Rayner Stephens
HIGH SCHOOL

Curriculum Intent

for

Science

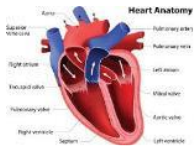
The intent of science at Rayner Stephens High School is to provide students with a high-quality science education that provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world's future prosperity, and all our pupils should be taught essential aspects of the knowledge, methods, processes and uses of science. Through building up a body of key foundational knowledge and concepts, our pupils will be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They will be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

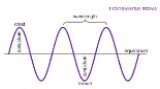
Rayner Stephens High School

Science Learning Journey

Written Exam
6 x 1hr 15 min for combined
6 x1hr45min for separate science

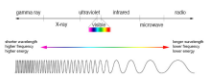
Revision
Ecology
Variation and Evolution
Using Resources
Magnetism
Chemistry and the atmosphere
Homeostasis
Organic Chemistry
Rate of chemical change

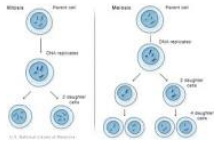




YEAR 11

Bioenergetics
Energy Changes
Particle Model of Matter
Chemical Changes
Infection and Response
The Periodic Table
Forces
Human Nervous system
Chemical Analysis
Waves
Reproduction



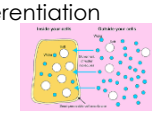


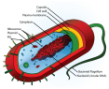
YEAR 10

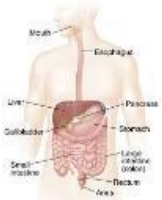
Electricity
Bonding, structure and matter
Quantitative Chemistry
Cell Division
Using Resources
Home Electricity
Heating
Human Interaction

YEAR 9

Light
Nutrition
Growth and Differentiation
Acceleration
Chemistry of the Atom
Genetics
Sound and Waves
Life Diversity
Changing Substances
Movement and Pressure
Tissues and Organs





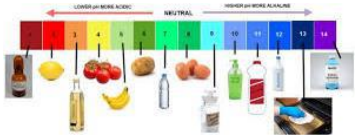


YEAR 8

Electric Circuits: Resistance
Earth Systems
Magnetism
Respiration and Photosynthesis
Acids and Alkalis
Electric Circuits: Current and Voltage
Mixtures

YEAR 7

Particles
Reproduction
Gravity
Cells
Contact Forces
Elements, atoms and compounds
Interdependence
Energy Transfer



Year 9 - Science						
Curriculum intent	During year 9 learners will consolidate the knowledge they have learnt so far in science, to further develop their scientific knowledge and conceptual understanding through the study of biology, chemistry and physics. Learners will deepen there understanding of the nature, processes and methods of science through different types of scientific enquiries that help them to answer scientific questions about the world around them. Through these learners will be given the opportunities to apply their scientific knowledge to understand the uses and implications of science, today and for the future.					
Term	**Autumn 1**	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Knowledge	**Growth & Differentiation -** Learners will use a range of investigative techniques to understand how cells in different organisms vary and will model how substances are transported between cells in both unicellular and multicellular organisms. **Periodic Table and Elements -** Learners will look at the structure of the periodic table, and how an elements position in it can be used to work out is properties. They will also develop their knowledge of constructing word and symbol equations	**Acceleration –** Learners will use a range of investigative techniques to understand how to identify vector and scalar quantities and then to calculate speed.	**Human Interaction –** Learners will study about Biodiversity on our planet, how carbon is recycled and calculate their carbon footprint. Learners will look at how human activities have affected the Earth's atmosphere **Chemistry of the Atom -** Learners will use a range of investigative techniques to understand how certain factors can impact the rate of a reaction and how we can measure this.	**Heating -** Learners will use a range of investigative techniques to understand how the type of material influences the rate at which it heats and cools.	**Genetics -** Learners will use a range of investigative and modelling techniques to understand how DNA controls the structure and function of organisms. **Sound-**Learners will use a range of investigative and modelling techniques to understand how sound behaves	**Electricity Usage:** Learners will use a range of investigative techniques to understand how reaction energy may be transferred to or from the surroundings and apply this to the efficiency of electrical appliances. **Using Resources** – Learners will explore the damages to Earth's resources and learn about the importance of recycling and sustainability.
Skills	**The following skills will be developed throughout the whole of year 9 and will enable learners to build a deep understanding of science:** **Scientific attitudes:** □ pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility					

	□ understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review □ evaluate risks. **Experimental skills and investigations:** □ ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience □ make predictions using scientific knowledge and understanding □ select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate □ use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety □ make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements □ apply sampling techniques. **Analysis and evaluation:** □ apply mathematical concepts and calculate results □ present observations and data using appropriate methods, including tables and graphs □ interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions □ present reasoned explanations, including explaining data in relation to predictions and hypotheses □ evaluate data, showing awareness of potential sources of random and systematic error □ identify further questions arising from their results. **Measurement:** □ understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature □ use and derive simple equations and carry out appropriate calculations □ undertake basic data analysis including simple statistical techniques.					
Assessments	End of half term tests & HFL'S	End of half term tests & HFL'S	End of half term tests & HFL'S	End of half term tests & HFL'S	End of half term tests & HFL'S	End of half term tests & HFL'S
Enrichment	Lab Rats Leaders-Opportunity to complete crest award Trip to Manchester museum- Small group activities Science career talks					

Year 9 Science Autumn Term Knowledge Organiser Growth and Differentiation

Key Vocabulary:

