

Year 9 Science Knowledge Booklet

Term 1

Name:

Class:

Homework 1 Due: 21st September

Homework 2 Due: 5th October

Homework 3 Due: 19th 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:

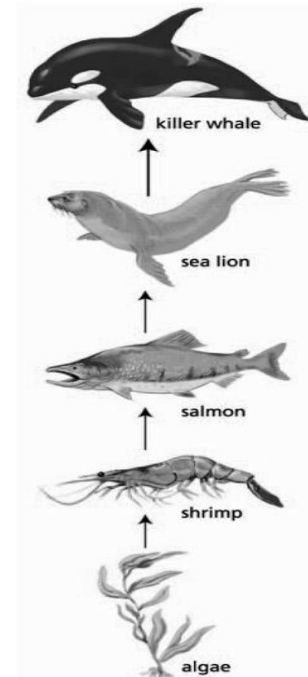
- Eat both plants and animals

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



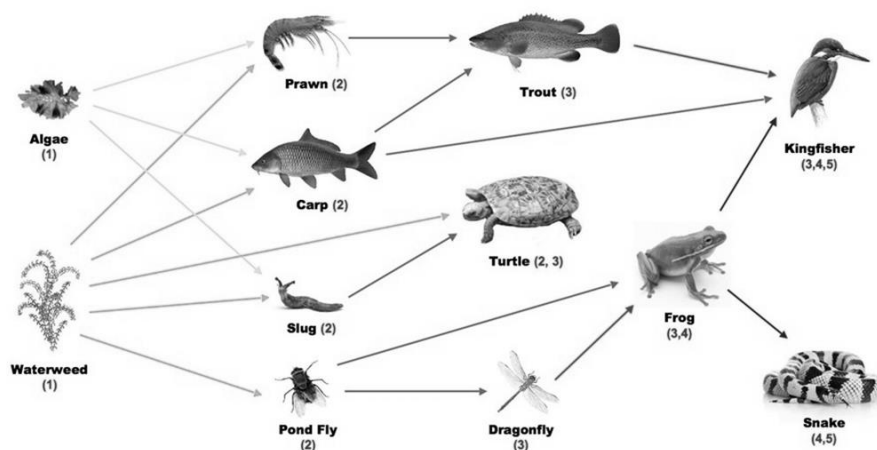
Energy only flows in one direction through the community:

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

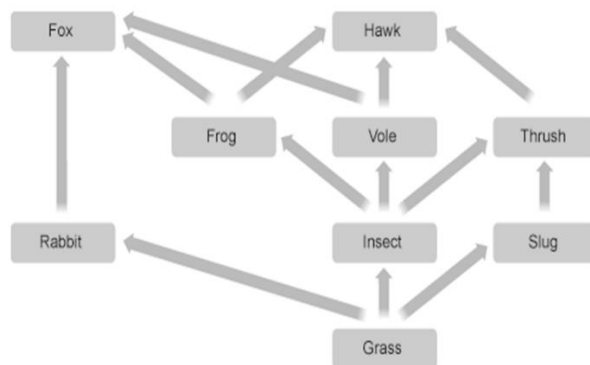


What happens if we disrupt food webs?

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?

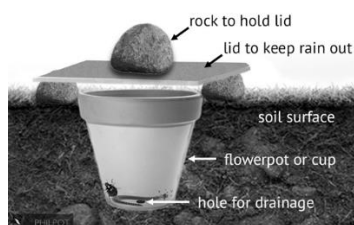
- It occurs when toxins build up - or accumulate - in a food chain.
- The animals at the top of the food chain are affected most severely.

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.

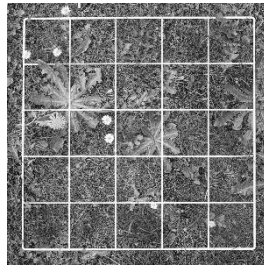
Key knowledge question	Your answer
How do you avoid bias in a quadrat sampling investigation?	
Name two abiotic factors.	
Name two biotic factors.	
What do the arrows in food chains represent?	
What is a carnivore?	
What is a herbivore?	
What is a producer?	
What is a quadrat used for?	
What is a transect?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

How can we count plants in a habitat?

