2021-22 CURRICULUM MAP FOR SCIENCE YEAR 10

HALF TERM 1:

Cell biology

1. Describe the structure of eukaryotic and prokaryotic cells.
2. Explore how structural differences between types of cells enables them to perform specific functions within the organism.
3. Explain the importance of cell differentiation.
4. Understand how microscopy techniques have developed over time.
6. Rearrange the equation to calculate image size or magnification.

$$real\ size = \frac{image\ size}{magnification}$$

7. Understand the three overall stages of the cell cycle.
8. Describe what a chromosome is and where chromosomes are found in the cell.
9. Describe how cells must divide by mitosis producing two new identical cells.
10. Define the term diffusion, osmosis and active transport.
11. Explain how temperature, concentration gradient and surface area affect the rate of diffusion.
12. Describe and explain how an exchange surface is made more effective.
13. Describe where stem cells can be found in animals and plants.
14. Describe how stem cells could be used to help treat some medical conditions.
15. Evaluate risks and benefits, as well as the social and ethical issues concerning the use of stem cells from embryos in medical research and treatments.

Atomic Structure

1.Use the names and symbols of the first 20 elements in the periodic table.
2.Write word equations and balanced chemical equations for the reactions.
3.Write balanced half equations and ionic equations. (HT)
4.Suggest suitable separation and purification techniques for mixtures.
5.Describe how and why the atomic model has changed over time.
6.Describe the structure of the atom- identify the charge and mass on each subatomic particle.
7.Calculate the numbers of protons, neutrons and electrons in an atom or ion, given its atomic number and mass number for the first 20 elements.
8.Describe why atoms have no overall charge.
9.Calculate the relative atomic mass of an element given the percentage abundance of its isotopes.
10.Represent the electronic structures of the first twenty elements of the periodic table in both forms.
11.Explain how the position of an element in the periodic table is related to the arrangement of electrons in its atoms and hence to its atomic number.
12.Describe steps in the development of the periodic table.
13.Explain the differences between metals and non-metals based on their characteristic physical and chemical properties.
14.Explain how properties of the elements in Group 0 depend on the outer shell of electrons of the atoms.
15.Describe the reactions of the first three alkali metals with oxygen, chlorine and water.

Read articles about current stem cell uses and potential uses.

Europe's stem cell hub – Stem cell videos and films

Daily News Articles - stem cells | The Scientist Magazine®

Required practical activity 1: Use a light microscope to observe. Draw and label a selection of plant and animal cells.

Required practical activity 2: Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.

Present arguments in favour of or against the use of embryonic stem cells (doctor, person with diabetes, human rights activist).

History- Development of the periodic table.

MfL- Develop skills to communicate through use of symbolic equations.

Maths- scale and size of cells and be able to make order of magnitude calculations, including the use of standard form. Rearranging and balancing equations.
Convert values for the units: cm, mm, µm and nm. Calculate and compare surface area: volume ratios. Use SI units and the prefix nano.

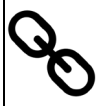
2020-21 CURRICULUM MAP FOR SCIENCE YEAR 10

