Topic: Structure and Function of Living Organisms		Duration: 3 weeks	Composite:
Key vocabulary: **Cell** **Microscope** **Magnification** **Resolution** **Mitochondria** **Gametes** **Oviduct** **Ciliated** **Nucleus** **Osmosis** **Diffusion** **Passive** **Turgid** **Flaccid**	**Core knowledge Components** • What is the main difference between a prokaryote and a eukaryotic cell? • Explain structural differences between plant and animal cells. • Detailed examples of specialised cells and their features that make them adapted to function including cilia and villi with increased surface area for absorption. • What are the names of the parts of the microscope? • What are main steps in setting up and operating a light microscope. • How has light microscopy evolved over the centuries? • Why is osmosis a special kind of diffusion? • How have technological improvements improved our understanding of cells? • What processes can carry substances into and out of cells? • What are the main steps you should use when setting up and using a microscope? • How can experiments be used to work out the amount of osmosis or diffusion that is occurring?	**Powerful knowledge components crucial to commit to long term memory** • **What are the main parts of a plant and animal cell?** • **What are prokaryote cells?** • **What are eukaryote cells?** • **Name the basic rules of microscope drawing.** • **What is the role of mitochondria in a cell?** • **What are the major adaptations in eggs and sperm; oviducts and intestines?** • **Name the major advantage of electron microscopes.** • **What is the equation used to work out the magnification power of a microscope?** • **What is the equation that can help work out the size of an object using a microscope?** • **What is diffusion?** • **Why is osmosis a special kind of diffusion?** • **What is meant by the term passive process?**	**Links to previous and future topics** Year 7 - cells and reproduction topics Year 8 – Food and digestion WRT the digestive system, Microbes as prokaryotes and Inheritance through nuclear material. Year 10 /11 Links to CB6 and CB8 – Plant structures and Exchange.

Topic: Genetics (Inheritance and DNA)		Duration: 6 weeks	Composite:
Key vocabulary: **Chromosome** **Haploid** **Diploid** **Fertilisation** **Meiosis** **Embryo** **Gamete** **Daughter** **DNA** **Gene** **Helix** **Heterozygous** **Homozygous** **Hereditary** **Phenotype genotype** **Probability** **Mutation** **Variation.**	**Core knowledge Components** Be able to state key features of male and female sex cells Sex cells reduce their chromosome number in a process called meiosis Recombination of chromosomes happens at fertilisation Describe the discovery of the DNA molecule. Describe the genotypes and phenotypes of genetic crosses and perform punnet square analysis and pedigree chart analysis. How can data from continuous and discontinuous phenotypic features be used to show traits in a population. What conditions can cause mutations and how often they occur harmlessly. How do cancers develop? Understand the basis for the Human Genome Project and its implications. Draw normal distribution curves from data and explain.	**Powerful knowledge components crucial to commit to long term memory** **Name female and male gametes** **Human chromosome number is 46** **Gametes have half the full number** **What is haploid?** **What is diploid?** **What are chromosomes made of?** **Name and describe the structure of DNA molecule including sugar phosphate backbone and bases.** **What is an allele?** **What is genotype and phenotype?** **What is a mutation?** **Give an example of discontinuous variation** **Give an example of continuous variation.**	**Links to previous and future topics** Year 7 Cells, Reproduction Year 8 Inheritance Year 10/11 CB4 Genetics CB2Cells and control

Topic: Evolution

Duration: 9 lessons

Key vocabulary:

Evolution

Variation

Natural selection

Ancestor

Species

Fossil

Hominid

Resistant

Antibiotic

Kingdom

Genus

Domain

fungi

Protist

Prokaryotes

Archaea

Selective breeding

Variety

Yield

Artificial selection

Genetic engineering

Core knowledge Components

Core Knowledge Questions

- Why were ideas about evolution not widely accepted when they were published?
- How does the depth of fossils indicate potential age of organisms?
- What are the problems with the fossil record?
- What techniques can be used to determine the age of fossils?
- What are the implications for antibiotic resistance?
- What are binomial names?
- Explain the impact of DNA analysis on classification
- Give examples of selective breeding and explain how it is carried out
- Explain what happens during genetic modification.
- Give examples of genetic modification
- Comment on the debate around genetic modification

Powerful knowledge components crucial to commit to long term memory

- **Who first published ideas about evolution?**
- **Where is the earliest evidence for human activity found?**
- **What is the fossil record?**
- **What causes variation?**
- **What is antibiotic resistance?**
- **What is survival of the fittest?**
- **Name the five kingdoms**
- **What is the difference between selective breeding and GM**
- **State some concerns with GM**

