THE DUSTON SCHOOL
Knowledge itself is power
TDS 4-19

Year 8 Science Knowledge Booklet

Term 2

Name:	**Class:**
Homework 1 Due: 19th November	**Homework 2 Due: 3rd December**
Homework 3 Due: 10th December	

Science Homework 1

Read all of this knowledge organiser. The work covered will be in the first knowledge quiz of the term.

Big questions: What do we mean by inheritance?

What is variation?
How do we vary from each other?
What does adaptation mean?
What do living things compete for?
What do we mean by evolution?
What is our evidence for evolution?
How do we produce new varieties of plants and animals?

Key vocabulary

Adaptation	A feature or characteristic that helps an organism survive in the conditions of its natural environment.
Charles Darwin	A scientist who proposed the theory of evolution via natural selection.
Distribution	Where organisms are found in a particular area.
Evolution	The changing of inherited characteristics of a population over time.
Extinction	When no living individuals of a species remain.
Fossil	The remains or impression of a prehistoric plant or animal embedded in rock and preserved in petrified form.
Genetically modified organism	Organisms in which the genetic material (DNA) has been altered in a way that does not occur naturally.
Inbreeding	When closely related animals or plants breed together.
Mutation	The changing of an organisms DNA.
Natural selection	The process by which species evolve.
Organism	An individual animal, plant or single celled life form.
Predator	An animal that hunts and kills other animals.
Prey	An animal that is hunted and killed by other animals.
Selective breeding (artificial selection)	When humans artificially select the plants or animals that are going to breed so that the genes for a particular characteristic remain in the population,
Species	A group of similar organisms that can reproduce and give fertile offspring.
Variation	The differences that exist between individuals.

What is variation?

A characteristic is a feature of an organism:

- It can be something we can see (like hair colour) or something we can't see (like blood group).
- All humans have different combinations of characteristics, meaning we all look different.

A difference in our characteristics is called **variation**.

Differences in the **characteristics** of individuals may be due to:

- inherited genes
- environmental causes
- a combination of both

Characteristics	Inherited?	Environmental?	Both?
Hair colour			X
Eye colour	X		
Blood type	X		
Height			X
Weight			X
Scar		X	

How do we vary from each other?

Although all humans have the similar characteristics individuals are different to each other.

Continuous Variation

Has no limit on the value that can occur within a population. A line graph is used to represent continuous variation. Examples include height, weight, heart rate, finger length, leaf length.

Discontinuous Variation

Has distinct groups for organisms to belong to. A bar graph is used to represent discontinuous variation. Examples include tongue rolling, finger prints, eye colour, blood groups.

Inherited Variation

A characteristic that is the result of genetic inheritance from the biological parents. Examples include eye colour, hair colour, and skin colour.

Environmental Variation

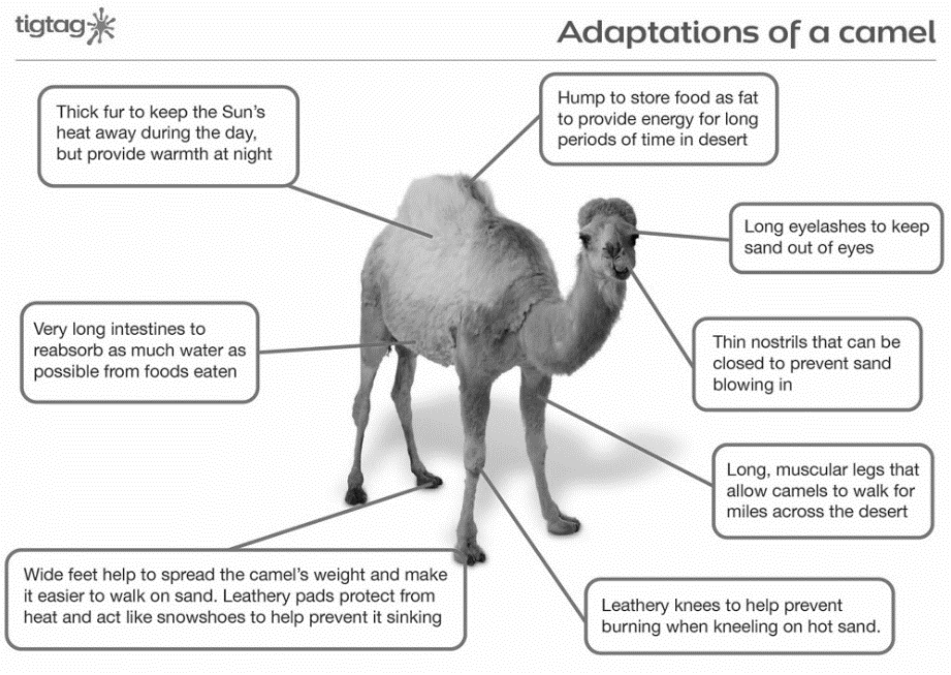
Is variation caused by the surroundings. Examples include scars, tattoos, and flower colour in hydrangeas (these plants produce blue flowers in acidic soil and pink flowers in alkaline soil.