16.Explain how properties of the elements in Group 1 depend on the outer shell of electrons of the atoms. 17.Describe the nature of the compounds formed when chlorine, bromine and iodine react with metals and non-metals. 18.Explain how properties of the elements in Group 7 depend on the outer shell of electrons of the atoms.		
HALF TERM 2: Energy 1. Describe, for common situations, the changes involved in the way energy is stored when a system changes. 2. Calculate how energy is redistributed in a system when it changes. 3.Work is done when charge flows in a circuit. Work done = Force x Distance 4. Calculate the kinetic energy of a moving object, stored by a stretched spring and an object raised above ground level. $K.E. = 0.5\ x\ mass\ x\ (speed)^2$ 5. The amount of elastic potential energy stored in a stretched spring can be calculated using the equation: $Elastic\ potential\ energy = 0.5\ x\ spring\ constant\ x\ (extension)^2$ 6. The amount of gravitational potential energy gained by an object raised above the ground level can be calculated using the equation: $g.p.e = mass\ x\ gravitational\ field\ strength\ x\ height$ 7. Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed. 8. Whenever there are energy transfers in a system only part of the energy is usefully transferred. The rest of the energy is dissipated so that it is stored in less useful ways. This energy is often described as being wasted. 9. Unwanted energy transfers can be reduced in several ways, for example, through lubrication and the use of thermal insulation. 10. The rate of cooling of a building is affected by the thickness and thermal conductivity of its walls. 11. The energy efficiency for any energy transfer can be calculated using the equation: $efficiency = \frac{useful\ output\ energy\ transfer}{total\ input\ energy\ transfer}$ 12. Describe ways to increase the efficiency of an intended energy transfer. (HT) 13. Describe the main energy resources available for use on Earth. Include: fossil fuels (coal, oil and gas), nuclear fuel, bio-fuel, wind, hydro-electricity, geothermal, the tides, the Sun and water waves. 14. Distinguish between energy resources that are renewable and energy resources that are non-renewable. 15. Compare the ways that different energy resources are used. The uses to include transport, electricity generation and heating. 16. Understand why some energy resources are more reliable than others. Bonding and Structure 1.Explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons. 2.Draw dot and cross diagrams for ionic compounds formed by metals in Groups 1 and 2 with non-metals in Groups 6 and 7.	   	Research articles on the some uses of covalent substances. Describe the structure of diamond, silicon dioxide and graphite. Required practical activity 14: an investigation to determine the specific heat capacity of a materials. Link the decrease of one energy store (or work done) to the increase in temperature and subsequent increase in thermal energy stored. Extended writing: describe the properties of matter in a solid, liquid and gas. Extended writing: describe the history of fullerenes. Discuss energy wasted by the machines and ways to reduce it. Why does the temperature of a pan of oil increase faster than a pan of water? Investigate ways of reducing the wasted energy transfer in a rollercoaster. Make links between the uses of metal substances, their properties and structure. Political, social, ethical and economic considerations that may arise from the use of different energy resources. Maths- translate data between diagrammatic and numeric forms. Visualise and represent 2D and 3D forms of 3D objects.

2020-21 CURRICULUM MAP FOR SCIENCE YEAR 10

3.Calculate the charge on the ions of metals and non-metals from the group number of the element, limited to the metals in Groups 1 and 2, and non-metals in Groups 6 and 7. 4.Describe the limitations of using dot and cross, ball and stick, to represent giant structures. 5.Draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane. 6.Deduce the molecular formula of a substance from a given model or diagram in these forms showing the atoms and bonds in the molecule. 7.Recognise substances as giant metallic structures from diagrams showing their bonding and structure. 8.Predict the states of substances at different temperatures given appropriate data 9.Explain the limitations of the particle theory in relation to changes of state when particles are represented by solid spheres which have no forces between them. (HT) 10.Balance chemical equations and include state symbols in for the reactions. 11.Recognise substances as small molecules, polymers or giant structures from diagrams showing their bonding. 12.Explain why alloys are harder than pure metals in terms of distortion of the layers of atoms in the structure of a pure metal.		
HALF TERM 3: Organisation 1.Explain the terms cell, tissue, organ, organ system and organism, and be able to give examples of each. 2.Describe the main organs/ systems in the human body and their functions. 3.Describe the functions of the digestive system to digest and absorb foods. 4.Explain how the small intestine is adapted for its function. 5.Define the terms 'catalyst' and 'enzyme'. 6.Describe the properties of enzymes. Use the lock and key theory and collision theory to explain enzyme action. 7.Describe the three types of enzymes involved in digestion, including the names of the substrates, products and where the enzymes are produced. 8.Describe the functions of the heart and circulatory system. 9.Describe the flow of blood from the body, through the heart and lungs and back to the body. 10.Describe the function of the pacemaker cells and coronary arteries. 11.Label the main structures in the gas exchange - explain how the alveoli are adapted for efficient gas exchange. 12.Explain how the blood vessels are adapted for their function. Describe problems associated with the heart and explain how they can be treated. 13.Explain how diet, stress and life situations can affect physical and mental health. 14.Describe the effects of diet, smoking, alcohol and exercise on health.	 	Science in the News- reading and extracting key information: BBC Bitesize – Drugs and the human body Cancer research: https://www.cancerresearchuk.org/?gclid=EAIaIQobChMI25KHnPaw8wIV4-jtCh18LARvEAAYASAAEgJFdfD_BwE&gclsrc=aw.ds Required practical activity 3: use qualitative reagents to test for a range of carbohydrates, lipids and proteins. Required practical activity 4: investigate the effect of pH on the rate of reaction of amylase enzyme. Required practical activity 15: Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits: • the length of a wire at constant temperature • combinations of resistors in series and parallel. Required practical activity 16: Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a filament lamp, a diode and a resistor at constant temperature.

