

# Grade 8 Science

Fluids

Class 11

## Flow Rate

- Flow rate – a measure of how quickly fluids move; measured in volume per unit time (L/s)
- Depends on:
  - The type of fluid that is flowing
  - The force pushing on the fluid
  - The size of the pipe or opening the fluid is flowing through
  - The type of surface over which the fluid is flowing



## Checkpoint



Find the flow rate if a 1L container takes 4 seconds to fill from your kitchen tap

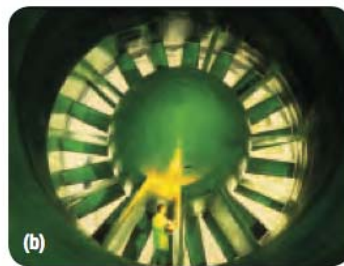
## Controlling Fluid Flow

- Fluid mechanics – study of how fluids behave when at rest and when moving
- Fluids dynamics – the study of fluids in motion
  - Aerodynamics: the study of moving gases
  - Hydrodynamics: the study of moving liquids



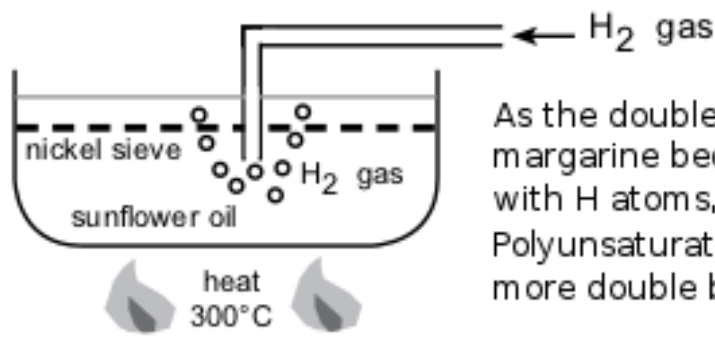
# Aeronautics

- The study of the science of flight
- Examples:
  - Wing designs to control airflow around wings
  - Parachute and paraglider designs
  - Wind tunnel used to study and control airflow around objects



## Fluid Control in the Food Industry

- Margarine and shortening made made by bubbling hydrogen gas through vegetable oil
- If hydrogen gas mixes too quickly, a substance called “trans fat” may be produced



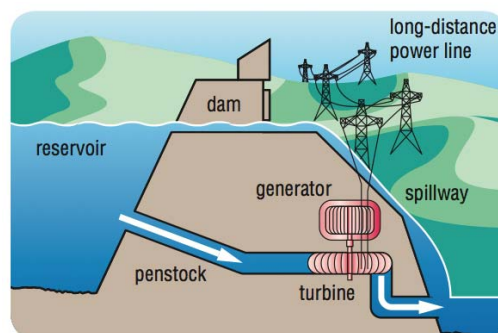
As the double bonds break the margarine becomes saturated with H atoms, and harder. Polyunsaturated margarine has more double bonds and is softer.

- Ethylene gas can help ripen fruit
- Fruits are picked and transported before they are ripe because ripened fruit is firmer and less likely to damage
- Fruit is stored in a ripening room where it is exposed to ethylene gas



## Water Dams

- Dams are used to control the flow of water and to generate electricity
- Flow of the water spins the blades of the electric turbine thereby generating electricity

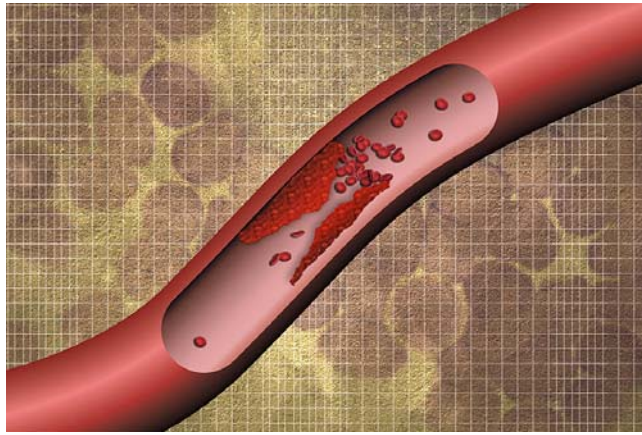


Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Does not emit air pollution</li> <li>• Does not create radioactive wastes</li> <li>• Renewable and clean energy source</li> <li>• Reliable energy</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of land due to flooding</li> <li>• Construction of dam removes wetlands, agricultural land and lands for First Nations people</li> <li>• Affects fish populations</li> </ul>