What does adaptation mean?

Adaptation is a feature or behaviour that makes an organism particularly suited to its habitat.

Adaptations may be:

- structural
- behavioural
- functional



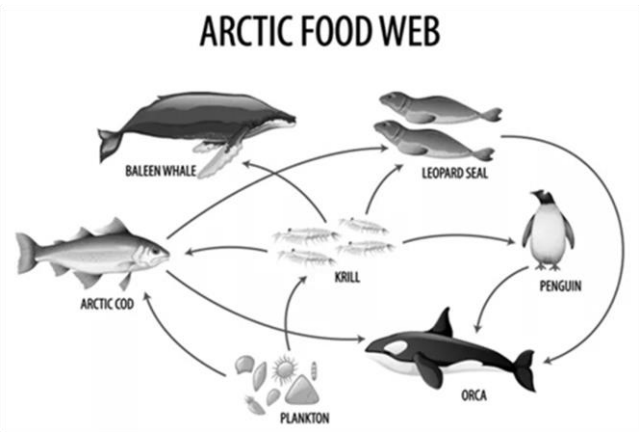
What do living things compete for?

What do plants compete for?

- Water
- Space
- Light

What do animals compete for?

- Food
- Water
- Space
- Mates



An ecosystem is:

An environment which includes the flora (plants) and fauna (animals) that live and interact within that environment.

Science Homework 2

Try to answer all of these key knowledge questions. Then check your answers using the last page. These are some of the questions that will be in the knowledge quizzes and the end of term tests.

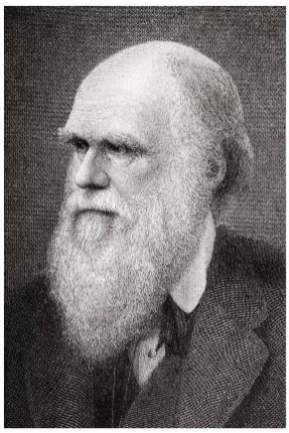
Questions in *italics* are from older work.

Key knowledge question	**Your answer**
Give an example of variation in humans caused only by genes.	
Give an example of variation in humans that is continuous.	
Give an example of variation in humans that is discontinuous.	
Give two resources that plants compete for.	
Give an example of variation in humans caused only by the environment.	
Which scientist developed the theory of evolution based on his observations of birds on the Galapagos Islands?	
Define adaptation	
Define adaptation	
Give two resources that animals compete for.	
Define evolution.	
What is the function of the cell membrane?	
What type of organisms have eukaryotic cells?	
What is the name given to the structures inside cells?	
What is the function of the mitochondria?	

What do we mean by evolution?

Evolution: The process by which different kinds of living organism are believed to have developed from earlier forms during the history of the earth.

