

# Year 8 Science Knowledge Booklet

## Term 1

**Name:**

**Class:**

**Homework 1 Due: 17<sup>th</sup> September**

**Homework 2 Due: 1<sup>st</sup> October**

**Homework 3 Due: 15<sup>th</sup> October**





# Science Homework 1

Read all of this knowledge organiser.

## Big questions: What do we mean by internal energy?

What are the properties of solids, liquids and gases?

What is the Kinetic theory of matter?

What happens to particles when we change the temperature?

What happens to the temperature of things when they change state?

Do all things heat up by the same amount when they get the same amount of heat energy?

How much energy is needed to change 1kg of ice into 1kg of water?

## Key vocabulary

<b>States of matter</b>	Substances (matter) can exist in three states: the solid state, the liquid state and the gas state.
<b>Change of state</b>	Melting, freezing, boiling, condensing, evaporating and sublimation are the names given to changes of state. Eg. Melting is the change of the state of a substance from solid to liquid.
<b>Heating</b>	The transfer of energy from a hotter object to a colder one.
<b>Temperature</b>	How hot or cold something is. Temperature increases if the average speed of the particles increases
<b>Kinetic theory</b>	The idea that all matter is made of particles that are in constant motion. Heat energy can increase the motion of the particles and raise the temperature or break the bonds between them and change the state.
<b>Gas pressure</b>	The pressure exerted when the particles of a gas collide with its surroundings. Gas pressure increases as the gas gets hotter.
<b>Specific heat capacity</b>	The energy needed to raise the temperature of 1kg of a substance by 1°C.
<b>Latent heat of fusion</b>	The energy required to melt 1kg of a substance from solid to liquid with no temperature rise.
<b>Latent heat of vaporisation</b>	The energy needed to boil 1kg of substance from liquid to gas without temperature rise.

**What are the properties of solids, liquids and gases?****Solids:**

- Have a fixed shape.
- Do not flow.
- Cannot be compressed.
- Are generally denser than liquids or gases.

**Liquids:**

- Take the shape of their container.
- Do flow.
- Cannot be compressed.
- Are less dense than solids.

**Gases:**

- Have no fixed shape. They fill their container.
- Do flow.
- Can be easily compressed.
- Are much less dense than liquids or solids.

**These are called the three states of matter.**

- Heat energy or pressure can change the state
- Changes of state are physical changes and are reversible

**What is the Kinetic theory of matter?**

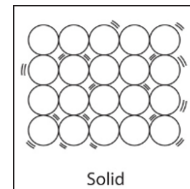
Scientists use an idea called the kinetic theory of matter to explain why solids, liquids and gases have different properties.

Kinetic theory says:

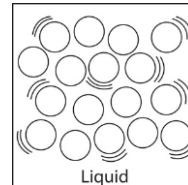
- that everything is made of very tiny particles called atoms.
- the particles are always moving and move more when they gain energy by heating.

**The particles in a solid are:**

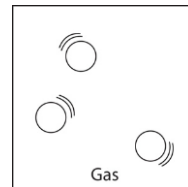
- Close together.
- Arranged in an organised way.
- Have little energy so are just vibrating.
- Fixed in position by strong forces between the particles (bonds).

**The particles in a liquid are:**

- Close together.
- Disorganised.
- Have more energy so are able to move around and over each other.
- Held together by quite strong forces between them.

**The particles in a gas are:**

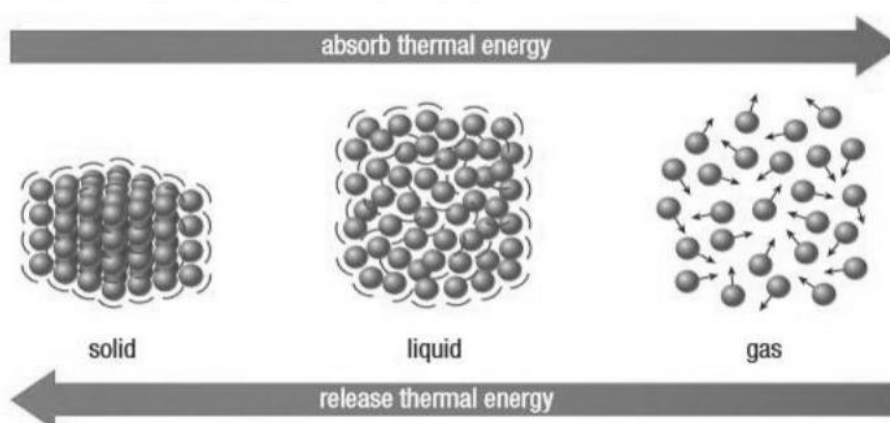
- Far apart.
- Disorganised.
- Have lots of energy so are fast moving in random directions.
- Have really weak forces between them

