Particle diagrams and coffee shops

There are over 1000 different chemical compounds in coffee. Some of these are responsible for the taste, flavour and smell of coffee.

Source: © Shutterstock

1 The familiar smell of the coffee shop is inviting to most people. Some of the coffee particles escape and move freely in the atmosphere. When these particles reach your nose, you smell coffee.

(a) What state are the coffee particles in when they reach your nose?

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(b) Draw a particle diagram to represent the coffee particles in this state.

(c) Which of these other properties belong to the coffee particles when they reach your nose? Circle the **two** correct answers.

A They are regularly arranged.

B They are randomly arranged.

C They have high energy.

D They have low energy.

2 When baristas make coffee, they allow water at 95°C to filter through ground-up coffee beans into your coffee cup.

(a) Draw a particle diagram to represent the state of the water molecules at 95°C. Use small circles to represent the water molecules.

(b) Explain how your diagram shows that water can flow and filter through the coffee grounds.

(c) The coffee machine measures out a fixed volume of water to make the cup of coffee. Explain why this fixed volume of water does not have a fixed shape.

3 People can also buy iced drinks in coffee shops. Ice also has a fixed volume but, unlike water, it has a fixed shape.

(a) Draw a particle diagram to represent the particles in ice. Use small circles to represent the ice molecules.

(b) Explain why ice has a fixed shape.

(c) Complete the table to show the differences between the particles in water and the particles in ice. Select from the following:

the particles are close together/touching **the particles move around each other**

the particles are arranged randomly **the particles vibrate in fixed positions**

the particles are arranged regularly **about 60% of the particles are touching**

	Particles in water	Particles in ice
How close are the particles?		
How do the particles move?		
How are the particles arranged?		

4 Some people add sugar to their coffee. The chemical name for sugar is sucrose.

(a) The amount of sucrose added to a cup of coffee is its concentration. What units are used to measure concentration?

(b) An average coffee cup contains 200 cm^3 coffee. If the coffee includes 10 g of sucrose, what is the concentration of the sucrose?

(c) If a 200 cm^3 cup of coffee has a sucrose concentration of 25 g/dm^3, what mass of sucrose does the cup of coffee contain?

5 A particle diagram of a liquid shows one type of particle only. Can a liquid particle diagram be used to represent a cup of coffee? Explain your answer.

Which question(s) did you get wrong? Why?

What will you do next time you're asked a similar question?