Darwin's theory of evolution by natural selection states that …
'all species evolved from simple life forms that first developed more than three billion years ago'

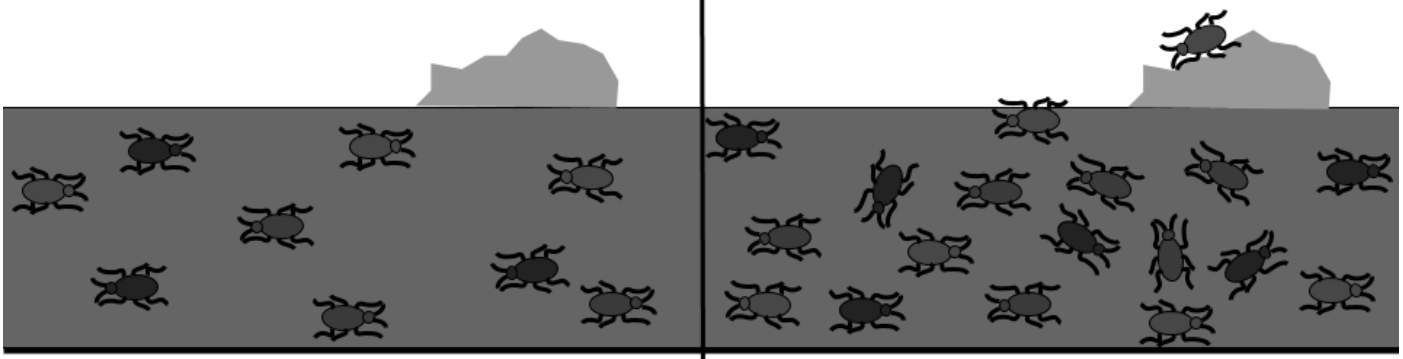


Variation

There is natural variation in the characteristics of individuals that are part of a population.

Overproduction

Ecosystems are unable to support all individuals within a population to an age of reproduction, causing competition among offspring.

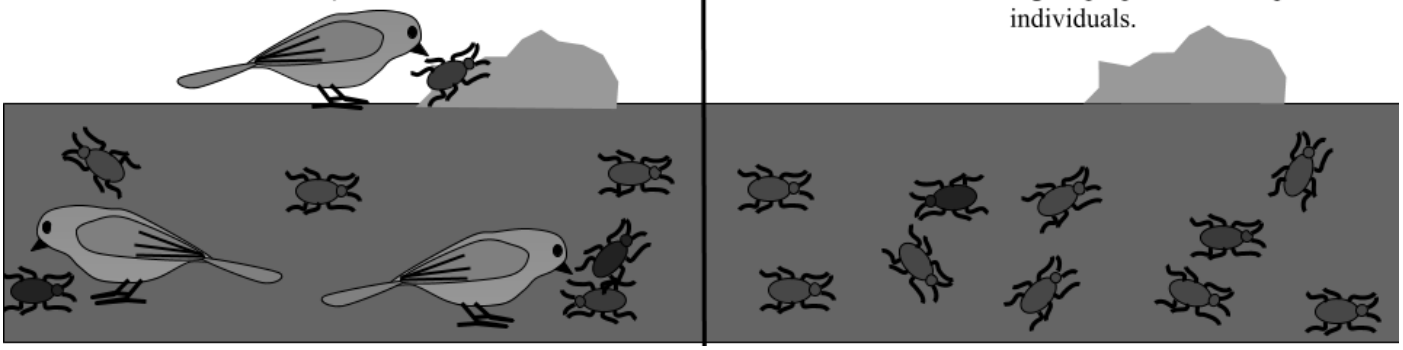


Selection

The more adapted individuals within a population are more likely to survive while those who have less adapted characteristics are less likely.

Reproduction

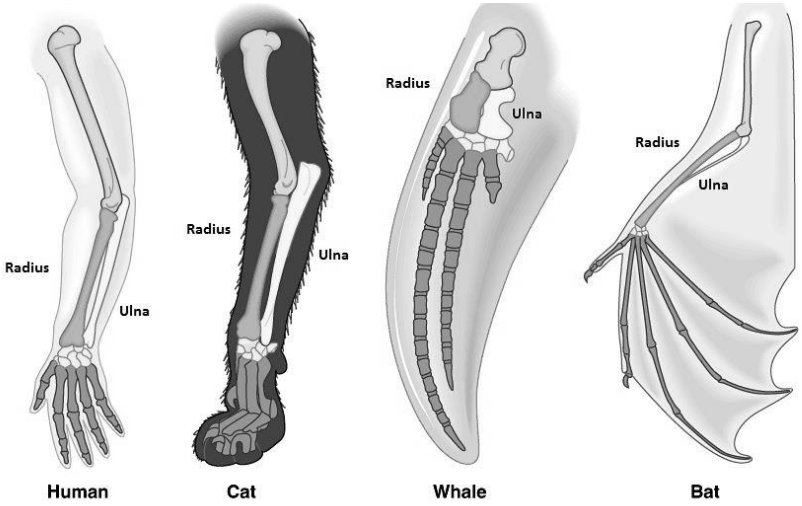
The better adapted individuals survive to reproduce and pass on their characteristics. Over time the population will see a shift to a higher proportion of adapted individuals.



