

Science: GCSE Organic Chemistry

1. Key Words

Hydrocarbon	Compound made up of only carbon and hydrogen atoms
Alkane	Saturated hydrocarbon containing only single bonds between the atoms
Alkene	Unsaturated hydrocarbon containing at least one double bond
Cracking	A process that uses high temperatures and a catalyst to break down long chain alkanes into smaller alkanes and alkenes making more useful products
Fractional Distillation	A process of separating the different chain lengths of hydrocarbons found in crude oil
Crude oil	Fossil fuel made from the remains of dead plants and sea creatures millions of years ago and contains a millions of years ago, containing a mixture of different hydrocarbons

2. Properties of Hydrocarbons

Viscosity	This refers to the thickness of the liquid hydrocarbon. As the length of the hydrocarbon chain increases, the viscosity increases and the liquid compound becomes thicker
Boiling point	This refers to the temperature at which the liquid hydrocarbon changes into a gas. The longer the hydrocarbon chain, the higher the boiling point
Flammable	This refers to how easily the hydrocarbon sets on fire. The smaller the hydrocarbon chain the more flammable it is

Challenge Questions

1	How is crude oil formed?
2	Why would hexane be an unsuitable fuel for cars?
3	How could you investigate the effects of temperature on the viscosity of a hydrocarbon?
4	Research some uses of simple alkenes (ethane to hexane)

3. Alkanes

General Formula		C_nH_{2n+2}
Alkane name	Alkane formula	Alkane structure
Methane	CH ₄	<pre> H H — C — H H </pre>
Ethane	C ₂ H ₆	<pre> H H H — C — C — H H H </pre>
Propane	C ₃ H ₈	<pre> H H H H — C — C — C — H H H H </pre>
Butane	C ₄ H ₁₀	<pre> H H H H H — C — C — C — C — H H H H H </pre>
Pentane	C ₅ H ₁₂	<pre> H H H H H H — C — C — C — C — C — H H H H H H </pre>
Hexane	C ₆ H ₁₄	<pre> H H H H H H H — C — C — C — C — C — C — H H H H H H H </pre>

Science: GCSE Chemical Analysis

1. Key Words

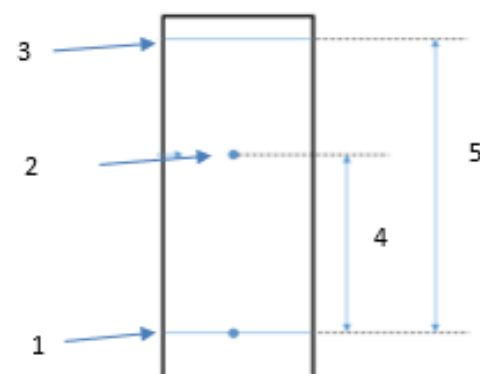
Pure substance	A substance that contains a single element or compound, not mixed with any other substance
Formulation	A mixture that has been designed for a specific purpose
Melting point	The temperature at which a substance changes from a solid to a liquid
Boiling point	The temperature at which a substance changes from a liquid to a gas

2. Chromatography

This is a separation technique used to separate mixtures in dyes inks, paint and DNA

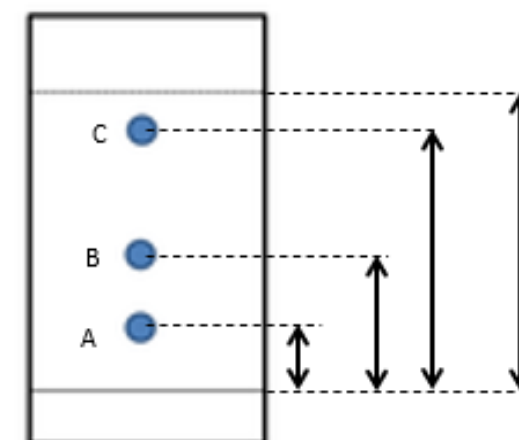
The R_f value is a measure of how far up the chromatography paper the solute moves compared to the solvent.