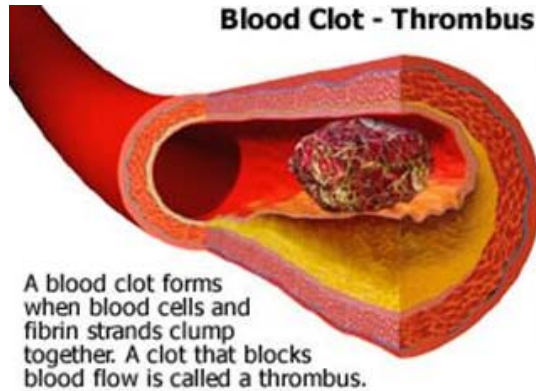


## Controlling Blood Flow

- Blood flow is one of the most important fluid movement within the body
  - Blood thinners – medicines for patients whose blood clots too easily which can lead to heart attacks and strokes
  - Hemophilia – genetic condition that causes the patient to bleed excessively; medicine needed to promote clotting
  - Artificial hearts – transplanted into people whose hearts are not strong enough to continuously pump blood



**Blood Clot - Thrombus**



A blood clot forms when blood cells and fibrin strands clump together. A clot that blocks blood flow is called a thrombus.

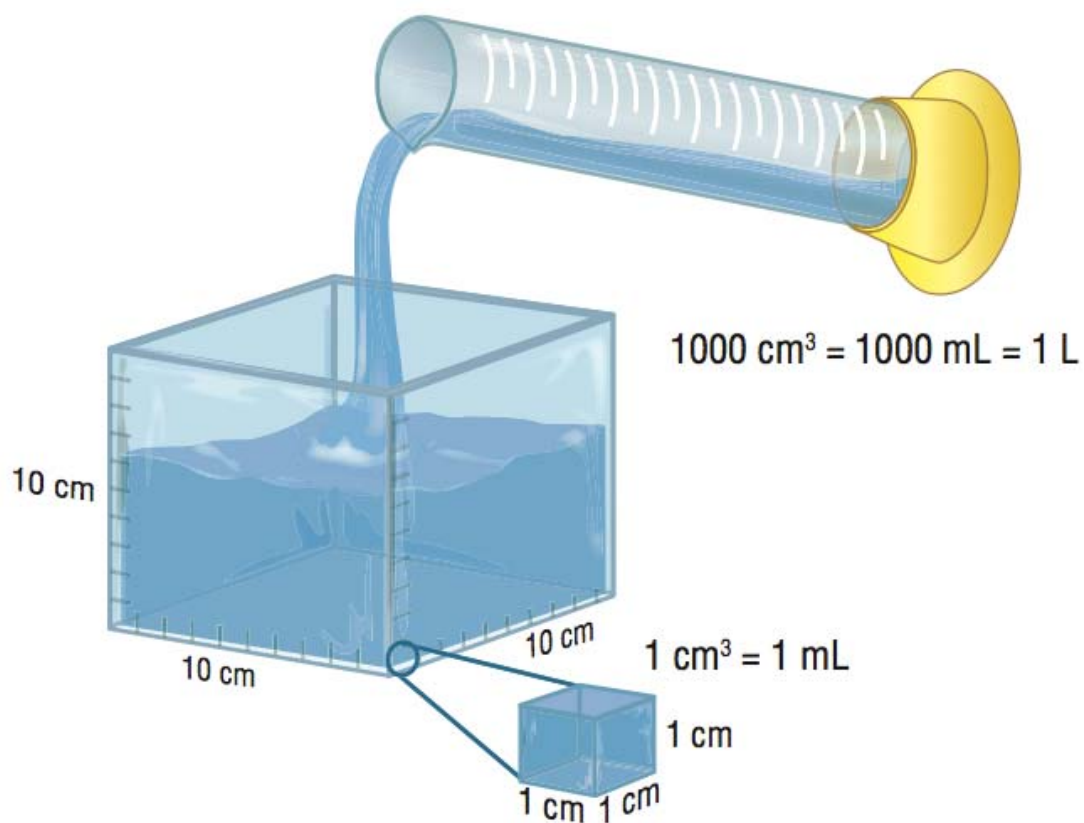
## Volume

- Volume – how much space an object occupies

$$\text{volume} = \text{length} \times \text{width} \times \text{height}$$

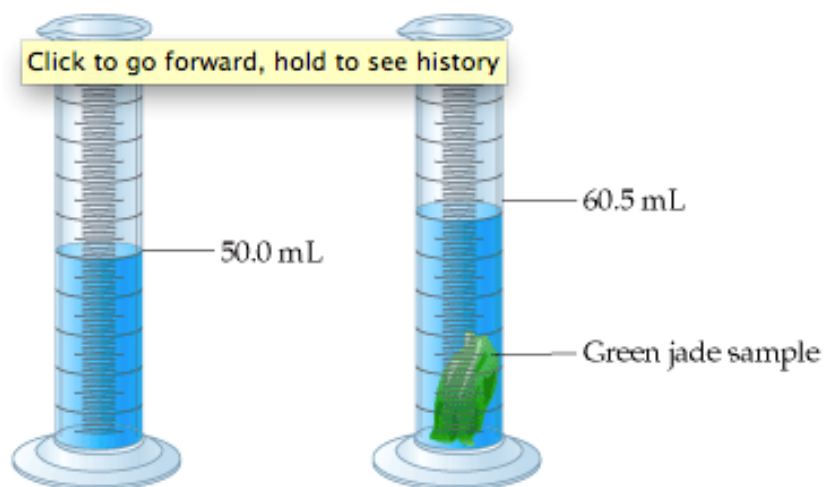
- For solids:  $\text{cm}^3$ ,  $\text{m}^3$
- For gases:  $\text{m}^3$
- For liquids: mL, L

**Conversion:**  
 **$1\text{cm}^3 = 1\text{mL}$**



## Finding Volume by Displacement

- Used to measure irregularly-shaped objects
