THE DUSTON SCHOOL
Knowledge itself is power
4-19

Year 9 Science Knowledge Booklet

Term 1

Name:	**Class:**
Homework 1 Due: 16st September	**Homework 2 Due: 30th September**
Homework 3 Due: 14th October	

Science Homework 1

Read all of this knowledge organiser.

Big questions: How do living things interact with their environment?

What do food chains show?

What happens if we disrupt food webs?

How can we count animals in a habitat?

How can we count plants in a habitat?

How can we investigate the distribution of daisies on a field?

How are organisms effected by their environment?

Key vocabulary

Adaptation	A feature or characteristic that helps an organism to survive in the conditions of its natural environment
Biodiversity	The variety of different species of organisms on Earth, or within an ecosystem.
Bioaccumulation	The build-up of toxins within a food chain. The organism at the top is affected the most severely
Community	The populations of different species living in a habitat.
Distribution	Where organisms are found in a particular area.
Ecosystem	The interaction of a community of living organisms with abiotic parts of their environment.
Evolution	The changing of inherited characteristics of a population over time.
Extinction	When no living individuals of a species remain.
Habitat	The place where an organism lives.
Inbreeding	When closely related animals or plants breed together.
Interdependence	Where, in a community, each species depends on other species for things such as food, shelter, pollination and seed dispersal.
Natural Selection	The process by which species evolve.
Predator	An animal that hunts and kills other animals.
Prey	An animal that is hunted and killed by another animal.
Primary consumer	An organism in a food chain that feeds on a producer.
Producer	An organism at the start of a food chain that makes its own food using energy from the sun.
Secondary consumer	An organism in a food chain that eats a primary consumer.
Species	A group of similar organisms that can reproduce and give fertile offspring.
Tertiary consumer	An organism in a food chain that eats a secondary consumer.
Variation	The differences that exist between individuals.

What do food chains show?

Food chains show the transfer of energy from one organism to the next.

Grass → Rabbit → Fox

The arrows show the flow of energy up the food chain.

Carnivores:

- Eat only meat

Omnivores:

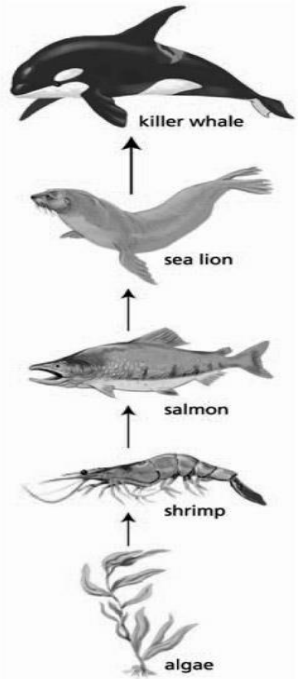
- Eat both plants and animals

Herbivores are:

- Primary consumers
- Eat only producers (plants)

Plants are:

- Producers
- Able to trap energy from the sun through photosynthesis
- The base (first thing) of every food chain
- The source of food for all animals

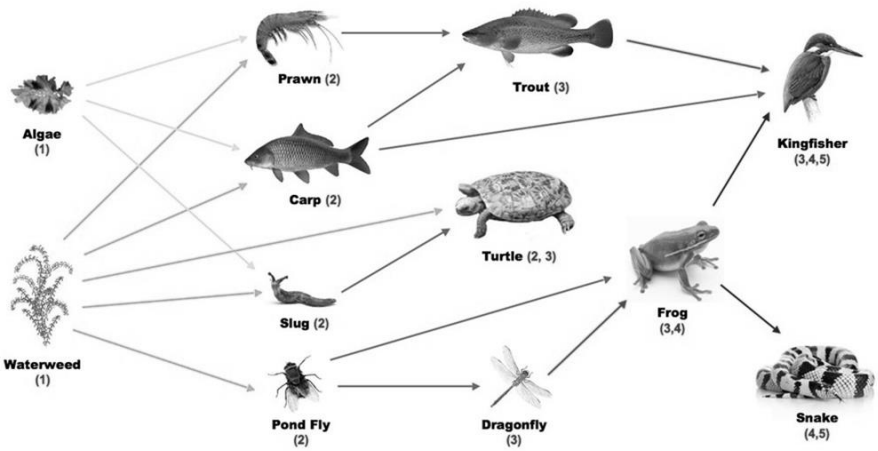


Energy only flows in one direction through the community:

producers → herbivores → carnivores

Food chains – show a single path taken by nutrients and energy through trophic levels.
Trophic level – the position an organism occupies in a food chain. Basically the 'number of steps' the organism is from the start of the chain.