Topic: States of Matter and Mixtures

Duration: 9 lessons

Composite:

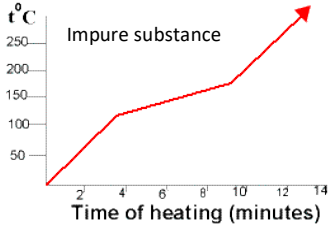
Key vocabulary:

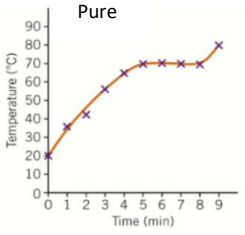
State
Physical
Predict
Describe
Explain
Connective
Element
Compound
Mixture
Pure/Impure
Solvent
Solute
Solution
Soluble
Insoluble
Condensation
Condenser
Hazard
Risk
Chromatography
R_f value
Chromatogram
Mobile phase
Stationary phase
Solvent front
Sedimentation
Filtration
Chlorination
Potable
Precipitate
Vapour
Crystallisation
Evaporation
Concentration
Fractional Distillation
Aquifer
Relative
Residue
Spattering

Core Knowledge in this unit: All matter is made of particles which are attracted to one another. Their movement is due to kinetic energy which increases with temperature.
There are weak attractions between small molecules called intermolecular forces which can be broken if heated sufficiently.
An element contains one type of atom and is found on the Periodic Table.
A compound contains two or more different elements chemically bonded together in fixed amount shown in a formula.
A mixture contains two or more different substances not chemically bonded together and therefore it can be easily separated. It has no chemical formula.
A pure substance has a specific melting point but impure substances melt over a range of temperatures.


A pure element

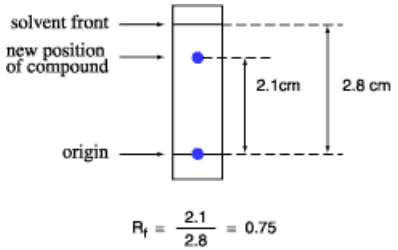

A pure compound





Solvent	the liquid in which a solute dissolves
Solute	the substance that dissolves in a liquid to form a solution
Solution	is the mixture formed when a solute has dissolved in a solvent
Soluble	describes a substance that will dissolve
Insoluble	describes a substance that will not dissolve

Crystallisation is used to separate a soluble substance from a solvent.
Filtration is used to separate an insoluble substance from a liquid.
Simple distillation separates a liquid from a mixture by evaporation and condensation.
Fractional distillation separates a mixture of more than two liquids.
Paper chromatography is used to separate and identify coloured substances.



$R_f = \frac{2.1}{2.8} = 0.75$

The ratio of the distance moved by a compound (centre of spot from origin) can be expressed as its R_f value:

$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$

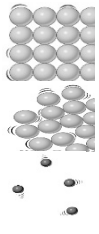
When calculating the R_f value, remember the **solvent will always travel further than the substance** so the **R_f value can never be greater than 1.**

Chromatography can be used to separate **mixtures of soluble substances** by running a solvent (**mobile phase**) through the mixture on the paper (**stationary phase**) causing the substances to **move at different rates.**

Filtration cannot be used to purify seawater as the dissolved salts would pass through the small holes in the filter paper.

Distilled water is used for chemical tests as it is pure and does not contain dissolved substances which could give false test results.

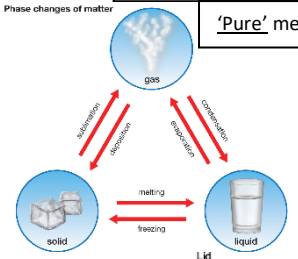
Powerful Knowledge components critical to commit to long term memory:



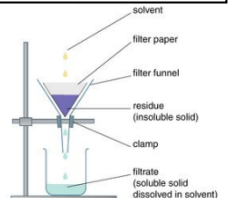
Solid Particles are arranged in a repeating regular pattern with no spaces between them and can only vibrate about a fixed position

Liquid Particles are touching, not in a pattern and can move past one another

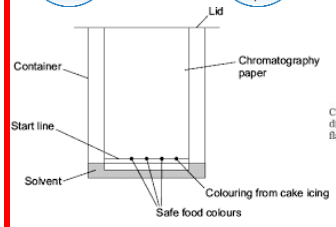
Gas Particles have empty spaces between them, they are not in a pattern and can move past one another



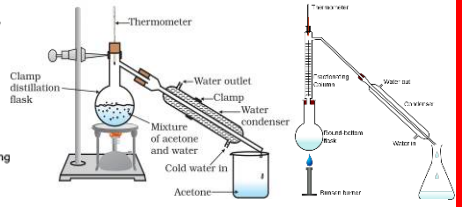
'Pure' means made of one type of substance in Chemistry.



