Age Related Expectations in Science

Age-related expectations identify what is expected of our learners by a specified age, stage or year group. Our curriculum defines these as a set standard of expectations which are defined either as exemplars, descriptors or questions.

Year 8

Biology Age Related Expectations and Sub grains

Big Idea	Topic	Age Related Expectations	Subgrains
Bioenergetics	Bioenergetics	Respiration is a chemical reaction that transfers energy within all organisms.	1. Living organisms need energy for building up larger molecules from smaller ones for growth (e.g. building proteins from amino acids in plants and animals and building cellulose for cells walls from glucose), muscle contraction for movement and for keeping warm (so mammals and birds can keep their body temperatures constant). 2. Cellular respiration is a life process that is carried out continuously by all living organisms (animals, plants, bacteria, fungi) 3. Cellular respiration is an exothermic reaction where the energy is transferred/released from glucose. 4. Cellular respiration happens in the mitochondria of all cells. 5. Respiration can take place with oxygen (aerobic respiration) and without oxygen (anaerobic respiration) 6. The equation for aerobic respiration; Glucose + oxygen carbon dioxide + water (+ energy transferred) 7. In animals, anaerobic respiration takes place during strenuous exercise and causes muscle fatigue. 8. The equation for anaerobic respiration in animals; glucose lactic acid (+ energy transferred) 9. Compared to aerobic respiration, anaerobic respiration produces less energy than aerobic respiration but produces this energy more slowly. 10.Anaerobic respiration in plant cells and yeast cells is called fermentation. 11.The equation for anaerobic respiration in plants and yeast cells. Glucose Ethanol + carbon dioxide + water (+ energy transferred)

			12.Know that temperature and the amount of glucose affect the rate of fermentation in yeast. (investigation) 13.Humans make use of anaerobic respiration by yeast in bread making and in producing alcoholic drinks.
Transport	Transport	One way that molecules can move from one place to another and across membranes in living things is by diffusion	1. Diffusion is the spreading out of the particles of any substance in solution or a gas from an area of higher concentration to a lower concentration. 2. Substances may move into or out of cells across the cell membrane diffusion. 3. Oxygen and glucose usually move into cells by diffusion. 4. Carbon dioxide and waste (urea) usually move out of cells by diffusion. 5. The bigger the surface area the faster the rate of diffusion. (Investigation)
Transport		The respiratory system brings oxygen into the body and removes carbon dioxide	1. The respiratory system includes the lungs (trachea, bronchi, bronchioles and alveoli), diaphragm, ribs and rib muscles. 2. When we breathe in, air enters the lungs; it travels through the trachea, bronchi, bronchioles then into the alveoli. 3. The trachea is held open by rings of cartilage to stop it collapsing when the neck is moved and bent. 4. The trachea and the bronchi are lined with ciliated epithelial cells and mucus. Dust and microorganisms in the air we breathe in stick to the mucus. The cilia beat to move the dirty mucus up and out of the lungs and it is then swallowed. 5. The lungs contain millions of microscopic alveoli. These are tiny air sacs that are just one cell thick and are surrounded by tiny blood vessels called capillaries. 6. Oxygen from the air we breathe in moves from the alveolus into the red blood cells in the capillary by diffusion. 7. Carbon dioxide in the blood moves from the blood into the alveolus by diffusion. The carbon dioxide is then removed when we breathe out. 8. The movement of oxygen out of the alveolus and carbon dioxide into the alveolus is called gas exchange. 9. There are millions of tiny alveoli to give a large surface area for diffusion. 10.The walls of the alveoli are very thin so the substances don't have far to diffuse. 11.Breathing is brought about by the intercostal muscles between the ribs and the diaphragm. 12.Breathing in is also called inhaling and occurs when the intercostal muscles contract and move the ribs up and out and the diaphragm contracts and flattens. This increases the volume inside the thorax and decreases the pressure in the thorax which draws air into the lungs.