R_f equations	$\frac{\text{Distance moved by the solute}}{\text{Distance moved by the solvent}}$	
1	Baseline	Pencil line that the solute is placed on
2	Solute	The final position of the solute
3	Solvent front	The final position of the solvent
4	Distance moved by the solute	
5	Distance moved by the solvent	



3. Testing for Gases

Gas	Test	Positive Result
Hydrogen	Place a lit splint into the gas	Squeaky pop noise
Oxygen	Place a glowing splint into the gas	Splint will relight
Carbon dioxide	Bubble the gas through limewater	Limewater will change from colourless to cloudy
Chlorine	Place damp blue litmus paper into the gas	Litmus paper will change colour to pink and then bleach to white



Challenge Questions

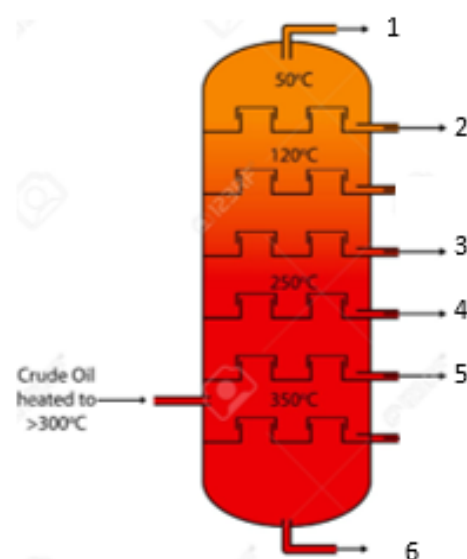
1	Name 3 formulations
2	Calculate the R_f of solute B
3	Why might you need to test for the presence of a gas
4	Use the diagram above to explain the relationship between R_f value and the distance travelled by the solute

Science: GCSE Organic Chemistry

4. Fractional Distillation

1. In a furnace, crude oil is heated until it boils.
2. The vapour then passes into the fractionating column which cools as it moves up the column.
3. Those hydrocarbons with the highest boiling points condense first and are extracted.
4. This continues up the column

	Fraction and chain length	Use
1	Fuel gas (C 1 – 4)	In camper stoves and gas bottles
2	Petrol (C 5 – 10)	Used as fuel in cars
3	Kerosene (C 10 – 16)	Used a fuel for aeroplanes
4	Diesel (C 14 – 20)	Used as fuel for cars and lorries
5	Lubricating oil (C 20 – 50)	Used in making oils, waxes and polishes
6	Bitumen (C 70+)	Used to tar roads and felt roofs

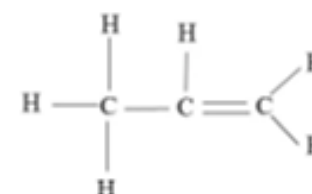


5. Alkenes and Cracking

Formula of alkenes



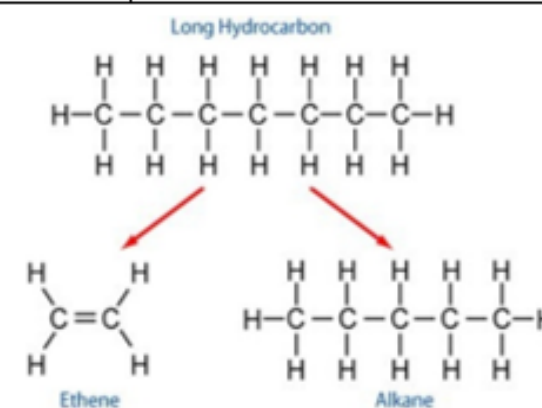
Alkenes contain a double bond between one of the carbon-carbon bonds
e.g. propene



Cracking: Most hydrocarbons produce products with limited or no use.
Cracking allows the large chain hydrocarbons to be broken down into useful products.