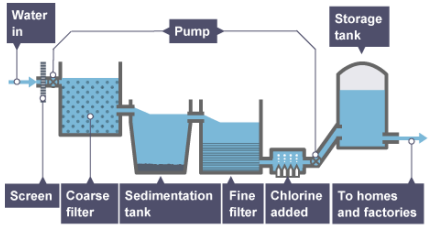
How to carry out crystallisation and filtration



Paper chromatography



Simple and fractional distillation



Seawater is not safe to drink as it contains a high concentration of salts but it can be turned into potable water by using simple distillation.

Potable water is water that is safe to drink but it is not pure as it contains dissolved substances such as salts. It also contains added chlorine, which destroys microorganisms.

Links to previous and future topics

KS2 Materials

KS3 Elements, compounds and reactivity (Yr7)

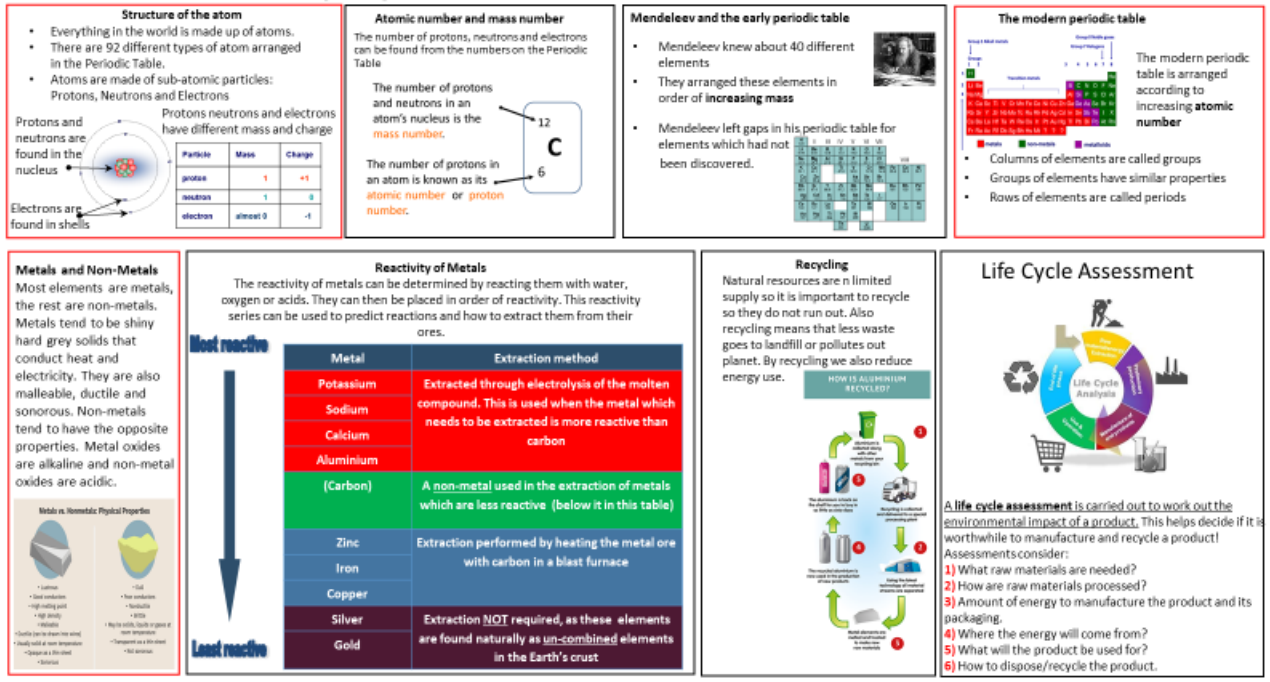
KS3 Separations & Mixtures (Yr7)

KS3 Particles & Solutions (Yr7)

KS3 Solutions & Mixtures (Yr8)

KS4 States of Matter & Mixtures (Chem)

KS4 Particle Model (Physics)