			13.Breathing out is also called exhaling and occurs when the intercostal muscles relax and move the ribs down and in and the diaphragm relaxes and bulges upwards. This decreases the volume inside the thorax and increases the pressure in the thorax which pushes the air out of the lungs. 14.The bell jar lungs can model inhaling but the model has problems. It doesn't show what the ribs do and the scale of the lungs is incorrect. 15.Cigarette smoke contains tar (which can cause lung cancer), carbon monoxide (which reduces the amount of oxygen the blood can carry and causes breathlessness) and nicotine (which is addictive). Smoking damages the cilia, which leads to a smokers cough.
Transport		Different cells have different jobs and they are adapted to carry out these jobs	1. The respiratory system includes the lungs (trachea, bronchi, bronchioles and alveoli), diaphragm, ribs and rib muscles. 2. When we breathe in, air enters the lungs; it travels through the trachea, bronchi, bronchioles then into the alveoli. 3. The trachea is held open by rings of cartilage to stop it collapsing when the neck is moved and bent. 4. The trachea and the bronchi are lined with ciliated epithelial cells and mucus. Dust and microorganisms in the air we breathe in stick to the mucus. The cilia beat to move the dirty mucus up and out of the lungs and it is then swallowed. 5. The lungs contain millions of microscopic alveoli. These are tiny air sacs that are just one cell thick and are surrounded by tiny blood vessels called capillaries. 6. Oxygen from the air we breathe in moves from the alveolus into the red blood cells in the capillary by diffusion. 7. Carbon dioxide in the blood moves from the blood into the alveolus by diffusion. The carbon dioxide is then removed when we breathe out. 8. The movement of oxygen out of the alveolus and carbon dioxide into the alveolus is called gas exchange. 9. There are millions of tiny alveoli to give a large surface area for diffusion. 10.The walls of the alveoli are very thin so the substances don't have far to diffuse. 11.Breathing is brought about by the intercostal muscles between the ribs and the diaphragm. 12.Breathing in is also called inhaling and occurs when the intercostal muscles contract and move the ribs up and out and the diaphragm contracts and flattens. This increases the volume inside the thorax and decreases the pressure in the thorax which draws air into the lungs.

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Transport		The circulatory system transports molecules around the body.	1. The circulatory system includes the heart, blood vessels and blood. 2. The function of the circulatory system is to transport substances around the body. For example, it transports the reactants for aerobic respiration - oxygen from the lungs to the body cells and glucose from the digestive system to the body cells. 3. The heart is an organ made from muscle tissue and nerve tissue. The heart muscle contracts to pump blood around the body. Heart muscle is a unique type of muscle because it doesn't tire. 4. The heart has four chambers called the left atrium, right atrium, left ventricle and right ventricle. 5. The right side of the heart pumps deoxygenated blood to the lungs. 6. The left side of the heart pumps oxygenated blood to the head and body. 7. The heart is a double pump and there is double circulation (one to the lungs and one to the head and body) 8. Arteries are blood vessels that carry blood away from the heart under high pressure. 9. Capillaries are tiny blood vessels with walls that are one cell thick. Substances such as glucose, oxygen can move out of capillaries into cells. Carbon dioxide can move into capillaries from cells. 10.Veins are blood vessels that carry blood to the heart under low pressure. 11.Blood is made up from red blood cells, white blood cells, platelets floating in a pale yellow liquid called plasma. 12.Red blood cells carry oxygen around the body. White blood cells are part of the immune system and are involved in fighting disease and platelets are needed for blood clotting. Plasma transports dissolved glucose and carbon dioxide. 13.There are 4 different blood groups called O,A,B and AB. 14.If a person loses lots of blood due to an accident or an operation, they might need to have a blood transfusion.