Food web – these are more complex, showing different cross-linked food chains

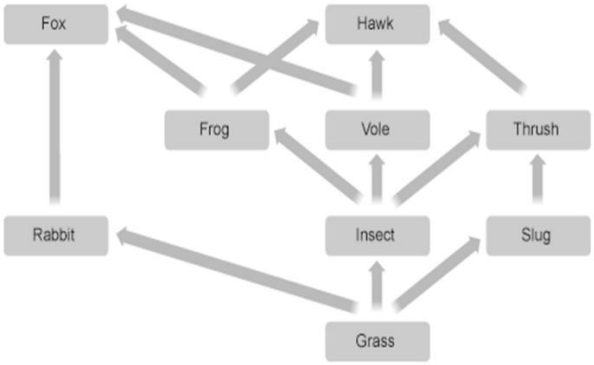


What happens if we disrupt food webs?

Interdependence - Organisms in a food chain or web depend on each other for survival.

What would happen if the population of slugs decreased?

- Slugs, rabbits and insects all eat grass.
- Fewer slugs, more grass for rabbits and insects.
- More food, rabbits and insects would increase.
- Thrushes would eat more insects to maintain their population, so insect numbers could decrease.
- Therefore maybe a reduction of voles and frogs.



What would happen if the population of insects decreased?

- Fewer insects, more grass.
- More food for rabbits and slugs, so their numbers would increase.
- Less food for frogs and voles, so their populations would decrease.
- Less food for the foxes and hawks, but maybe more rabbits and thrushes for them to eat, so their populations are likely to stay the same.

What is bioaccumulation?

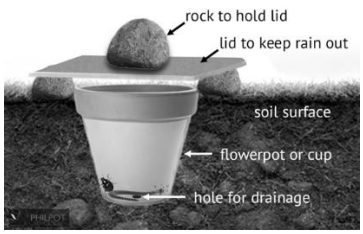
- It occurs when toxins build up - or accumulate - in a food chain.
- The animals at the top of the food chain are affected most severely.

How can we count animals in a habitat?

A pitfall trap is often used to get a sample of small invertebrates living on the ground, such as beetles, spiders and slugs.

Sweep nets are useful for collecting insects and other small animals from bushes, long grass and ponds.

Random Sampling maximises validity and reliability.



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.

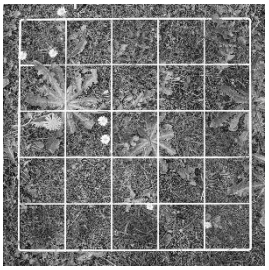
Key knowledge question	**Your answer**
How do you avoid bias in a quadrat sampling investigation?	
Name two abiotic factors.	
Name two biotic factors.	
What do the arrows in food chains represent?	
What is a carnivore?	
What is a herbivore?	
What is a producer?	
What is a quadrat used for?	
What is a transect?	
What is bioaccumulation?	
What are the three states of matter?	
What is the boiling point of pure water?	
What is the name for the state change from gas to liquid?	
Which out of solids, liquids, and gases can easily be compressed?	

How can we count plants in a habitat?

Sampling is used to investigate plant populations and how they are distributed.

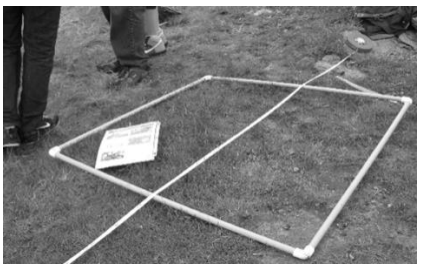
Quadrats

These are squares that we use to mark out an area of land to sample, it is possible to count all of the organisms in the sample, or the percentage of the quadrat they cover, when it would not be possible to count all of them in a habitat.



