

Order	Title and content	Additional Info	Spec link	Literacy/Numeracy/FBV/SMSC links	Alleyes skills for life
1	The Brain	<p>The brain controls complex behaviour. It is made of billions of interconnected neurones and has different regions that carry out different functions. Identify the cerebral cortex, cerebellum and medulla on a diagram of the brain, and describe their functions. Explain some of the difficulties of investigating brain function and treating brain damage and disease. Neuroscientists have been able to map the regions of the brain to particular functions by studying patients with brain damage, electrically stimulating different parts of the brain and using MRI scanning techniques. The complexity and delicacy of the brain makes investigating and treating brain disorders very difficult. Evaluate the benefits and risks of procedures carried out on the brain and nervous system.</p>	4.5.2.2	Key terminology in the correct context	Literacy
2	The eye & accomodation	<p>Eye structure & vision correction. Relate the structures of the eye to their functions. This includes:</p> <ul style="list-style-type: none"> • accommodation to focus on near or distant objects • adaptation to dim light. The eye is a sense organ containing receptors sensitive to light intensity and colour. Identify the following structures on a diagram of the eye and explain how their structure is related to their function: • retina • optic nerve • sclera • cornea • iris • ciliary muscles • suspensory ligaments. <p>Accommodation is the process of changing the shape of the lens to focus on near or distant objects.</p> <p>To focus on a near object:</p> <ul style="list-style-type: none"> • the ciliary muscles contract • the suspensory ligaments loosen • the lens is then thicker and refracts light rays strongly. <p>To focus on a distant object:</p> <ul style="list-style-type: none"> • the ciliary muscles relax • the suspensory ligaments are pulled tight • the lens is then pulled thin and only slightly refracts light rays. <p>Two common defects of the eyes are myopia (short sightedness) and hyperopia (long sightedness) in which rays of light do not focus on the retina.</p> <ul style="list-style-type: none"> • Generally these defects are treated with spectacle lenses which refract the light rays so that they do focus on the retina. • New technologies now include hard and soft contact lenses, laser surgery to change the shape of the cornea and a replacement lens in the eye. <p>Interpret ray diagrams, showing these two common defects of the eye and demonstrate how spectacle lenses correct them</p>	4.5.2.3	Correcting vision	Empathy

Feedback systems

	3	Thermoregulation	<p>Body temperature is monitored and controlled by the thermoregulatory centre in the brain. The thermoregulatory centre contains receptors sensitive to the temperature of the blood. The skin contains temperature receptors and sends nervous impulses to the thermoregulatory centre. If the body temperature is too high, blood vessels dilate (vasodilation) and sweat is produced from the sweat glands. Both these mechanisms cause a transfer of energy from the skin to the environment. If the body temperature is too low, blood vessels constrict (vasoconstriction), sweating stops and skeletal muscles contract (shiver). Explain how these mechanisms lower or raise body temperature in a given context.</p>	4.5.2.4	How we keeping cool on holiday	Problem solving	
	4	Maintaining water and nitrogen balance in the body	<p>Explain the effect on cells of osmotic changes in body fluids. Water leaves the body via the lungs during exhalation. Water, ions and urea are lost from the skin in sweat. There is no control over water, ion or urea loss by the lungs or skin. Excess water, ions and urea are removed via the kidneys in the urine. If body cells lose or gain too much water by osmosis they do not function efficiently.</p> <p>The digestion of proteins from the diet results in excess amino acids which need to be excreted safely. In the liver these amino acids are deaminated to form ammonia. Ammonia is toxic and so it is immediately converted to urea for safe excretion.</p> <p>Describe the function of kidneys in maintaining the water balance of the body. The kidneys produce urine by filtration of the blood and selective reabsorption of useful substances such as glucose, some ions and water. Knowledge of other parts of the urinary system, the structure of the kidney and the structure of a nephron is not required. Translate tables and bar charts of glucose, ions and urea before and after filtration. Describe the effect of ADH on the permeability of the kidney tubules. The water level in the body is controlled by the hormone ADH which acts on the kidney tubules. ADH is released by the pituitary gland when the blood is too concentrated and it causes more water to be reabsorbed back into the blood from the kidney tubules. This is controlled by negative feedback. People who suffer from kidney failure may be treated by organ transplant or by using kidney dialysis. Basic principles of dialysis. Describe how kidney dialysis works. Evaluate the advantages and disadvantages of treating organ failure by mechanical device or transplant.</p>	4.5.3.3	Ethics of kidney treatment	Empathy	
		Literacy activity					Literacy
	5	Revision - tutorial					
	6	EOT - feedback systems					
7	Feedback						

