measure these liquids?

## Why Is Viscosity Important to Us?

What would it be like to paint the walls of a room with paint that was too thick or thin. Paints require an appropriate degree of viscosity in order to spread properly.

Motor Oil is used as lubrication for the moving parts of an engine. The viscosity must be high enough to maintain lubricating film, but low enough that the oil can flow around the engine parts satisfactorily to keep them well coated under all conditions.

## Why are some More Liquid Viscous?

A liquid's viscosity is affected by the friction between the particles that make up the substance.

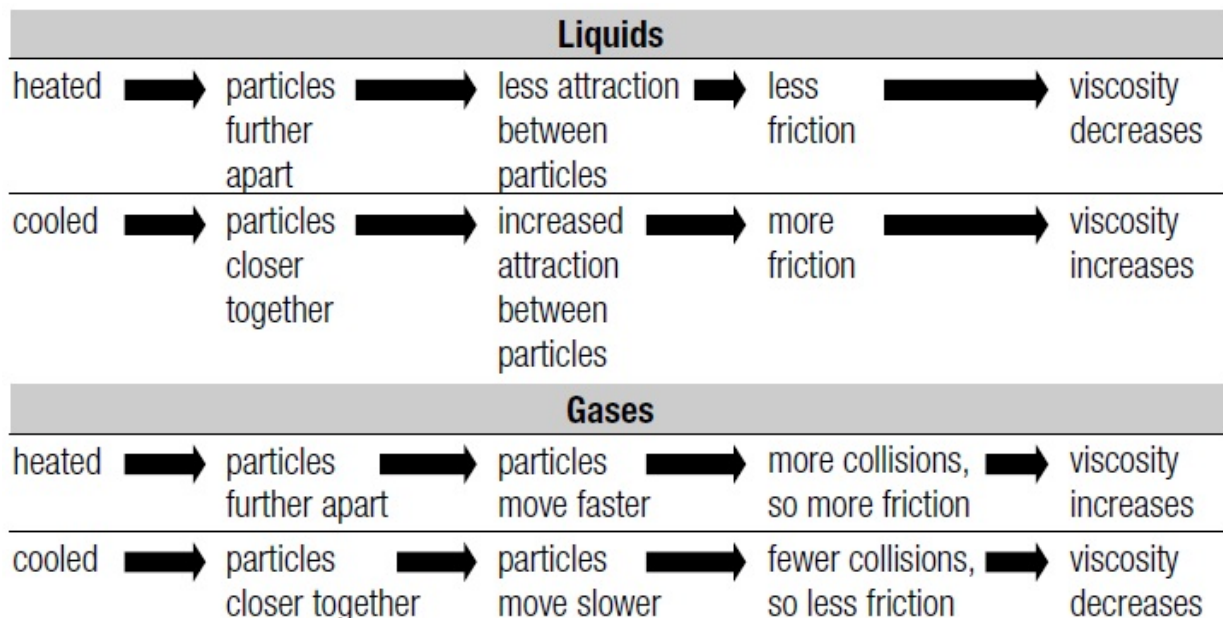
The greater the friction or rubbing of the particles in the fluid the higher the viscosity. The amount of friction between the particles can be impacted by:

- Size of particles
- Shape of Particle
- Attraction between particles

## Factors Affecting Viscosity

1. Temperature	Particles are constantly in motion. As they acquire more energy, they move faster and farther apart. As a result, the viscosity decreases because there is less friction and the attractive force between particles is reduced.)
2. ) Strength of Attraction between Particles	If the attractive forces between the particles of a liquid are strong, it is difficult for the particles to pull away from each other and slide past each other. The liquid flows slowly, and therefore has a high viscosity.
3. Concentration:	Concentration refers to the amount of substance in a given space. If a liquid is concentrated, it means that there are more particles in a given space. As a result, the viscosity increases because there is more friction and the attractive force between particles is increased.