Transects

- Transects are tape measures put across the habitat
- Use quadrats at different points on the transect
- Allows you to see how the habitat is changing as you move along it



Key points for both:

- Only work for immobile/slow moving populations
- The more data you collect, the more reliable your result
- Quadrats should be placed randomly to maximise validity

How can we investigate the distribution of daisies on a field?

- On the field, look for two areas, by the edge of a path and away from the path
- Put down a transect line leading away from the edge of the path
- Do not look at the grass as you lay the line down
- Place the quadrat next to the line at the start
- Count how many daisy plants you can find in each quadrat
- It may only be the leaves of a plant, so look carefully
- Record the number in a results table
- Move the quadrat further along the transect, deciding how far apart to lace each qudrat

How are organisms effected by their environment?

Abiotic factors

- Non-living things in an environment
- Examples – soil, water, light, temperature, pH

Biotic factors

- Living things in an environment
- Examples – plants and animals, diseases, predators and prey

What is biodiversity?

The term biodiversity (from "biological diversity") refers to the variety of life on Earth at all its levels, from genes to ecosystems, and can encompass the evolutionary, ecological, and cultural processes that sustain life.

Wider reading

More than a fifth of reptile species could be wiped out by threats such as farming, logging, urban development and invasive species, according to the first global assessment of reptiles at risk of extinction.

Bruce Young at NatureServe, an international biodiversity organisation based in Arlington, Virginia, and his colleagues collated data from over 900 researchers around the globe to assess the extinction risk for 10,196 reptile species, including turtles, crocodiles and lizards.

By accounting for local factors such as habitat degradation and population sizes, they estimated that 21.1 per cent of reptile species are threatened with extinction.

The researchers found that farming, logging and urban development posed the largest threats, with species in tropical regions of South-East Asia, West Africa, northern Madagascar and the Caribbean islands at the highest risk. What's more, the analysis revealed that 31 reptile species have already gone extinct.

The results are worrying because these animals play a vital part of food webs. "Reptiles are good for people because they help control pests, such as insects and rodents," said Blair Hedges at Temple University in Philadelphia, Pennsylvania, at a press briefing. "They fill a crucial intermediate role in the food chain between insects and the predators of reptiles.

Read more: https://www.newscientist.com/article/2317753-over-a-fifth-of-reptile-species-are-at-risk-of-extinction/#ixzz7XRXGPLMD

Key knowledge question	**Answer**
How do you avoid bias in a quadrat sampling investigation?	Use a random number generator to select co-ordinates
Name two abiotic factors.	Water; sunlight; temperature
Name two biotic factors.	Predator/prey; availability of mates
What do the arrows in food chains represent?	Transfer of energy
What is a carnivore?	Eats animals
What is a herbivore?	Eats plants
What is a producer?	Organism that uses sunlight, water and carbon dioxide to make energy stores
What is a quadrat used for?	Environmental sampling
What is a transect?	A line along the ground that quadrats are placed along
What is bioaccumulation?	Build-up of substances in organisms in the food chain
What are the three states of matter?	*Solid. Liquid and gas*
What is the boiling point of pure water?	*$100^{o}C$*
What is the name for the state change from gas to liquid?	*Condensation*
Which out of solids, liquids, and gases can easily be compressed?	*Gases*

Big questions: How can the properties of different structures be compared?

How are different molecules held together?

What is the difference between simple and giant in chemistry?

How can metallic structures be made more useful?

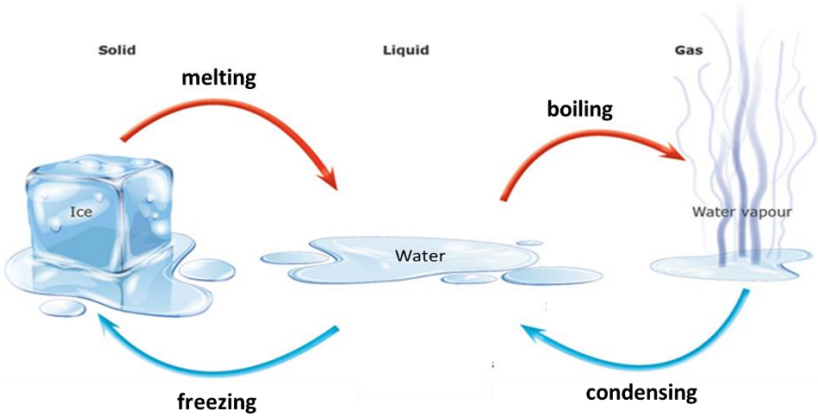
Why are artificial materials useful?