**What happens to particles when we change the temperature?****When a substance is heated:**

- its particles gain kinetic energy and move faster.
- The temperature of the substance rises.
- Bonds between particles can be broken

Energy is transferred, if particles move fast enough, bonds between particles can be broken

- **Melting** → strong bonds in a solid that fix particles in place are broken
- **Boiling** → bonds in a liquid are broken, particles can move freely





## Science Homework 2

Try to answer all of these key knowledge questions. Then check your answers using the last page.

Questions in *italics* are from older work.

Key knowledge question	Your answer
Define specific heat capacity of a substance.	
How can you tell from heating curve when state change occurs?	
In which state of matter do particles have the greatest energy?	
Name the change of state that happens when a solid becomes a liquid.	
What happens to the kinetic energy of the particles of a liquid when it is heated?	
What happens to the temperature of a substance if the kinetic energy of its particles increases?	
What is the idea that all matter is made of particles that are in constant motion called?	
What is the name for the state change from gas to liquid?	
What name is given to the amount of energy needed to change the state of 1kg of substance from solid to liquid?	
When a substance changes state from a gas to a liquid, what happens to it's mass?	
<i>Describe how a red blood cell is adapted to its function.</i>	
<i>How is DNA stored in a prokaryotic cell?</i>	
<i>If a small leaf is 10 millimetres in diameter what is its diameter in micrometers</i>	
<i>Osmosis is the movement of water across what?</i>	

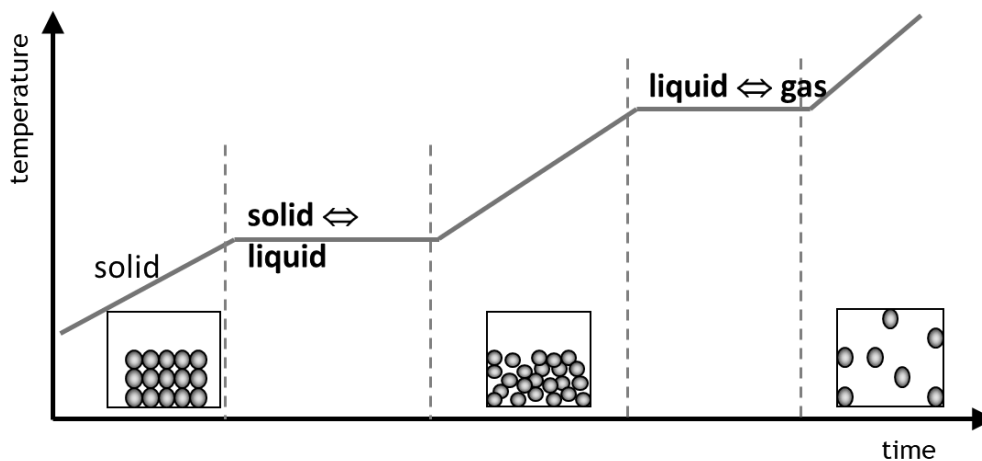
## What happens to the temperature of things when they change state?

Heating transfers energy from the particles of a hotter substance to the particles of a colder one. This energy transfer can:

- Increase the kinetic energy of the particles and make them move faster. If this happens then the substance gets hotter.
- Increase the distance between particles and make the bonds weaker. If this happens then the substance changes state.

When something is changing state) its temperature stays the same.

We can show this on cooling curve graphs.



## Do all things heat up by the same amount when they get the same amount of heat energy?

Substances have different specific heat capacities. This means they heat up by different amounts.