Conditions needed for cracking

Temperatures between 450 - 700°C
A catalyst called zeolite which contains aluminium oxide and silicon oxide



Testing for the presence of alkenes

Adding bromine water to the sample. If the sample turns colourless, then the sample is an alkene.

Science: GCSE Using Resources

1. Key Words

Finite resource	A resource that will eventually run out
Renewable resources	Resources that reform at a similar, or faster, rate that we use them
Life Cycle Assessment (LCA)	An assessment of the environmental impact of a product over each stage of its life
Sustainable development	Meeting the needs of the present society whilst not damaging the lives of future generations

2. Life Cycle Assessments

These are often used to determine the most environmentally viable option in production of a product.

LCA Stage	Plastic bag	Paper bag
Raw Materials	Crude oil	Timber
Manufacturing and packaging	Key components extracted by fractional distillation. Waste has other uses	Takes lots of energy to pulp timber and creates lots of waste
Using the product	Reusable	Single-use
Product disposal	Recyclable, not biodegradable	Biodegradable and recyclable

3. Extracting Copper

Copper is a finite resource that is becoming scarce
Sustainability can be improved by extracting copper from low grade ores

Phytomining	Plants are grown in copper rich soils The plants absorb the copper and levels build up in the leaves Crops are harvested and burned to leave ash containing copper compounds Copper is extracted using a displacement reaction with scrap iron.
Bioleaching	Bacteria are used to convert the copper compounds in the ore into soluble copper compounds The copper is then extracted using electrolysis

4. Recycling

Recycling helps to save on the large amounts of energy required to extract and process natural resources.

Material	Process	Extra Info
Recycling metals	Waste metals are melted down and recast into new products	Amount of separation required for the recyclable metal depends on the metal and the final product
Recycling glass	Waste glass is separated in to colours, crushed and melted This is then reshaped in to new products	Glass bottles can also be washed and sterilised and used again instead of recycling them

Science: GCSE Using Resources

5. Treating Water

Key Word	Definition
Potable water	Water that is safe to drink
Pure water	Water that contains only water molecules
Ground water	Water from underground rocks and rain
Treating ground water to produce potable water:	
1	Passed through a mesh that removes larger debris such as twigs and stones
2	Passed through a filter to remove any smaller solid bits
3	Water is sterilised to kill off any harmful microbes using chlorine, ozone or UV light
There are two methods of treating salt water to produce potable water:	
Distillation	Reverse osmosis
Water is boiled and the condensed to remove the salt	The water is passed through a membrane that only allows water molecules through

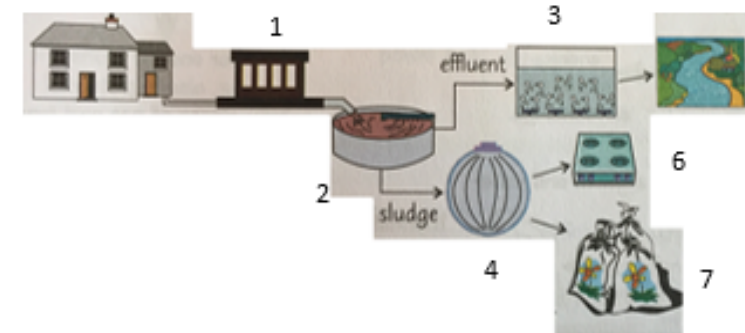
Life cycle stage of a pillow case	Lifetime energy use (%)
Raw materials	10
Manufacture	15
Use	70
Disposal	5

Challenge Questions

1	What do humans use natural resources for?
2	How can sustainability be improved?
3	Why might extracting metals from low grade ores be desirable?
4	Evaluate the use of energy in the lifecycle of a pillow case and suggest how the energy use could be reduced