			The blood that is transfused needs to be compatible. If it is not compatible, the immune system will attack it 15.People with blood group 'O' are called universal donors as their blood can be given to all of the other types. 16.People with blood group AB are called the universal recipient because they can receive blood of all types. Recipient Donor A B AB O A √ x √ x B x √ √ x AB x x √ x O √ √ √ √ 17.The heart is an example of an organ that can be transplanted. This might be needed if a heart is damaged (e.g. by disease). 18.The organ that is transplanted needs to be compatible between the donor and the recipient to reduce the chance of the recipient's body rejecting the organ. Rejection occurs when the recipients' immune system attacks the organ. 19.Transplanted organs are donated by people who have died (usually after an unexpected accident). 20.Organ transplant lists are often very long and it can be difficult to find a compatible organ donor.
Transport		The structure and function of the transport systems in plants.	1. Xylem cells transport water and minerals from the roots to the leaves in an upward direction. 2. Phloem cells transport sugars around the plant from the leaves to the roots and flowers. 3. Transpiration is the loss of water from a plant by evaporation. 4. Although transpiration causes water to be lost, it is essential for moving water up through the plant. 5. The rate of transpiration is affected by the temperature. (Investigation) 6. Plants need minerals from the soil for healthy growth. 7. Nitrates and magnesium are examples of minerals. 8. Nitrates are needed to make proteins. A plant that is deficient in nitrates has stunted growth and yellow leaves. 9. Magnesium is needed for making chlorophyll. 10.Fertilisers can be added to the soil to improve the growth of crops and plants.
Interdependence	Interdependence Biodiversity	Biodiversity refers to the range of organisms within an	1. An ecosystem is the interaction of a community of living organisms with the non-living parts of their environment. E.g. rainforest, desert, African Savannah.

		ecosystem and can be affected by different factors	2. Biodiversity is the variety of all of the different species of organisms on Earth, or within an ecosystem. 3. A large biodiversity helps to keep an ecosystem stable as the living organisms don't just rely on one other organism for their survival e.g. food/shelter. Rainforests have a high biodiversity and deserts have a low biodiversity. 4. Humans rely on a large range of plants and animals for our survival. E.g. plants provide the oxygen we need to breathe, crops produce the food, some plant provide medicines. Animals such as bees pollinate plants, animals such as cows, sheep and pigs provide food. 5. The population of bees is falling due to a combination of diseases and the use of insecticides. Insecticides are chemicals that kill insects which are crop pests, but they also kill bees too. A reduction in the bee population could have a significant impact on the production of food and cause a food security problem because the crop plants are not pollinated. 6. Biodiversity can be affected by human activities such as global warming, deforestation, pollution. 7. The greenhouse effect is a natural process that allows the Earth to be warm enough to support life. 8. The greenhouse effect is caused by greenhouse gases (carbon dioxide, methane and water vapour) 9. Human activities such as burning fossil fuels, deforestation are increasing the amount of carbon dioxide in the atmosphere. This is enhancing the greenhouse effect and causing an increase in the global average temperature. 10.The consequences of global warming are; melting of the polar ice caps causing a rise in sea level and flooding; changing weather patterns and more severe storms and droughts; Changing migration patterns for animals; changes in the distribution of plants and animals. 11.Deforestation is the removal of huge areas of rainforest to make land available for farming and mining and for timber. 12.Deforestation contributes to global warming as the felled trees are burnt or decay, which releases carbon dioxide, and they are no longer able to remove carbon dioxide from the atmosphere. 13.Deforestation also reduces global biodiversity. 14.Plastics are increasingly polluting the planet. They are non-biodegradable (which means they cannot be broken down by microorganisms) and pollute the land and the water. 15.Micro-plastics (e.g. microbeads in cosmetics) can get into the oceans via sewage systems. Some countries have banned the use of microbeads. 16.Plastics can harm animals (both on land and in the sea) if they eat them (either intentionally or not) or they can