1	**Eukaryotic cells**	have membrane-bound organelles and have genetic material contained in the nucleus
2	**Aseptic techniques**	must be used to prepare cultures to prevent contamination of the culture and the growth of harmful bacteria
3	**Microscopy**	is the field of using microscopes to view samples that cannot be seen with the naked eye
4	**Diffusion**	is the spreading out of particles, of a gas or liquid, resulting in net movement from an area of high concentration to low concentration
5	**Osmosis**	is the diffusion of water from a **dilute solution** to a **concentrated solution** through a **partially permeable membrane**
6	**Cancer**	is caused by uncontrolled cell division
7	**Stem cells**	1. are cells that are capable of **differentiating** into other types of cell

Cells

8

All eukaryotic cells have a nucleus, mitochondria, ribosomes, cytoplasm and a cell membrane. Plant cells also have a cell wall, vacuole and chloroplasts

Prokaryotic cells do not contain membrane-bound organelles

Prokaryotic cells are approximately 10 orders of magnitude smaller than eukaryotic cells

9 Microscopy

The parts of a light microscope include the eyepiece lens, objective lenses, stage, coarse focusing wheel, fine focusing wheel, light/mirror

A sample used with a light microscope must be very thin to allow light to pass through

Magnification is the number of times larger an image is than the object

Resolution is the ability to distinguish between two points

10 Aseptic Technique

Petri dishes are used to produce cultures of bacteria and other micro-organisms

Cultured bacteria are grown on a nutrient medium in controlled conditions

Aseptic techniques must be used to prepare cultures to prevent contamination of the culture and the growth of harmful bacteria

11 Cancer

Cancer is caused by uncontrolled cell division

A tumour is a mass of cells caused by uncontrolled cell division

Benign tumours are a mass of cells contained in one area

Malignant tumours are formed of cancer cells that invade other tissues and spread around the body where they form secondary tumours

12 Stem Cells

Embryonic stem cells can differentiate into all human cell types

Adult bone marrow contains stem cells that can differentiate into different types of blood cell

13 Aseptic Technique

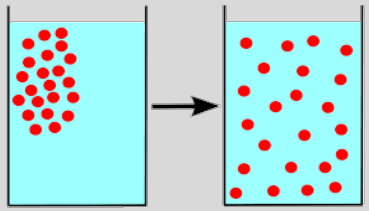
Petri dishes are used to produce cultures of bacteria and other micro-organisms

Cultured bacteria are grown on a nutrient medium in controlled conditions

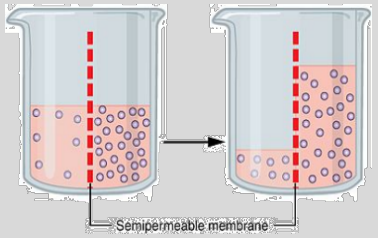
Aseptic techniques must be used to prepare cultures to prevent contamination of the culture and the growth of harmful bacteria

14 Movement of Particles

Diffusion is the spreading out of particles, of a gas or liquid, resulting in net movement from an area of high concentration to low concentration



Osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane



Active transport moves substances from a more dilute solution to a more concentrated solution, requiring energy from respiration

Year 9 Science Autumn Term Knowledge Organiser – Human Interaction

Key Vocabulary:

1	Biodiversity	The variety of different species in an ecosystem
2	Sampling	Techniques used to measure populations of living organisms.
3	Quadrat	1 meter wooden square used to estimate populations of living organisms.
4	Abundance	A measure of a population.
5	Stable ecosystem	Where species in an ecosystem do not depend on each other.
6	Peat	Peat from peat bogs is used for compost for gardens and farms, destroying habitats
7	Greenhouse gases	Carbon dioxide, methane and water vapour. Released from combustion of fossil fuels and farming.
8	Global warming	
9	Pollution	Substance released from human waste that damage ecosystems. E.g. Water, air and land pollution.
10	Biomass	Total quantity or weight of biological matter.
11	Trophic level	Level or position in a food chain.
12	Fusarium fungus	Fusarium fungus is used to produce mycoprotein (Quorn), a protein-rich food suitable for vegetarians.
13	GM (Genetic modification)	GM crops, such as golden rice, can be used to provide increased nutritional value in areas where it is lacking
14	Sustainable	Able to be maintained at a certain rate or level.

Human Interactions

15 Sampling

a) Techniques used to measure populations of living organisms.

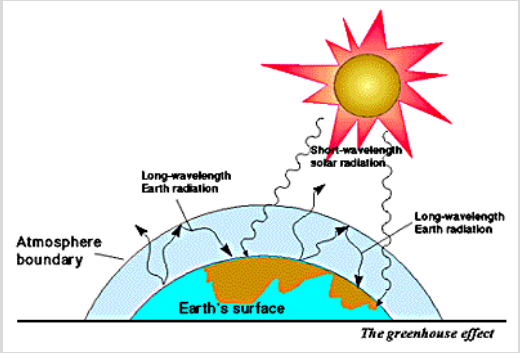
b) Random sampling - Used to measure the abundance of a living organism in a habitat using random coordinates.

c) Systematic sampling - Used to measure the effect of a factor on the distribution of a species, using a transect.

d) Quadrat

16 Greenhouse Effect

Levels of carbon dioxide and methane in the atmosphere are increasing, contributing to global warming



17 Consequences of Global Warming

There are many biological consequences to global warming including:

a) Melting polar ice caps
b) Rising sea levels
c) Extreme weather patterns
d) Flooding
e) Loss of habitats

18 Reducing Human Impact

How humans can reduce their impact on Biodiversity by:

a) Protecting rare habitats
b) Maintaining nature reserves
c) Breeding programmes for endangered species
d) Recycling resources to reduce landfill waste
e) Reducing deforestation
f) Growing hedgerows on farms to allow more crops to grow

Increasing Human Population

19 Increasing Human Population

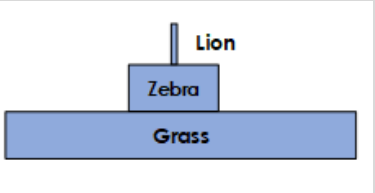
The increasing human population means that more resources are required and more waste is produced. More waste is also produced through the improved standard of living.

