THE DUSTON SCHOOL
Knowledge itself is power
4-19

Year 11 Science Knowledge Booklet

Term 1

Name:	Class:

Year 11 Knowledge and Pillars Test Timetable and Workbook Deadlines		
Homework 1	16th September	C4 Chemical Changes
Homework 2	30th September	B5 Homeostasis and Control
Homework 3	15th October	P5 Forces

Science Homework 1

Complete the section of the homework workbook identified on the front of this Knowledge organiser and learn the key knowledge questions and answers ready for the knowledge quiz.

Big questions: What is an ecosystem?

What do we mean by a community?
What are abiotic and biotic factors?
How do we measure the distribution of organisms?
How do we analyse the distribution of organisms?
What do we mean when we say organisms have adaptations?
What do food chains show?
What is the water cycle?
What is the carbon cycle?
What is biodiversity?
How do we maintain biodiversity?
How is the human population changing?
What harm is caused by waste?
What is land used for?
Why do we cut down trees?
What do we mean by climate change?

Key vocabulary

Abiotic Factor	A non-living factor of the environment.
Adaptation	A feature or characteristic that helps an organism to survive in the conditions of its natural environment
Bias	Prejudice towards or against something.
Biodiversity	The variety of different species of organisms on Earth, or within an ecosystem.
Biotic factor	A living factor of the environment.
Community	The populations of different species living in a habitat.
Deforestation	The cutting down of forests (large areas of trees).
Distribution	Where organisms are found in a particular area.
Ecosystem	The interaction of a community of living organisms with the abiotic parts of their environment.
Global warming	The rise in the average global temperature.
Habitat	The place where an organism lives.
Interdependence	Where, in a community, each species depends on other species for things such as food shelter, pollination and seed dispersal.
Methane	A greenhouse gas.
Peat bog	An area of land that is acidic and waterlogged, so plants don't fully decompose when they die, producing peat.
Predator	An animal that hunts and kills other animals.
Prey	An animal that is hunted and killed by other animals.

Producer	An organism at the start of a food chain that makes its own food using sunlight energy.
Quadrat	A square frame enclosing a known area which can be used to study the distribution of organisms.
Sampling	Taking a number of organisms from a population to study.
Stable community	A community where all the species and environmental factors are in balance so that the population sizes are roughly constant.
Transect	A line which can be used to study the distribution of organisms across an area.

What do we mean by a community?

Ecosystem	**All the organisms and the environment in which they live.**
Population	**A group of the same species that live in a particular area.**
Community	**All the different organisms that live in a particular area.**
Habitat	**The area in which an organism or population lives**
Interdependent	**When two organisms are dependent upon each other.**

What do plants and animals need to survive?

Plants	**Animals**
Light	Food
Carbon dioxide	Water
Water	Shelter
Nutrients (minerals)	Space

What are biotic and abiotic factors?

Biotic factors are living factors in an ecosystem, they include:

- Predators
- Prey
- Disease

Abiotic factors are non-living factors in an ecosystem, they include:

- Temperature
- Water
- Sunlight
- Oxygen and carbon dioxide levels
- pH
- Wind

How do we measure and analyse the distribution of organisms?

Top tips for quadrat sampling:

- They only work for immobile/slow moving populations.
- The more data you collect, the more reproducible your result…the more samples the better!
- Quadrats should be placed randomly to avoid bias.
- If you don't know the exact size of your field you can estimate the percentage cover by seeing what percentage of each quadrat contains the organism and calculating the mean.

Interpreting results:

- Calculate the mean number of your sampled species per quadrat.
- Estimate the population of species per metre squared by multiplying the mean by the number of quadrats that fit into one square metre. (For example, if your quadrat was 50 cm × 50 cm, then four would fit into one square metre, so multiply the mean by four.)
- The units for your answer should be 'plants per m^2'

What do we mean when we say organisms have adaptations?

An adaptation is a feature that enables an organism to better survive in its habitat. Species living in different habitats require different adaptations.