Bonding and the periodic table	8	T- Transition metals	The transition elements are metals with similar properties which are different from those of the elements in Group 1. Describe the difference compared with Group 1 in melting points, densities, strength, hardness and reactivity with oxygen, water and halogens. Exemplify these general properties by reference to Cr, Mn, Fe, Co, Ni, Cu. Many transition elements have ions with different charges, form coloured compounds and are useful as catalysts.	4.1.3.1	Key terminology in the correct context	Literacy
	9	T- alloys and useful materials	Most metals in everyday use are alloys. Bronze is an alloy of copper and tin. Brass is an alloy of copper and zinc. Gold used as jewellery is usually an alloy with silver, copper and zinc. The proportion of gold in the alloy is measured in carats. 24 carat being 100% (pure gold), and 18 carat being 75% gold. Steels are alloys of iron that contain specific amounts of carbon and other metals. High carbon steel is strong but brittle. Low carbon steel is softer and more easily shaped. Steels containing chromium and nickel (stainless steels) are hard and resistant to corrosion. Aluminium alloys are low density. Recall a use of each of the alloys specified. Interpret and evaluate the composition and uses of alloys other than those specified given appropriate information.	4.10.3.2	Importance of alloys in every day life	Communication
	10	T- ceramics, composites and polymers	Most of the glass we use is soda-lime glass, made by heating a mixture of sand, sodium carbonate and limestone. Borosilicate glass, made from sand and boron trioxide, melts at higher temperatures than soda-lime glass. Clay ceramics, including pottery and bricks, are made by shaping wet clay and then heating in a furnace. The properties of polymers depend on what monomers they are made from and the conditions under which they are made. For example, low density (LD) and high density (HD) poly(ethene) are produced from ethene. Thermosoftening polymers melt when they are heated. Thermosetting polymers do not melt when they are heated. Explain how low density and high density poly(ethene) are both produced from ethene. Explain the difference between thermosoftening and thermosetting polymers in terms of their structures. Most composites are made of two materials, a matrix or binder surrounding and binding together fibres or fragments of the other material, which is called the reinforcement. Students should be able to recall some examples of composites	4.10.3.3	Importance of composites in every day life	Creativity