- Displacement – the volume that the object displaces



- The volume of objects too large to fit in a graduated cylinder can be measured using an overflow can



## Density

- Density – the measure of the amount of matter in a given volume of a substance
- Characteristic property – a property that makes a particular substance distinct from others

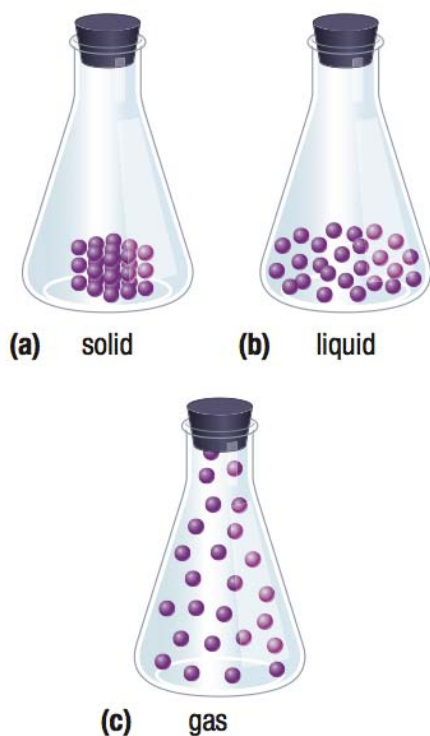
$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

- For solids and liquids: g/cm<sup>3</sup> or g/mL
- For gases: kg/m<sup>3</sup>





- 1kg of styrofoam and 1kg of gold may have the same mass but styrofoam would require more volume
- Gold is more dense than styrofoam
- For the same volume, there would be more gold particles than styrofoam particles



- Particles of solids are usually closer together than liquids and gases
- Space between gas particles are larger than solids and liquids
- Gases are less dense and more compressible



## Checkpoint



An empty container has a mass of 50g. When 75mL of oil are placed in it, the total mass is 120g. Calculate the density of the oil.