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

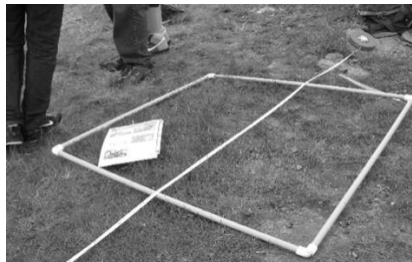
Quadrats

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 place each quadrat

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
<i>What are the three states of matter?</i>	<i>Solid. Liquid and gas</i>
<i>What is the boiling point of pure water?</i>	<i>100°C</i>
<i>What is the name for the state change from gas to liquid?</i>	<i>Condensation</i>
<i>Which out of solids, liquids, and gases can easily be compressed?</i>	<i>Gases</i>

Big questions: How do atoms bond together?

How do metals and non-metals form bonds with each other?

Why do ionic compounds have high melting points?

How do non-metals react with each other?

What are the properties of covalent structures?

How do metal atoms form bonds?

Key vocabulary

Atom	The smallest particle of a chemical element that can exist
Element	A substance that cannot be broken down into other substances. It made up of the same type of atoms
Compound	A substances made up of atoms of 2 or more elements chemically bonded together in a fixed ratio.
Electron	A subatomic particle. It has a charge of -1 and a relative mass of 1/1836
Bond	A strong force of attraction between atoms or oppositely charged ions
Properties	The characteristics or typical features (melting point, density, conductivity).
Ionic bond	The (electrostatic) force of attraction between oppositely charged ions. Typically a positive metal ion and negative non-metal ion
Covalent bond	The (electrostatic) force of attraction between the nuclei of atoms and a shared pair of electrons.
Metallic bond	The (electrostatic) force of attraction between positively charged metal ions and the delocalised electrons.
Intermolecular force	A weak attraction between molecules. The bigger the atom / molecule, the MORE intermolecular forces there are
Molten	Term used to describe metals / ionic compounds in a liquefied state
Aqueous	Dissolved in water

How do metals and non-metals form bonds with each other?

Bond type	Preamble	Positive charged thing		Negatively charged thing
Ionic	The electrostatic force of attraction between ...	Positively charged ions	AND	Negatively charged ions
Covalent		Nuclei of atoms		Shared pair of electrons
Metallic		Positive metal ions		Delocalised electrons

In forming ionic bonds, electrons are transferred from a metal to a non-metal:

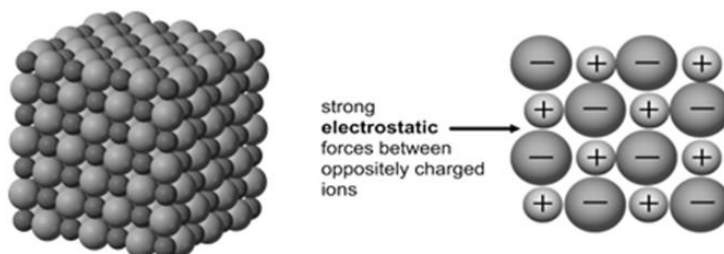
- Metal forms a positive ion
- Non-metal forms a negative ion

With ionic compounds, we need to be very careful with the language that we use to describe the compound, particularly in terms of the number of ions present. The chemical formula for ionic compounds (Sodium Chloride is NaCl) does not tell us the number of ions, but instead the ratio of ions, (in sodium chloride there is 1 sodium ion for every 1 chloride ion).

- Group 1 atoms always have 1 outer shell electron → they need to lose this to get a full outer shell forming an M^+ ion
- Group 7 atoms always have 7 outer shell electrons → they need to gain one to get a full outer shell forming a X^- ion

Why do ionic compounds have high melting points?