Types of adaptation:

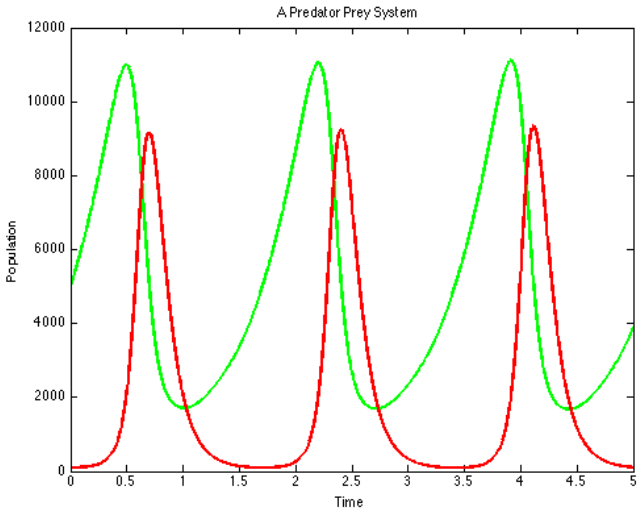
- Physical Adaptations
    - A changing feature of a living thing that helps it to survive in a particular environment. These changes usually happen very gradually over generations (years).
- Behavioural Adaptations:
    - A thing that a living thing does to survive in a particular environment, such as the way they feed, breed or move.
- Structural Adaptations:
    - A body part or structure that aids survival.

Extremophiles are animals that live and thrive under extreme environmental conditions.

What do food chains show?

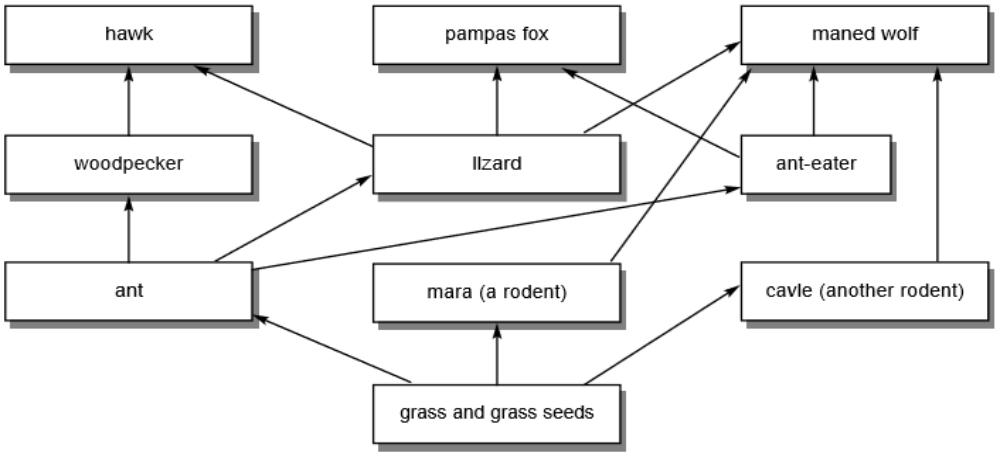
Feeding relationships can be represented by food chains. A food chain begins with a producer which synthesises molecules. Producers are eaten by consumers. Consumers that eat other animals are predators, and those eaten are prey. In a stable community the numbers of predators and prey rise and fall in cycles.

<u>Predator/prey relationships are cyclic:</u>



Food webs:

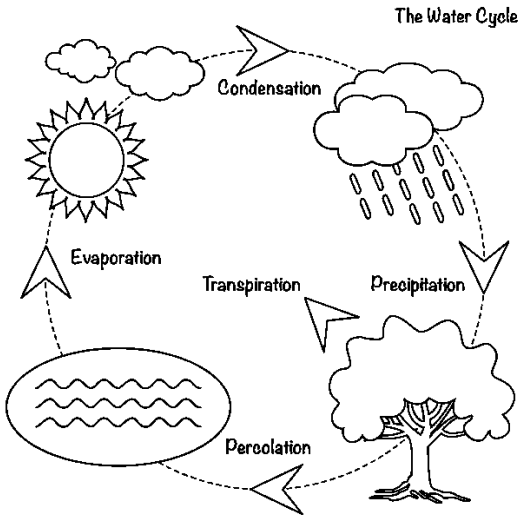
The food web is a series of food chains all connected to each other. Plants are eaten by a variety of consumer animals and then those animals may be eaten by a variety of different carnivores.



What is the water cycle?

