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**Year 8 Curriculum Intent**

Our science curriculum intends to train excellent scientists. This means that they will be able to:

1. Recall, understand, apply and link knowledge.
2. Select appropriate equipment
3. Formulate an aim and hypothesis
4. Risk assess
5. Follow and write a method
6. To identify and change the independent variable
7. To identify and measure the control variable
8. To identify the control variable and ensure that it is constant
9. Draw tables and identify anomalies
10. Calculate mean values\*
11. Draw line graphs and analyse the data\*
12. Understand how to ensure accurate and precise data
13. Write a conclusion from a set of data
14. Evaluate the validity of an experiment
15. Equations: identify, substitute, and re-arrange subjects.\*
16. Identify the correct units and convert them.\*

*\*Cross – curricular links with Mathematics.*

The curriculum teaches the fundamental ideas which are the building blocks of scientific understanding, and we sequence these in the best order so that students can see how these fundamental ideas link together.

**Biology**

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| **Topic** | **Key ideas** | **Why they are learning it and in what order.** | **What students often get wrong** |
| Photosynthesis and Respiration | Photosynthesis and respiration are endothermic and exothermic chemical reactions respectively.  Word equation for photosynthesis  aerobic and anaerobic respiration. | By transferring energy from the sun plants produce glucose to use in their own respiration.  Because we cannot produce our own glucose, humans need plants for our own supply of glucose for respiration.  Plants are good for our environment as they take in carbon dioxide for photosynthesis.  This also recaps on cell organelles and their functions from year 7.  Aerobic respiration is the most endothermic reaction but we learning what happens if enough oxygen is not available and cells respire anaerobically.  We learn what uses we can use plant anaerobic respiration (fermentation)– brewing and bread  But also the poisonous lactic acid produced by animal anaerobic respiration. | Students often incorrectly think:  All plant cells have chloroplasts and photosynthesise.  Photosynthesis and respiration “make” energy.  Breathing and respiration are the same .  . |
| Breathing and movement | Ventilation is movement of air in and out of the lungs.  We breathe to ensure enough oxygen is available for blood to carry around the body and to excrete carbon dioxide.  Air is inhaled because pressure is lowered in the thorax and the reverse for exhalation.  Muscles work as antagonistic pairs.  The skeleton has many functions as well as support- protection, white blood cell production, shape and fat storage.  The skeleton is alive and its cells are replaced on a regular basis. | This unit initially builds on the mathematical concept of volume and surface area. This follows on from cells and why they are the size they are.  Gas exchange builds on diffusion learnt in particle theory. The structure of an alveolus is important to maximise this exchange. This is the same principles as digestion, leaf structure, fish gills, synapses and placenta.  Red blood cells are specialised cells from cell unit. More closely examined for shape and function (again surface area and adaptation). | Students often incorrectly think:  Breathing is the same as respiration.  Muscles can extend by themselves.  Students often have no realisation that the lungs are an excretory organ. |
| Digestion | The organs of the digestive system and their functions.  Enzymes are biological catalysts and are specific to a reaction.  How enzymes help digestion and what can affect their function.  We need to digest food before absorption as the molecules are too large to pass through cell membranes- especially protein and starch. | This unit is the second organ system to be studied following on from respiratory system.  The students start by learning the main food types (carbohydrates, proteins, fats etc) and what constitutes a balanced diet so that when digestion is taught, students are clear what food types there are.  By following food down the GI tract (from mouth to anus) students will learn the function of each organ and where enzymes are active.  Body temperature of 37 Celsius is recognised as optimum for enzyme and body chemical reactions. This leads on to KS4 RPA and investigation into pH and temperature affecting enzymes.  Following photosynthesis unit students will understand that starch is a chain of smaller glucose molecules (and protein is made up of amino acids, for KS4). | Students often incorrectly think:  Digestion is either just eating/ chewing.  That the large intestine is longer than the small intestine.  Students forget:  Digestion is mechanical as well as chemical.  Bile is alkali as well as an emulsifier. |