What is our evidence for evolution?

Evidence for evolution comes from a number of different things

Fossils that show species that no longer exist and species that are similar to those alive now.
Fossil layers – we can track through ages and see how there are changes over time.
Similarities in living organisms – things like most animals having five bones in their feet or hands.
Similarities in DNA that let us see how species are related.
Similarities in embryos – many very different species have very similar embryos.

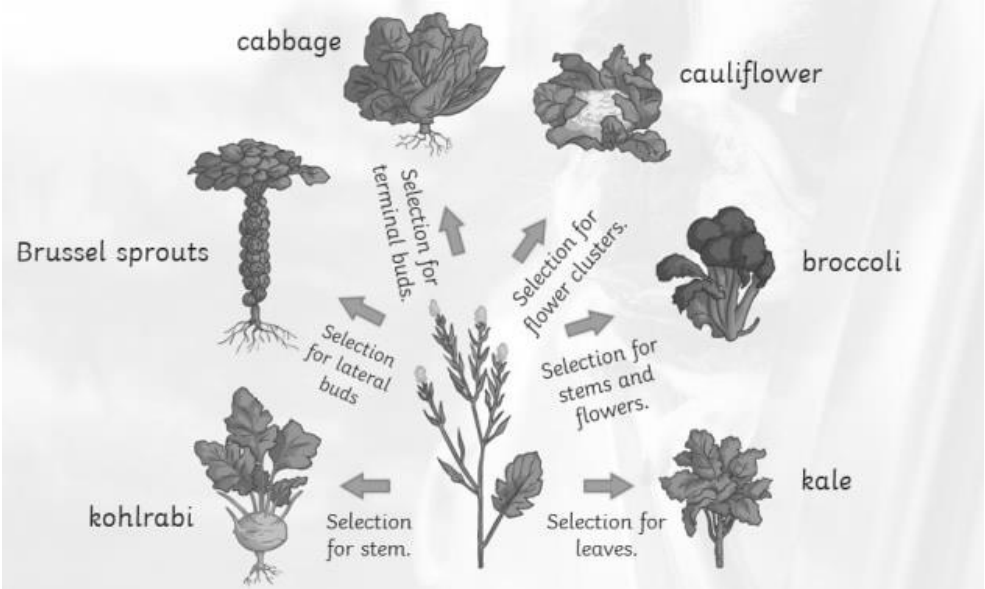


How do we produce new varieties of plants and animals?

Selective breeding or artificial selection has been used for by humans for thousands of years to produce new varieties of plants and animals.

The method:

- desired characteristics are identified
- individuals bred together
- Offspring with desired characteristics are bred
- Repeated over several generations until the desired characteristic is fully developed



Wider reading

SCIENTISTS SAY GENETICS

Scientists Say: Evolution

This is a process by which groups of living organisms change over time

Tawny owls can come in gray or brown. As the climate changes, scientists have shown that brown owls are becoming more common — a sign of a species evolving.
JOHNDPORTER/ISTOCK/GETTY IMAGES PLUS

By **Bethany Brookshire**

November 16, 2020 at 6:30 am

Evolution (noun, "EE-vol-oo-shun", verb "evolve," "EE-volve")

In biology, evolution is a process by which species change over time. Evolution is a theory — an explanation about how the world works, backed by evidence. The theory of evolution states that groups of organisms change over time. The theory also explains how groups change. That's because some individuals in the group survive to reproduce and pass on their genes. Others do not.

Keep in mind that groups don't evolve to become more "advanced" than their ancestors. Their ancestors did well enough to pass on their genes, after all! But species are always changing. So are their environments. Sometimes their environment might have more or less food. A new predator might appear. The climate might change. Those challenges make it harder or easier for some individuals in a group to survive.

