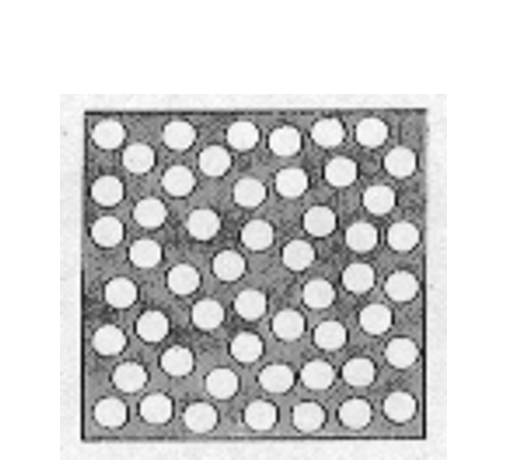
**Particle diagram of a liquid**

This diagram is from a textbook.

It is a diagram of the particles in a liquid.



**To answer**

1. What are three things that make this a good diagram?
2. What are three things that make this diagram wrong?

*How would you change these to make it better?*

*Physics > Big idea PMA: Matter > Topic PMA1: Heating and cooling > Key concept PMA1.1: Temperature*

|  |
| --- |
| **Response activity** |
| **Particle diagram of a liquid** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Temperature is a measure of the average speed at which the particles in a substance or material are moving |
| Observable learning outcome: | Describe the arrangement and movement of particles in a substance in the solid and liquid states |
| Activity type: | Critique a representation |
| Key words: | Particle, arrangement, move freely |

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

* Diagnostic question: Particle model SL

**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**

Students should complete this activity in pairs or small groups, and the focus should be on the discussions. It is through the discussions that students can check their understanding and rehearse their explanations.

Philosophically science can be said to be a description of the ‘best model’ we have for the world. In this activity students should identify ways in which this particular model is a good representation of the real world, and ways in which it is not.

Students should work together to follow the instructions on either the worksheet or the PowerPoint. Giving each group one worksheet to complete between them is helpful for encouraging discussion, but each member should be able to report back to the class. Listening in to the conversations of each group will often give you insights into how your students are thinking.

You may 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?

Ending with the students completing the worksheet or questions from the PowerPoint individually, might help them to consolidate their learning.

*Differentiation*

You may choose to use simplified worksheets for some students, for example with gaps to fill in so they can focus on the science. In some situations it may be more appropriate for a teaching assistant to read and/or scribe for one or two students.

**Expected answers**

Suitable answers could include:

**Good representation**

* Particles are not in a regular pattern
* Particles are shown to be moving (if that is what the darker pattern shows)
* The particles are not rigidly bound to each other

**Not an accurate representation**

* Particles are not close enough together- they should be touching
* There is ‘stuff’ shown between the particles
* It is not clear that the particles are moving around past each other

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Developed by Helen Harden (UYSEG) for the BEST key concept CPS\_1\_1 and adapted by Peter Fairhurst (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) 393-412