Scheme of work

Tutor/Department	Element
	B1: Core science concepts
Guided learning hours (GLH)	**Number of sessions**
120	40 Each session is planned for 3 hours.

About this Element

The aim of this element is to develop student's knowledge of fundamental scientific concepts which have application across Health, Healthcare Science and Science.

Learning for Element

1.1 The 3 principles of cell theory.
1.2 The different types of cells that make up living organisms.
1.3 The structure and function of the organelles found within eukaryotic cells.
1.4 The similarities and differences between plant and animal cells in relation to the presence of specific organelles and their function.
1.5 How eukaryotic cells become specialised in complex multi-cellular organisms.
1.6 How prokaryotic cells differ from eukaryotic cells.
1.7 The relationship between the structure, properties and functions of proteins.
1.8 The relationship between the structure, properties and functions of carbohydrates.
1.9 The relationship between the structure, properties and functions of lipids.
1.10 How the surface area to volume ratio affects the process of exchange and gives rise to specialised systems.
1.11 The principles of cellular exchange and the transport mechanisms which exist to facilitate this exchange.
1.12 The advantages of having specialised cells in relation to the rate of transport across internal and external membranes.

1.13	The purpose of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) as the carrying molecules of genetic information and the role they play in the mechanism of inheritance.
1.14	The relationship between the structure of DNA and RNA and their role in the mechanism of inheritance.
1.15	The function of complementary base pairing in forming the helical structure of DNA.
1.16	The process and stages of semi-conservative replication of DNA.
1.17	How this semi-conservative replication process ensures genetic continuity between generations of cells.
1.18	The link between the semi-conservative replication process and variation.
1.19	The difference between genetics and genomics.
1.20	The classification and characteristics (size of cell, type of cell, presence of organelles) of microorganisms.
1.21	The benefits of using the following microscopes when investigating microorganisms.
1.22	How to calculate magnification from the size of the image and the size of the object.
1.23	The uses of differential staining techniques.
1.24	The nature of infection.
1.25	Causative agents of infection and examples of resulting diseases.
1.26	The different ways in which causative agents may enter the body (for example transmission routes).
1.27	How infectious diseases can spread amongst populations and communities.
1.28	The definition of an antigen and an antibody.
1.29	The link between antigens and the initiation of the body's response to invasion by a foreign substance.
1.30	The stages and cells involved in the body's response to an antigen.
1.31	The differences between cell-mediated immunity and antibody-mediated immunity.
1.32	The role of T and B memory cells in the secondary immune response.
1.33	The relationship between the atomic structure and physical and chemical properties of metals.
1.34	How the arrangement of electrons is linked to the way in which elements are situated within groups in the periodic table.
1.35	The correct names for sub-atomic particles and their position in an atom - protons, electrons and neutrons.
1.36	The physical and chemical properties of acids.
1.37	The concept of strong and weak acids (as distinct from dilute and concentrated solutions.
1.38	How to determine the name of the salt produced in the following acid-base reactions.
1.39	The principles of collision theory.
1.40	The effect of temperature on rates of reaction.

1.41 The definition of a catalyst and the role of catalysts in a reaction.
1.42 The principles of the following tests and techniques used to separate substances in order to detect or identify chemical composition.
1.43 The tests that could be used to quantify components in a mixture
1.44 The principle of titration.
1.45 The definitions of, and how to calculate, charge and current using Q = IT.
1.46 The definitions of, and how to calculate, current, potential difference and resistance, using Ohm's law V = IR.
1.47 How to calculate total resistance of multiple fixed resistors in a series and parallel circuit.
1.48 The difference between alternating and direct current.
1.49 The properties of mains electricity in the United Kingdom.
1.50 Magnetism and magnetic poles.
1.51 Magnetic fields.
1.52 The uses of electromagnetism and electromagnets.
1.53 The definition of a wave.
1.54 The relationship between frequency, wavelength and speed using the wave equation v = fλ.
1.55 The properties of longitudinal and transverse waves.
1.56 The uses of different types of waves.
1.57 The types and properties of radioactive radiation.
1.58 The definitions of half-life and count-rate.
1.59 The main types of radioactive decay in relation to unstable nuclei.
1.60 How radiation interacts with matter.
1.61 The applications of radioactivity within the health and science sector.
1.62 The use of the international system of units (SI).
1.63 How to convert between units.
1.64 The importance of using significant figures and science notation.