Since every individual within a group is different, some usually have traits that help them survive the change. These individuals will be more likely to survive and reproduce. Over time, the group evolves as more and more individuals with those traits survive.

Scientists have a lot of evidence that evolution occurs. For example, fossils show how apes came to walk upright over millions of years, leading to the evolution of humans. Standing on two legs is a great way to get around. But it has some drawbacks — in the form of sprained ankles and lower back pain. Overall, though, it was beneficial to the species that tried it — which is why we're standing here today.

There's also plenty of evidence that evolution is taking place now. For example, bacteria are evolving in ways that help them resist antibiotics. As the climate changes, tawny owl populations are becoming more brown than grey. There is less snow cover that might make a brown owl stand out, and browner owls hide better in brown trees.

Key knowledge question	**Answer**
Give an example of variation in humans caused only by genes.	Blood group, eye colour, genetic gender, tongue rolling
Give an example of variation in humans that is continuous.	Height, weight anything that can be measured on a scale
Give an example of variation in humans that is discontinuous.	Blood group, eye colour, genetic gender, tongue rolling
Give two resources that plants compete for.	Water, light, nutrients
Give an example of variation in humans caused only by the environment.	Language spoken, scars, clothes
Which scientist developed the theory of evolution based on his observations of birds on the Galapagos Islands?	Charles Darwin
Define adaptation	Features that enable organisms to survive in their habitat
Give two resources that animals compete for.	Mates, food, habitat/space, water
Define evolution.	The process by which different kinds of living organism are believed to have developed from earlier forms during the history of the earth.
Name two abiotic factors.	Water; sunlight; temperature
What is the function of the cell membrane?	*A group of similar cells preforming a function*
What type of organisms have eukaryotic cells?	*Movement of particles from an area of low concentration into an area of high concentration, across a partially permeable membrane, involving energy*
What is the name given to the structures inside cells?	*Mineral ions entering roots*
What is the function of the mitochondria?	*Animal- sperm and egg, Plant- Pollen and egg/ ovule*

Internal Energy

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

States of matter	Substances (matter) can exist in three states: the solid state, the liquid state and the gas state.
Change of state	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.
Heating	The transfer of energy from a hotter object to a colder one.
Temperature	How hot or cold something is. Temperature increases if the average speed of the particles increases
Kinetic theory	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.
Gas pressure	The pressure exerted when the particles of a gas collide with its surroundings. Gas pressure increases as the gas gets hotter.
Specific heat capacity	The energy needed to raise the temperature of 1kg of a substance by 1^{o}C.
Latent heat of fusion	The energy required to melt 1kg of a substance from solid to liquid with no temperature rise.
Latent heat of vaporisation	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

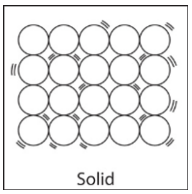
What is the Kinetic theory of matter?

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.

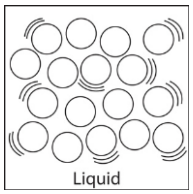
The particles in a <u>solid</u> are:

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



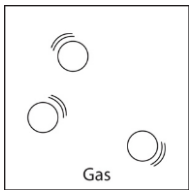
The particles in a <u>liquid</u> are:

- 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 <u>gas</u> are:

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



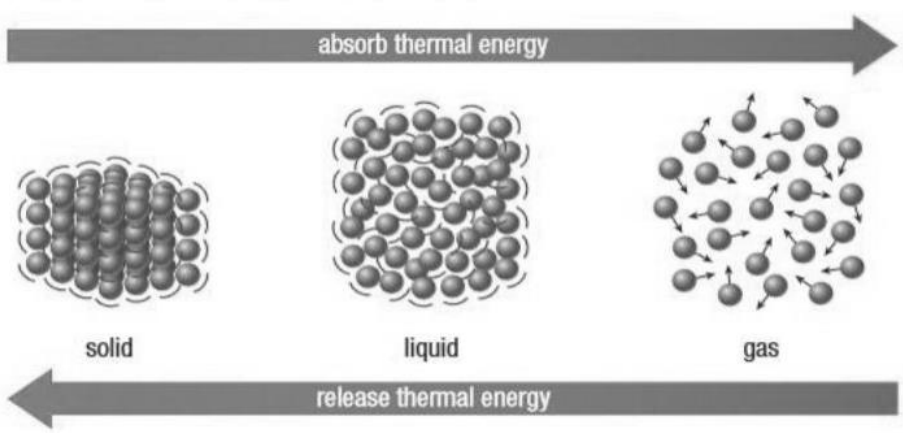
What happens to particles when we change the temperature?