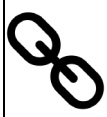
2020-21 CURRICULUM MAP FOR SCIENCE YEAR 10

15.Explain how and why the Government encourages people to lead a healthy lifestyle. 16.Describe some causes of cancer, eg viruses, smoking, alcohol, carcinogens and ionising radiation. 17.Describe the difference between benign and malignant tumours. Explain how cancer may spread from one site in the body to form a secondary tumour in another part of the body. 18.Label the main organs of a plant and describe their functions. 19.Identify the tissues in a leaf and describe their functions. Relate the structure of each tissue to its function in photosynthesis. 20.Describe the role of stomata and guard cells to control water loss and gas exchange. 21.Describe the role of xylem, phloem and root hair cells and explain how they are adapted for their functions. 22.Define the terms 'transpiration' and 'translocation'. Electricity 1. Electric current is a flow of electrical charge. The size of the electric current is the rate of flow of electrical charge. Draw circuit diagrams using standard symbols. 2. The current (I) through a component depends on both the resistance (R) of the component and the potential difference (V) across the component. $V = I R$ 4. Describe the conditions for which Ohm's law is valid. 5. Draw the I-V graphs for a filament lamp and a diode. Explain the shape of the resulting graph in terms of resistance and current. 6. Describe p.d and resistance in series and parallel circuits. 7. Describe the difference between ac and dc. Mains electricity is an ac supply. 8. Construction of a three-core electric cable: live wire, neutral, earth wire 9. The amount of energy an appliance transfers depends on how long the appliance is switched on for and the power of the appliance. Describe how different domestic appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices. 10.The amount of energy transferred by electrical work can be calculated using the equation: energy transferred = power × time 11. Explain how the power of a circuit device is related to the potential difference across it and the current through it and the energy transferred over a given time. 12. Describe how electrical power is transferred from the power stations to the consumers via the National Grid- including the types of transformer used and how the potential difference in the wire's changes at each stage of the process. 13. Use the equation: potential difference across primary coil x current in primary coil = potential difference across secondary coil x current in secondary coil (HT) Quantitative Chemistry 1. Explain the meaning of the law of conservation- how this can be represented by balanced symbol equations. 2. Calculate the relative formula mass (Mr) of a compound from its formula, given the relative atomic masses. 3.Represent the distribution of results and make estimations of uncertainty.		How does the earth wire help prevent electrocution?
		Health & Social care – body system Evaluate the use of drugs, mechanical devices and transplants to treat heart problems, including religious and ethical issues. Food technology- food groups and nutrition PE – circulatory and respiratory system Economics- financial cost of non-communicable diseases on individuals, communities, nations and globally. Maths - Use and rearrange electricity equations. Draw and interpret line graphs. Tabulation of data, identify patterns and trends, making inferences and drawing conclusions. Translate disease incidence information between graphical and numerical forms. Understand the principles of sampling as applied to scientific data, including epidemiological data.