Employer engagement/enrichment

- Guest speakers from the Health, Healthcare Science and Science sectors.
- Work visits to various science sector employers.
- Employer opportunity to feedback on presentations/formative assessment.

Core skills and general competencies

Core skills and competencies that must be taught across this scheme:

- CS2, CS3, CS5, CS7 (Science)
- CS2, CS3, CS5, CS6 (Health)
- CS1, CS3, CS4, CS6 (Healthcare Science)
- GEC1, GEC2, GEC3, GEC4, GEC6, GDC1, GDC2, GDC3, GDC5

Other resources available from STEM Learning ©

STEM Learning © - T Level resources including general mathematic competencies.
For B1, the relevant topics within 'Core component section B: science and further science concepts' are listed below.

Biology – Cell structure and tissues; Biological molecules; Exchange and transport mechanisms; DNA and protein synthesis; Classifying and observing microorganisms; Pathogens and immunology.

Chemistry – Materials and chemical properties; Acids, bases and chemical changes; Rates of reactions, energy changes and kinetic changes; Chemical analysis of substances.

Physics – Electricity; Magnetism and electromagnetism; Waves; Particles and radiation; Units. (Last accessed 5th of October 2021)

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Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
1-3	**1.1** The 3 principles of cell theory. **1.2** The different types of cells that make up living organisms. **1.3** The structure and function of the organelles found within eukaryotic cells. **1.4** The similarities and differences between plant and animal cells in relation to the presence of specific organelles and their function.	1.1 to 1.4 Tutor input: Cell theory, different types of cells, structure and function of organelles and similarities and differences between plant and animal cells Think, pair, repair activity: In each session, pose an open-ended question in relation to cell theory, structure, function, similarities/differences. • Ask individual students to come up with their best answer. • Pair students up and get them to agree on a response. • Get two pairs together, so that the four students come up with an agreed response. • Continue getting students together until class is in two equal halves. • Each 'half' to share their agreed response. Students to write up notes from each session in their own files.	Student files/pens/paper Computer/internet access Tutor input	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
4	**1.5** How eukaryotic cells become specialised in complex multi-cellular organisms. **1.6** How prokaryotic cells differ from eukaryotic cells.	1.6 Paired activity: Pairs to research how prokaryotic cells differ from eukaryotic cells. Students to document findings visually. 1.5 Paired activity: Complete activity sheet on how eukaryotic cells become specialised in complex multi-cellular organisms.	Student files/pens/paper Computer/internet Access Digital resources Task sheet on how eukaryotic cells become specialised in complex multi-cellular organisms	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**
5-6	**1.7** The relationship between the structure, properties and functions of proteins. **1.8** The relationship between the structure, properties and functions of carbohydrates.	1.1 to 1.9 Tutor input: Protein, carbohydrate and lipids: relationship between structure and function. 1.1 to 1.9 Think-pair-repair activity: In each session, pose an open-ended question in relation to either proteins, carbohydrates or lipids. • Ask individual students to come up with their best answer. • Pair students up and get them to agree on a response.	Student files/pens/paper Computer/internet Access Tutor input	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
	1.9 The relationship between the structure, properties and functions of lipids.	• Get two pairs together, so that the four students come up with an agreed response. • Continue getting students together until class is in two equal halves. • Each 'half' to share their agreed response. Students to write up notes from each session in their own files.		
7-8	**1.10** How the surface area to volume ratio affects the process of exchange and gives rise to specialised systems. **1.11** The principles of cellular exchange and the transport mechanisms which exist to facilitate this exchange.	1.10 to 1.12 Tutor input: Surface area to volume ratio, principles of cellular exchange and the advantages of having specialised cells in relation to rate of transport. 1.10 to 1.12 Think, pair, repair activity: In each session, pose an open-ended question in relation to surface area to volume ratio, principles of cellular exchange and the advantages of having specialised cells in relation to rate of transport. • Ask individual students to come up with their best answer. • Pair students up and get them to agree on a response.	Student files/pens/paper Computer/internet Access Tutor input	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
	1.12 The advantages of having specialised cells in relation to the rate of transport across internal and external membranes.	• Get two pairs together, so that the four students come up with an agreed response. • Continue getting students together until class is in two equal halves. • Each 'half' to share their agreed response. Students to write up notes from each session in their own files.		
9-11	**1.13** The purpose of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) as the carrying molecules of genetic information and the role they play in the mechanism of inheritance.	1.13 to 1.15 Tutor input: DNA and RNA including purpose, relationship between structure and function, function of complementary base pairing. 1.16 and 1.17 Class activity: Students watch video/on-line animation of the process and stages of semi-conservative replication. 1.16 and 1.17 Paired activities: Students produce a summary of how the semi-conservative replication process ensures genetic continuity between generations of cells and the link between the semi-conservative replication process and variation.	Tutor input including use of virtual model of DNA Video/on-line animation of process and stages of the process and stages of semi-conservative replication Student files/pens/paper	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
	1.14 The relationship between the structure of DNA and RNA and their role in the mechanism of inheritance. **1.15** The function of complementary base pairing in forming the helical structure of DNA. **1.16** The process and stages of semi-conservative replication of DNA. **1.17** How this semi-conservative replication process ensures genetic continuity between generations of cells.	1.18 and 1.19 Paired activity: Students research and identify the difference between genetics and genomics. Pairs share findings with rest of class. Students to write up notes from each session in their own files.	Computer/internet Access	

