Worksheet answers

1. Describe the position and motion of particles in each state of matter.

solid

Particles are in fixed positions in a lattice structure. They are tightly packed together.

liquid

Particles roll around at the bottom of the container. They are close together.

gas

Particles move around really fast. They travel in straight lines until they hit an edge or another particle. They are widely spaced.

2. As you test substances, record your observations in the following table.

TEST	SOLID	LIQUID	GAS
shake container	*Particles move as a block, staying together. When movement stops the block returns to the bottom of the container.*	*Particles move around the container and spread out. When shaking stops they return to the bottom of the container.*	*Particles continue to move in random straight lines and remain spaced apart.*
remove lid and pour onto table	*Particles stay together as a block. The block slides out of the container and stays in position on the bench.*	*Particles roll out of the container and onto the bench. They spread out and move around.*	*Particles escape as soon as the lid opens. They spread around the whole space, moving in random straight lines.*
poke it	*Particles move as a block. They can be pushed to one side of the container but remain a block.*	*Particles are displaced and may overflow from the container, pouring down the sides and settling on the bench.*	*Particles move in random motion around the whole available space. If hit with the stick they bounce off.*
change shape of container	*Particles drop to the bottom of the new container. They remain in their block shape.*	*Particles drop to the bottom of the new container. They rearrange to take the shape of the new container.*	*Particles move around the whole available space in random, straight-line motion.*
squash it	*Particles are close together and can't be squashed.*	*Particles are close together and can't be squashed.*	*Particles can be squashed right down to the bottom of the container. They move around in available space.*

3. Which test could you use to show the difference between each of the following pairs of substances? Explain why it would work.

   a solid and a liquid

   Any of the following tests: shake container, remove lid and pour onto table, poke it, change shape of container. In each case the solid keeps its shape but the liquid doesn't.

   a liquid and a gas

   Any of the following tests:

   shake container – liquid returns to bottom after shaking, gas doesn't

   remove lid and pour, poke or change container – liquid settles to bottom, gas fills whole space

   squash – gas squashes but liquid doesn't

   a gas and a solid

   Any of the following tests:

   shake container, remove lid and pour, poke, change container – solid stays same shape, gas fills whole space

   squash – gas squashes but solid doesn't

4. Summarise properties of the three states of matter by completing the following table with ticks and crosses.

TEST	SOLID	LIQUID	GAS
fixed shape	✔	✘	✘
fixed volume	✔	✔	✘
compressible	✘	✘	✔

5. How do you think granulated sugar would behave in each of the following tests:

   Shake container.

   Particles will move around individually and roll to the bottom of the container.

   Remove lid and pour it.

   Particles will form a pile on the surface.

   Poke it.

   The rod will push particles out of its way and some might fall out.

   Change shape of container.

   Particles will fill the bottom of the new container.

   Squash it.

   Particles will not compress.

6. What state of matter do you think granulated sugar is? Explain your choice.

   Solid. Granulated sugar does have some properties that appear more like a liquid, but when the sugar is poured out on the bench it forms a little pile rather than rolling to fill the container as a liquid would.

7. The learning object shows how a substance can change state when it is heated or cooled. What happens to the particles when they are:

   heated

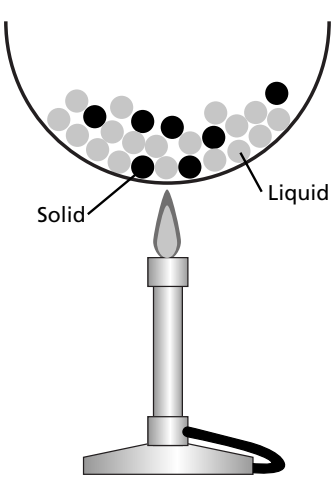
   Particles gain energy and move around faster. They break out of their fixed positions, turning into a liquid then into a gas.

   cooled

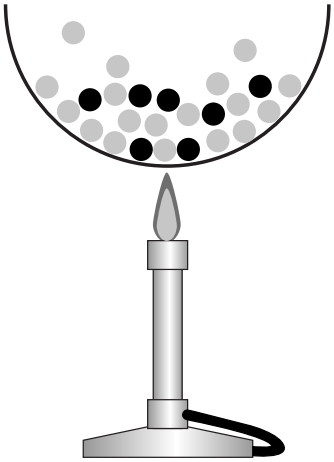
   Particles lose energy and move around more slowly. They slow down into a liquid then into a solid where the particles vibrate in fixed positions.

8. In the learning object you saw what happens to particles when they are heated. Use your knowledge to explain how two substances, with different boiling points, can be separated using evaporation. Use diagrams to help your explanation.

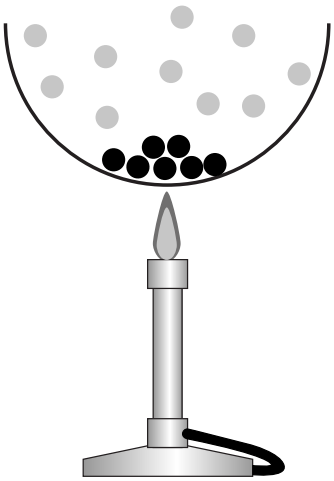
   A solid and liquid have different boiling points and can be separated using evaporation.



Heat



As the liquid particles heat up they gain energy, move faster and spread out as they become a gas.



The solid is left in the container.

9. A model has been used to show what particles in solids, liquids and gases look like. How is this model unrealistic? (There is more than one answer.)

   Particles should be moving, even in a solid. Particles should be so small they can't be seen. Particles in a liquid do have some attraction to each other (like surface tension) so shouldn't roll everywhere when poured out.

10. The learning object contains a real magnified photo of a solid on the last screen. How does its appearance compare with the model diagrams of a solid used in the animations?

    Particles in the photo look like round balls and are closely packed together, just like in the animation. The lattice pattern they display is different from the model.

11. Why haven't scientists been able to take a photo of a gas?

    Gas particles move too fast for a photo to be taken. It would require a camera with a much faster shutter speed than is currently possible.