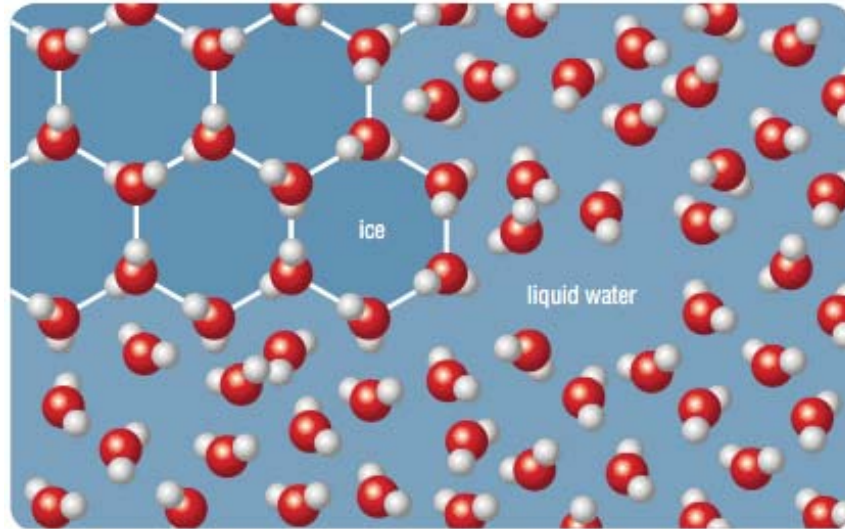
## Density of Water

**Table 1** The Density of Some Common Materials

Fluids	g/cm <sup>3</sup> or g/mL	kg/m <sup>3</sup>
air	0.001 3	1.3
carbon monoxide	0.001 45	1.45
gasoline	0.737	
distilled water (at 4 °C)	1.0	
sea water	1.03	
mercury (a liquid metal)	13.55	
<b>Solids</b>		
wood (balsa)	0.12	
ice	0.92	
lead	11.34	

- Usually fluids become more dense as they cool because the particles move slower and closer together
- This is true for water only until 4°C; water is most dense at 4°C
- As cooling continues, water particles move farther apart, volume increases and forms ice

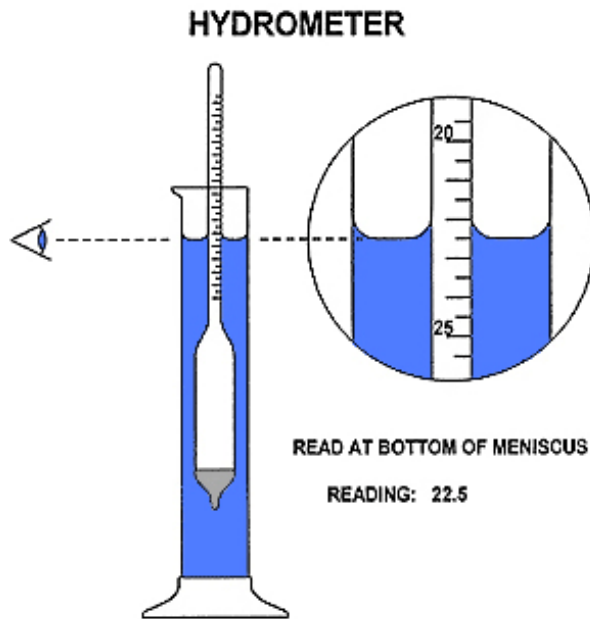
- Since the mass remains the same, but the volume increases, the density decreases
- Pure water is least dense at 0°C



- Ice forms at the top of lakes and floats on liquid water
- If water behaved like other liquids, our lakes would freeze solid in the winter, killing the plants and animals



# Hydrometer



- A glass tube with a weight on one end floats in the liquid sample
- Take a reading at the bottom of the meniscus when the hydrometer is not touching the sides of the column