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
	1.18 The link between the semi-conservative replication process and variation. **1.19** The difference between genetics and genomics.			
12-14	**1.20** The classification and characteristics (size of cell, type of cell, presence of organelles) of microorganisms. **1.21** The benefits of using the following microscopes when investigating microorganisms.	1.20 to 1.23 Tutor input/demonstration: Classification and characteristics, benefits of using the following microscopes when investigating microorganisms, how to calculate magnification from the size of the image and the size of the object and uses of differential staining techniques. 1.20 to 1.23 Paired practical activities: Microscopy carousel of activities to include setting up a microscope, calculations of magnification and undertaking staining techniques.	Student files/pens/paper Appropriate resources for carousel of practical microscopy activities	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input/demonstration and practical activities**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
	1.22 How to calculate magnification from the size of the image and the size of the object. **1.23** The uses of differential staining techniques.			
15-19	**1.24** The nature of infection. **1.25** Causative agents of infection and examples of resulting diseases. **1.26** The different ways in which causative agents may enter the body (for example transmission routes).	1.24 to 1.30 Tutor input: Infection, causative agents, how infectious disease can spread, antigens and antibodies, stages and cells involved in body's response to an antigen. 1.24 to 1.30 Think, pair, repair activity: In each session, pose an open-ended question in relation to infection, causative agents, antigens, stages and cells involved in body's response to an antigen. • Ask individual students to come up with their best answer. • Pair students up and get them to agree on a response. • Get two pairs together, so that the four students come up with an agreed response.	Student files/pens/paper Computer/internet Access Tutor input Digital resources to produce posters	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
	1.27 How infectious diseases can spread amongst populations and communities. **1.28** The definition of an antigen and an antibody. **1.29** The link between antigens and the initiation of the body's response to invasion by a foreign substance. **1.30** The stages and cells involved in the body's response to an antigen.	• Continue getting students together until class is in two equal halves. • Each 'half' to share their agreed response.		