	11	T- nanoparticles	Nanoscience refers to structures that are 1–100 nm in size, of the order of a few hundred atoms. Nanoparticles, are smaller than fine particles (PM2.5), which have diameters between 100 and 2500 nm (1×10^{-7} m and 2.5×10^{-6} m). Coarse particles (PM10) have diameters between 1×10^{-5} m and 2.5×10^{-6} m. Coarse particles are often referred to as dust. As the side of cube decreases by a factor of 10 the surface area to volume ratio increases by a factor of 10. Nanoparticles may have properties different from those for the same materials in bulk because of their high surface area to volume ratio. It may also mean that smaller quantities are needed to be effective than for materials with normal particle sizes. Calculate areas of triangles and rectangles, surface areas and volumes of cubes. Compare 'nano' dimensions to typical dimensions of atoms and molecules. Recognise and use expressions in standard form. Use ratios, fractions and percentages. Make estimates of the results of simple calculations.	4.2.4.1	Calculating areas and volumes	Numeracy
	12	T- uses of nanoparticles	Nanoparticles have many applications in medicine, in electronics, in cosmetics and sun creams, as deodorants, and as catalysts. New applications for nanoparticulate materials are an important area of research. Consider advantages and disadvantages of the applications of these nanoparticulate materials, but do not need to know specific examples or properties other than those specified. Given appropriate information, evaluate the use of nanoparticles for a specified purpose. Explain that there are possible risks associated with the use of nanoparticles.	4.2.4.2	Risks of nanoparticles to humans	Empathy
	13	Peer STAR				
Chemical analysis	14	T - Flame tests	Flame tests can be used to identify some metal ions (cations). Lithium, sodium, potassium, calcium and copper compounds produce distinctive colours in flame tests: • lithium compounds result in a crimson flame • sodium compounds result in a yellow flame • potassium compounds result in a lilac flame • calcium compounds result in an orange-red flame • copper compounds result in a green flame. If a sample containing a mixture of ions is used some flame colours can be masked. Identify species from the results of the test. Investigate flame colours	4.8.3.1	FBV Mutual respect and tolerance	Teamwork
	15	T- tests for metal hydroxides	Sodium hydroxide solution can be used to identify some metal ions (cations). Solutions of aluminium, calcium and magnesium ions form white precipitates when sodium hydroxide solution is added but only the aluminium hydroxide precipitate dissolves in excess sodium hydroxide solution. Solutions of copper(II), iron(II) and iron(III) ions form coloured precipitates when sodium hydroxide solution is added. Copper(II) forms a blue precipitate, iron(II) a green precipitate and iron(III) a brown precipitate. An opportunity to make precipitates of metal hydroxides. Write balanced equations for the reactions to produce the insoluble hydroxides. Not expected to write equations for the production of sodium aluminate.	4.8.3.2	Balancing equations	Numeracy

	16	T - tests for carbonates, halides, sulfates	Carbonates react with dilute acids to form carbon dioxide gas. Carbon dioxide can be identified with limewater. Halide ions in solution produce precipitates with silver nitrate solution in the presence of dilute nitric acid. Silver chloride is white, silver bromide is cream and silver iodide is yellow. Sulfate ions in solution produce a white precipitate with barium chloride solution in the presence of dilute hydrochloric acid.	4.8.3.3, 4.8.3.4, 4.8.3.5		Problem solving	
	17	T- instrumental methods and flame emission spectroscopy	Elements and compounds can be detected and identified using instrumental methods. Instrumental methods are accurate, sensitive and rapid. Students should be able to state advantages of instrumental methods compared with the chemical tests in this specification. Flame emission spectroscopy is an example of an instrumental method used to analyse metal ions in solutions. The sample is put into a flame and the light given out is passed through a spectroscope. The output is a line spectrum that can be analysed to identify the metal ions in the solution and measure their concentrations. An opportunity to observe flame spectra using a handheld spectroscope. Interpret an instrumental result given appropriate data in chart or tabular form, when accompanied by a reference set in the same form, limited to flame emission spectroscopy.	4.8.3.6, 4.8.3.7	Interpreting data	Numeracy	
	18	T- Required practical	Use of chemical tests to identify the ions in unknown single ionic compounds covering the ions from sections Flame tests to Sulfates	Required practical 7	FBV Mutual respect and tolerance	Teamwork	
	19	Revision - cornwells					
	20	EOT Bonding and chemical analysis					
21	Feedback						