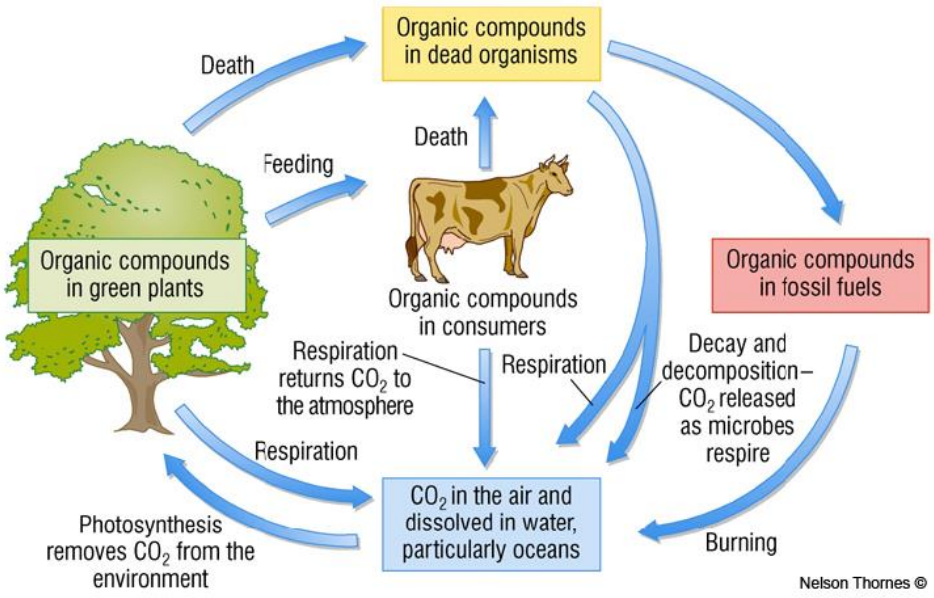
- Cycle – the movement of a simple substance through the soil, rocks, water, atmosphere, and living organisms of the earth.
- Hydrological – the science dealing with the occurrence, circulation, distribution, and properties of the waters of the earth and its atmosphere.
- Evaporation – the process of turning from liquid into vapour.
- Condensation – the conversion of a vapour or gas to a liquid.
- Precipitation – rain, snow, sleet, or hail that falls to or condenses on the ground. (Different to precipitation in chemistry)
- Porous – (of a rock or other material) having minute gaps through which liquid or air may pass.

- Percolation – the movement of water though the soil.
- Transpiration - the process where plants absorb water through the roots and then give off water vapor through pores in their leaves.



What is the carbon cycle?

- Carbon is a the backbone for all organic compounds and molecules present in living organisms, present in: lipids, proteins and carbohydrates
- The main source of carbon for land living organisms is from the atmosphere
- There is a constant cycle between the carbon dioxide in the air, land and in the organisms



What is biodiversity?

- **Biodiversity** - variety of life forms (the different species of organisms) within a given ecosystem or the world. An area with many different species has a higher biodiversity than one with few species.
- **Species** - Group of similar organisms which are capable of interbreeding (mating) to produce fertile offspring and are reproductively isolated from other species.

There are 3 main types of biodiversity –

- **Habitat Diversity** - the range of habitats in which different species live
- **Species Diversity** - the number of different species and the abundance of each species in an ecosystem
- **Genetic Diversity** - the variation of alleles within a species. The genetic variation between individuals belonging to the same species

Threats to biodiversity:

These include –

- **H** – habitat destruction
- **I** – invasive species
- **P** – pollution
- **P** – population increase
- **O** - overexploitation

How do we maintain biodiversity?

- Breeding programmes for endangered species.
- Protection and regeneration of rare habitats.
- Reintroduction of field margins and hedgerows.
- Reduction of deforestation and carbon dioxide emissions.
- Recycling resources.

How is the human population changing?

- Humans' ability to alter their environment is an underlying reason for human population growth.
- Construction of shelter, food cultivation, and the sharing of technology mean humans have overcome factors that would have otherwise limited their population growth.
- Advances in medicine, notably vaccines and antibiotics, as well as improvements in nutrition and vector control, have significantly reduced deaths from disease.

What harm is caused by waste?
Burning Fossil fuels:

When hydrocarbon fuels are burnt (combustion) in enough oxygen we produce carbon dioxide and water.

$$CH_{4\,(g)} + 2\,O_{2\,(g)} \rightarrow CO_{2\,(g)} + 2H_2O_{(l)}$$

If there is insufficient oxygen present combustion is incomplete – CO_2 is not produced.

$$CH_{4\,(g)} + 1\,{}^{1}\!/_{2}\,O_{2\,(g)} \rightarrow CO_{(g)} + 2H_2O_{(l)}$$

Carbon monoxide, CO, is a poisonous gas and replaces O_2 in your red blood cells causing death by asphyxiation (oxygen deficiency).