			become tangled in them. 17.Plastic pollution is being tackled by reducing single use plastic and improving recycling and disposal.
Organisation	Health and Disease	Communicable and non-communicable diseases affect the health of an organism	1. Diseases can be communicable or non-communicable. 2. Communicable diseases are infectious diseases that are spread from person to person by pathogens. 3. Non-communicable diseases are diseases that are not infectious – e.g. coronary heart disease, cancer, diabetes. 4. Microorganisms are organisms that are too small to see with the naked eye. Examples are bacteria, viruses and fungi. 5. Bacteria and fungi can be grown (cultured) on agar jelly. (Investigation) 6. Using aseptic technique helps to prevent unwanted microbes growing on the agar plates. (Investigation) 7. Micro-organisms that cause diseases are called pathogens. 8. Pathogens can be spread via droplet infection (e.g. flu), contact with contaminated objects (e.g. cold sores), drinking contaminated water (e.g. cholera), eating contaminated food (e.g. salmonella food poisoning) or sexually transmitted (e.g. chlamydia). 9. Understanding how diseases spread can help to prevent them. This is called epidemiology. In the 19th Century, John Snow looked at the pattern of cases of cholera in London to work out that the source was a water pump on Broad Street. For the first time people understood that Cholera was spread by dirty water. 10.Bacteria reproduce quickly inside living organisms and produce poisons/toxins that make us feel unwell. 11.Viruses reproduce inside living cells and damage these cells. 12.Non-specific defences against pathogens are: Skin, nose hairs and mucus, cilia and mucus in the lungs and stomach acid. They try to prevent pathogens entering our bodies 13.If the pathogens get past the non-specific defences they start to reproduce rapidly, we become unwell and an immune system response is triggered. 14.White blood cells are part of our immune system. There are two types of white blood cells. 15.One type of white blood cell can change its shape and engulf the pathogens. 16.A second type of white blood cell produces antibodies. These are substances that are specific to the pathogen. They attach to the pathogen and destroy/kill it. These white blood cells can remember how to make the correct antibody quickly and you are then immune to that disease. 17.Being immune to a disease means your white blood cells can make the correct antibody quickly enough to destroy

			the pathogens before they can make you unwell. 18.At the end of the 18th Century, Edward Jenner developed one of the first vaccinations against a deadly disease called smallpox. He infected a young boy with cowpox. The boy became unwell. He then exposed him to smallpox and he stayed well. He was immune to smallpox. Vaccinations have eradicated smallpox from the world. 19.Vaccinations contain a dead or weakened pathogen and they cause the white blood cells to make the correct antibody to destroy the pathogen. Therefore, if you encounter the real pathogen, the correct antibody can be made quickly. 20.Antibiotics are medicines that are used to treat bacterial diseases. They cannot be used to treat diseases caused by viruses. 21.Antibiotics were discovered by chance by Alexander Fleming in the early 20th Century. 22.There is an increasing problem with bacteria becoming resistant to antibiotics (e.g. MRSA/ Clostridium Dificile). Antibiotic resistance means the antibiotic no longer kills the bacteria. 23.To prevent antibiotic resistance, humans need to minimise the use of antibiotics and ensure they are used correctly and carefully. 24.Many infections get better on their own, without the need for antibiotics. Antibiotics should only be taken for bacterial infections and not viral infections such as colds and flu, and most coughs, sore throats, ear infections or sinusitis. When antibiotics are prescribed the course should be completed even if you feel better. 25.Scientists are researching into new types of antibiotics. 26.If our current antibiotics stop working before new antibiotics are found then minor infections could become fatal and operations might not be possible. 27.Plants can also suffer from ill health. 28.Plant ill health can be caused by pathogens (bacteria, viruses and fungi), aphids and mineral deficiencies. 29.Nitrates are need for making for protein for growth. Plants deficient in nitrogen have stunted growth and yellow older leaves. 30.Magnesium is needed for making chlorophyll. Plants deficient in magnesium have yellow leaves.