If waste is not treated properly it results in pollution:

a) **Water pollution** is caused by poor sewage treatment and leaching of fertilisers
b) **Air pollution** is caused by smoke and acidic gases
c) **Land pollution** is caused by landfill and toxic chemical waste

20 Pyramids of Biomass

- Biomass is lost between trophic levels in a food chain
- Biomass is lost through waste (faeces, urine, sweat, gas) and through life processes such as movement and thermoregulation



21 Farming

a) Efficiency of food production can be improved by restricting energy transfer from food animals to the environment.
b) This includes intensive farming methods where movement of animals is limited and the temperature of their surroundings is controlled.
c) Fish stocks in oceans are declining because of overfishing

22 Food Security

Food security is having enough food to feed a population. Many factors can threaten food security:

a) Increasing birth rate.
b) Changing diets in developed countries means that scarce food resources are being transported across the world
c) New pests and pathogens are affecting farming
d) Environmental changes, including droughts, which can lead to famines
e) Political instability and conflicts in some parts of the world threaten access to food and water

Year 9 Science Spring Term – Introduction to Quantitative Chemistry

Key Vocabulary:

1	**Atom**	The smallest part of an element that can exist independently.
2	**Atomic Number**	The number of protons in an atom of an element. This is he smallest number of the two numbers provided for each element on the periodic table.
3	**Chemical Formula**	A series of chemical symbols showing the number of atoms of each element in a compound.
4	**Compound**	A substance made up of two or more different elements chemically bonded together.
5	**Concentration**	The mass of solute dissolved in a given volume of solvent.
6	**Conservation of Mass**	The law of conservation of mass states that the total mass of reactants in any chemical reaction equals the total mass of product.
7	**Element**	A substance made of only one type of atom.
8	**Mass Number**	The total number of protons and neutrons in the nucleus of an atom. It is the larger of the two numbers beside each element in the periodic table.
9	**Mixture**	A material consisting of two or more different substances that are not chemically combined.
10	**Molecule**	A small group of non-metal atoms chemically bonded together.
11	**Relative Atomic Mass**	The relative atomic mass of an element is the relative mass of its atoms compared to the mass of a carbon-12 atom. The relative atomic masses for each element are given in the Periodic Table.
12	**Relative Formula Mass**	The relative formula mass of a substance is the sum of the relative atomic masses of its atoms, in the numbers shown in it's chemical formula.

13 Chemical Reactions

Chemical reactions always involve the formation of one or more new substances.

- Chemical reactions often involve a temperature change.
- Formulae are used to show the elements bonded together in a compound e.g. H_2O contains 2 hydrogen atoms and one oxygen atom.
- Compounds can only be separated into their elements by a chemical reaction e.g. $2H_2O \rightarrow 2H_2 + O_2$
- In chemical equations the three states of matter are shown as: solid = (s); liquid = (l) and gas = (g) aqueous solutions are shown as (aq)
    - e.g. $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$
- An aqueous solution is a substance dissolved in water.

14 Relative Formula Mass

- The relative atomic mass (A_r) is the average mass of the atoms of an element compared to the mass of carbon-12.
- The relative formula mass (Mr) of s substance is the sum of the A_r of all the atoms in the formula.
- e.g. What is the M_r of water (H_2O)?
    - (A_r H = 1.0; O = 16.0)
- There are 2 x H and 1 x O in the formula
    - (2 x 1.0) + (1 x 16.0) = 18.0
- A_r and M_r have no units as they are relative masses.
- In a balanced chemical equation:
- sum M_r reactants = sum M_r products
    - e.g. $2H_2O_2 \rightarrow 2H_2O + O_2$
- Mr reactants = 2 x 34 = 68
- Mr products = (2 x 18) + 32 = 68
- The percentage mass of an element in a compound can be calculated using the relative atomic mass and the relative formula mass.

15 Conservation of Mass & Balancing Equations

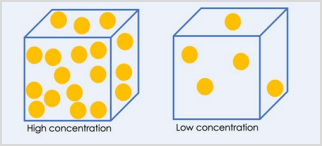
- No atoms are lost or made during a chemical reaction.
- mass of products = mass of reactants
- Chemical reactions can be represented by symbol equations which are balanced.
- This means the number of atoms of each element is balanced e.g. $2Mg + O_2 \rightarrow 2MgO$
- there are 2 magnesium atoms on each side of the equation.
- During the reaction hydrogen gas is produced. If the gas is free to leave the reaction container then the measured mass will decrease.
- Some reactions may appear to involve a change in mass, but this is normally because a reactant or a product is a gas e.g. $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

16 Uncertainty

- Scientific uncertainty means there is a range of possible values within which the true value of a measurement lies.
- Whenever a measurement is made, there is always some uncertainty about the result obtained.

17 Concentration

- Many chemical reactions take place in solutions.



