

## Prior Knowledge Review

Answer the questions below.

1. Name the three states of matter.

**Solid, liquid, gas**

2. Name the process by which a solid becomes a liquid.

**Melting**

3. In which state of matter do particles have the greatest internal energy?

**Gas**

4. Define internal energy.

**The sum of all the kinetic and potential energy of all the particles in a system.**

5. Describe the four different pathways by which energy can be transferred.

**Mechanically, electrically, by radiation or by heating**



## Prior Knowledge Review

### **Do Now:**

1. Name the three states of matter.
2. Name the process by which a solid becomes a liquid.
3. In which state of matter do particles have the greatest internal energy?
4. Define internal energy.
5. Describe the four different pathways by which energy can be transferred.

### **Drill:**

1. State the SI unit for energy.
2. State the SI unit for mass.
3. Convert 10 mL into SI units.



## Prior Knowledge Review

### Read Now:

Matter is one of the most fundamental ideas in science. Matter is anything that has mass and takes up space, no matter how tiny their mass or the space they take up. All matter is made up of particles but can exist in different states. The three states of matter are solids, liquids and gases and matter can change between these states if energy is transferred or removed from its system. When a substance changes state, the particles it is made of remain the same, but the spacing between them and their movement changes. This is why changes of state are physical changes not chemical reactions.

1. Define matter.
2. Name the three states of matter.
3. Describe how a substance can change state.
4. Describe what happens to the particles when a substance changes space.
5. Explain the difference between a physical change and a chemical reaction.