6. Waste Water Treatment

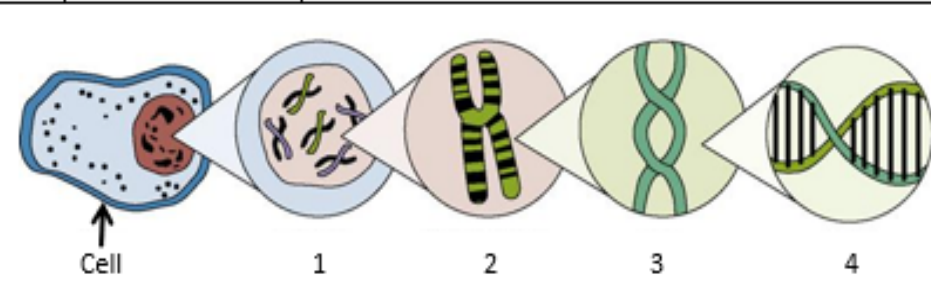
1	Screening	Large waste products are removed such as paper
2	Sedimentation	Tiny particles settle to the bottom of a still tank that then splits in to two sections effluent and sludge
3	Aerobic digestion of organic matter	The effluent is treated with aerobic bacterial to reduce the volume of solid waste
4	Anaerobic digestion of organic matter	The sludge is digested anaerobically by specific bacteria
5	Released back into the environment	The treated effluent is returned to rivers and water ways
6	Natural gas	Methane gas is produced from the anaerobic digestion of sludge and can be used as a fuel
7	Fertiliser	The remaining sludge is rich in minerals and can be used as a natural fertiliser



Science: GCSE Variation, Inheritance and Evolution

1. DNA

1	Nucleus	Organelle that contains the genetic material
2	Chromosomes	Long molecule of DNA that comes in pairs
3	DNA	Sequence that codes for the
4	Gene	Single section of DNA that is responsible to specific characteristics



2. The Human Genome Project

Genome	The entire sequence of the genetic material in an organism
Human Genome Project	25 year research project that mapped the entire human genome to identify specific locations of the genes each chromosome.
Application	Advantage
Genes linked to genetic diseases can be identified	Gives a better understanding of how genetic diseases are inherited, so effective treatments can be developed
Tiny differences in peoples genomes can be studied	Helps to trace migration patterns of past human populations

3. Cell Division in humans

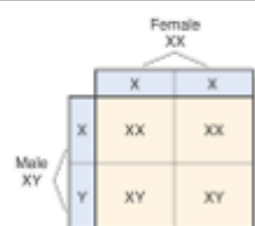
Mitosis	Meiosis
Used for growth and repair	Used in the production of gametes
Once cell division per cycle	Two cell divisions per cycle
Daughter cells contain 46 chromosomes	Daughter cells contain 23 chromosomes

4. Key Words

Gamete	Sex cell
Allele	Single gene from a gene pair
Genotype	Coding used for a characteristic
Phenotype	Description of the chearacteristic
Dominant	An allele that is always expressed
Recessive	An allele only expressed when there are 2 recessive genes present
Homozygous	Alleles code for the same characteristic
Heterozygous	Genes code for different characteristics
Sexual reproduction	Fusing of nuclei from gamets, produces variation
Asexual reproduction	One parent, produces genetically identical offspring
Mutation	A random change in the sequence of DNA
Variation	Changes in a population caused by a mutation (differences in phyisical, chemical and behavioural characteristics between organisms or individuals)
Genetic variation	Variation that is caused by the inheritance of alleles of genes
Environmental variation	Variatio that is caused by the effects of environmental factors

Science: GCSE Variation, Inheritance and Evolution

5. Determining Gender

Female Genotype	XX
Male Genotype	XY
Each time an egg is fertilised there is a 50% chance it will be a girl.	