**Chemistry**

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| **Topic** | **Key ideas** | **Why they are learning it and in what order.** | **What students often get wrong** |
| Chemical Energy | Particle arrangement in three physical states (solid, liquid, gas).  During a chemical reaction bonds are broken (requiring energy) and then new bonds are formed (releasing energy).  If less energy is required to make the new bonds the “excess” energy is released as heat, exothermic, and the surrounding environment will rise in temperature.  If more energy is required to form the new bonds then this is taken from the surroundings and the temperature will fall.  All reactions are either exothermic or endothermic.  Reactions all need a minimum activation energy to proceed.  Law of Conservation of Energy. | Starting with revision of physical state particle diagrams and the difference between physical and chemical reactions.  Building on knowledge of nomenclature of chemicals from Y7 Elements and Periodic Table/ Types of Reaction  students will use word equations, 3D representations and practicals to demonstrate that matter cannot be lost or created in reactions.  Students will use experimental observation to distinguish exothermic and endothermic reactions.  Following this they will draw energy level diagrams to show how energy changes within the chemicals for both reactions.  Using the idea of a catalyst from digestion and enzymes they will be able to explain and annotate these diagrams the effect of catalysts on activation energy. | Students often:  Get exothermic and endothermic the wrong way round.  Find difficult the concept that a negative value for bond enthalpy is exothermic.  Find difficult that activation energy has to be added to start a chemical reaction but is not part of the total gain or loss  Find difficult that melting/ boiling is a chemical reaction. |
| Heating and Cooling | Particle diagrams of three physical states.  Definition of conductor and insulator.  The difference between heat and temperature.  Three methods of transfer of thermal energy – conduction, convection and radiation.  A hot object has more energy than when it was cold. | Starting with revision of particles in different states from Chemical Energy and Particle Theory students will learn how the random movement of particles in liquids and gas increase when given thermal energy.  The lack of gaps between particles explain why close packed solid particles make the best conductors of thermal energy and the opposite.  Students then learn how thermal energy can be transferred in liquids and gases by particles moving. Convection. This is the cause of thermal currents and why heated particles are less dense and rise.  Thermal energy cannot be transferred in a vacuum by conduction or convection as there are no particles. This is how some double glazing windows work.  Students will then look at how radiation is a transfer of energy by waves – this links to photosynthesis and then onto wave properties. | Students often incorrectly think:  Heat and temperature are the same.  When something is heated the particles actually expand. |
| Pressure | Pressure = force (N) ÷ area (m2).  Pressure acts on a fluid in all directions.  Atmospheric pressure is the weight of air above a surface. | Using their understanding of particles from Particle Theory students will understand that in a liquid or gas the movement of the (amount of energy) particles acts in all directions.  In a liquid this creates a force – up thrust from the particles beneath you (you will float if gravity is a lower force). If you start to sink and dive deeper the weight above you will exert a force further downwards.  Students will use this concept to learn that the mass of air (air has mass from Particle Theory) above us depends on temperature.  To help us stay afloat or not sink the students then look at how the contact surface area affects the pressure. How do snow shoes work? | Students often incorrectly think:  That a book sitting on a desk has no forces as does a boat floating in water.  Students find difficulty in calculating area.  If it is misunderstood that gas has no mass then there is no pressure from the atmosphere above us. |
| Reactions of metals including acids and alkalis | Properties of metals.  Properties of non-metals.  pH is a scale of acidity to alkalinity from 0-14.  A base dissolved in water is called an alkali.  An indicator is used to identify the pH of a solution.  Examples of strong acid (e.g. Hydrochloric Acid) and weak acids (citric acid).  Concentration is a measure of the number of particles in a given volume. | Students start by relating the structure (Particle Theory) of metals and non-metals to their physical properties (especially good conductors of heat and electricity).  Focus is then made on Group 1 metals and their properties. Group 1 are known as alkali metals.  This leads on to alkalis and acids. The knowledge that metals form bases and non-metals acids.  Using atomic structure students learn that an acid is H+ ion and alkali OH-.  Leads on to pH (per Hydrogen ion) scale and that acids/ alkalis can be described as weak or strong. This relates to position on pH scale away from neutral at pH7.  We test pH using suitable indicators, referring back to scale of 0-14. The lower the number the more acidic.  We relate the pH of every day solutions to their uses (e.g. toilet cleaner, oven cleaner, antacids).  How can we alleviate the sting of bees or wasps who have opposite pH by neutralising?  Students learn that pH scale has opposites and strong (weak) acids can neutralise (cancel out) strong (weak) alkalis. | Students often incorrectly think:  Acids are strong and anything else is weak.  Increasing acidity means a higher pH.  Metals are all hard or solid at room temperature.  Students do not often realise that a strong alkali will neutralise a strong acid |

**Physics**

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| **Topic** | **Key ideas** | **Why they are learning it and in what order.** | **What students often get wrong** |
| Energy costs | Power is a calculation of how quickly energy is being transferred (units Watts).  An energy RESOURCE has stored energy that can be released in a useful way.  Energy resources are renewable and non-renewable (finite).  Description of fossil fuels.  The products of burning fossil fuels.  Calculate the costs of home energy use. | Students will start with a revision of Law of Conservation of energy and energy stores from previous unit Y7.  They will then investigate how power is a measure of how quickly energy is being transferred. They will measure their own power outputs.  Using the knowledge on power we will then relate this to household energy cost (kWH) – a measure of how energy companies bill us.  Having looked at household energy we move on to electricity production. How energy resources for generation of electricity can be non-renewable (finite, fossil fuels) and renewable (wind, solar) and the effects on our world. This links with Human Geography as well as KS4.  The effects of greenhouse gases on global warming are investigated. (links to wave unit).  Finally as another way to become more environmentally friendly is to increase efficiency. We examine how to calculate efficiency and labelling of products. | Students often incorrectly think:  Power is the same as energy.  Energy resources are the same thing as energy stores.  Students often find difficult:  Converting units. |
| Properties of Waves | Waves are transverse or longitudinal.  Waves transfer energy.  The amplitude of a wave is an indicator of the amount of energy being transferred.  If wavelength increases frequency decreases (vice-versa). | Revision of transverse and longitudinal waves (light and sound Y7) starts off.  The reaffirmation that waves transfer energy and how this is done for each type.  We use practical examples using oscilloscopes to explain amplitude, wavelength, frequency and how in sound waves this relates to what we hear. What are the frequency ranges of different animals?  Wave speed = frequency x wavelength.  And relating this to electromagnetic spectrum and visible light.  This relates back to Light Unit and diffraction (rainbows). | Students often find difficult:  Amplitude is only measured from rest point to crest OR trough  Labelling frequency and wavelength – often wrong way round  That transverse waves move in a straight line direction with the wave movement perpendicular. |
| Electrical equations | Voltage = Resistance x Current  Power = Current x Voltage  Charge = Current x Time  Energy transferred = Power x Time | This unit reinforces Maths skills and the use of scientific formulae.  The students will practice numerical calculations and rearranging equations relating each equation to a practical.  V=IR leads on to KS4 P2 especially and 2 xRPAs . | Students can incorrectly think that voltage is the same as power.  Students often find difficult:  I is symbol for current – measured in Amps.  Charge has the symbol Q.  Time must be measured in seconds. |