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?	
Describe how a red blood cell is adapted to its function.	
How is DNA stored in a prokaryotic cell?	
If a small leaf is 10 millimetres in diameter what is its diameter in micrometers	
Osmosis is the movement of water across what?	

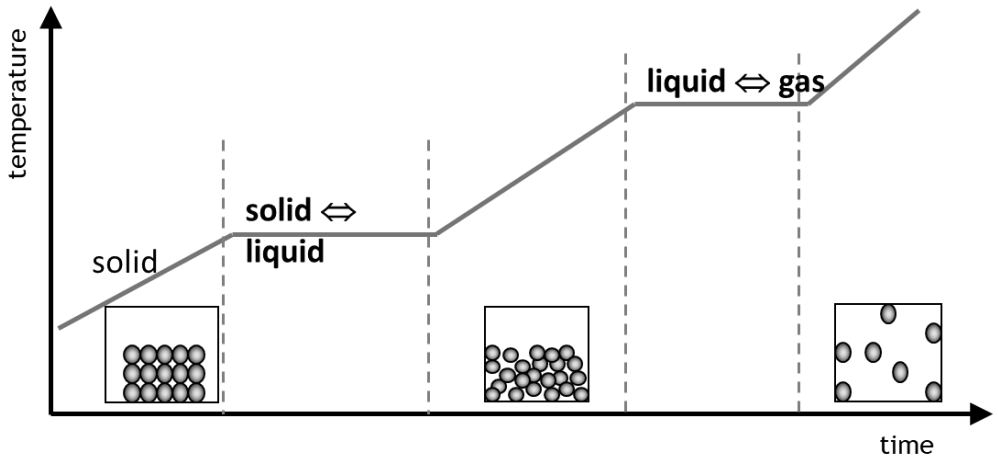
What happens to the temperature of things when they change state?

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 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**:**

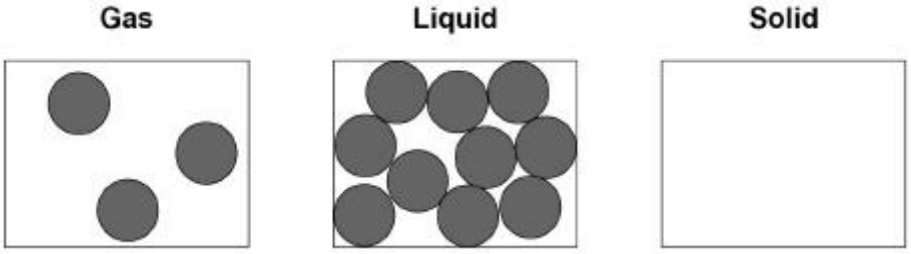
- Set up an electrical heater and a funnel of ice.
- Turn on the heater for 5 minutes. Collect the water that is melted.
- Weigh the water and the beaker to work out how much ice was melted.
- Record your results in a table like the one below
- Use the equation to work out how much energy was used to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

	Mass Before g	**Mass After g**	**Difference g**
Ice			
Water			

Key knowledge question	Answer
Define specific heat capacity of a substance.	The energy needed to raise the temperature of 1kg of substance by $1^{o}C$
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)
Describe how a red blood cell is adapted to its function.	*Small, rounded, big surface area, full of haemoglobin*
How is DNA stored in a prokaryotic cell?	*In loops in the cytoplasm*
If a small leaf is 10 millimetres in diameter what is its diameter in micrometers	*10,000 micrometers*
Osmosis is the movement of water across what?	*A partially permeable membrane*

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)

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
<u>You tube channels:</u>
Fuse school
Ted talks
Free science lessons
Primrose Kitten
<u>Shows on Netfilx</u>
Our planet
Tiny creatures
A life on our planet