Chemistry Age Related Expectations and Sub grains

Big Idea	Topic	Age Related Expectations	Subgrains
Chemical Reactions	Acids and Alkalis	Describe the difference between a chemical and a physical change Identify reactants and products in chemical reactions and write word equations. Name simple compounds Understand the position of acids and alkalis on the pH scale Describe how acids and alkalis can be neutralised in neutralisation reactions	1. In a chemical change a new substance is produced and are often difficult to reverse. 2. Physical changes are usually easy to reverse. 3. Chemical changes can result in any of the following: colour change, temperature change, gas release, solid produced (precipitation). 4. Reactants are substances needed for a chemical reaction to occur. 5. Products are substances made in a chemical reaction. 6. Word equations are written in the form reactant(s) --> product(s) and the arrow means "reacts to make". 7. Many simple compounds are made from a reaction between a metal and a non-metal. 8. Compounds that contain a metal and a non-metal are named by writing the metal, and then the first syllable of the non-metal with the suffix "-ide". 9. Acids are solutions that are reactive and corrosive. Their acidity can be measured using the pH scale. 10. The pH scale goes from 0 - 14, acids have a pH of below 7, the lower the pH, the more acidic the pH is. 11. Pure water has a pH of 7, which is neutral. 12. Alkalis are solutions with a pH of more than 7. 13. When acids and alkalis react together they form a neutral salt and water. These reactions are called neutralisation reactions. 14. The pH scale can be measured using universal indicator.
Atoms	Electronic Structure	Understand electronic structure of atoms	1. Electrons are found in shells around the nucleus of atoms. 2. The electron shells of an atom fill the inner shells first, because the closer to the nucleus the lower the energy of the shell.

			3. The first electron shell can have two electrons, the second and third electron shells can have eight electrons - known as the 2, 8, 8 rule. 4. Students can draw electron configurations are concentric rings with dots or crosses, known as dot and cross diagrams.
Bonding	Ionic and Covalent Bonding	Apply knowledge of electronic structure to covalent and ionic bonding	1. All atoms are most stable when they have full outer electron shells. This is why atoms react with each other. It is also why the Noble gases don't react. 2. Ionic bonding occurs between metals and non-metals. 3. Metals have a small number of electrons in their outer shell, and to become stable they lose these electrons, which gives them a full outer shell. They gain a positive charge because they now have more positive protons than negative electrons. They are now positively charged ions. 4. Non-metals have a larger number of electrons in their outer shell, and to become stable they gain electrons, to gain a full outer shell. They gain a negative charge because they now have more negative electrons than positive protons. 5. An ionic bond is formed when a positive ion and a negative ion are attracted to each other. 6. When drawing ions, the atom is drawn with the appropriate number of electrons. Square brackets are drawn around the atom, and the appropriate charge given. If the structure is an ionic compound, the other ion(s) involved is drawn next to it. 7. Covalent bonds occur between non-metal elements. 8. To gain a full outer shell, non-metals are able to share electrons with another non-metal element. 9. When drawing covalent bonds, the two outer shells overlap and the two shared electrons are drawn in the overlapping area. The electrons from one atom are dots and the electrons from the other atom are crosses. Limit to compounds with single covalent bonds.
Chemical Reactions	Energy Changes and Rates of Reaction	Describe how energy changes in chemical reactions Describe how to increase the rate of a reaction	1. Chemical reactions that cause a temperature increase are called exothermic reactions and chemical reactions that cause a temperature decrease are called endothermic reactions. 2. Exothermic reactions cause a temperature increase because thermal energy is released to the environment. 3. Endothermic reactions cause a temperature decrease because thermal energy is taken in from the surroundings and transferred to chemical energy in the products of the reaction.

			4. In the reaction profile of an exothermic reaction the reactants have more energy than the products. 5. In the reaction profile of an endothermic reaction the reactants have less energy than the products. 6. The rate of a chemical reaction means how quickly the reaction occurs. 7. The rate can be measured by how quickly a product is produced or how quickly a reactant is used up. 8. Chemical reactions occur when reactant particles collide successfully. 9. A successful collision occurs when particles collide with sufficient energy, called activation energy. 10. The rate of a reaction is affected by: the temperature, concentration (of a solution), pressure (in a gas), surface area (of a solid), adding a catalyst. 11. Concentration is the amount of a reactant dissolved in a volume of water. 12. Catalysts are substances that increase the rate of a reaction without being used up.
Chemical Reactions	Reactivity Series	Describe what is meant by reactivity - Apply knowledge of the reactivity series to displacement reactions	1. Reactivity is how likely a substance is to react. 2. Metals can react with water, oxygen and acids. 3. Metals can be arranged in order of their reactivity - called the reactivity series. 4. Displacement reactions occur when more reactive metals react with compounds containing a less reactive metal. The more reactive metal replaces the less reactive metal in the compound. 5. The reactivity series can be used to predict the outcome of displacement reactions.