Communicable diseases	22	Monoclonal antibodies	<p>Describe how monoclonal antibodies are produced. Monoclonal antibodies are produced from a single clone of cells. The antibodies are specific to one binding site on one protein antigen and so are able to target a specific chemical or specific cells in the body. They are produced by stimulating mouse lymphocytes to make a particular antibody. The lymphocytes are combined with a particular kind of tumour cell to make a cell called a hybridoma cell. The hybridoma cell can both divide and make the antibody. Single hybridoma cells are cloned to produce many identical cells that all produce the same antibody. A large amount of the antibody can be collected and purified. Describe some of the ways in which monoclonal antibodies can be used.</p> <p>Some examples include: • for diagnosis such as in pregnancy tests • in laboratories to measure the levels of hormones and other chemicals in blood, or to detect pathogens • in research to locate or identify specific molecules in a cell or tissue by binding to them with a fluorescent dye • to treat some diseases: for cancer the monoclonal antibody can be bound to a radioactive substance, a toxic drug or a chemical which stops cells growing and dividing. It delivers the substance to the cancer cells without harming other cells in the body. Recall any specific tests or treatments is not needed but given appropriate information they should be able to explain how they work. Monoclonal antibodies create more side effects than expected. They are not yet as widely used as everyone hoped when they were first developed.</p> <p>Evaluate the advantages and disadvantages of monoclonal antibodies.</p>	4.3.2.2	SMSC - ethics of monoclonal antibodies	Empathy
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23	Plant defences, detection & identifying disease		4.3.3.1 4.3.3.2		Literacy
24	Culturing microorganisms	<p>Bacteria multiply by simple cell division (binary fission) as often as once every 20 minutes if they have enough nutrients and a suitable temperature. Bacteria can be grown in a nutrient broth solution or as colonies on an agar gel plate. Uncontaminated cultures of microorganisms are required for investigating the action of disinfectants and antibiotics. Calculate the number of bacteria in a population after a certain time if given the mean division time. Calculate cross-sectional areas of colonies or clear areas around colonies using πr^2. Describe how to prepare an uncontaminated culture using aseptic technique. They should be able to explain why: • Petri dishes and culture media must be sterilised before use • inoculating loops used to transfer microorganisms to the media must be sterilised by passing them through a flame • the lid of the Petri dish should be secured with adhesive tape and stored upside down • in school laboratories, cultures should generally be incubated at 25°C. Express the answer in standard form</p>	4.1.1.6	Numeracy	Numeracy
25	T- Required practical effect of antibiotics	investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition	Required practical 2	SMSC cooperation with others	Teamwork
26	Revision - tutorial				

	27	EOT - feedback systems and communicable				
	28	Feedback				
Acids and alkalis	29	T- Titrations	The volumes of acid and alkali solutions that react with each other can be measured by titration using a suitable indicator. Describe how to carry out titrations using strong acids and strong alkalis only (sulfuric, hydrochloric and nitric acids only) to find the reacting volumes accurately	4.4.2.5	Writing instructions	Literacy
	30	T- Required practical - titrations	Determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration.	Required practical 2	FBV Mutual respect and tolerance	Teamwork
	31	T- corrosion and prevention	Corrosion is the destruction of materials by chemical reactions with substances in the environment. Rusting is an example of corrosion. Both air and water are necessary for iron to rust. Corrosion can be prevented by applying a coating that acts as a barrier, such as greasing, painting or electroplating. Aluminium has an oxide coating that protects the metal from further corrosion. Some coatings are reactive and contain a more reactive metal to provide sacrificial protection, eg zinc is used to galvanise iron. Describe experiments and interpret results to show that both air and water are necessary for rusting. Explain sacrificial protection in terms of relative reactivity. Investigate conditions for rusting	4.10.3.1	SMSC cooperation with others	Teamwork
	32	Literacy activity				
	33	Peer STAR				
	34	Moles recap	Recap calculating moles - taught in combined spec	4.3.2.1	Numeracy	Numeracy
Quantitative	35	T- Percentage yield	Even though no atoms are gained or lost in a chemical reaction, it is not always possible to obtain the calculated amount of a product because: <ul style="list-style-type: none"> the reaction may not go to completion because it is reversible some of the product may be lost when it is separated from the reaction mixture some of the reactants may react in ways different to the expected reaction. The amount of a product obtained is known as the yield. When compared with the maximum theoretical amount as a percentage, it is called the percentage yield. $\% \text{ Yield} = \frac{\text{Mass of product actually made}}{\text{Maximum theoretical mass of product}} \times 100$. Calculate the percentage yield of a product from the actual yield of a reaction. Calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction. Recognise and use expressions in decimal form. Use ratios, fractions and percentages. Use an appropriate number of significant figures. Change the subject of an equation.	4.3.3.1	Numeracy	Numeracy