- The more concentrated a solution the more particles it contains in a given volume.
- The concentration of a solution can be measured in mass per given volume of solution e.g. grams per dm^3 (g/dm^3).
    - $\frac{\text{mass of solute}}{\text{volume of solution}}$ = concentration
- Volumes need to be in dm^3
- 1 dm^3 = 1000 cm^3

18 Making Soluble Salts

- Soluble substances dissolve in a solvent.
- Insoluble substances cannot dissolve in a solvent.
- Neutralisation reaction general equation is acid + base → salt + water
- Metal + acid → salt + hydrogen
- Metal oxide + acid → salt + water
- Metal hydroxide + acid → salt + water
- Metal carbonate + acid → salt + water + carbon dioxide
- Soluble salts can be made from acids by reacting them with solid insoluble substances, such as metals, metal oxides, hydroxides, or carbonates.
- The solid is added to the acid until no more reacts and the excess solid I filtered off to produce a solution of the salt.
- Salt solutions can be crystallised to produce solid salts.
- Copper oxide reacts with sulfuric acid solution to produce copper sulfate and water.
- This reaction can be represented with the equation CuO(s) + H2SO4(aq) → CuSO4(aq) + H2O(l)
- Copper sulfate solution is a blue liquid.
- Copper sulfate crystals are blue.

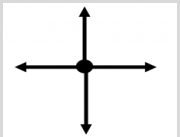
Year 9 Science Knowledge Organiser – Acceleration

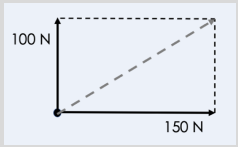
Key Vocabulary:

1	**Acceleration**	The rate of change of velocity.
2	**Action**	A description of a change in a physical system.
3	**Balanced**	Equal in size and opposite in direction.
4	**Component**	The horizontal or vertical part that makes up a diagonal vector.
5	**Constant Velocity**	When an object travels at the same speed in the same direction.
6	**Contact Force**	Is a force that acts when objects are physically touching each other.
7	**Curve**	A continuous and smooth flowing line without any sharp turns.
8	**Deceleration**	Slowing down, also known as negative acceleration.
9	**Distance**	The length of a path or length between two points.
10	**Displacement**	The change in position of an object.
11	**Gradient**	The slope of a graph.
12	**Initial Velocity**	A vector quantity that describes the velocity of an object before an acceleration.
13	**Mass**	Mass is a measurement of how much matter is in an object.
14	**Non-contact Force**	A force which acts on an object over a distance.
15	**Resultant**	The sum of two or more vectors: the result of adding two or more vectors together.
16	**Scalar**	Quantities that have magnitude (size) only.
17	**Speed**	The distance covered per unit time.
18	**Tangent**	A straight line touching a curve at a single point without crossing the line.
19	**Unbalanced**	Forces that are not equal and opposite, a non-zero resultant force.
20	**Vector**	Quantities that have both magnitude (size) and direction.
21	**Velocity**	The speed of an object in a given direction.
22	**Vertical**	Perpendicular to an x-axis (an up or down line).

23 Scalars & Vectors

1. Scalars are quantities which only have size (magnitude), such as distance, speed, mass and energy.
2. Vectors are quantities with size and direction, such as displacement, velocity, acceleration, force and weight.
3. Resultant force is a vector quantity
4. Forces acting in the same direction can be added together
5. Forces acting in opposite directions can be subtracted
6. Resultant forces can be resolved into their horizontal and vertical components





24 Acceleration

1. Acceleration is the rate of change of velocity
2. Change in velocity is calculated using final velocity minus initial velocity
3. Acceleration happens when there is change in velocity (speeding up, slowing down or a change in direction)
4. Negative acceleration (slowing down) can be called deceleration
5. The SI unit for acceleration is m/s^2
6. An object moving in a circle is accelerating because it is constantly changing direction
7. Objects near Earth's surface experience gravitational acceleration of 9.8 m/s^2
8. Air resistance/drag increases with speed

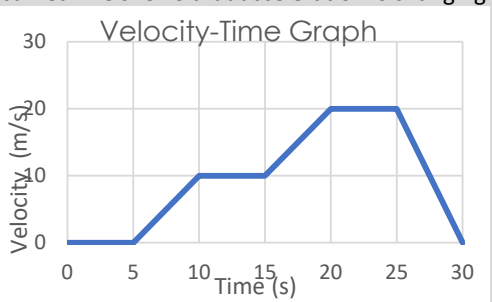
$$Acceleration = \frac{Change\ in\ velocity}{Time}$$

25 Newtons Laws

1. Newton's Third Law states that every action has an equal and opposite reaction
2. Newton's First Law states than an object's motion will not change unless acted upon by an unbalanced force
3. If the resultant force is 0 N a stationary object will remain stationary
4. If the resultant force is 0 N an object in motion will continue moving at the same velocity
5. If the resultant force is not 0 N a stationary object will accelerate in the direction of the resultant force
6. If the resultant force is not 0 N an object in motion will accelerate in the direction of the resultant force

26 Velocity-Time Graphs

1. Velocity-time graphs can be used to describe motion
2. A horizontal line shows a constant velocity
3. A straight line with a positive gradient (slope) shows that an object has a positive acceleration (speeding up)
4. A straight line with a negative gradient (slope) shows that an object has a negative acceleration/deceleration (slowing down)
5. Acceleration can be calculated by calculating the gradient
6. Distance can be calculated from the area under the graph
7. A curved line shows that acceleration is changing



Year 9 Science Autumn Term Knowledge Organiser Periodic Table

Key Vocabulary:

1	Atom	The smallest part of an element that can exist independently. The centre of an atom is called the nucleus
2	Electronic structure	The number of electrons in each energy level (shell) of an atom. A sodium atom has an electronic structure of 2, 8, 1.
3	Isotopes	Atoms of the same element with mass numbers due to different numbers of neutrons in the nucleus. Carbon-12, carbon-13, and carbon-14 are three isotopes of the element carbon with mass numbers 12, 13, and 14, respectively.
4	Atomic model	A model that represents the structure of the atom. The atomic model has been revised over time as new evidence has become available.
5	Periodic table	A table of all the known elements arranged in order of atomic number so that elements with similar properties are in columns, known as groups. All of the elements we know are represented in the periodic table.
6	Noble gas	An inert gas found in group 0 of the periodic table. Argon is a noble gas.
7	Alkali metal	An element in group 1 of the periodic table. Lithium is an example of an alkali metal.

Atomic Structure

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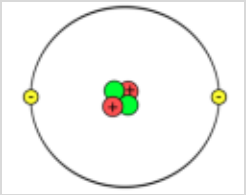
Atoms consist of a positively charged nucleus, containing protons and neutrons, surrounded by negatively charged electrons



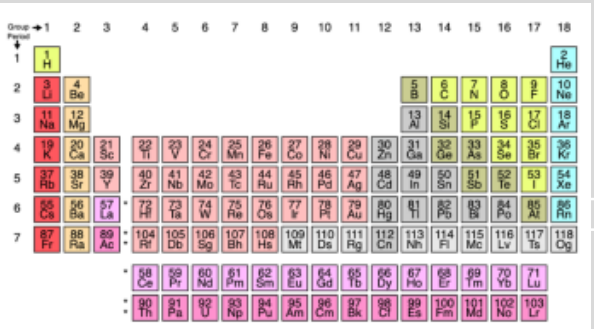
9 Atomic and Mass Number

The atomic number is the number of protons in an atom of the element 7. All atoms of a particular element have the same number of protons in their nuclei 8. Atoms of different elements have different numbers of protons
The mass number of an element is the total number of protons and neutrons 10. The relative charges of the subatomic particles are: protons (+), electrons (-) and neutrons (0)

10 Electronic Configuration

Electrons in an atom occupy the lowest available energy level 13. The electronic structure of an atom can be represented by numbers or a diagram 14. Atoms have no overall electrical charge because the number of electrons is equal to the number of protons in the nucleus
Elements in the periodic table are arranged in order of increasing atomic number and elements with similar properties

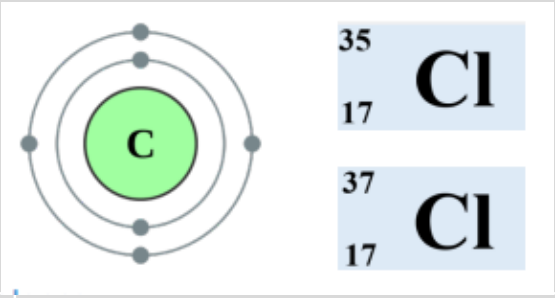
11 The Periodic Table



The Groups

12 Isotopes

Isotopes are atoms of the same element that have different numbers of neutrons 20. An element's relative atomic mass is an average value that takes account of the abundance of different isotopes



13 The Halogens

Elements in Group 7 are known as the Halogens 46.
They have similar reactions because they all have 7 electrons in their outer shell 47.
The Halogens are non-metals and consist of molecules made up of pairs of atoms 48. Melting and boiling points increase with increasing relative molecular mass (as you go down the group) 49.
Reactivity decreases as you do down the group 50. A more reactive halogen can displace a less reactive halogen from an aqueous solution of its salt

14 The Transition Metals

Metals including Cr, Mn, Fe, Co, Ni and Cu are transition metals with similar properties, which are different from the properties of Group 1 52.
Many transition elements form ions with different charges, form coloured compounds and can be useful as catalysts

15 The Noble Gases

Elements in Group 0 are called the Noble Gases 35. They are unreactive and do not easily form molecules because they have a stable arrangement of electrons 36. They have 8 electrons in their outer shell, except Helium which has 2 37. Boiling point increases with increasing atomic mass (as you go down the group)

Year 9 Science Summer Term Knowledge Organiser – Home Electricity

Key Vocabulary:

1	**Alternating Current (A.C)**	Alternating current reverses direction continually.
2	**Direct Current (D.C.)**	Direct current travels in one direction only.
3	**Fossil Fuel**	Non-renewable energy resources, formed from the remains of living things.
4	**Frequency**	The frequency of a wave is the number of waves that pass a point in one second.
5	**Fuse**	A fuse is a safety device that prevents a high current from flowing through the circuit.
6	**Live Wire**	The wire that goes from the power source to an appliance.
7	**National Grid**	A system of cables, pylons and transformers which transfers electrical power from power stations to people's homes.
8	**Neutral Wire**	The wire that goes from the appliance back to the power source to complete the circuit.
9	**Power**	The rate at which energy is transferred or work is done.
10	**Renewable (energy resource)**	A renewable energy resources is one that is being (or can be) replenished as it is used.
11	**Resistance**	Opposition to the flow of charge.
12	**Static electricity**	The build-up of electrical charge on an object.
13	**Step-down transformer**	A part of the national grid, which decreases the potential difference to make electricity safe to use.
14	**Step-up transformer**	A part of the national grid, which increases the potential difference to transfer electricity more efficiently.