Why are carbon-based materials so different?

Key vocabulary

Atom	Simple particle of an element that can exist
Molecule	A particle that consists of two or more atoms chemically bonded together
Compound	2 or more different elements bonded together in a fixed ratio
Mixture	2 or more different substances (elements/compounds), that are not chemical bonded together
Element	Made up of one type of atom only
Intermolecular force	Force of attraction between molecules
Bond	Electrostatic force of attraction between atoms
Simple	Specific number of atoms within a molecule
Giant	The bonding within the structure could go on inifinitely
Lattice	Regular arrangement of atom/ions
Delocalised electrons	Electrons free to move throughout the whole structure
Alloy	Mixture of a metal and another element
Property	Feature or characteristic of a substance
Melting point	The temperature which a solid will change state to a liquid
Polymer	Polymers are large molecules made up of repeating units known as monomers. These monomers are joined together through chemical reactions, to form long chains.
Ceramic	Class of materials that are made by shaping and moulding raw materials and then heating them to high temperatures.
Composite	Composites are materials made from different types of materials. They are very useful because they combine two or more materials which have unique properties.

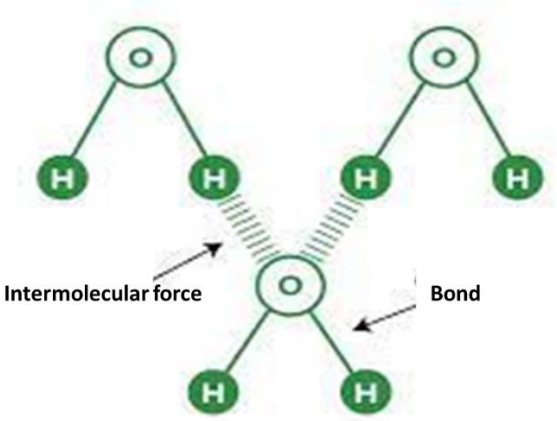
How are different molecules held together?



Simple molecules are elements or compounds that have a specific number of elements present.

A bond is an attraction between atoms, and holds atoms together in a molecule.

An intermolecular force holds different molecules together.

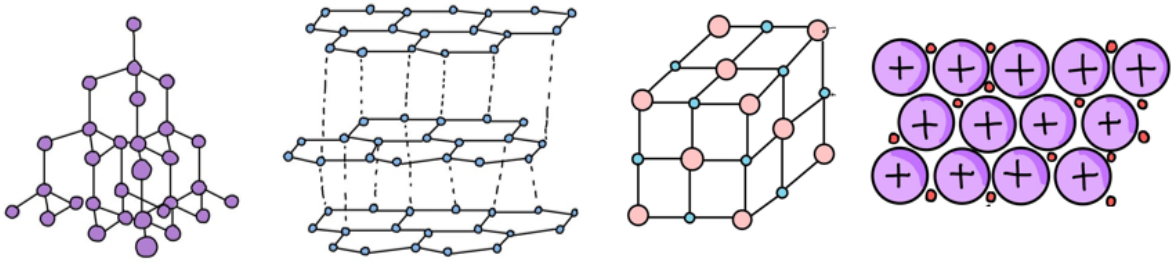


If a substance changes state, like going from a solid to a liquid; the forces holding the molecules together will break. The bonds will not.

A water molecule will still be two hydrogen atoms bonded to an oxygen atom; whether it is ice, water, or steam.

What is the difference between simple and giant in chemistry?

Structures can also be giant. This means that the bonding within the structures could go on infinitely.



The diagrams above are examples different giant structures.