If even less oxygen is present the incomplete combustion forms the solid pollutant, Carbon, more commonly known as Soot.

Soot is a carbon particulate, which can cause asthma and cancer.

$$CH_{4\,(g)} + O_{2\,(g)} \rightarrow C_{(s)} + 2H_2O_{(l)}$$

Sulphur dioxide (**SO_2**) and **NO_x** are the major contributors to the formation of "Acid rain".

Acid Rain - The Key Facts

- Acid rain has a pH that is lower than normal.
- It is formed when fossil fuels are burned, releasing sulfur dioxide (SO2) that is absorbed by rain to form sulfuric acid.
- Acid rain is also caused by nitrogen oxides (NOx) that combine with rain and fall as nitric acid. Although some nitrogen oxides come from power stations, around half come from road traffic.

What is land used for?

10% of the world is covered by glaciers, and a further 19% is barren land – deserts, dry salt flats, beaches, sand dunes, and exposed rocks. This leaves what we call 'habitable land'.

Half of all habitable land is used for agriculture.

This leaves only 37% for forests; 11% as shrubs and grasslands; 1% as freshwater coverage; and the remaining 1% – a much smaller share than many suspect – is built-up urban area which includes cities, towns, villages, roads and other human infrastructure.

Peatland

Peatlands are a type of wetlands that occur in almost every country on Earth, currently covering 3% of the global land surface. The term 'peatland' refers to the peat soil and the wetland habitat growing on its surface.

Large amounts of carbon, fixed from the atmosphere into plant tissues through photosynthesis, are locked away in peat soils, representing a valuable global carbon store.

A lack of awareness of the benefits of peatlands means that they have been severely overexploited and damaged as a result of actions including drainage, agricultural conversion, burning and mining for fuel, among others. About 15% of the world's peatlands have been drained. This has released huge amounts of greenhouse gases, such as carbon dioxide (CO_2), from the carbon stored within peat soils.

Impact of our land use:

As the human population has grown we have needed more land to grow more crops to feed the population.

This means there is less land left unused.

Not all types of land are suitable for turning into farmland, so some land types are impacted more than others.

Why do we cut down trees?

Deforestation - the permanent removal of trees to make room for something besides forest. This can include clearing the land for agriculture or grazing, or using the timber for fuel, construction or manufacturing.

Reasons for deforestation:

- Harvesting of wood
- Fires
- Conversion to agriculture

Impacts of deforestation:

- Loss of biodiversity
- Increased greenhouse gas emissions
- Disruption of water cycles
- Increased soil erosion
- Disrupted livelihoods

What do we mean by climate change?

Climate -the weather conditions prevailing in an area in general or over a long period.

Global warming - the increase in the mean temperature of the earth.

What causes climate change?

- The climate on Earth has been changing since it formed 4.5 billion years ago. Until recently, natural factors have been the cause of these changes.
- However, since the Industrial Revolution in the 1800s, the global temperature has increased at a much faster rate. Burning fossil fuels, deforestation, cement production and agriculture all contribute to the human causes of climate change.

Effects of climate change:

The Earth is warming, rainfall patterns are changing, and sea levels are rising. These changes can increase the risk of heatwaves, floods, droughts, and fires. Climate change can lead to habitat destruction and loss of biodiversity.

Greenhouse gases and the greenhouse effect

- The greenhouse effect is a good thing- it traps heat from the sun which keeps the planet at a suitable temperature for life. Without the greenhouse effect the temperature on earth would be around -18°C.

- Because of the increased greenhouse gas emissions from human activity, more heat is being trapped than ever before, causing the earth to heat up too much.
- The greenhouse gases that you need to know about are carbon dioxide and methane.

Science Homework 2

Complete the final section of the homework workbook identified on the front and learn the key knowledge questions and answers for all of the areas covered in this knowledge organiser ready for the end of term test.