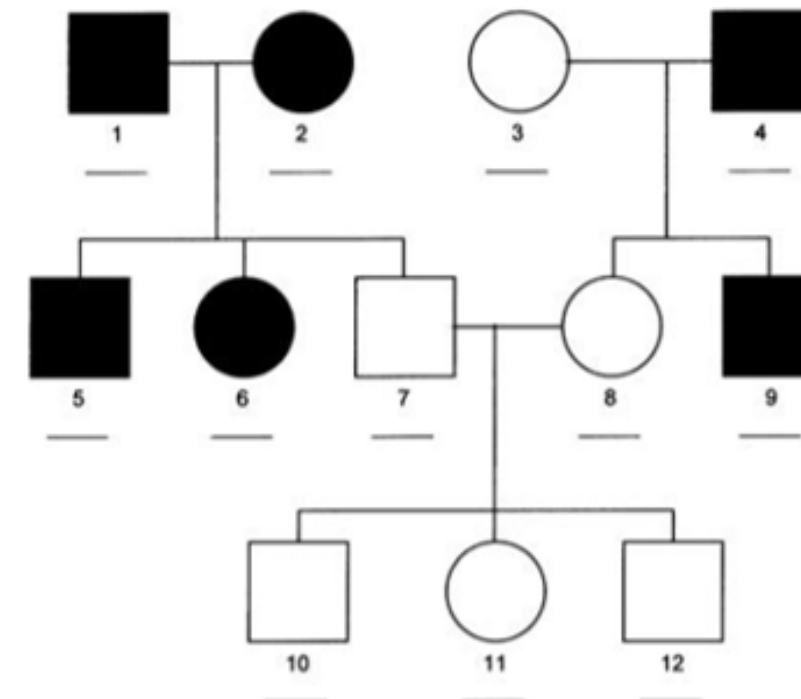
6. Inherited diseases

Cystic Fibrosis	Caused by a recessive gene Affects the cell membrane formation, causing mucus to build up in the lungs and digestive tract
Polydactyly	Caused by a dominant gene Causes an extra digit to grow on the hand or feet

7. Embryo Screening

This is where one cell from an embryo is taken and the DNA is checked for the presence of specific genes

For	Against
It will help prevent people suffering	Screening is expensive
Treating disorders costs the government a lot of money	People might want to screen embryos so they can pick the most 'desirable' trait
There are laws to stop the procedure being misused	Ethical issues as embryos found with genetic disorders are often destroyed (killing potential life)



Key

	Female without disorder		Male without disorder
	Female with disorder		Male with disorder

Challenge Questions

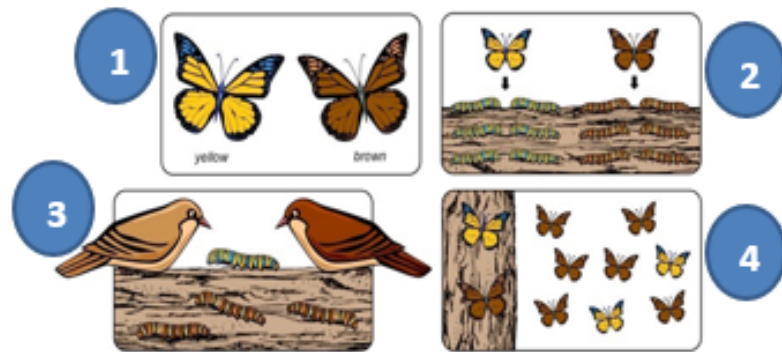
1	What is the function of DNA?
2	Compare sexual and asexual reproduction
3	How does the diagram above show that this is a recessive disorder?
4	Evaluate the statement – 'If parents 3 and 4 have another baby, there is a 50% chance of having a child with the disorder' Justify your answer

Science: GCSE Variation, Inheritance and Evolution

8. Evolution

The theory of EVOLUTION by NATURAL SELECTION was put forward by Charles Darwin

	Stage	Explanation
1	Variation	There is genetic variation within a population caused by inherited genes
2	Competition	Over production of offspring leads to increased competition
3	Selection	Individuals with beneficial adaptations are more likely to survive to pass on their genes
4	Inheritance	Over many generations there is a change in the allele frequency



Species	A group of organisms that have similar features that can breed to produce fertile offspring
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9. Extinction