## How do heating and cooling affect viscosity?



**PART A: MULTIPLE CHOICE.**

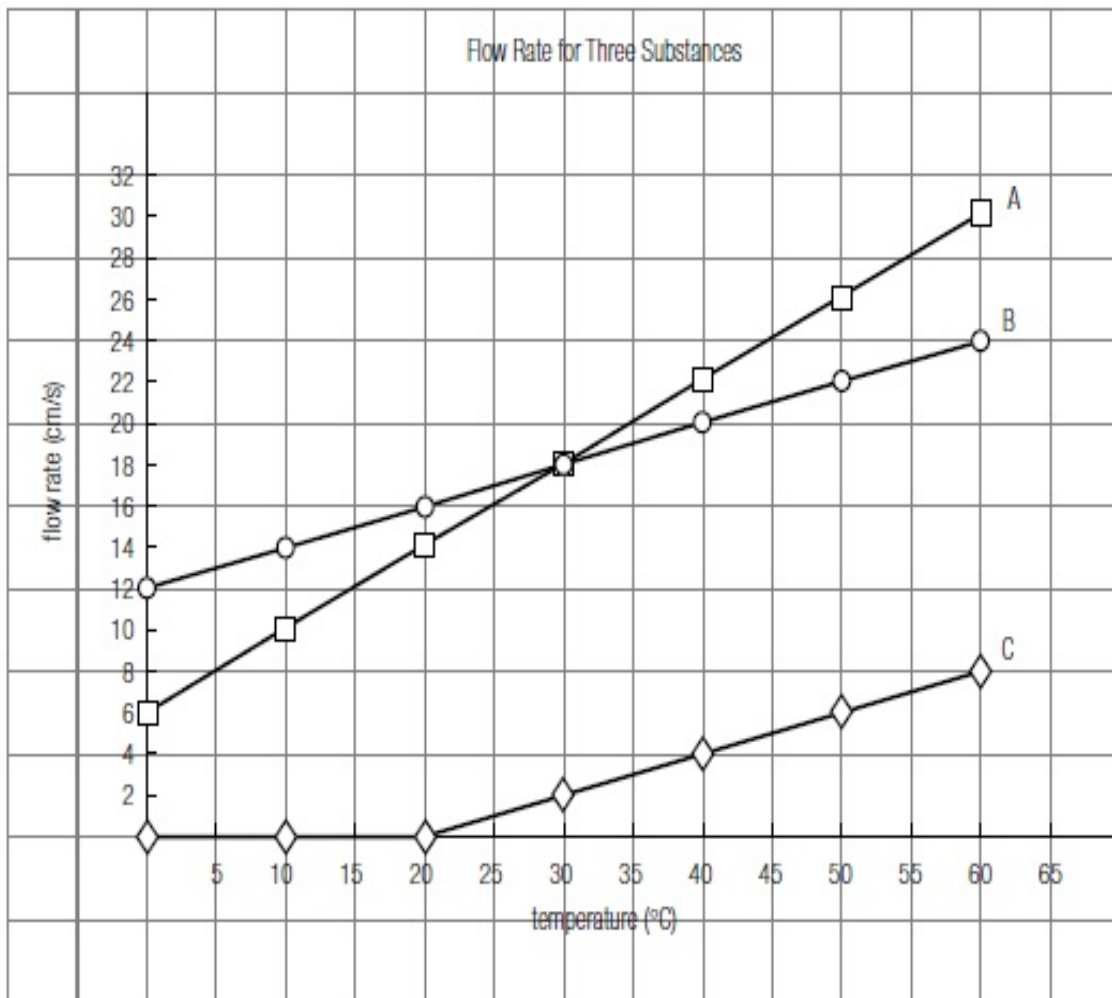
*Instruction: Circle the correct answer below each question. Also, transfer your answers to the bubble sheet provided.*

1. What measures a material's resistance to flow?
  - (A) Matter
  - (B) Volume
  - (C) Hardness
  - (D) Viscosity
  
2. The viscosity of liquids can be compared by observing their ...
  - (A) Clarity
  - (B) Volume
  - (C) Resistance to flow
  - (D) Resistance to acceleration
  