Key knowledge question	**Answer**
What is a biotic factor?	A living factor in an ecosystem
What is an abiotic factor?	A non living factor in an ecosystem
Give an example of a biotic factor	Predators, prey, disease
Give an example of an abiotic factor	pH, water, temperature, sunlight, wind, oxygen levels, carbon dioxide levels
What is an adaptation?	A feature that better enables an organism to survive in their habitat
Define biodiversity	A measure of all of the different species of organism in an environment
Name two greenhouse gases	Carbon dioxide, methane, water vapour
Give 2 consequences of global warming	Ice caps melting, reduction of biodiversity, habitat destruction
Name 2 processes that release carbon dioxide into the air	Respiration, combustion, decomposition
Which process in plants removes carbon dioxide from the air?	Photosynthesis

Big questions:

What are hydrocarbons?
What are the properties of hydrocarbons?
What is fractional distillation?
How can we increase the supply of high demand fractions?
What are alkenes used for?

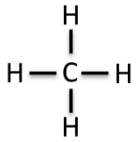
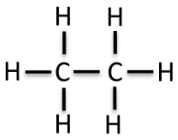
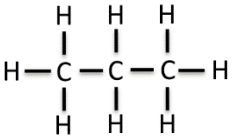
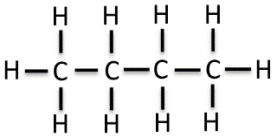
Key vocabulary

Alkane	A hydrocarbon with only single carbon-carbon bonds. The general formula is C_nH_{2n+2}
Alkene	A hydrocarbon with a double carbon-carbon bond. The general formula is C_nH_{2n}.
Boiling Point	The temperature at which substance changes state from a liquid to a gas (or condenses from a gas to a liquid).
Cracking	A reaction that breaks a large alkane down into smaller alkanes and an alkene.
Crude oil	A mixture of hydrocarbons.
Demand	The amount of a substance wanted by customers.
Feedstock	The raw materials needed for a product.
Flammability	How easy it is to set fire to a substance.
Fractional distillation	The process that separates crude oil into fractions of alkanes with different boiling points.
Hydrocarbon	A molecule that <u>only</u> contains hydrogen and carbon atoms.
Intermolecular forces	Forces between molecules.
Polymer	A long chain molecules. Plastics are polymers made using alkenes.
Supply	The amount of a substance available for customers.
Viscosity	How thick and sticky a liquid is. Honey is a liquid with a high viscosity.

What are hydrocarbons?

Crude oil is a mixture of hydrocarbons.

A hydrocarbon is a molecule that only contains hydrogen and carbon atoms.

Name	Formula	Displayed formula
Methane	**CH_4**	
Ethane	**C_2H_6**	
Propane	**C_3H_8**	
Butane	**C_4H_{10}**	

What are the properties of hydrocarbons?

Hydrocarbons have different boiling points, viscosity and flammability.

- Boiling point – the longer the chain length the higher the boiling point.
- Viscosity – the longer the chain length the higher the viscosity.
- Flammability – the longer the chain length the less flammable the hydrocarbon.

Combustion (burning)

The general word equation for combustion is:

Hydrocarbon + oxygen → carbon dioxide + water

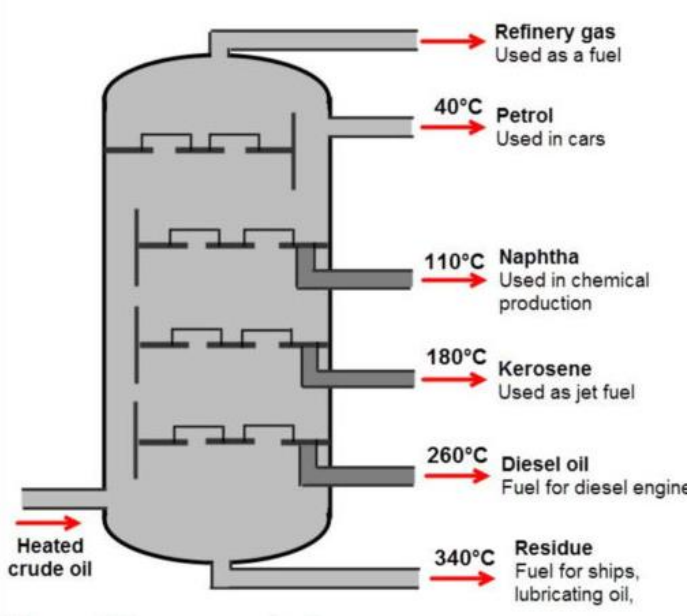
e.g. methane + oxygen → carbon dioxide water

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

What is fractional distillation?

Fractional distillation separates crude oil into different fractions based on their different boiling points.