What is extinction?	When the all the organisms of a species have die and there are none left alive
Causes of extinction	<ol style="list-style-type: none"> 1. NEW disease 2. NEW predator 3. Lack of food 4. Climate change 5. Natural disasters

10. Fossils

What are fossils?	Remains or imprint of an organism that dies millions of years ago, found in rocks, ice and peat
How do fossils form? (rocks)	<ol style="list-style-type: none"> 1. Organism dies and falls to the ground 2. Layers of sediment over the dead organism 3. Over millions of years, the layers turn to rock and minerals in the rock replace the minerals in the bones of an animal <p>This happens because decay cannot occur.</p>
What information can fossils tell us?	<p>Early life was simple.</p> <p>The evolution of a species can be predicted by looking at differences between the fossils of a species.</p>
Why do we not have fossils for the early life on Earth?	<p>Fossilisation is rare as most organisms decay</p> <p>Fossils can be easily become damaged as the rocks move due to tectonic plates</p> <p>Most early life has soft body forms which do not fossilise</p>

11. Classification

Carl Linnaeus	Developed the system of classification used today
Binomial name	Official name of a species including the genus and species name
3 domain system developed by Carl Woese	<p>All organisms can be classified in to 3 domains</p> <ul style="list-style-type: none"> • Archaea – ancient simple bacteria, often extremophiles • Prokaryote – bacteria • Eukaryote – complex organisms including animals and plants.

Group	Mnemonic
Kingdom	King
Phylum	Philip
Class	Came
Order	Over
Family	For
Genus	Good
Species	Soup

Science: GCSE Variation, Inheritance and Evolution

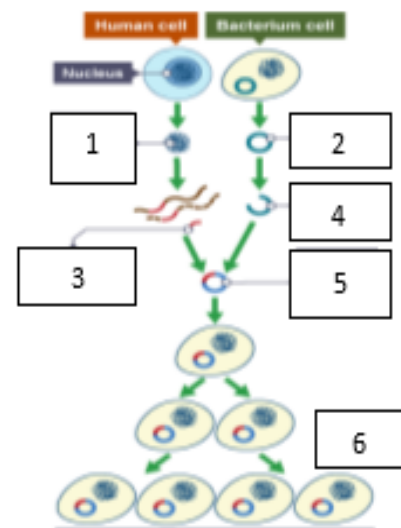
12. Genetic engineering

Genetic Engineering (Genetic Modification – GM)	Process of inserting the gene of one organism to the DNA of another to change or enhance specific characteristics.
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Plasmid	Ring of secondary DNA in a bacteria cell
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Genetically engineering insulin using bacteria (HT only)

1	Chromosome containing desired gene is removed
2	Plasmid from a bacteria is removed
3	Enzymes are used to cut the gene from the DNA
4	Enzymes are used to cut out a section of the plasmid DNA
5	The desired gene is inserted in to the plasmid using enzymes
6	The plasmid is placed back into the bacteria, which multiplies rapidly, copying the gene and making insulin



13. Selective Breeding

Process of selecting individuals of the same species with the desired characteristic and breeding them to produce offspring with the desired characteristics

Benefits of selective breeding	Produce disease resistant crops, increase the yield of milk and meat from cattle, increased growth rate of chickens so meat can be sold earlier, domestication of pets (more attractive and docile) and many more
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Concerns of selective breeding	It does not always work and takes a long time. Interbreeding of organisms can cause disease or defects
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Method for selective breeding

1.	Select a male and female with the desired characteristics
2.	Breed together
3.	Check the offspring for the desired characteristics
4.	If desired characteristics are present continue to interbreed until the characteristic is always present. If the desired characteristic is not present, go back to step 1.

Challenge Questions

1	Why might people not agree with the use of GM crops as food sources?
2	Why are bacteria used in genetic engineering of human proteins?
3	Explain how a cactus with small spines may have evolved from an ancestor with larger leaves.
4	Compare the information gained from ice fossils compared to the information gained from fossils formed in rocks.