Topic: The Periodic Table		Duration:	Composite: Unit test
Key vocabulary:	**Core knowledge Components**	**Powerful knowledge components crucial to commit to long term memory**	**Links to previous and future topics**
Atom Element Proton Electron Neutron Nucleus Periodic Table Mendeleev Metals Non-Metals Oxide Reactivity Displacement Recycling Life Cycle Assessment Ore Resource Raw material	**The Periodic Table Knowledge Organiser** (Powerful Knowledge components critical to commit to long term memory in red box)  **Structure of the atom** • Everything in the world is made up of atoms. • There are 92 different types of atom arranged in the Periodic Table. • Atoms are made of sub-atomic particles: Protons, Neutrons and Electrons Protons and neutrons are found in the nucleus Protons neutrons and electrons have different mass and charge Electrons are found in shells **Atomic number and mass number** The number of protons, neutrons and electrons can be found from the numbers on the Periodic Table The number of protons and neutrons in an atom's nucleus is the mass number. The number of protons in an atom is known as its atomic number or proton number. **Mendeleev and the early periodic table** • Mendeleev knew about 40 different elements • They arranged these elements in order of **increasing mass** • Mendeleev left gaps in his periodic table for elements which had not been discovered. **The modern periodic table** The modern periodic table is arranged according to increasing **atomic number** • Columns of elements are called groups • Groups of elements have similar properties • Rows of elements are called periods **Metals and Non-Metals** Most elements are metals, the rest are non-metals. Metals tend to be shiny hard grey solids that conduct heat and electricity. They are also malleable, ductile and sonorous. Non-metals tend to have the opposite properties. Metal oxides are alkaline and non-metal oxides are acidic. **Reactivity of Metals** The reactivity of metals can be determined by reacting them with water, oxygen or acids. They can then be placed in order of reactivity. This reactivity series can be used to predict reactions and how to extract them from their ores. Most reactive Least reactive Metal / Extraction method Potassium, Sodium, Calcium, Aluminium: Extracted through electrolysis of the molten compound. This is used when the metal which needs to be extracted is more reactive than carbon (Carbon): A non-metal used in the extraction of metals which are less reactive (below it in this table) Zinc, Iron, Copper: Extraction performed by heating the metal ore with carbon in a blast furnace Silver, Gold: Extraction NOT required, as these elements are found naturally as un-combined elements in the Earth's crust **Recycling** Natural resources are n limited supply so it is important to recycle so they do not run out. Also recycling means that less waste goes to landfill or pollutes out planet. By recycling we also reduce energy use. **Life Cycle Assessment** A **life cycle assessment** is carried out to work out the environmental impact of a product. This helps decide if it is worthwhile to manufacture and recycle a product! Assessments consider: 1) What raw materials are needed? 2) How are raw materials processed? 3) Amount of energy to manufacture the product and its packaging. 4) Where the energy will come from? 5) What will the product be used for? 6) How to dispose/recycle the product.	Atoms make up everything Atoms are made of protons, electrons and neutrons Elements are placed in atomic number order in the periodic table Elements in the same group have similar properties Metals and non-metals have opposite properties	

Topic: ENERGY

KS3 National Curriculum sub-topics:-

- **Energy Changes & Transfers**
- **Changes in Systems**
- **Domestic Context**

Duration: 10 lessons

Composite: Unit test

Key vocabulary:

Energy
Resource
Fossil fuel
Crude oil
Coal
Oil
Gas
Nuclear
Greenhouse gas
Climate change
Pollution
Renewable
Solar
Wind turbine
Geothermal
Tidal
Geothermal
Bio-fuels
Chemical
Kinetic
Thermal
Gravitational potential
Elastic potential
Electrostatic
Magnetic
Equilibrium
Conservation
Mechanically
Heating
Electrically
Radiation
Sound
System
Power rating
Watt
Efficiency
Watt

Core knowledge Components
Powerful knowledge components crucial to commit to long term memory (in red box)

1. Fuels are energy resources
2. Uses of energy resources include:- heating, cooking, generating electricity, power life, move objects

Non-renewable:-

3. Examples are:- coal, petrol, natural gas, nuclear, diesel, fossil fuels, crude oil

Renewable:-

4. Examples and their sources are:- Solar – Sun; Tidal – moving tides; Hydroelectric – falling water; Geothermal - hot rocks; Wood – trees; Wind – wind; Biofuels – animal waste/plants
5. Renewable energy resources release little or no pollution so cause less damage to the environment.
6. Disadvantages include:-not sunny at night; not always windy; land-locked countries don't have tides; Hydroelectric stations involve dams that destroy habitats; biofuels use land for plant growth that could be used for growing crops; wind – visual pollution and noisy

Energy Stores & Transfers

7. A system is an object or group of objects being studied that are energy stores
8. Useful energy is energy that has been transferred to a desired store
9. Wasted energy is energy that has not been transferred to a useful store
10. Thermal energy dissipates. This means that it spreads out thinly and widely into the surroundings and so cannot be transferred to a useful store
11. Sankey diagrams show: the input and output energy stores; state useful and wasted energies; state amounts of energy
12. Efficiency is a measure of how good a machine is at transferring energy into useful stores.