# Prior Knowledge Review

P4.1.1

Science  
**Mastery**

## ➤ P4.1.1 Prior Knowledge Review

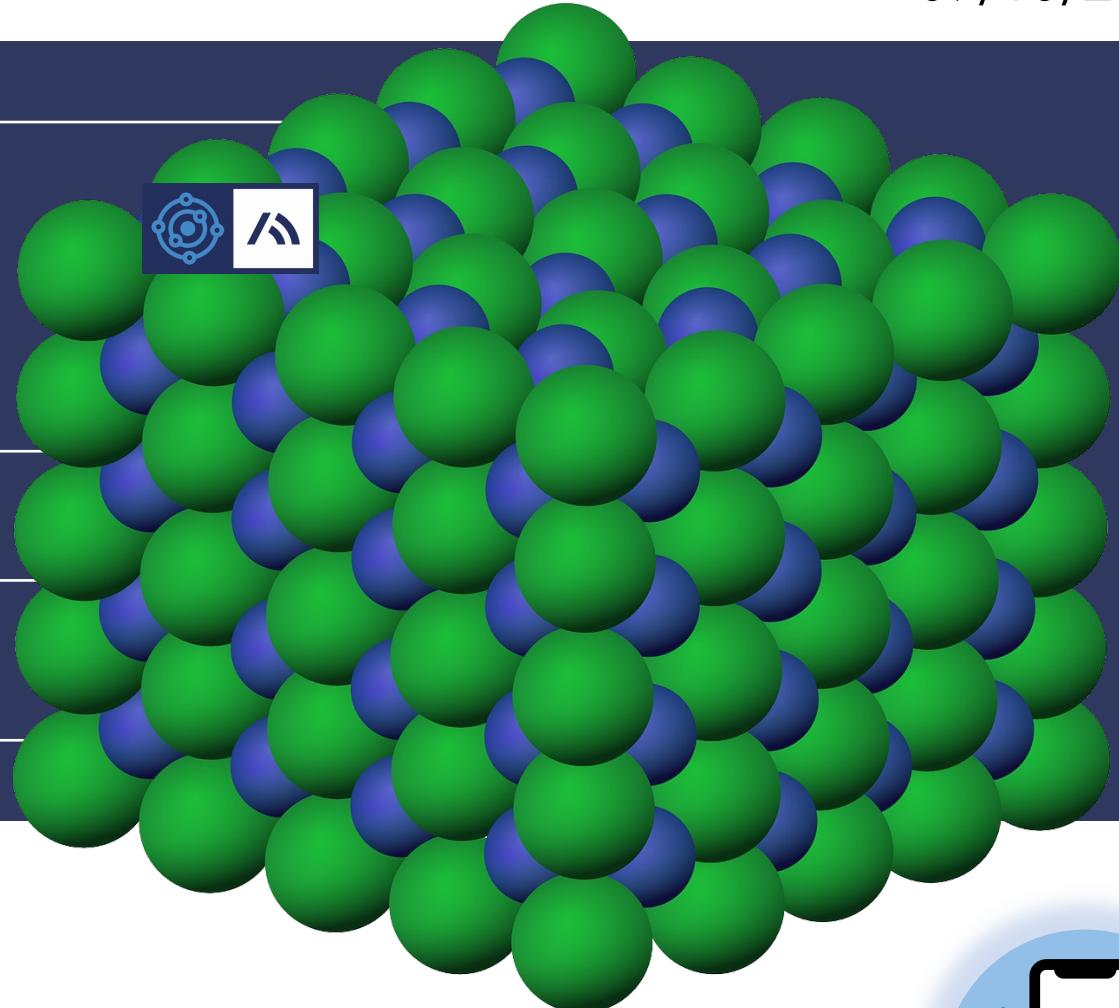
P4.1.2 Density

P4.1.3 Measuring Density

P4.1.4 Gas Pressure

P4.1.5 Taking it Further: Pressure

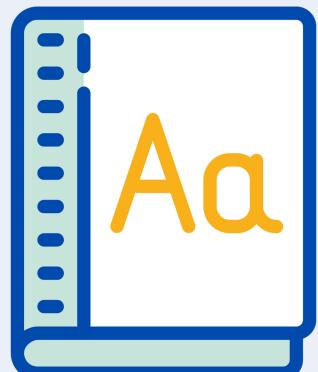
P4.1.6 Taking it Further: Pressure in Fluids



## Following this lesson, students will be able to:

- Draw particle models to represent the arrangement of particles in each state of matter
- Compare and explain the arrangement and movement of particles in each state of matter

### Key Words:



matter

state

particle diagram

forces of attraction

# The Big Idea: Energy is Conserved

 Science Mastery

## Matter

Why do some substances exist as solids and others as gases? What is the difference between solids and liquids? Why do some objects float on water and others sink? How can the density of objects be compared?

Matter makes up everything. All objects in the universe are made of particles and it is the arrangement of these particles that determines their properties. Different materials can exist as solids, liquids or gases at room temperature, which means their particles are arranged in different ways.

This is the **third** unit we are studying as part of the big idea: **Energy is Conserved**

In this unit we will learn about energy in particles and how they are arranged in the different states of matter and their properties. We will look at density and how to measure it, as well as how particles exert pressure.

We will develop our mathematical skills in this unit by practising substitutions into equations.

We will develop our practical enquiry skills in this unit by doing an investigation into how the density of regular and irregular shaped objects can be measured.

**TASKS:**  
What subject will this unit focus on?  BIOLOGY  CHEMISTRY  PHYSICS  
(circle the correct subject)

There are lots of keywords underlined above. List these into the two columns:

Words I know	Words I haven't seen before



 Science Mastery

**To answer before the unit:**

1. What are you most excited to learn about in this topic?  


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2. What do you already know about this topic?  


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3. Why do you think it's important to learn about how energy is conserved?  


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4. What knowledge from previous science lessons might help us?  


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5. What questions do you have about this topic?  


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**To answer at the end of the unit:**

1. Tick off any words in the 'words I haven't seen before' column that you are now confident with. Circle any you still need more practice to use.
2. What have you most enjoyed about this unit?  


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3. What more would you like to learn about forces as part of the big idea: 'energy is conserved'?  