2020-21 CURRICULUM MAP FOR SCIENCE YEAR 10

4. The mass of one mole of a substance in grams is equal to its relative formula mass. The number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is 6.02 x 1023 per mole. (HT) 5. Calculate the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product. (HT) 6. Be able to explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams. (HT) 7. Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution. Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution. (HT)		
HALF TERM 4: Infection & response 1. Pathogens are microorganisms such as viruses, bacteria, fungi and protists that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. 2. Explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced using vaccination. 3. Since the 1940s a range of antibiotics have been developed which have proved successful against several lethal diseases caused by bacteria. Unfortunately, many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics. 4. Describe the main steps in the development and testing of a new drug. Chemical changes 1. Metals react with oxygen to produce metal oxides. The reactions are oxidation reactions because the metals gain oxygen. 2. Metals can be arranged in order of their reactivity in a reactivity series. A more reactive metal can displace a less reactive metal from a compound. 3. Metals less reactive than carbon can be extracted from their oxides by reduction with carbon. 4. Explain the process of oxidation and reduction. 5. Acids react with some metals, metal oxides, metal hydroxides and metal carbonates to produce salts- name these salts. 6. Describe neutralisation and how it can be measured using universal indicator or a pH probe. H+ (aq) + OH– (aq) → H2O (l) 7. Compare strong and weak acids. As the pH decreases by one unit, the hydrogen ion concentration of the solution increases by a factor of 10. 8. Describe electrolysis of simple ionic compounds, aluminium oxide and aqueous solutions. 9. Write half equations for the reactions occurring at the electrodes during electrolysis. (HT)	   	Science in the News- reading and extracting key information: https://www.sciencenews.org/ Microbiology Online – Downloadable resources BBC Bitesize – Infested with malaria BBC search on Antibiotic resistance ABPI –Developing medicines https://6634.stem.org.uk/medicines4.html Research how aluminium is extracted from its ore. Required practical activity 8: Preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate, using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution. Group project using ICT, researching to find out about the symptoms, mode of transmission, prevention and treatment for measles, HIV and AIDS, salmonella and gonorrhoea- prepare class presentations. Imagine the world we would live in if antibiotics stopped working. Make a model to describe the process of electrolysis. Health & Social care - health and disease Application of science and personal and social implications related to diseases. Consider the ethical issues and risks associated with Jenner's method. Travel and tourism – prevalence of diseases around the world. Geography – Origin of Covid-19 and how it spread throughout the world.

2020-21 CURRICULUM MAP FOR SCIENCE YEAR 10

		History - Work of Fleming, Florey, Chain and discuss the impact of their work on society. Compare the year of discovery of a metallic element with its position in the reactivity series. Historical context to show an understanding of why and describe how scientific methods and theories develop over time. Produce a timeline to show how our ideas about atoms have changed since ancient Greek times. Industry – Extraction of aluminium Maths – Use and rearrange electricity equations. Recognise expressions given in standard form. Draw graphs. Tabulation of data, identify patterns and trends, making inferences and drawing conclusions.
HALF TERM 5: **Bioenergetics** 1.Explore how plants harness the Sun's energy in photosynthesis to make food- identify factors that limit and increase the rate. 2. Describe how animals and plants use oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. 3. Compare this to anaerobic respiration and how the body responds under vigorous exercise. 4. Explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids. 5. Define metabolism and what it includes. **Particle model of matter** 1. Draw simple diagrams to represent the difference between solids, liquids and gases. Describe how substances change state. Explain the differences in density between the different states of matter in terms of the arrangement of atoms or molecules. 2. Distinguish between specific heat capacity and specific latent heat. 3. Calculate the change in thermal energy, mass, specific heat capacity or the temperature change of a substance that is heated or cooled. 4. Describe specific latent heat of fusion and vaporisation. 5. Interpret heating and cooling graphs that include changes of state. 6. Describe and explain how changing the temperature of gas increases the gas pressure inside the container **Atomic Structure** 1. Describe the structure, charge and size of atoms. 2.Atoms of the same element can have different numbers of neutrons; these atoms are called isotopes of that element.		Reading and extracting information about Van Helmont's experiments on plant growth. Evaluate newspaper articles of local fires that have involved gas canisters exploding and the reasons for the explosion in terms of gas pressure.
		Required practical activity 5: Investigate the effect of light intensity on the rate of photosynthesis Required practical activity 17: Use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids.
		Debate – are underground or vertical farms the answer to providing food in cities? Can a vegetarian diet provide all necessary nutrients? Discuss how many daily products come from plants?
		STEM – Design a greenhouse to maintain optimum growth of plants on the moon. Explain all its design features. Agriculture- Investigate growth of tomatoes in greenhouse, lab and outside. Historical context to show an understanding of why and how scientific methods and theories develop over time. Produce a timeline to show how our ideas about atoms have changed since ancient Greek times.