36	T- Atom economy	The atom economy (atom utilisation) is a measure of the amount of starting materials that end up as useful products. It is important for sustainable development and for economic reasons to use reactions with high atom economy. The percentage atom economy of a reaction is calculated using the balanced equation for the reaction as follows: $\frac{\text{Relative formula mass of desired product}}{\text{Sum of relative formula masses of all reactants}} \times 100$. Calculate the atom economy of a reaction to form a desired product from the balanced equation. Explain why a particular reaction pathway is chosen to produce a specified product given appropriate data such as atom economy (if not calculated), yield, rate, equilibrium position and usefulness of by-products. Recognise and use expressions in decimal form. Use ratios, fractions and percentages. Change the subject of an equation.	4.3.3.2	Numeracy	Numeracy
37	T/H Concentration of solution mol/dm ³	Calculate the chemical quantities in titrations involving concentrations in mol/dm ³ and in g/dm ³ . The concentration of a solution can be measured in mol/dm ³ . The amount in moles of solute or the mass in grams of solute in a given volume of solution can be calculated from its concentration in mol/dm ³ . If the volumes of two solutions that react completely are known and the concentration of one solution is known, the concentration of the other solution can be calculated. Explain how the concentration of a solution in mol/dm ³ is related to the mass of the solute and the volume of the solution.	4.3.4	Numeracy	Numeracy
38	T/H Molar volume of gases	Equal amounts in moles of gases occupy the same volume under the same conditions of temperature and pressure. The volume of one mole of any gas at room temperature and pressure (20°C and 1 atmosphere pressure) is 24 dm ³ . The volumes of gaseous reactants and products can be calculated from the balanced equation for the reaction. Calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass. Calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product. Change the subject of a mathematical equation.	4.3.5	Numeracy	Numeracy
39	Revision				
40	EOT -Chemical changes and Quantitative				
41	Feedback				

Plants	42	Plant Hormones	Plants produce hormones to coordinate and control growth and responses to light (phototropism) and gravity (gravitropism or geotropism). Unequal distributions of auxin cause unequal growth rates in plant roots and shoots. Gibberellins are important in initiating seed germination. Ethene controls cell division and ripening of fruits. The mechanisms of how gibberellins and ethene work are not required. Describe the effects of some plant hormones and the different ways people use them to control plant growth. Plant growth hormones are used in agriculture and horticulture. Auxins are used: • as weed killers • as rooting powders • for promoting growth in tissue culture. Ethene is used in the food industry to control ripening of fruit during storage and transport. Gibberellins can be used to: • end seed dormancy • promote flowering • increase fruit size. Understand how the everyday use of hormones as weed killers has an effect on biodiversity.	4.5.4.1	SMSC effects of weedkiller on biodiversity	Empathy
	43	Effects of light on seedling growth	Investigate the effect of light or gravity on the growth of newly germinated seedlings. Record results as both length measurements and as careful, labelled biological drawings to show the effects.	Required practical 8	FBV Mutual respect and tolerance	Teamwork
	44	Revision				
	45	EOT - Ecosystems and plants and feedback				
	46	Feedback				
	Energy changes	47	Chemical cells and fuel cells	Cells contain chemicals which react to produce electricity. The voltage produced by a cell is dependent upon a number of factors including the type of electrode and electrolyte. A simple cell can be made by connecting two different metals in contact with an electrolyte. Batteries consist of two or more cells connected together in series to provide a greater voltage. In non-rechargeable cells and batteries the chemical reactions stop when one of the reactants has been used up. Alkaline batteries are non-rechargeable. Rechargeable cells and batteries can be recharged because the chemical reactions are reversed when an external electrical current is supplied. Interpret data for relative reactivity of different metals and evaluate the use of cells. Do not need to know details of cells and batteries other than those specified.	4.5.2.1	SMSC How batteries work
48		Fuel cells	Fuel cells are supplied by an external source of fuel (eg hydrogen) and oxygen or air. The fuel is oxidised electrochemically within the fuel cell to produce a potential difference. The overall reaction in a hydrogen fuel cell involves the oxidation of hydrogen to produce water. Hydrogen fuel cells offer a potential alternative to rechargeable cells and batteries. Evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries. (HT only) write the half equations for the electrode reactions in the hydrogen fuel cell.	4.5.2.2	SMSC importance of alternative fuels	Creativity
49		Revision - letiners flashcards				
50		EOT				