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
20	**1.31** The differences between cell-mediated immunity and antibody-mediated immunity. **1.32** The role of T and B memory cells in the secondary immune response.	1.31 and 1.32 Paired activity: Pairs to research the differences between cell-mediated immunity and antibody-mediated immunity including the role of T and B memory cells in the secondary immune response. Students to produce a visual poster summary of their research. All posters to be displayed and viewed by rest of the class. Students to write up notes from each session in their own files.	Student files/pens/paper Computer/internet Access Tutor input Digital resources to produce posters	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**
21-22	**1.33** The relationship between the atomic structure and physical and chemical properties of metals.	1.33 to 1.35 Tutor input: Relationship between the atomic structure and physical and chemical properties of metals, how the arrangement of electrons is linked to the way in which elements are situated within groups in the periodic table and correct names for sub-atomic particles and their position in an atom - protons, electrons and neutrons.	Student files/pens/paper Computer/internet Access Tutor input	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
	1.34 How the arrangement of electrons is linked to the way in which elements are situated within groups in the periodic table. **1.35** The correct names for sub-atomic particles and their position in an atom - protons, electrons and neutrons.	1.33 to 1.35 Think, pair, repair activity: In each session, pose an open-ended question in relation to materials and chemical properties. • Ask individual students to come up with their best answer. • Pair students up and get them to agree on a response. • Get two pairs together, so that the four students come up with an agreed response. • Continue getting students together until class is in two equal halves. • Each 'half' to share their agreed response.		
23-24	**1.36** The physical properties of acids. **1.37** The concept of strong and weak acids (as distinct from dilute and concentrated solutions).	1.36 to 1.38 Tutor input: Physical properties of acids, concept of strong and weak acids and how to determine the name of the salt produced in the following acid-base reactions. 1.36 to 1.38 Think, pair, repair activity: In each session, pose an open-ended question in relation to materials and chemical properties.	Student files/pens/paper Computer/internet Access Tutor input Task sheet on naming salts	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
	1.38 How to determine the name of the salt produced in the following acid-base reactions.	• Ask individual students to come up with their best answer. • Pair students up and get them to agree on a response. • Get two pairs together, so that the four students come up with an agreed response. • Continue getting students together until class is in two equal halves. • Each 'half' to share their agreed response. 1.38 Individual activity: Students complete activity sheet of questions on determining the name of the salts produced following acid-base reactions (for example, HCl + NaOH → NaCl + H20). Students to write up notes from each session in their own files.		**Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
25-26	**1.39** The principles of collision theory. **1.40** The effect of temperature on rates of reaction. **1.41** The definition of a catalyst and the role of catalysts in a reaction.	1.39 to 1.41 Video of practical's/on-line animation: Students watch and make notes on the principles of collision theory, effect of temperature on rates of reaction and the role of catalysts in a reaction. 1.39 to 1.41: Individual activity: Students are asked to come up with a definition of a catalyst based on the video/animation they have watched. Agree a class definition (see qualification specification). 1.40 Paired practical activity: Students complete a practical to investigate the effect of temperature on rate of reaction and better understand the principles of collision theory (for example: between sodium thiosulfate and hydrochloric acid). Students to write up notes from each session in their own files.	Student files/pens/paper Video/on-line animation of practical's Resources to complete practical activity	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
27-28	**1.42** The principles of a range of tests and techniques that are used to separate, detect and therefore identify chemical composition. **1.43** The tests that could be used to quantify components in a mixture. **1.44** The principle of titration.	1.42 and 1.43 Video of practical's: Students watch and make notes on the following practical activities: thin layer chromatography, column chromatography, gas chromatography, high performance liquid chromatography and mass spectrometry. 1.44 Tutor input/demonstration: The principles of titration. 1.44 Paired practical activity: Students complete a titration practical to determine the volume of acids and alkalis required for neutralisation to occur. Students to write up notes from each session in their own files.	Student files/pens/paper Video(s) of practical's Tutor input Resources to complete practical titration activity	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during videos and during practical activity**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