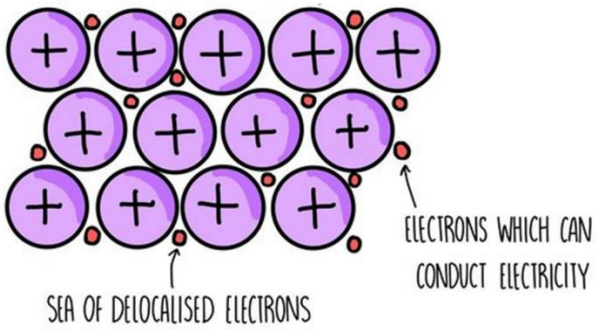
They can also be described as having a lattice structure.

Properties of giant structures

- High melting point – requires a lot of energy to break the bonds
- Some conduct electricity as solids – contains delocalised electrons

If it doesn't conduct electricity as a solid, but will when the substance is dissolved, it has a different charged particle that can move.

How can metallic structures be made more useful?



Structure of a metal

An alloy is a mixture made of a metal and another element. This is to change the properties of the metal to make it more useful – eg. Make it stronger.

In metals the atoms are arranged tightly in rows. The rows can slide over each other and this makes the metal soft. Sudden pressure, however, can cause cracks to form across the rows, making the pure metal brittle. When another metal is added, its atoms help to strengthen the first metal. It does this by holding the parts of the metal together, so stopping its rows from sliding over each other.

Alloy compared to pure metal structures

Science Homework 3

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
What holds atoms together in a molecule?	
What holds different molecules together in a solid?	
Why do simple molecules have low melting points?	
Why do metals conduct electricity?	
Why is graphite soft?	
How many bonds are made by each carbon atom in diamond?	
Why are alloys stronger than metals?	
What natural polymer is made from amino acids?	
What is a molecule?	
What does the term lattice mean?	
Is carbon dioxide a simple molecule or giant structure?	

Why are artificial materials useful?

Polymer - Polymers are large molecules made up of repeating units known as monomers. These monomers are joined together through chemical reactions, to form long chains.

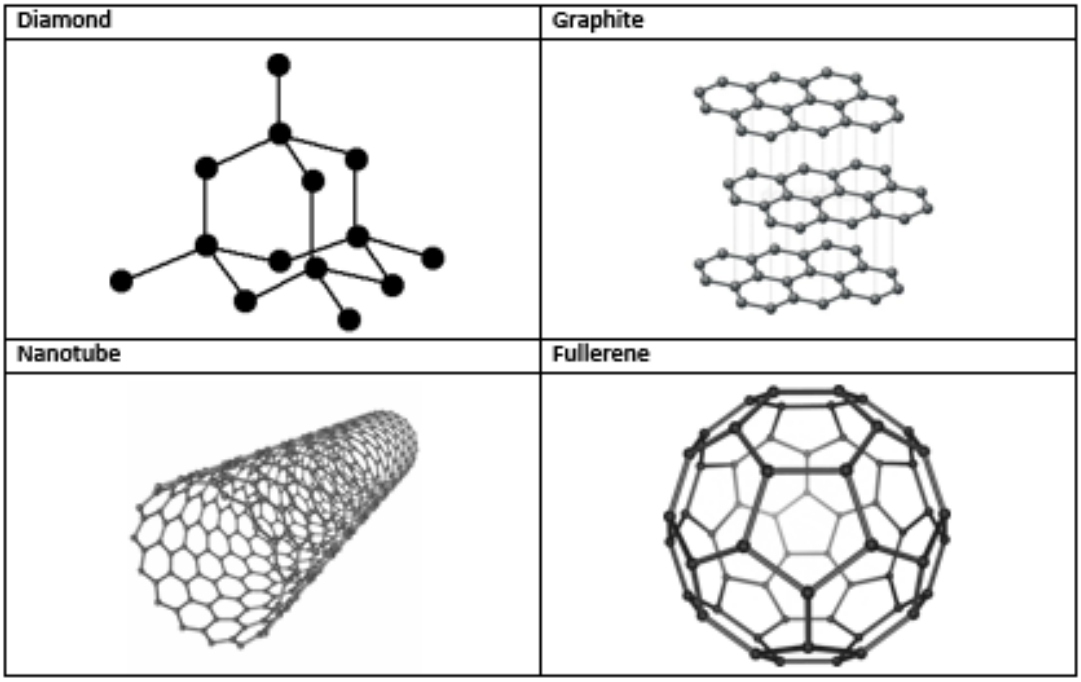
Ceramic - Class of materials that are made by shaping and moulding raw materials and then heating them to high temperatures.