- The crude oil is heated into a vapour (gas).
- The vapours cool down as they go up the fractional distillation column.
- The vapours condense back into a liquid at different boiling points.

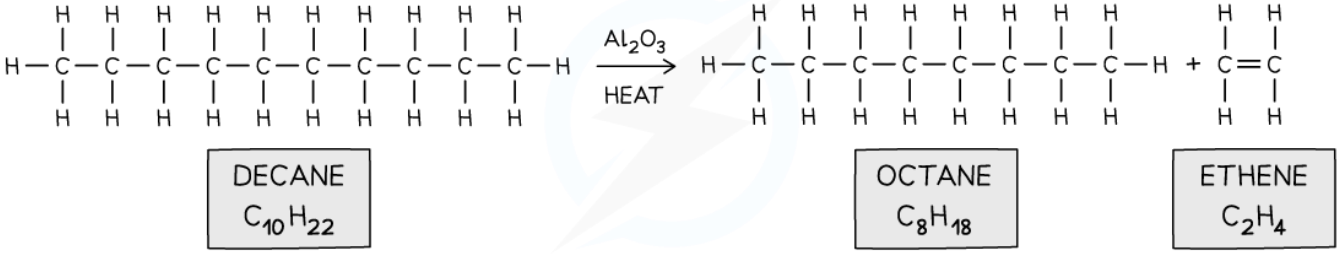


The fractions have different boiling points because:

- The longer the chain length, the stronger the intermolecular forces (forces between molecules)
- so more energy is needed to separate the molecules.

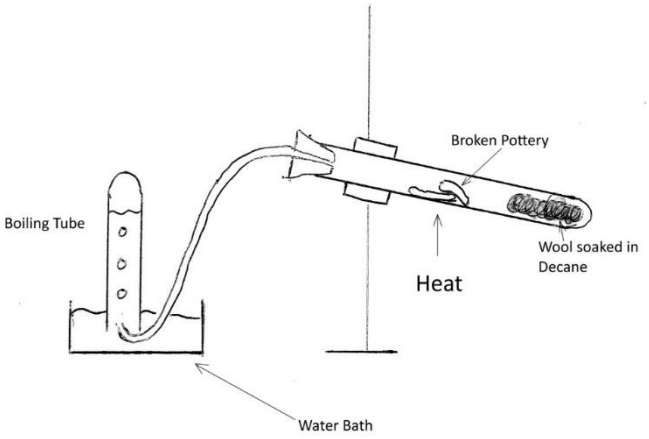
How can we increase the supply of high demand fractions?

Some fractions like petrol have high demand but low supply. Other fractions like kerosene have low demand but high supply. Cracking breaks down a large alkane into smaller alkanes and an alkene.



Cracking requires:

- **<u>high temperature</u>** to evaporate the alkane into a vapour (a gas)
- **<u>a catalyst</u>** to pass the hot vapours over to react (the catalyst lowers the activation energy to allow the reaction to occur at a lower temperature)



What are alkenes used for?

Alkenes are used to make **plastics**.

The test for alkenes is: **<u>bromine water</u>** turns from **<u>orange</u>** to **<u>colourless</u>**.

Science Homework 3

Complete the final section of the homework workbook identified on the front and learn the key knowledge questions and answers for all of the areas covered in this knowledge organiser ready for the end of term test.

Wider reading

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 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 is crude oil?	A mixture of hydrocarbons
What is a hydrocarbon?	A molecule that only contains hydrogen and carbon atoms.
What is an alkane?	A hydrocarbon with only single carbon-carbon bonds.
What is an alkene?	A hydrocarbon with a double carbon-carbon bond.
What is the general formula for alkanes?	C_nH_{2n+2}
What is the general formula for alkenes?	C_nH_{2n}
What is the formula for propane?	C_3H_8
What is the formula for butene?	C_4H_8
What process separates crude oil into different fractions?	Fractional distillation
What are forces between molecules called?	Intermolecular forces
How does boiling point change as chain length increases?	Increases
How does viscosity change as chain length increases?	Increases
How does flammability change as chain length increases?	decreases
Complete the word equation for combustion of butane. Butane + oxygen →	Carbon dioxide + water
What is cracking?	Breaking down a large alkane into smaller alkanes and an alkene
What are the conditions needed for cracking?	High temperature and a catalyst.
What are alkenes used for?	To make plastics.