Substances with low specific heat capacities heat up very quickly (and cool down quickly as well).

Substances with high specific heat capacities heat up slowly (and cool down slowly). They need a lot of energy to increase their temperature.

The energy needed is given by:

$$\Delta E = mc\Delta\theta$$

**Energy changed = mass x specific heat capacity x temperature change**

**How much energy is needed to change 1kg of ice into 1kg of water?**

When a substance is melting or boiling the temperature stays the same. The heat energy transferred to the substance is being used to break bonds between particles so that they can move more freely.

- The kinetic energy of the particles does not change.
- The potential energy of the particles increases.

**We can work out how much energy is needed to change somethings state using this equation:**

$$E = m \times L_f$$

**Energy= mass x Latent Heat**

We can measure the **specific latent heat of fusion** of ice like this:

- Set up an electrical heater and a funnel of ice.
- Turn on the heater for 5 minutes. Collect the water that is melted.
- Weigh the water and the beaker to work out how much ice was melted.
- Record your results in a table like the one below
- Use the equation to work out how much energy was used to melt the ice.

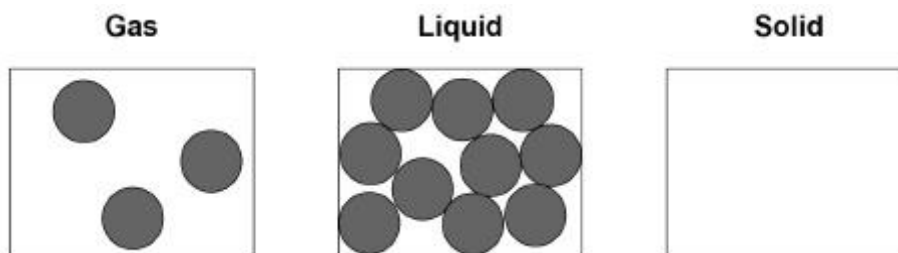
	Mass Before g	Mass After g	Difference g
<b>Ice</b>			
<b>Water</b>			

<b>Key knowledge question</b>	<b>Answer</b>
Define specific heat capacity of a substance.	The energy needed to raise the temperature of 1kg of substance by 1°C
How can you tell from heating curve when state change occurs?	Time is continuing but there is no change in temperature
In which state of matter do particles have the greatest energy?	Gases
Name the change of state that happens when a solid becomes a liquid.	Melting
What happens to the kinetic energy of the particles of a liquid when it is heated?	It increases
What happens to the temperature of a substance if the kinetic energy of its particles increases?	It increases
What is the idea that all matter is made of particles that are in constant motion called?	Kinetic Theory
What is the name for the state change from gas to liquid?	Condensation
What name is given to the amount of energy needed to change the state of 1kg of substance from solid to liquid?	(Specific) latent heat (of fusion)
When a substance changes state from a gas to a liquid, what happens to it's mass?	It is conserved (it stays the same)
<i>Describe how a red blood cell is adapted to its function.</i>	<i>Small, rounded, big surface area, full of haemoglobin</i>
<i>How is DNA stored in a prokaryotic cell?</i>	<i>In loops in the cytoplasm</i>
<i>If a small leaf is 10 millimetres in diameter what is its diameter in micrometers</i>	<i>10,000 micrometers</i>
<i>Osmosis is the movement of water across what?</i>	<i>A partially permeable membrane</i>



This is an example of the sort of question you might be asked about internal energy.

The diagram shows a model of the particles in a gas and in a liquid.



- (a) Complete the diagram to show the arrangement of particles of the same substance as a solid.

(2)

- (b) What is the name of the process when a substance changes from a gas to a liquid?

Tick **one** box.

Condensing

Evaporating

Freezing

Melting

(1)

- (c) Which **two** quantities are needed to calculate the energy required to turn a liquid into a gas with no change in temperature?

Tick **two** boxes.

Mass of the liquid

Specific heat capacity of the gas

Specific latent heat of vaporisation

Time the liquid is heated

(2)

**Big questions: How do living things get their energy?**

How do plants use light?

How can we show plants are photosynthesising?

How do gases move in and out of leaves?