Ionic compounds have the oppositely charged ions in a fixed ratio. They arrange in order of alternating charges in 3 dimensional structure.



When melting ionic compounds we need to break the strong ionic bonds holding the ionic lattice together. This requires a lot of energy, so they have to be heated to a comparatively high temperature for them to melt.

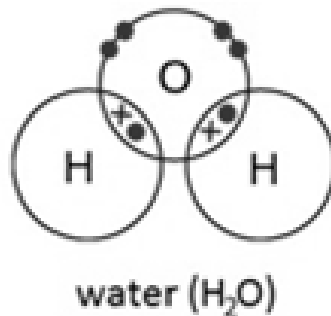
How do non-metals react with each other?

Non-metals can bond to other non-metals with covalent bonds.

In covalent bonding, the atoms share UNPAIRED electrons to complete their outer shell.

They experience a force of attraction from both nuclei

- Group 6 atoms \rightarrow 6 electrons in outer shell, needs 2 more to complete outer shell so forms 2 covalent bonds.
- Hydrogen \rightarrow 1 electron in the outer shell, needs 1 more to complete shell so forms 1 covalent bond (first shell can only hold 2 electrons)



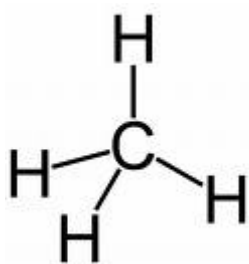
The biggest difference between covalent bonding and ionic bonding is how the atoms achieve complete outer shell.

In ionic compounds, there is a transfer of electrons, the metal lose the electrons and they are gained by the non-metal.

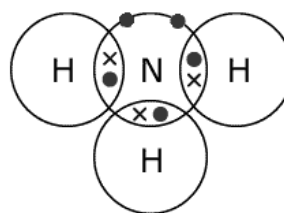
In covalent bonding the electrons are shared.

Covalent bonding leads to two types of structures:

- **Simple molecules** \rightarrow these have a definite number of atoms in each molecule.

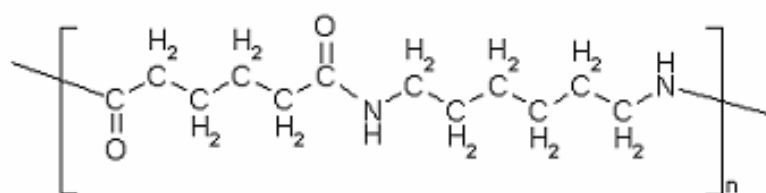


Methane



Ammonia

- **Giant covalent structures** \rightarrow these can have any number of atoms in the structure.



Nylon



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
How are atoms arranged in graphite?	
How are atoms arranged in a metal?	
What ion is formed when sodium loses an electron?	
What is the difference between a compound and a mixture?	
What is the electron configuration for $^{24}_{12}\text{Mg}$?	
What is the electron configuration for $^{39}_{19}\text{K}$?	
What type of bond forms between a non-metal and a metal?	
What type of bond forms between two non-metals?	
What type of bond forms within metals?	
What type of bond is found in diamonds?	
<i>What equation links mass, gravity and weight?</i>	
<i>What is a light year?</i>	
<i>What is the unit of gravitational field strength?</i>	
<i>What is the unit of mass</i>	

What are the properties of covalent structures?