Composite - Composites are materials made from different types of materials. They are very useful because they combine two or more materials which have unique properties.

There are both natural and synthetic polymers

Natural Polymers	**Synthetic Polymers**
Silk	Nylon
Wool	Polyethylene
Cellulose	Polyester
Proteins	Teflon

Why are carbon-based materials so different?



Diamond

In diamond, each carbon atom makes 4 bonds. This makes diamonds incredibly strong.

Graphite

In graphite, each carbon atom makes 3 bonds. This means that there is 1 electron free from each carbon atom.

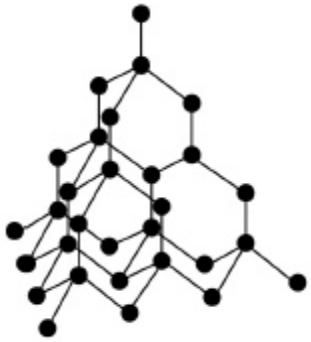
The bonding of the carbon atoms in graphite is very similar to the bonding in the nanotube and the fullerene, where each carbon makes 3 bonds.

They all conduct electricity because the structures contain delocalised electrons

Answer these questions using the knowledge organiser to help you.

Figure 1 shows part of the structure of diamond.

Figure 1



(a) Complete the sentence.

Choose the answer from the box.

calcium	**carbon**	**chromium**	**cobalt**

Diamond is a form of _____ .

(1)

(b) Which **two** statements about diamond are correct?

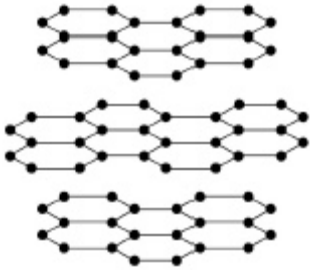
Tick **two** boxes.

- Diamond has a giant structure. ☐
- Diamond is made of layers. ☐
- Diamond has weak bonds. ☐
- Each atom is joined to four other atoms. ☐

(2)

Figure 2 shows part of the structure of graphite.

Figure 2



(c) Explain why graphite is soft and slippery.

Use **Figure 2** and your own knowledge.

_____

_____

_____

_____

_____

_____

(3)

(d) Graphite has covalent bonds between the atoms.

How many covalent bonds does each atom form?

Tick **one** box.

1 ☐ 2 ☐ 3 ☐ 4 ☐

(1)

(e) Explain why graphite can conduct electricity.

You should include a reference to electrons in your answer.

_____

_____

_____

_____

(2)

(Total 9 marks)

Wider reading

Scientists have created an entirely new material that can't be explained, they say.

The material can be made like plastic, but conducts electricity like a metal. The discovery goes against what scientists would expect to see, and could lead to new kinds of breakthroughs, researchers say.

Read more at: https://news.yahoo.com/scientists-create-entirely-material-t-150710218.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAACsZQf_OQoc2qIAe4W_pInQUkc0aDfP0QaNBz4gqQ34jBbRANUR2CEF8UcUDNRljPeC8Z_eoYG33AP5Rlv6ugPsCyn3bWIkHsRDgv_P5djVwEwt1UzVbf4jAqOCIswag-Y5PzDhzBU-DJqgUJsZ4t-v7uvVED40woSpkii68KnTx

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

Key knowledge question	Answer
What holds atoms together in a molecule?	Bonds
What holds different molecules together in a solid?	Intermolecular forces
Why do simple molecules have low melting points?	Because intermolecular forces don't require much energy to break
Why do metals conduct electricity?	They contain delocalised electrons
Why is graphite soft?	The layers are held together by weak intermolecular forces and will slide
How many bonds are made by each carbon atom in diamond?	4
Why are alloys stronger than metals?	The layers are disrupted by different sized molecules and won't slide over as easily
What natural polymer is made from amino acids?	Proteins
What is a molecule?	A particle that consists of two or more atoms chemically bonded together
What does the term lattice mean?	Regular arrangement of atoms/ions
Is carbon dioxide a simple molecule or giant structure?	Simple