What is aerobic respiration?

What is anaerobic respiration?

**Key vocabulary**

<b>Active Transport</b>	The movement of particles against a concentration gradient using energy transferred during respiration.
<b>Aerobic Respiration</b>	The reactions involved in breaking down glucose using oxygen.
<b>Anaerobic Respiration</b>	The incomplete breakdown of glucose without the use of oxygen.
<b>Enzyme</b>	A protein that acts as a biological catalyst.
<b>Translocation</b>	The movement of dissolved sugars around a plant, through the phloem.
<b>Diffusion</b>	The spreading out of particles from an area of high concentration to an area of low concentration.
<b>Osmosis</b>	The movement of water molecules across a partially permeable membrane from a dilute solution to a more concentrated solution.
<b>Limiting factor</b>	The factor that limits the reaction rate in any physiological process governed by many variables
<b>Photosynthesis</b>	The process by which plants use energy to convert carbon dioxide and water into glucose and oxygen.

## How do plants use light?

Plants are producers because they make their own food. They convert materials from the environment to produce glucose, using energy from the sun.

Producers (plants) use photosynthesis to make their own food.

Photosynthesis is a chemical process in which plants take in **carbon dioxide** and **water** and change them into **glucose** and **oxygen**.

The glucose is the food and the oxygen is a waste product.

This is the word equation for photosynthesis:



This is the symbol equation for photosynthesis:



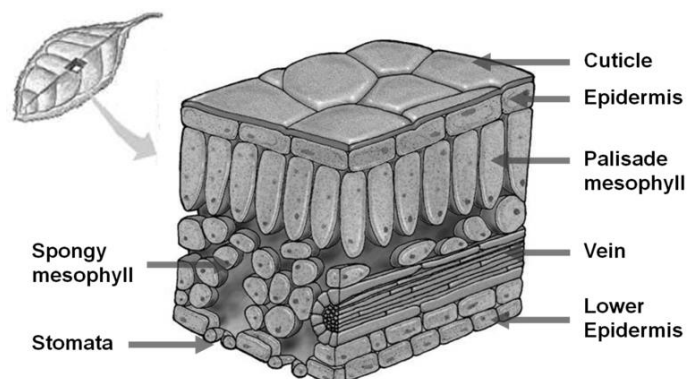
## How can we show plants are photosynthesising?

- Photosynthesis occurs mainly in the leaf cells.
- Plants are green because they contain a green substance called chlorophyll.
- Leaves are green because of chlorophyll.

Chlorophyll absorbs light and uses the energy to convert carbon dioxide and water into glucose and oxygen.

## How do gases move in and out of leaves?

- Leaves are specially adapted for photosynthesis.
- Each part of the leaf has a specific function and helps it carry out photosynthesis.
- There are tiny holes underneath the leaf called stomata.
- Stomata are open and closed by guard cells.





## Science Homework 3

Try to answer all of these key knowledge questions. Then check your answers using the last page.

Questions in *italics* are from older work.

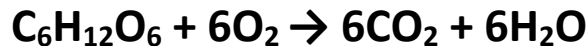
Key knowledge question	Your answer
Give two uses of glucose in plants.	
State the balanced symbol equation for photosynthesis.	
State the role of stomata in photosynthesis and respiration.	
State the word equation for anaerobic respiration in animals.	
State the word equation for anaerobic respiration in plants.	
The build-up of which chemical causes muscle fatigue?	
What cells are found either side of stomata?	
What does light provide to plants?	
What is chlorophyll?	
What is oxygen debt?	
What is the word equation for aerobic respiration in animals?	
What is the word equation for photosynthesis?	
<i>What is the function of the nucleus?</i>	
<i>What is the name given to the structures inside cells?</i>	

**What is aerobic respiration?**

- By reacting glucose with oxygen the energy it contains can be released.
- This is the energy that living things need to stay alive, to move, stay warm and make other molecules.
- This is the word equation for aerobic respiration:

**glucose + oxygen → carbon dioxide + water**

This is the symbol equation for aerobic respiration:



- This reaction happens in the mitochondria of cells in both animals and plants.
- In animals the glucose and oxygen get to the cells in the blood.