Properties of Simple covalent molecules

Low boiling point

- Because there are weak forces between the molecules
- So little energy is needed to separate the molecules
- Simple covalent molecules are usually gases
- The larger the molecule the higher the boiling point
- Because there are stronger forces between the molecules
- So more energy is needed to separate the molecules

Cannot conduct electricity

- Because there are no delocalised electrons

Properties of Giant Covalent Structures

High melting point

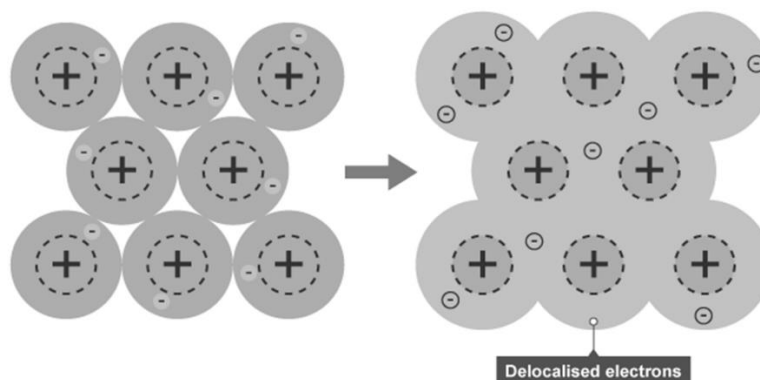
- Because there are strong covalent bonds between atoms
- So lots of energy is needed to separate atoms
- How do metal atoms form bonds?

Most cannot conduct electricity – but some can

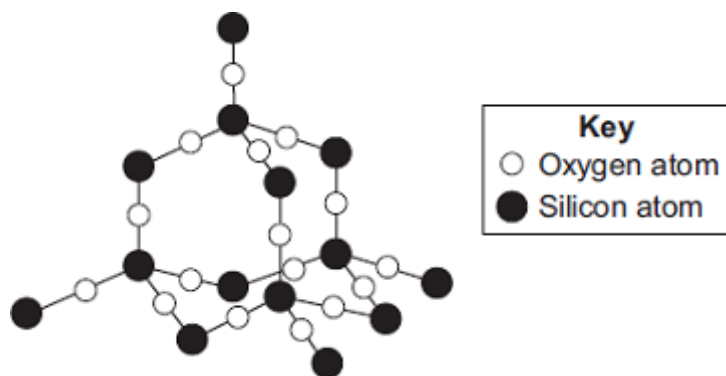
- Because there are no delocalised electrons in most, but there are in some

How do metal atoms form bonds?

- The properties of metals come from its structure.
- The positively charged ions arrange themselves into what's called a metallic lattice.
- This is a regularly ordered 3d arrangement of the ions, with delocalised electrons forming the metallic bonds, and acting like a glue to hold the positively charged ions together.



The diagram shows a small part of the structure of silicon dioxide.



(a) Use the diagram above to answer the question.

Draw a ring around the correct answer to complete each sentence.

In silicon dioxide, each silicon atom is bonded with

two

three

four

oxygen atoms.

The bonds in silicon dioxide are

ionic.

covalent.

metallic.

(2)

(b)



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Silicon dioxide is used as the inside layer of furnaces.

Suggest why.

(1)

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 Netfilx

Our planet

Tiny creatures

A life on our planet

Key knowledge question	Answer
How are atoms arranged in graphite?	In hexagons and in layers
How are atoms arranged in a metal?	In a regular pattern surrounded by delocalised electrons
What ion is formed when sodium loses an electron?	$[\text{Na}]^+$
What is the difference between a compound and a mixture?	In a compound atoms are bonded together in a fixed ratio
What is the electron configuration for $^{24}_{12}\text{Mg}$?	2,8,2
What is the electron configuration for $^{39}_{19}\text{K}$?	2,8,8,1
What type of bond forms between a non-metal and a metal?	Ionic
What type of bond forms between two non-metals?	Covalent
What type of bond forms within metals?	Metallic
What type of bond is found in diamonds?	(Giant) covalent
<i>What equation links mass, gravity and weight?</i>	<i>Weight = mass x gravitational field strength</i>
<i>What is a light year?</i>	<i>A measure of distance, it is the distance travelled by light in one year.</i>
<i>What is the unit of gravitational field strength?</i>	<i>Newtons per kilogram (N/kg)</i>
<i>What is the unit of mass</i>	<i>Kilograms (kg)</i>