Domestic Context

13. The power rating of an appliance tell us how much energy is transferred per second
14. A unit of electricity : (1 unit = 1kWh – energy transferred to a device multiplied by the time the device is used for.
15. Electricity costs can be reduced by: Insulation – curtains, carpets, draught excluders, double glazing, cavity wall, loft; More efficient appliances; Energy saving light bulbs

POWERFUL KNOWLEDGE

- Energy resources are stores of energy.
- There are 2 types of energy resources: renewable and non-renewable.
- Non renewable energy resources are those that are being used at a faster rate than they can be replaced.
- Burning non renewable energy resources releases a range of pollutants that result in damage to the environment.
- The effects of the main pollutants released by no-renewable resources include:-
  - CO2: a greenhouse gas which contributes to global warming
  - SO_2 and NO_2 which form acid rain
  - Particulates: breathing problems and dirty
  - Nuclear: radioactive waste
- Renewable energy resources can be replaced at the same, or faster rate, than they are being used.
- Law of Conservation of Energy = Energy cannot be created or destroyed but can be transferred from one store to another.
- Energy is 'located' only in stores: thermal; kinetic; gravitational potential; elastic potential; chemical; nuclear
- Energy is moved between stores only by: heating; mechanically; electrically; radiation; sound.
- Thermal energy moves between stores only if there is a difference in temperature. The thermal energy moves from the hotter area to the cooler area until the temperatures are the same; this point is called thermal equilibrium.
- Efficiency is a measure of how much input energy is transferred to useful stores.
- Wasted energy is often thermal energy that dissipates into the surroundings.
- Efficiency can be increased by lubrication, insulation and reducing electrical current.
- Increased efficiency can reduce costs to the consumer, reduces environmental pollution and conserves non-renewable resources.
- Power is the rate the energy transfer
- Energy suppliers bill households in 'units' – this is a measure of how much energy is transferred and how long the device is used for.

Links to previous and future topics

KS2: Use of everyday materials

Y7: Energy Resources

Y8: Heating & Cooling; Earth & Atmosphere; Light & Sound

KS4: Conservation of Energy; Earth & Atmospheric Science; Ecosystems & Material Cycles; Electricity & Circuits; Particle Model

Topic: YEAR 9 WAVES

Duration: 10 lessons

Composite: Unit test

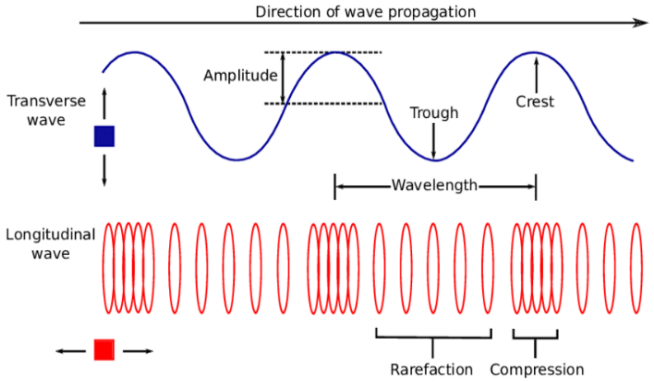
Core Key vocabulary:

Vibration
Energy
Amplitude
Frequency
Wavelength
Peak
Transverse
Longitudinal
Reflection
Refraction
Superpose
Compression
Rarefaction
Hertz
Medium
Vacuum
Decibel
Perpendicular
Incident
Normal
Dense
Speed
Direction
Convex
Lens
Eye
Electromagnetic Spectrum
Radiation
Radio
Microwave
Infrared
Visible
Ultraviolet
X-rays
Gamma`
Speed
Time Period
Distance
Time
Metres
Seconds

Core knowledge Components

Powerful knowledge components crucial to commit to long term memory (Powerful in red box)