15 Mains Electricity

1. Voltage can also be called potential difference
2. Potential difference is measured in Volts (V) using a voltmeter.
3. A simple circuit has two wires - a live wire and a neutral wire.
4. The live wire (brown) goes from the power source to the appliance.
5. The neutral wire (blue) goes from the appliance back to the power source to complete the circuit. It is important to have a switch attached to the live wire so that when an appliance or socket is switched off it is not live.

16 Direct & Alternating Current

1. Direct current (d.c.) travels in one direction only.
2. Cells and batteries supply direct current.
3. Alternating current (a.c.) continually reverses direction.

17 Plugs

1. In the UK, most appliances use a three-core cable.
2. The neutral wire is blue, the live wire is brown, and the earth wire is green and yellow.
3. The earth wire is a safety feature and is not needed to complete the circuit.
4. The earth wire connects to the case of the appliance, so that if a loose wire touches it, the case will not conduct electricity.

18 Energy Resources

1. Fossil fuels are non-renewable energy resources. Examples include coal, oil and natural gas.
2. Fossil fuels can be burned to heat water, which produces steam. The steam turns a turbine, which powers a generator (to generate electricity).
3. Nuclear energy is obtained by the splitting up of atomic nuclei. Examples include Uranium & Plutonium.
4. A renewable energy resource is one that is being (or can be) replenished as it is used. Examples include biofuels, wind.

19 Power

1. The function of an appliance is to bring about an energy transfer.
2. The amount of energy an appliance transfers depends on how long it is switched on for, and the power of the appliance.
3. Power is the rate at which energy is transferred or work is done.

Measured in Watts (W) → $\text{Power} = \frac{\text{Energy}}{\text{Time}}$ ← Measured in Joules (J); Measured in seconds (s)

$$P = \frac{E}{t}$$

4. Watt of power = 1 joule of energy transferred each second.

Energy transferred = Power x Time

$E = P \times t$

20 The Cost of Electricity

When we say we are 'using electricity', we are using energy which has been transferred electrically.
Electricity meters measure the number of units of electricity (energy) used in a home or building. The more units used, the greater the cost.
When calculating the cost of electricity, we calculate energy transferred in kilowatt-hours (kWh). kWh is a unit of energy transferred.

Energy transferred = Power x Time
Units (kWh) = power (kW) × time (h)

Total cost = number of units × cost per unit
Units (kWh)

We can also calculate power if we know the current flowing through an appliance and the p.d. across it

Measured in Amps (A); Measured in Watts (W); Measured in Volts (V)

Power = Current x Potential Difference

$P = I V$

We know that

$E = P \times t$ and $P = I V$

Putting these together we see that..

$E = I \times V \times t$

Which can also be written as..

$E = I t V$

To calculate the energy transferred by an appliance we use the equation:

Energy (Joules) = Power (Watts) x time (seconds)
E (J) = P (W) x t (s)

We can also use the equation:

Energy (Joules) = Charge flow (Coulombs) x Potential difference (Volts)
E (J) = Q (C) x V (V)

Year 9 Science Summer Term – Using Resources

Key Vocabulary:

1	Reactivity series	is a list of metals in order from most reactive at the top to least reactive at the bottom
2	Composite	is made of two or more materials with different properties.
3	Ores	are rocks or minerals which contain enough metal that can be extracted economically
4	Renewable	Resources that can be replenished and will not run out e.g. wood
5	Potable water	Water that is safe to drink
6	Desalination	means to remove salt. Desalination can be done by distillation or reverse osmosis. These processes require large amounts of energy.
7	Finite	Resources that are being used up more quickly than they are being made e.g., fossil fuels and uranium.

8

- Some metals are more reactive than others
- Some metals tarnish because they react with oxygen in the air

9

- When a metal reacts with an acid, a salt and hydrogen gas are made
- Bubbles observed in the solution indicate that a gas is being made in the reaction
- By observing the reactions of metals and acids, it is possible to deduce the order of reactivity of the metals
- The reactivity series can be used to make predictions about the reactions of metals, such as whether a reaction will take place and how vigorous that reaction will be

10

- Sewage treatment includes screening and grit removal, sedimentation to produce sewage sludge and effluent, anaerobic digestion of sewage sludge and aerobic biological treatment of effluent.

11

- Most potable water is produced by choosing an appropriate source of fresh water, passing the water through a metal grid and filter beds, and sterilising with chlorine, ozone or ultraviolet light.
- If supplies of fresh water are limited, desalination of salty water or sea water may be required.

12

- The Earth's resources can be divided into two groups: finite and renewable.
- Finite resources from the Earth, oceans and atmosphere are processed to provide energy and materials.

13

- A composite is made of two or more materials with different properties.
- When these materials are combined, they produce a material that has a combination of these properties.
- Most composites are made of two materials:

a. a matrix which surrounds and binds together fibres or fragments of the other material
b. a reinforcement.

14

- Life Cycle Assessments (LCAs) are used to assess the environmental impact of a product.
- The assessment is broken into the following stages: extracting and processing raw materials, manufacturing and packaging, use and maintenance during its lifetime, disposal at the end of its useful life.
- Transport and distribution is assessed at each stage.

15

- Lots of products can be reused or recycled to reduce the energy needed to make new products.
- By reducing, reusing and recycling, people can help the environment by

a. Reducing the – often finite – raw materials that have to be extracted and processed.
b. Reducing the energy needed to turn these raw materials into products.
c. Reducing waste.

16

- Plastic can hang around for thousands of years in the environment because it is non-biodegradable. If it ends up as litter, it can pollute rivers, lakes and oceans and harm the wildlife that inhabit them.
- Once a company has completed a life cycle assessment for a product, they then need to evaluate what their next steps will be from the information provided.