**What is anaerobic respiration?**

- If a cell needs energy but does not have enough oxygen for aerobic respiration it can release some energy by anaerobic respiration.
- The body still has a supply of glucose.
- The body can harness some energy from the glucose without oxygen.
- A by-product called lactic acid is produced.
- This releases less energy than aerobic respiration.
- Lactic acid is poisonous to muscles.
- It stops them contracting and relaxing.
- They become fatigued.

This is the word equation for anaerobic respiration in **animals**:

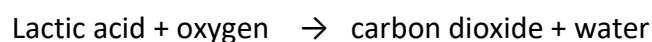
**glucose → lactic acid + energy**

This is the word equation for anaerobic respiration in **yeast and plants**:

**glucose → carbon dioxide and ethanol**

**Oxygen debt**

Lactic acid needs to be broken down by oxygen to allow muscles to return to normal



This is an example of the sort of question you might be asked about photosynthesis.

Green plants are able to make their own food.

Complete each sentence by drawing a ring around the correct answer in the box.

- (a) Green plants make their own food during the process of

diffusion
photosynthesis
respiration

(1)

- (b) This process can be summarised by the equation:

carbon dioxide + water → glucose +

mineral salts
light
oxygen

(1)

- (c) The energy needed for this process is trapped for the plant by

chlorophyll
glucose
light

(1)

- (d) Some of the food made by plants is stored as insoluble

chlorophyll
glucose
starch

(1)

(Total 4 marks)

**Wider reading**

For some amazing facts about ice and a strange fourth state of matter go to the following website

<https://education.nationalgeographic.org/resource/ice>

Photosynthesis is critical for the existence of the vast majority of life on Earth. It is the way in which virtually all energy in the biosphere becomes available to living things. As primary producers, photosynthetic organisms form the base of Earth's food webs and are consumed directly or indirectly by all higher life-forms. Additionally, almost all the oxygen in the atmosphere is due to the process of photosynthesis. If photosynthesis ceased, there would soon be little food or other organic matter on Earth, most organisms would disappear, and Earth's atmosphere would eventually become nearly devoid of gaseous oxygen.

Read more at - <https://www.britannica.com/question/Why-is-photosynthesis-important>

**How to get the most out of your knowledge organiser:**

- To get the most use out of the knowledge organisers you should be learning sections and then self-testing.
- There are several different things you can do
  - Look, cover, write, check, correct
  - Read through the organisers
  - Mind maps
  - Key spellings
  - Make a glossary
  - Missing out key words
  - Questions/answers answers/questions
  - Flash cards
  - Revision clock learning
  - Mnemonics

**Science Learning Tools and wider study:**

The Oak Academy – Online Science lessons

BBC Bitesize KS3 science

You tube channels:

Fuse school

Ted talks

Free science lessons

Primrose Kitten

Shows on Netflix

Our planet

Tiny creatures

A life on our planet

Key knowledge question	Answer
Give two uses of glucose in plants.	Respiration, combined with nitrates to make amino acids, cellulose for cell walls, lipids
State the balanced symbol equation for photosynthesis.	$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
State the role of stomata in photosynthesis and respiration.	Gas exchange
State the word equation for anaerobic respiration in animals.	glucose $\rightarrow$ Lactic acid + Energy
State the word equation for anaerobic respiration in plants.	glucose $\rightarrow$ carbon dioxide and ethanol
The build-up of which chemical causes muscle fatigue?	Lactic acid
What cells are found either side of stomata?	Guard cells
What does light provide to plants?	Energy
What is chlorophyll?	Green pigment found in chloroplasts, absorbs sunlight for photosynthesis
What is oxygen debt?	The amount of oxygen required to break down lactic acid produced during anaerobic respiration
What is the word equation for aerobic respiration in animals?	glucose + oxygen $\rightarrow$ carbon dioxide + water (and energy)
What is the word equation for photosynthesis?	carbon dioxide + water $\rightarrow$ glucose + oxygen
<i>What is the function of the nucleus?</i>	<i>To control the cells activities, hold genetic information</i>
<i>What is the name given to the structures inside cells?</i>	<i>Organelles</i>