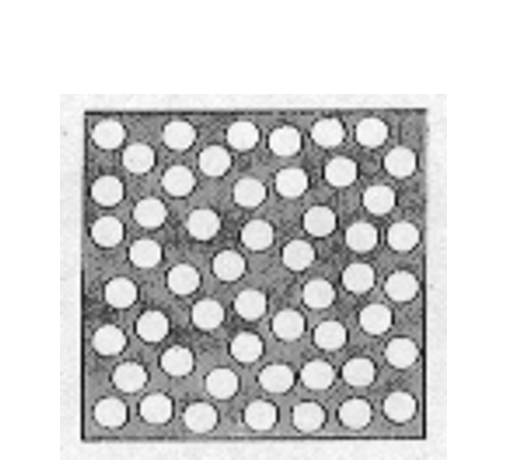
**Particle diagram – liquid state**

This diagram from a textbook illustrates the particle model for the liquid state.



**To answer**

State three ways in which you think the diagram is **a good representation** of the liquid state:

1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

State three ways in which you think the diagram is **not an accurate representation** of the liquid state:

1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Chemistry > Big idea CPS: Particles and structure > Topic CPS1: Substances and mixtures > Key concept CPS1.1: Particle model for the solid, liquid and gas states*

|  |
| --- |
| **Response activity** |
| **Particle diagram – liquid state** |

|  |  |
| --- | --- |
| Learning focus: | Understand a basic particle model of matter that can explain the properties of substances in the solid and liquid states. |
| Observable learning outcome: | Describe the arrangement and movement of particles in a substance in the solid and liquid states. |
| Activity type: | critiquing a representation |
| Key words: | liquid, state, particle |

This activity can help develop students’ understanding by addressing the misunderstandings revealed by the following diagnostic question:

* A particle model for the solid and liquid states

**What does the research say?**

Johnson (1998) identifies three alternative models of matter held by students:

1. Substances are continuous (with no recognition of particle ideas)
2. Particles are located within a continuous substance (rather than being the substance)
3. Particles are the substance (but macroscopic properties are given to the particles)

These contradict the standard particle model in which the particles are the substance but where the macroscopic properties of the substances arise collectively from the particles.

**Ways to use this activity**

This activity may be used to stimulate small group student discussion to answer the question ‘Is this a good representation of a substance in the liquid state?’. Any member of the group should be able to feedback to the class their group’s answer and reasoning for this.

You may also wish to question students about the grey background behind the particles. What does it represent? Does this make sense if the particles are the substance in the liquid state? What is this continuous ‘stuff’ made from?

**Expected answers**

Suitable answers could include:

**Good representation**

1 Particles are not in a regular pattern

2 Particles are shown to be moving (if that is what the darker pattern shows)

3 The particles are not rigidly bound to each other

**Not an accurate representation**

1 Particles are not close enough together- they should be touching

2 There is ‘stuff’ shown between the particles

3 it is not clear that the particles are moving around past each other

**Acknowledgments**

Developed by Helen Harden (UYSEG), from an idea by Andrew Hunt drawn from the Evidence-based Practice in Science Education project (EPSE diagnostic question M2-10).

Images: EPSE

**References**

Johnson, P. (1998). Progression in children’s understanding of a ‘basic’ particle theory: a longitudinal study. *International Journal of Science Education*. 20 (4) p393-412

Johnson, P. (2012). Introducing particle theory. In Taber, K. (ed.) *ASE Science Practice: Teaching Secondary Chemistry.* New edition ed. London: Hodder Education.