Experiments with particles

Learning objectives

1 Predict how the volume will change when two substances are mixed together.

2 Make careful observations.

3 Apply your knowledge of particles to explain your observations.

Introduction

When materials are added together, they may acquire new properties. When a solid and a liquid are mixed, the solid may or may not dissolve. When two liquids are mixed they may become one liquid or stay separate.
Before you carry out each experiment, make a prediction about what you will observe.

Equipment

Apparatus

- Eye protection: safety glasses to EN166F
- Stirring rod
- Measuring cylinders x 2 (100 cm^3)
- Spatula

Chemicals

- Sodium chloride
- Water
- Sand
- Dried peas
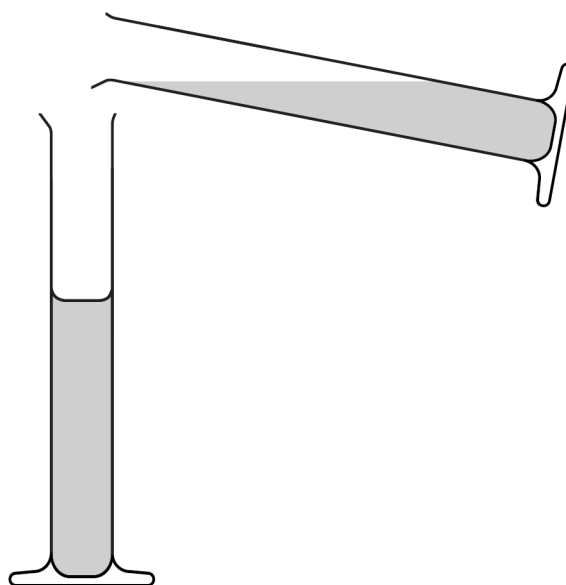- Ethanol (DANGER: highly flammable liquid and vapour)

Health and safety

- Wear eye protection
- Ethanol is flammable, no naked flames or other sources of ignition.

Diagram

Take measurements when eye is level with liquid surface.

Method

Activity 1

1. Add approximately 25 cm³ of dried peas and 25 cm³ of sand to separate measuring cylinders. Accurately measure and record the volumes.
2. Add the contents of one cylinder to the other and shake until the two substances mix together.
3. Place the measuring cylinder on the bench and gently shake from side to side to allow the mixture to settle.
4. Read and record the combined volume.

I predict that the combined volume will be **more than/less than/the same as** the total of the two individual volumes.

I think this because _____

Volume of peas/cm³	Volume of sand/cm³	Combined volume/cm³

Activity 2

1. Add approximately 25 cm^3 of ethanol and 25 cm^3 of water to separate measuring cylinders. Accurately measure and record the volumes.
2. Add the contents of one cylinder to the other and shake from side to side for 15–30 seconds until the two substances mix together, and then leave to stand for 1 minute.
3. Read and record the combined volume.

I predict that the combined volume will be **more than/less than/the same as** the total of the two individual volumes.

I think this because _____

Volume of ethanol/cm^3	Volume of water/cm^3	Combined volume/cm^3

Activity 3

1. To the measuring cylinder, add approximately 75 cm^3 of water. Accurately measure and record the volume.
2. Add spatulas of salt one at a time until salt begins to be left at the bottom of the cylinder, despite continued stirring.
3. Read and record the combined volume.

I predict that the combined volume will be **more than/less than/the same as** the initial volume of water.

I think this because _____

Initial volume of water/cm^3	Final volume of salt solution/cm^3

Questions

1. For **Activity 1**, calculate the difference between the combined volume at the end and the total volume at the start.

    Difference in volume = combined volume – (volume of peas + volume of sand)

    = _____ – (_____ + _____)

    = _____

    Suggest a reason for your answer.

    _____

    _____

2. For **Activity 2**, calculate the difference between the combined volume at the end and the total volume at the start.

    Difference in volume = combined volume – (volume of ethanol + volume of water)

    = _____ – (_____ + _____)
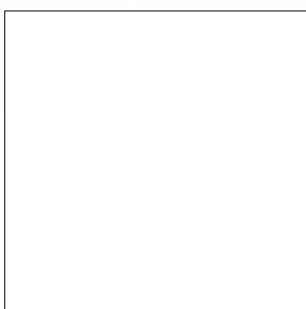
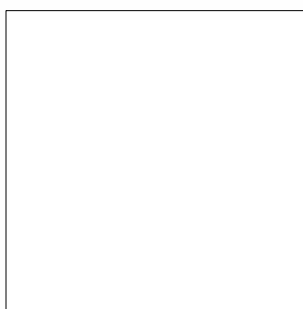   = _____

    Suggest a reason for your answer.

    _____

    _____

3. Draw a particle diagram to show how the particles are arranged in:

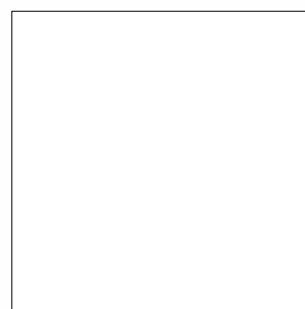 | (a) water | (b) salt crystals | (c) salt solution |
    |---|---|---|
    | | | |

4. Suggest a reason for the result observed in **Activity 3**.

    _____

    _____