17

Sustainable development is development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.

Year 9 Science Summer Term – Sound Waves

Key Vocabulary:

1	Perpendicular	at an angle of 90° to a given line, plane, or surface or to the ground.
2	Frequency	The number of waves that pass a point each second. The unit is Hertz (Hz)
3	Period	The length of time it takes one wave to pass a given point. The unit is seconds (s)
4	Wavelength	the distance from one point on one wave to the identical point on the next wave. The unit is metres (m)
5	Amplitude	the maximum distance of a point on the wave from its rest position
6	Ultrasound	Ultrasound is produced by high frequency vibrations beyond the range of human hearing. The frequency of ultrasound is therefore greater than 20,000 hertz.
7	Seismic	Shock waves travelling through the Earth, usually caused by an earthquake. There are two types of seismic waves: P-waves, which are longitudinal waves S-waves, which are transverse waves

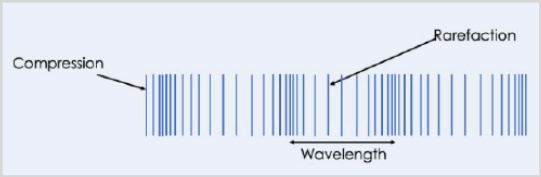
Properties of waves

8

Waves transfer energy
There are two types of wave;
Longitudinal:
And Transverse:

9

Longitudinal waves have oscillations parallel to the direction of energy transfer. Longitudinal waves show areas of compression and rarefaction. E..g. Sound Waves



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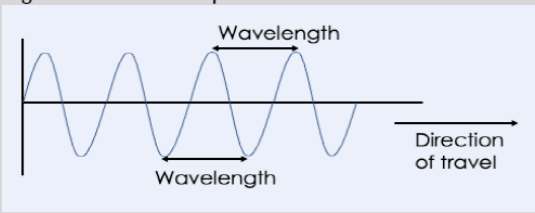
Transverse waves have oscillations perpendicular to the direction of energy transfer
A light wave is an example of a transverse wave



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The velocity of a wave is the speed in the direction the wave is travelling
The equation that links velocity of a wave, displacement of a wave and time is;
Velocity = displacement/time
The equation that links velocity of a wave, frequency and wavelength is:
Velocity = frequency x wavelength

12

Waves can be reflected or refracted

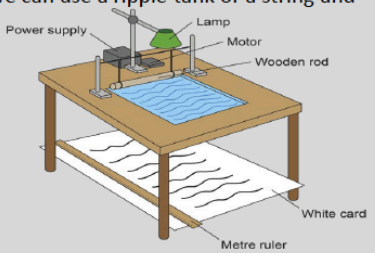
Investigating reflection and refraction

13

The method for investigating reflection and refraction is;
•Use the ruler to draw a straight line near the middle of the A3 paper.
•Use the protractor to draw the normal at right angles to the first line
•Place the first transparent block against the ruler line and draw around it.
•Place the slit (and lens if required) into the ray box and switch on the power.
•Direct the ray of light at an angle at the point where the normal line meets the block.
•You should observe incoming and outgoing rays. Mark these with crosses.
•Switch off the ray box and join up the crosses to make three straight lines. Then label these.
•Measure the angles of incidence, reflection, and refraction with the protractor and record these.

14

To investigate waves we can use a ripple tank or a string and frequency generator.



15

Waves can be absorbed, reflected or transmitted at the boundary between materials

16

Ultrasound waves are partially reflected at the boundary between two materials. The time taken to reach a detector can determine how far away an object is

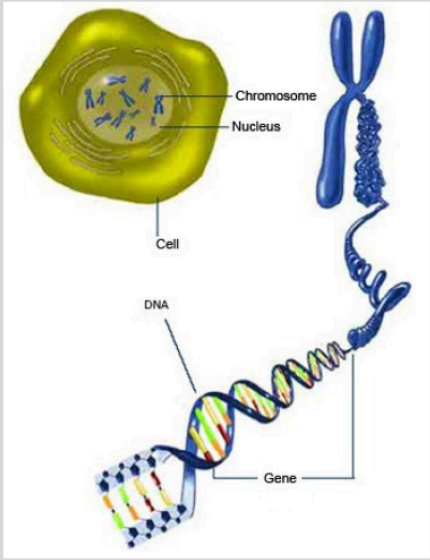
17

Ultrasound can be used for seeing unborn babies, finding cracks in pipes and finding how far away underwater objects are.

Year 9 Science Summer Term Knowledge Organiser – Genetics

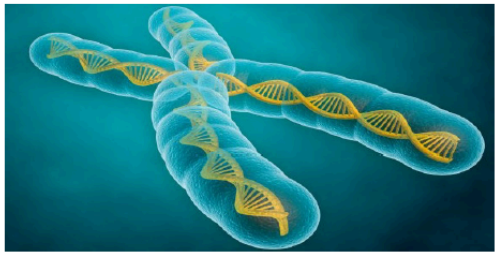
Key Vocabulary

1	**Allele**	A version of a gene. *The mouse contained two **alleles** which both coded for white fur.*
2	**Amino Acid**	A monomer (single unit) of proteins. *A protein is made of a sequence of **amino acids**.*
3	**Base**	The variable part of a nucleotide. *The **bases** in DNA pair up to form a double helix structure.*
4	**Chromosome**	A section of DNA that contains many genes. *Human cells contain 23 pairs of **chromosomes**.*
5	**Clone**	An identical copy of an organism. *The two daughter cells made during mitosis are **clones**.*
6	**Daughter Cells**	New cells that are produced during cell division. *During mitosis, two genetically identical **daughter cells** are produced.*
7	**DNA**	A chemical substance which carries genetic information.