3. Which best describes a fluid with a high viscosity?
  - (A) Runs slowly and is thick
  - (B) Runs slowly and is thin
  - (C) Runs quickly and is thick
  - (D) Runs quickly and is thin
  
4. Which correctly describes the flow rate of a fluid that runs 20 cm in 10 seconds?
  - (A) 0.5 cm/s
  - (B) 2 cm/s
  - (C) 10 cm/s
  - (D) 20 cm/s
  
5. Which flow rates indicate fluids listed in order from lowest to highest viscosity?
  - (A) 2 cm/s, 5cm/s, 10 cm/s, 20 cm/s
  - (B) 5cm/s, 10 cm/s, 2 cm/s, 20 cm/s
  - (C) 10 cm/s, 5cm/s, 20 cm/s, 2 cm/s
  - (D) 20 cm/s, 10 cm/s, 5cm/s, 2 cm/s
  
6. Which best describes a fluid with a slow flow rate?
  - (A) thick, high viscosity
  - (B) thick, low viscosity
  - (C) thin, high viscosity
  - (D) thin, low viscosity
  
7. Which of the following explains how the viscosity of a fluid is related to its flow rate?
  - (A) As the viscosity of a fluid decreases, its flow rate increases
  - (B) As the viscosity of a fluid increases, its flow rate also increases
  - (C) As the viscosity of a fluid decreases, its flow rate also decreases
  - (D) As the viscosity of a fluid decreases, its flow rate stays the same
  
8. Which of the following has the greatest viscosity at room temperature?
  - (A) Water
  - (B) Milk
  - (C) Vegetable oil
  - (D) Molasses

9. Which of the following statements correctly describes the viscosity in a liquid?
- I. As a liquid is heated, the viscosity increases.
  - II. As a liquid is heated, the viscosity decreases.
  - III. As a liquid is cooled, the viscosity increases.
  - IV. As a liquid is cooled, the viscosity decreases
- (A) I and III only  
(B) I and IV only  
(C) II and III only  
(D) II and IV only
10. Which of the following statements correctly describes the viscosity in a gas?
- I. As a gas is heated, the viscosity increases.
  - II. As a gas is heated, the viscosity decreases.
  - III. As a gas is cooled, the viscosity increases.
  - IV. As a gas is cooled, the viscosity decreases
- (A) I and III only  
(B) I and IV only  
(C) II and III only  
(D) II and IV only
11. Which of the following is not a factor that affects viscosity?
- (A) The shape and size of particles.  
(B) The container the particles are held in.  
(C) The amount of attraction between particles.  
(D) The kinetic energy of the particles.
12. Which of the following statements regarding the viscosity of fluids is true?
- (A) Heating gases and liquids will increase their viscosity.  
(B) Heating a gas increases its viscosity; heating a liquid decreases its viscosity.  
(C) Heating gases and liquids will decrease their viscosity.  
(D) Heating a gas decreases its viscosity; heating a liquid increases its viscosity

**PART B: SHORT AND LONG ANSWER**

1. Data has been collected from an experiment investigating how temperature affects the viscosity of three substances.



Use the data in the graph above to answer the questions below.

1. Which substance is a solid at room temperature (about 20°C)? \_\_\_\_\_
2. At what temperature is the viscosity of substance A and substance B equal?  
\_\_\_\_\_
3. When the temperature is 20°C, which substance has the greatest flow rate?  
\_\_\_\_\_
4. When the temperature is 50°C, which substance has the greatest flow rate?  
\_\_\_\_\_
5. Suppose that substance A was at 65°C. Use your graph to predict how fast substance A would flow. \_\_\_\_\_

3. Complete the diagram below by giving a definition, listing some characteristics, and providing examples and non-examples of viscous (thick) liquids. Some examples are already given to guide you.