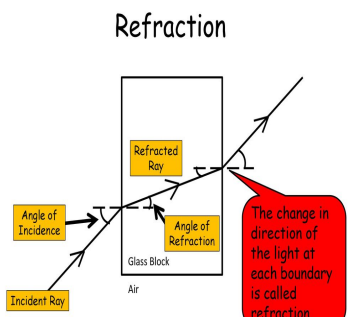
1. Waves move from a source to a receiver. E.g. radio waves move to the ear.
2. When waves hit a barrier or another substance (medium), they can:-
   a. Reflect = bounce off
   b. Refract = change speed so change direction
   c. Disperse = spread out thinly in all directions
   d. Superpose = waves add together or cancel out
   e. Diffract = waves spread out when they superpose
3.

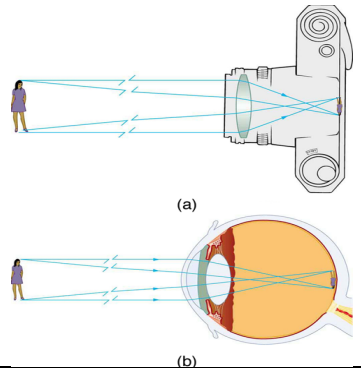


Transverse wave = vibrations are perpendicular to the direction that the wave is travelling in. E.g. light, water, all EM waves.

Longitudinal wave = vibrations are parallel to the direction in which the wave is travelling E.g. sound and p-wave (seismic)

4. Humans hear frequencies 20 to 20,000Hz Ultrasound = above 20,000Hz Infrasound = below 20Hz
5. Sound wave: **frequency** increases **= pitch** increases & **if Amplitude** increases = **volume** increases
6. The eye and the camera change the speed and so the direction of light..
7. The eye and the camera result in chemical and electrical changes to photosensitive material (material that is affected by light)





- Waves are caused by vibrations from a source. E.g. a pebble landing in water
- When the wave moves, it transfers energy and/or information from one place to another.
- There are different types of wave that move different amounts of energy in different ways.
- The 2 types of wave are called transverse and longitudinal.
- Features of waves can be measured e.g. wavelength, frequency and amplitude.
- Wavelength (λ) : unit = metres (m)
- Frequency (f) : unit = Hertz (Hz) or 'per second'
- Amplitude (A) : unit = metres (m)
- Speed (s or v) : unit = metres per second (m/s)
- Distance (d) : unit = metres (m)
- Time (t) : unit = seconds (s)

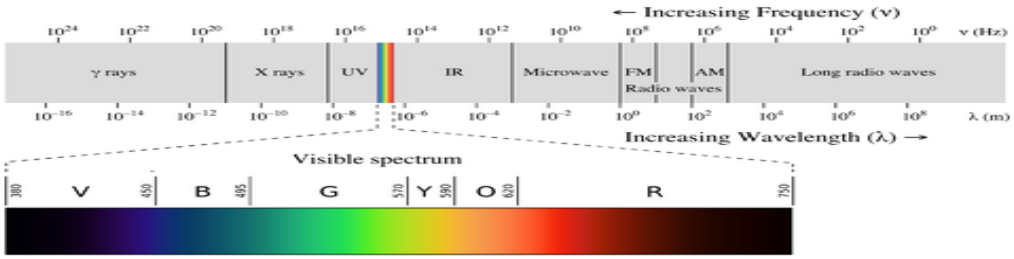
Links to previous and future topics

KS3: Y8 Light and Sound

KS4: Waves; Light and the EM Spectrum; Radioactivity – Electrons & Orbits

KS5: Physics: Waves 1 and 2, Oscillations, Stars, Cosmology

8. **White light is a spectrum of colours that each have different Wavelength, Frequency, and energy. Red has the longest wavelength, lowest frequency and lowest energy.**
9. The Electromagnetic Spectrum is a continuous wave whose amount of energy transfer changes from one end of the spectrum to the other.
10. This changing energy results in different uses and dangers for each group in the Spectrum



	Radio	Microwave	Infra-red	Visible	U-V	X-ray	Gamma
Uses	**TV Radio**	**Mobiles Oven**	**Heating food**	**Camera Eye**	**Sterilise water**	**Medical – inside body**	**Sterilising, medical imaging**
Dangers	**None**	**Unknown for phones**	**Skin burns**	**Retina damage**	**Damage cells or…**	**…mutate DNA……..**	**…….that may lead to cancer or kill cells.**

Distance = Speed x Time

$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$

$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$