Physics Age Related Expectations and Sub grains

Big Idea	Topic	Age Related Expectations	Subgrains
Electricity and Magnetism	Electricity, Magnetism and Electromagnetism	Explain a circuit as a flow of charge.	1. Draw the electrical symbols for: switch, cell, battery, diode, resistor, variable resistor, LED, lamp, fuse, voltmeter, ammeter, thermistor and LDR. 2. Define and explain current as the flow of charge. 3. Define and explain Potential Difference as the energy per unit of charge. 4. Define and explain resistance as impeding current. 5. Define an electrical conductor as having low resistance and an electrical insulator as having high resistance. 6. Define a series circuit: a closed circuit in which the current follows one path. 7. Define a parallel circuit: a closed circuit in which the current divides into two or more paths before recombining to complete the circuit.
		Apply Kirchoff's laws to calculate missing values in circuits.	1. Define Kirchoff's current law: current flowing into a node (or a junction) must be equal to current flowing out of it. This is a consequence of charge conservation. 2. Define Kirchoff's voltage law: the sum of all voltages around any closed loop in a circuit must equal zero. 3. Apply Kirchoff's laws to series circuits to calculate potential differences. 4. Apply Kirchoff's laws to parallel circuits to calculate currents. 5. Apply Kirchoff's laws and V=IR to calculate current and potential difference in parallel circuits.
		Describe and explain applications of circuits.	1. Explain how lighting circuits care connected in parallel to ensure bulb brightness. 2. Describe the resistance of (negative coefficient) LDRs decreasing with increased light intensity. 3. Describe the resistance of (negative coefficient) thermistors decreasing with increased light intensity. 4. Describe a sensing circuit as being a LDR or thermistor in series with a fixed resistor. 5. Explain the change in potential difference over the fixed resistor as environmental factor (light or

			temperature) is changed. 6. Describe the application of light and temperature sensing circuits in everyday life.
		Describe and use combinational logic circuits as decision making circuits.	1. Recognise 1/0 as two state logic levels. 2. Define the outputs using truth tables for the following logic gates: AND, NAND, OR, NOR, NOT, XOR, XNOR. 3. Use simple Boolean algebra to represent the output of truth tables or logic gates. 4. Design simple processing systems consisting of logic gates to solve problems.
Forces	Forces 2 Motion	Be able to use distance/ time graphs.	1. Plot distance - time graphs using measurements from different contexts. 2. Sketch distance - time graphs given a description of an objects journey. 3. Measure the gradient of a distance - time graph and calculate velocity from the gradient. 4. Understand that a positive gradient means a positive velocity, a negative gradient means a negative velocity (velocity in the opposite direction) and zero gradient means the object is stationary.
		Be able to use velocity - time graphs.	1. Plot velocity - time graphs using measurements from different contexts including objects travelling with a negative velocity (in the opposite direction). 2. Sketch velocity - time graphs given a description of an objects journey. 3. Measure the gradient of a velocity - time graph and calculate acceleration from the gradient. 4. Understand that a positive acceleration means increasing speed, a negative acceleration means decreasing speed and a zero acceleration means a uniform speed. 5. Calculate the displacement of the object between two times from the total area of the graph.
		Understand the relationship between Force, Mass and Acceleration using Newton's second law.	1. Calculate acceleration using the equation F = ma 2. Explain the units of acceleration as m/s^2 3. Plot a graph of force against acceleration and explain how the shape of the graph shows a directly proportional relationship.
Particles	The Particle Model	Draw and explain	1. Draw/recognise particle models for solids, liquids and gases.

