Atoms Moving

Topic

Diffusion

Introduction

All matter – whether in the form of a solid, liquid or gas – consists of atoms, and usually of atoms combined to form molecules. These atoms and molecules are referred to collectively as "particles." Particles in a solid are packed closely together, and only few of them (some of those around the edges of the solid) are able to move freely. Particles in a liquid are able to move within the body of the liquid, and some are also able to escape into the surrounding air (a process known as evaporation). In a gas, particles can move even more freely. You can demonstrate that particles from solids are free to move in a gas by opening a package of chocolate cookies at one end of a room and note how, in a few minutes, people at the other end of the room can smell chocolate. This is because particles of chocolate have traveled through the air. This, however, only involves a very few particles from the outside of the cookies. In this experiment, you will show how colored particles spread throughout a colorless liquid without being stirred or shaken. You will also demonstrate that gas particles are able to move through the walls of a balloon. This gradual movement of particles is known as diffusion.

Time required

Part A: 20 minutes on one day plus 5 minutes on the following day
Part B: 10 minutes on one day plus 5 minutes each day for a week

Materials

For Part A:
test tube
test tube rack
fluorescein powder
spatula (metal)
eyedropper
water
safety glasses

For Part B:
balloon
flexible tape measure
0° – 100°C thermometer

Safety note

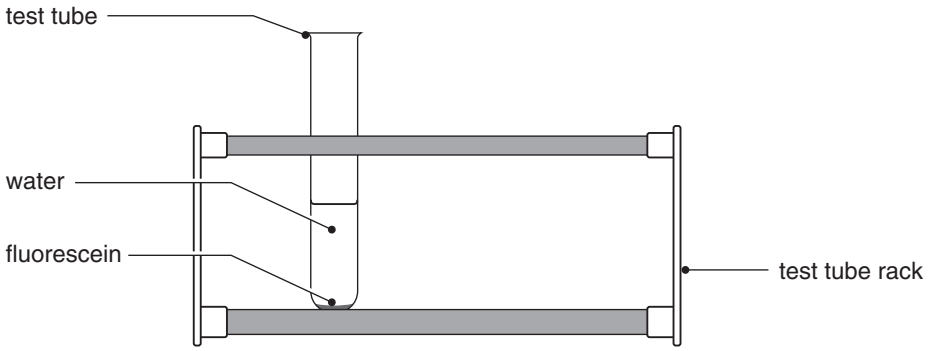
Fluorescein powder may act as an irritant. Wear safety glasses and wash your hands afterwards. Follow the instructions with the fluorescein powder when disposing of the colored water.

Procedure

Part A: Spreading color

1. Carefully place a spatula full of sodium fluorescein at the bottom of a clean dry test tube.
2. Using an eyedropper, very carefully add water to the test tube until the test tube is between a third and a half full (see diagram 1 below).

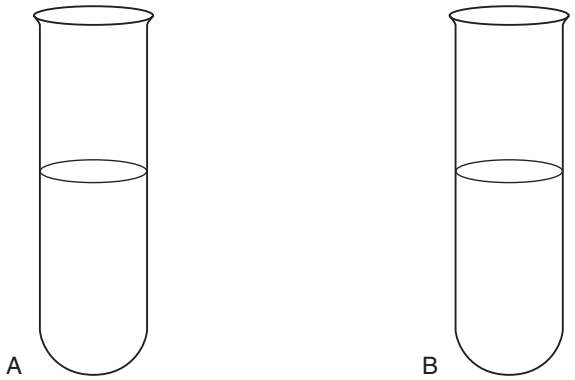
1



Water added to the test tube

3. Carefully place the test tube in a test tube rack.
4. Draw a picture of the contents of the test tube in test tube A in diagram 2 below.
5. Leave the test tube undisturbed in the test tube rack for at least 24 hours.
6. Draw a picture of the contents of the test tube in test tube B in diagram 2 below.

2



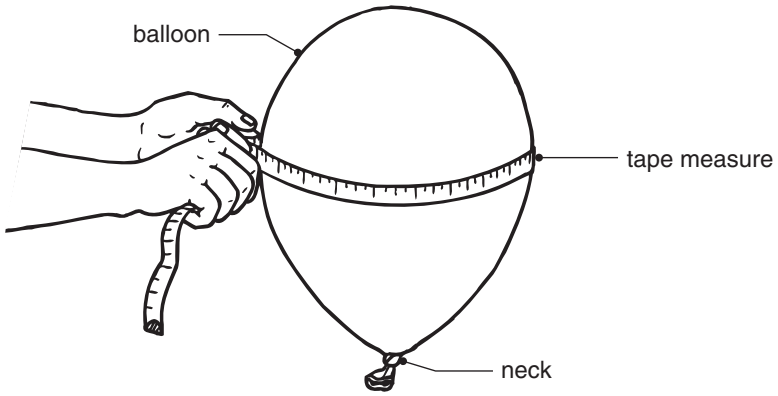
Contents of the test tube: (A) just after adding the water and (B) after 24 hours

Part B: A shrinking balloon

1. Inflate the balloon to its maximum size and make a secure knot around the neck of the balloon.
2. Leave the balloon for about 10 minutes to allow the air in the balloon to reach room temperature.
3. Measure the circumference of the balloon by placing the tape measure around the widest point (see diagram 3 on the next page). Record this measurement in the data table on the next page.

4. Use the thermometer to measure the temperature of the air around the balloon and record this in the data table.
5. Every day for the next week, repeat the measurement of the balloon's circumference and the temperature of the air around it.

(3)



Measuring the circumference of the balloon

DATA TABLE		
Day	**Circumference of balloon (cm)**	**Temperature (°C)**
1		
2		
3		
4		
5		
6		
7		

Analysis

Part A: Spreading color

1. What did the contents of the test tube look like initially?
2. What did the contents of the test tube look like after being left for a day?

Part B: A shrinking balloon

1. What has happened to the balloon
2. What do you think has happened to the air in the balloon?
3. What do you think would have happened if the balloon had been filled with hydrogen rather than air?
4. Why is the temperature of the air around the balloon important?

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