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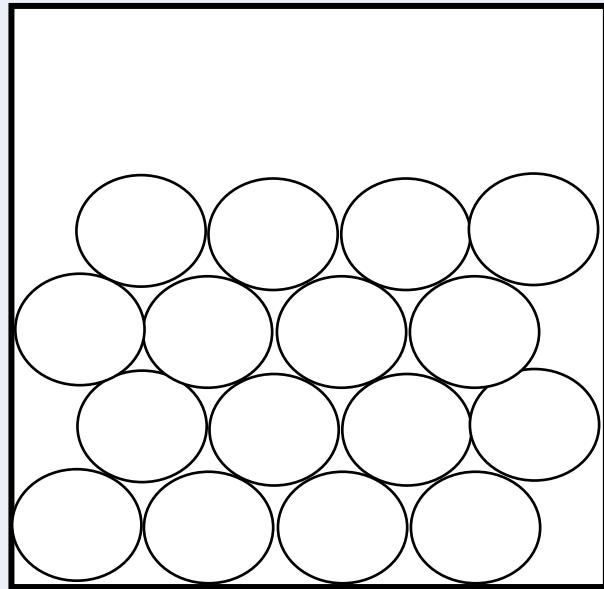

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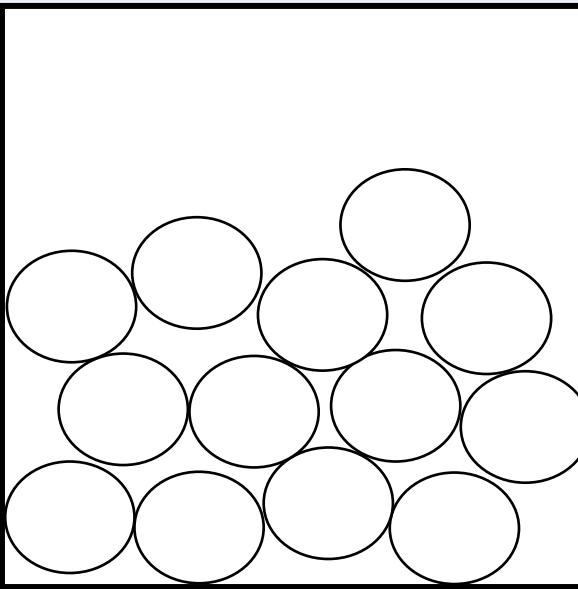

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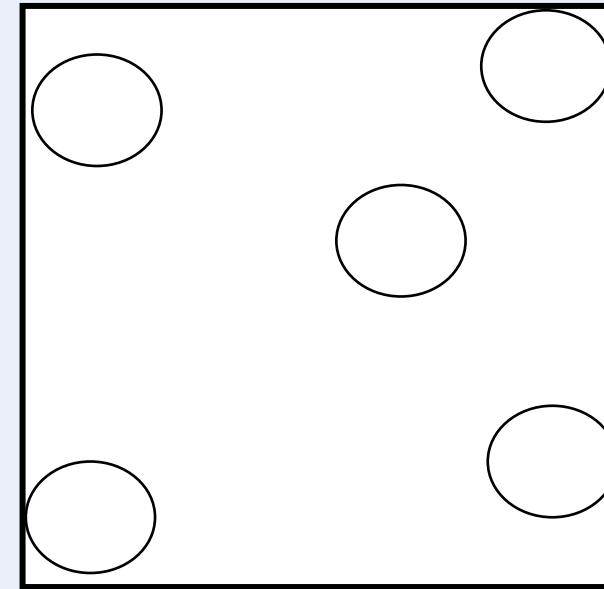
# How can we explain the properties of solids, liquids and gases?