2020-21 CURRICULUM MAP FOR SCIENCE YEAR 10

3. New experimental evidence led to the scientific model being changed - describe the work of Dalton, Thomson, Rutherford, Bohr and Chadwick. 4. Some atomic nuclei are unstable- describe radioactive decay. Describe the properties of alpha particles, beta particles and gamma rays- limited to their penetration through materials, their range in air and ionising power. 5. Define half-life. Calculate half-life of a radioactive isotope. (HT) 6. Compare the hazards associated with contamination and irradiation. 7. Know the safety precautions taken when dealing with radioactive sources.		Maths – Link to numeracy with balancing equations and expression in standard and decimal form. Use an appropriate number of significant figures. Use ratios, fractions and percentages. Understand and use the symbols: =, <, <<, >>, >, ∝,~ . Solve simple algebraic equations. Change the subject of a mathematical equation. Plot and draw appropriate graphs selecting appropriate scale for axes. Translate information between graphical and numeric form.
HALF TERM 6: Energy Changes 1. Energy is conserved in chemical reactions. Describe and give examples of exothermic and endothermic reactions. 2. Reaction profiles can be used to show the relative energies of reactants and products, the activation energy and the overall energy change of a reaction. 3.During a chemical reaction: energy must be supplied to break bonds in the reactants and energy is released when bonds in the products are formed. (HT) 4. The energy needed to break bonds and the energy released when bonds are formed can be calculated from bond energies. (HT) Waves 1.Waves may be either transverse or longitudinal- describe how they travel. 2. Define amplitude, wavelength and frequency. 3. Describe methods to measure the speed of sound waves in air, and the speed of ripples on a water surface. 4. Electromagnetic (transverse) waves form a continuous spectrum and all electromagnetic wave travel at the same velocity through a vacuum or air. Describe how waves that form the electromagnetic spectrum are grouped in terms of their wavelength and their frequency. 5. Construct ray diagrams to illustrate the refraction of a wave. 6. Different wavelengths of electromagnetic waves are reflected, refracted, absorbed or transmitted differently by different substances and types of surface. (HT). Use wave front diagrams to explain refraction in terms of the change of speed that happens when a wave travels from one medium to a different medium. (HT) 7. Ultra-violet waves, X-rays and gamma rays can have hazardous effects on human body tissue. The effects depend on the type of radiation and the size of the dose. Radiation dose (in Sieverts) is a measure of the damage caused by the radiation in the body. 8. Describe the applications of electromagnetic waves have many practical applications. Explain why each type of electromagnetic wave is suitable for the practical application. (HT)		Articles about nuclear disasters: Chernobyl, Fukushima.
		Required practical activity 20: Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements. Required practical activity 21: Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface. Required practical 10: Investigate the variables that affect temperature changes in reacting solutions such as, eg acid plus metals, acid plus carbonates, neutralisations, displacement of metals.
		Why can I get TV signal at home but not a mobile phone signal? Research the first radio communication sent across the Atlantic. Does sunbathing cause cancer? Are sunbeds safer than sunbathing?
		Maths – Balancing equations. Recall and apply equation. Rearrange equations. Calculate the energy transferred in chemical reactions using bond energies supplied. Recognise expressions given in standard form. Probability- calculating half life. Music- pitch / frequency of sound Media/communication/ security- use of waves

2020-21 CURRICULUM MAP FOR SCIENCE
YEAR 10