8	Meiosis The type of cell division by which gametes are produced. After meiosis, gametes have half the number of chromosomes.
9	Mitosis The type of cell division which results in two genetically identical daughter cells. The cells are dividing by mitosis.
10	Protein A sequence of amino acids folded into a specific structure.
11	
12	A gene is a section of a chromosome that codes for a particular protein. genes and chromosomes 9.DNA is a polymer. It is made of two strands which form a double helix. 10.The DNA is contained in structures called chromosomes.

Variation

13	Differences between individuals of the same species. There was clear variation in height between pupils in different year groups.
14	Phenotype The expressed characteristic determined by the organism's genotype and its interaction with the environment.
15	Genotype The combination of alleles possessed for the same gene. The mouse's genotype for fur colour is Bb.
16	Mutation A change in the genetic material of an organism. There was a mutation in the DNA which altered the structure of the protein.



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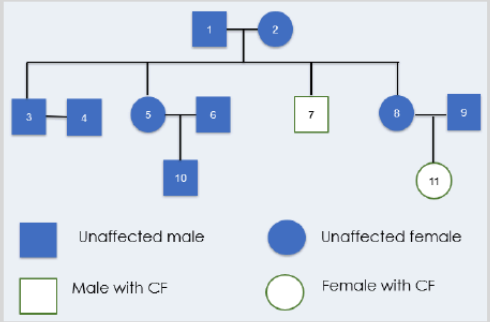


Year 9 Science Summer Term Knowledge Heating

Key Vocabulary:

1	**Kinetic energy**	A store of energy that any object or particle has when moving. *Particles in a gas have the greatest store of **kinetic energy**.*
2	**Potential energy**	A store of energy related to the position of objects or particles. *Particles in a gas have the greatest store of **potential energy**.*
3	**Radiation**	Thermal transfer as a wave, by infrared radiation. ***Radiation** is the method of thermal transfer that does not require particles.*
4	**Specific Heat Capacity**	The energy required to heat 1 kg of a material by 1 ºC. *The greater the **specific heat capacity** of a material, the more energy it will require to increase its temperature.*
5	**Specific Latent Heat**	The energy required to change the state of 1 kg of a material (with no change in temperature). *Each different material has a different **specific latent heat**.*
6	**Specific Latent Heat of Vaporisation**	***Specific latent heat of vaporisation** is used when calculating how much energy is required to turn 1 kg of water into steam.*
7	**Temperature**	Related to the average kinetic energy of particles in a system. ***Temperature** is measured in ºC.*
8.	**Vacuum**	An area where there are no particles. *Radiation can occur in a **vacuum** but conduction and convection cannot.*

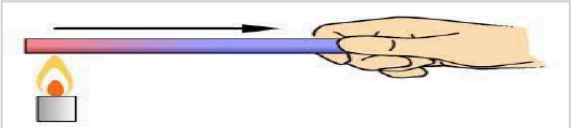
Internal Energy

9.

Internal energy = kinetic energy of the particles in a system + potential energy of particles in a system.
Particles in solids, liquids and gases have kinetic energy because they are always moving.
The hotter a material is the faster its particles move and the larger the kinetic store of energy.
Particles have potential energy because their motion keeps them separated. The further apart the particles the larger the potential energy.
Particles in a gas have more internal energy because they have more kinetic energy and potential energy.
Heating changes the energy stored in the system by increasing the energy of the particles that make up the system.
Heating either raises the temperature of the system or produces a change of state.
The thermal energy of an object depends on its mass, temperature and what it is made of.

10. Thermal transfers

Energy transfers from hotter substances to cooler substances.
Temperature is a measure of the motion and energy of the particles. It is related to their kinetic energy.
When thermal energy is transferred to an object by heating, its temperature depends on what the substance is made from, its mass and the amount of energy transferred.
The more thermal energy transferred the higher the temperature unless there is a change in state.
Conduction is thermal transfer by the vibration of particles. Metals are good thermal conductors because they contain delocalised (free) electrons which can move freely through the metal.



Convection is thermal transfer when particles in a heated fluid rise.
A fluid is a substance with no fixed shape – a liquid or a gas.
Liquids and gases expand when they are heated, the gaps between particles increases.
The liquid or gas becomes less dense and rises. The denser, colder fluid sinks, forming a convection current.

Radiation is the transfer of thermal energy as a wave.
Thermal transfer by radiation can occur in a vacuum as it does not require particles.
Some surfaces are better than others at absorbing and reflecting radiation. Shiny silvered surfaces are good at reflecting radiation.

11 Specific heat capacity

Specific heat capacity is the energy needed to raise the temperature of 1 kg of substance by 1 ºC.

$\Delta E = m\, c\, \Delta\theta$

ΔE = energy change (J)
m = mass (kg)
c = specific heat capacity (J/kg °C)
$\Delta\theta$ = temperature change (°C)

Different materials require different amounts of energy to heat up or change state.

13 Specific latent heat

Specific latent heat of a material is the energy needed to change the state of 1 kg of the substance with no change in temperature.

$E = m\, L$

E = energy for a change of state (J)
m = mass (kg)
L = specific latent heat (J/kg)

Specific latent heat of fusion refers to a change of state from solid to liquid.
Specific latent heat of vaporisation refers to a change of state from liquid to vapour.