**Solid**



**Liquid**



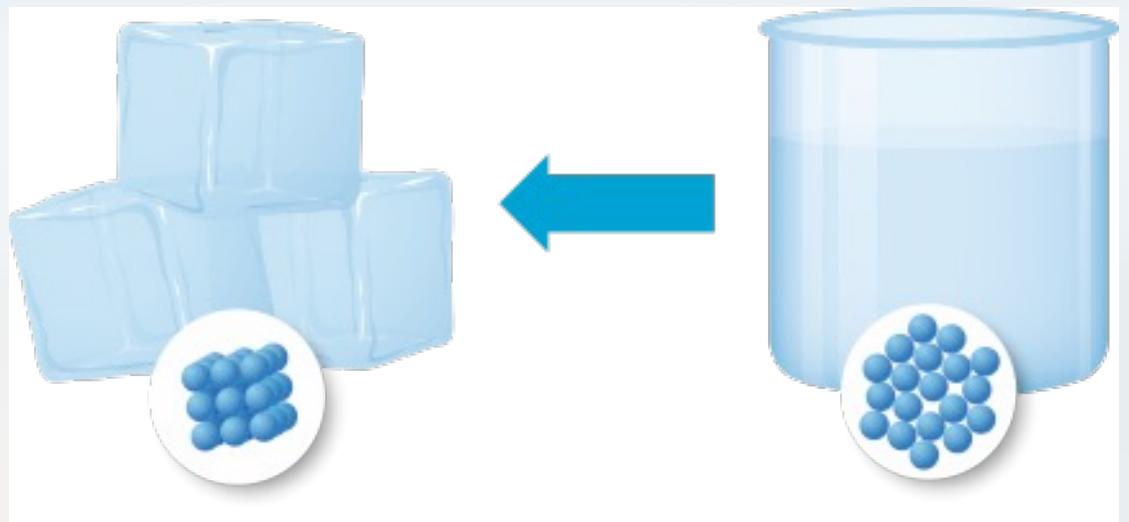
**Gas**



# What happens to the particles when a solid melts?

When a solid melts the particles gain **energy** from the surroundings, so they begin to **vibrate faster**.

The particles move away from their places in the arrangement and start to move around more.



# Melting and Boiling Points

Why are some substances liquid at room temperature but others are solid?

1. What state is water at **65 °C**?

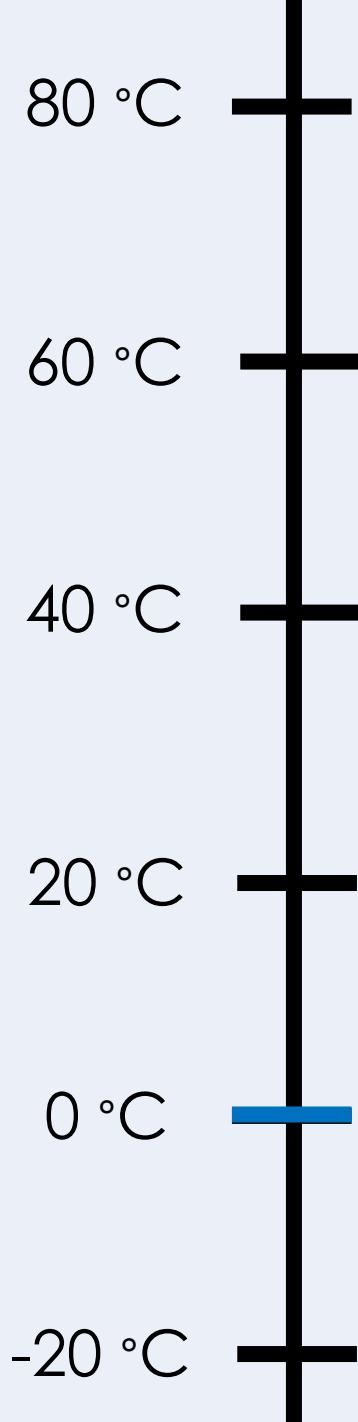
Liquid

2. What state is water at **-10 °C**?

Solid

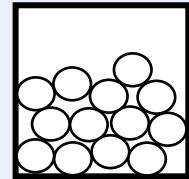
3. What state is water at **1 °C**?