		particle diagrams.	2. Explain the effect on particle motion in a solid as the temperature is increased. 3. Explain the effect on particle motion in a liquid as temperature is increased. 4. Explain the effect on particle motion in a gas as temperature is increased. 5. Explain in terms of particles the state changes: melting/freezing, boiling/condensation, sublimation/deposition.
		Define, calculate and suggest methods for measuring density.	1. Define density as the mass per unit volume of a material with units kg/m^3. 2. Calculate densities for objects given their mass and volume. 3. Calculate the density of a regular object (cuboid, cone, etc) given its volume and dimensions. 4. Calculate the density of an irregular object given its volume and the mass of water it displaces in a Eureka can. 5. Calculate the density of a volume of liquid given its mass. 6. Calculate the density of a volume of gas given its mass.
		Explain pressure in fluids.	1. Define pressure as the force per unit area (at right angles) to a surface. 2. State Boyle's law: For a fixed mass of gas at constant temperature, the volume is inversely proportional to the pressure. 3. Explain, using Boyle's law the effect on pressure of changing temperature of a gas. 4. State Charles's law: For a fixed mass of gas at constant pressure, the volume is directly proportional to the temperature. 5. Explain, using Charles's law the effect on pressure of changing volume of a gas. 6. Describe that an object will float when it is less dense than the water surrounding it. 7. Students should be able to describe that a submerged object experiences a greater pressure as it is submerged at increasing depth due to the height of the column of water above it. 8. Explain that the force of upthrust is due to the difference in pressures between the bottom surface and top surface of a submerged or partially submerged object.
Waves	Waves	Define wave properties and compare with particle properties.	1. The wavelength is defined as the length of one complete wave 2. The amplitude is defined as the height of a wave form the equilibrium position 3. Time period is the time taken for one complete wave to pass a point 4. An oscillation is a regular variation around a central point

			5. A wave carries energy and information but does not transfer matter.
		Compare the properties of transverse and longitudinal mechanical waves	1. A mechanical wave is the oscillation of matter to transmit energy 2. Mechanical waves require a medium in which to travel 3. A longitudinal wave is where the oscillations are parallel to the direction of energy transfer 4. Examples of longitudinal waves are sound waves and seismic P waves 5. A transverse wave is a where the oscillations are perpendicular to the direction of energy travel 6. Examples include water waves and seismic S waves. 7. A ripple tank can be used to visualise waves and calculate frequency and wavelength. 8. Light waves are transverse however they are not caused by oscillating matter and can therefore travel through a vacuum 9. Light waves travel at the speed of light in a vacuum
		Explain and draw ray diagrams for reflection of light.	1. When light interact with a surface it will either reflect, be absorbed or be transmitted 2. Reflection can be either specular of diffuse 3. The angle of incidence is equal to the angle of reflection 4. Students should be able to construct accurate ray diagrams to show the relationship between angle of incidence and angle of reflection. 5. A normal is a line at right angles to the object
		Explain and draw ray diagrams for refraction of light.	1. Refraction is where a wave changes direction due tpo a change in speed when there is a change of density of medium 2. When light enters a more dense medium, it bends towards the normal 3. When light enters a less dense medium it bends away from the normal 4. Students should be able to draw an accurate ray diagram showing light passing through a Perspex block at different angles. 5. A convex lens creates an image by refracting light rays onto a principal focus 6. The eye creates an image by refracting light onto a focal point
		Describe and explain the properties of sound	1. Sound waves are longitudinal waves which require a medium travel. 2. Sound can reflect off surfaces, this is known as an echo.

			3. Sound moves at 340m/s this is much slower than the speed of light 4. The speed of sound varies according to the density of the medium 5. Humans have an auditory range between 20 Hz and 20000 Hz 6. Sound higher than human's auditory range is known as ultrasound 7. Sound lower than human's auditory range is known as infrasound 8. Ultrasound can be used to produce an image of a foetus