Liquid



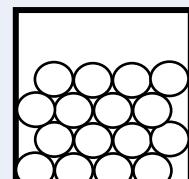
The **melting point** is the temperature at which a solid changes state into a liquid.

Liquid water



Melting point of water

Solid water (ice)



# Internal Energy

Particles in solids, liquids and gases have a store of **kinetic energy** because the particles are always **moving** or vibrating.

Particles also have a store of **potential energy** because their motion keeps them **separated**.

**Internal energy** is the **total** amount of kinetic energy **and** potential energy of **all** the particles in a system.



# Internal Energy

The **hotter** a material is, the **faster** its particles move and therefore the larger the store of **kinetic** energy.

The **temperature** of a substance is related to the average **kinetic** energy of each particle.

The **further apart** the particles are from one another, the larger their store of **potential** energy (related to their state: solid, liquid, gas).



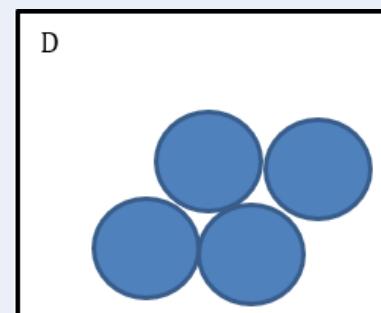
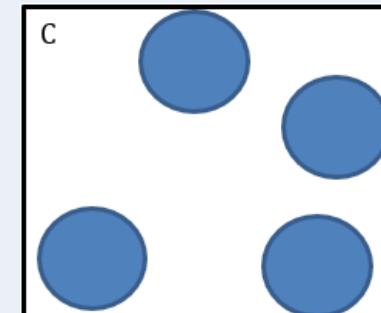
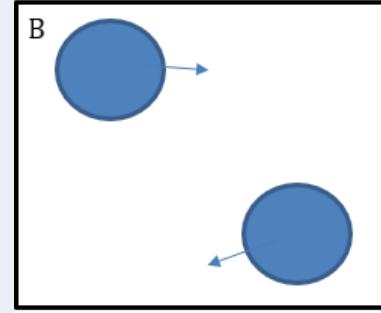
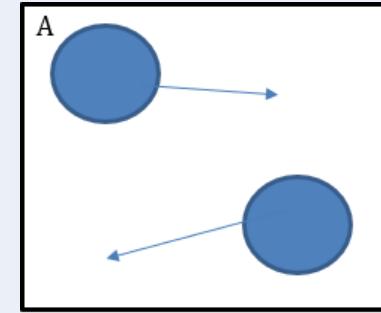
# Internal Energy

Which of these images, A or B, shows a larger kinetic energy store? Why?

**A, the particles are moving faster**

Which of these images, C or D, shows a larger potential energy store? Why?

**C, the particles are further apart**

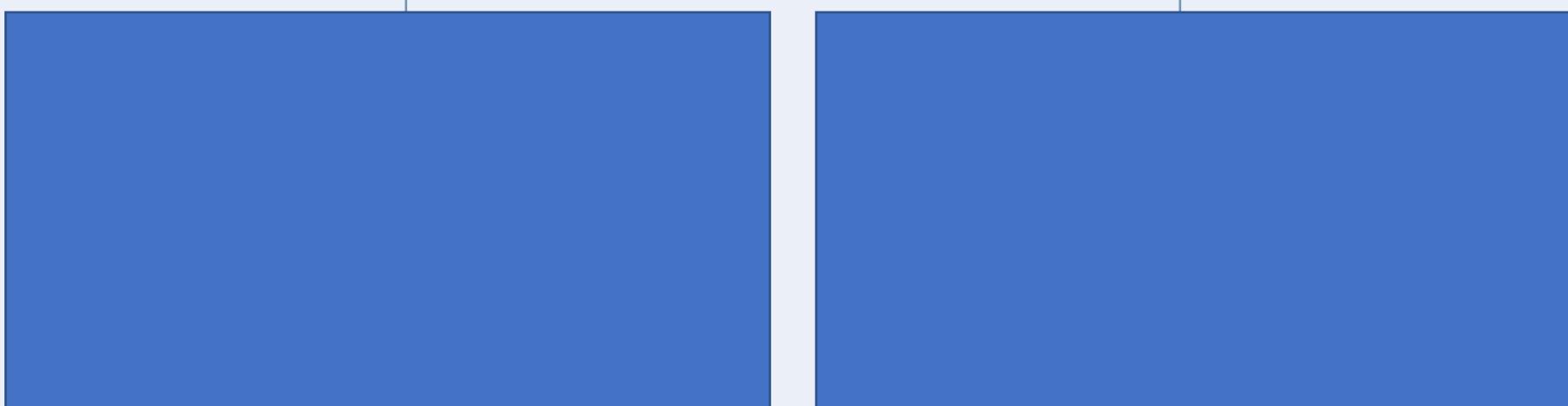


# Internal Energy

Heating a substance increases its internal energy.

When a substance is heated (when you add energy), the internal energy can change in two ways:

Increase in internal energy



## Which statements do you agree with?

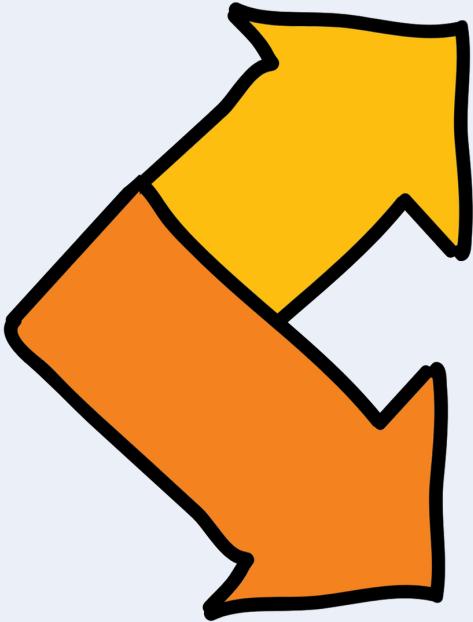
When ice melts to form water, the particles react to form a new substance

When ice melts to form water, the particles expand

When ice melts to form water, the particles become more spread out

When ice melts to form water, the forces of attraction are weakened

**Can you describe and explain the difference between the properties of these two states of matter?**



# Solid Gas

*What are the properties of each?*

*What is the arrangement of particles in each?*

*How do the particles move in each?*

*What can be said about the energy of particles in each?*

*How can the properties be linked to the arrangement of particles?*

## Drill

1. Name the three states of matter.
2. Name the state(s) of matter which has a fixed shape.
3. Name the state(s) of matter which has a fixed volume.
4. Name the state(s) of matter that can be compressed.
5. Name the state of matter in which particles have the most energy.
6. Define internal energy.
7. Describe the two effects that heating can have on a system.

## Drill answers

1. Solid, liquid and gas
2. Solid
3. Solid and liquid
4. Gas
5. Gas
6. The total amount of kinetic energy and potential energy of all the particles in a system.
7. Cause an increase in temperature or a change of state

## Answer the questions below.

1. In which state(s) of matter are particles able to flow?  
 A. Gases only  
 B. Liquids and gases  
 C. Solids, liquids and gases
  
2. Which statement is true of a change of state?  
 A. Atoms are rearranged to make new products  
 B. The spacing between particles changes  
 C. New particles are made
  
3. Which state of matter is the most dense?  
 A. Solid  
 B. Liquid  
 C. Gas

## Lesson P4.1.1

What was good about this lesson?

What can we do to improve this lesson?

[Send us your feedback by clicking this link. Thank you!](#)