29-31	**1.45** The definitions of, and how to calculate, charge and current using Q=IT. **1.46** The definitions of, and how to calculate, current, potential difference and resistance, using Ohm's law V=IR. **1.47** How to calculate total resistance of multiple fixed resistors in a series and parallel circuit. **1.48** The difference between alternating and direct current.	1.45 to 1.49 Tutor input: Electricity to include all requirements of sections 1.45 to 1.49. 1.45 to 1.49 Think, pair, repair activity: In each session, pose an open-ended question in relation to topics on electricity. • Ask individual students to come up with their best answer. • Pair students up and get them to agree on a response. • Get two pairs together, so that the four students come up with an agreed response. • Continue getting students together until class is in two equal halves. • Each 'half' to share their agreed response. Students to write up notes from each session in their own files.	Student files/pens/paper Tutor input	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
	1.49 The properties of mains electricity in the United Kingdom.			
32	**1.50** Magnetism and magnetic poles. **1.51** Magnetic fields. **1.52** The uses of electromagnetism and electromagnets.	1.50 and 1.51 Tutor input: Magnetism and magnetic poles and Magnetic fields. Students listen and make notes. 1.52 Group activity: Students to research the uses of electromagnetism and electromagnets including: • Portative and tractive electromagnets. • Principles of electromagnetic induction - the production of voltage. • Principles of the motor effect - causing movement in a motor. • Applications of electromagnets in electric and electromechanical devices (for example, transformers, induction heating, MRI machines). Each group to present a summary of their research to rest of class. Students to write up notes from each session in their own files.	Student files/pens/paper Tutor input Computer/internet Access	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
33-34	**1.53** The definition of a wave. **1.54** The relationship between frequency, wavelength and speed using the wave equation v=fλ. **1.55** The properties of longitudinal and transverse waves. **1.56** The uses of different types of waves.	1.53 to 1.56 Tutor input: The topic of waves to include requirements of 1.53 to 1.56. 1.53 to 1.56 Think, pair, repair activity: In each session, pose an open-ended question in relation to topics on waves. • Ask individual students to come up with their best answer. • Pair students up and get them to agree on a response. • Get two pairs together, so that the four students come up with an agreed response. • Continue getting students together until class is in two equal halves. • Each 'half' to share their agreed response. Students to write up notes from each session in their own files.	Student files/pens/paper Tutor input	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
35-37	**1.57** The types and properties of radioactive radiation. **1.58** The definitions of half-life and count-rate. **1.59** The main types of radioactive decay in relation to unstable nuclei. **1.60** How radiation interacts with matter. **1.61** The applications of radioactivity within the health and science sector.	1.57 to 1.61 Tutor input: Radioactivity to include requirements of 1.57 to 1.61. 1.57 to 1.61 Think, pair, repair activity: In each session, pose an open-ended question in relation to topics on radioactivity. • Ask individual students to come up with their best answer. • Pair students up and get them to agree on a response. • Get two pairs together, so that the four students come up with an agreed response. • Continue getting students together until class is in two equal halves. • Each 'half' to share their agreed response. Students to write up notes from each session in their own files.	Student files/pens/paper Tutor input	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input**

Session	Learning outcome(s) Intent	Learning activities Implementation	Resources	Assessment Impact
38-39	**1.62** The use of the international system of units (SI). **1.63** How to convert between units. **1.64** The importance of using significant figures and science notation.	1.62 to 1.64 Tutor input: The topic of units: the use of international system of units, how to convert between units and importance of using significant figures. 1.62 to 1.64 Paired activity: Student complete activity sheets which requires them to convert between units and record figures using the correct significance and units. Students to write up notes from each session in their own files.	Student files/pens/paper Tutor input Activity sheet on using significant figures, units and science notation	**Interactive quiz** **Student summary of learning** **Reflection forms** **Tutor to check students notes for accuracy** **Q & A during tutor input** **Activity sheets**
40	Element B1: Core science concepts Summative Assessment: Core Science Concepts Test	Multiple choice and short answer questions.	Test paper.	**Summative Assessment: Core science concepts test**

Tutors may find this chart useful to record coverage of the general competencies relevant to the core teaching.	
General Competency	**Link to session**

Document information

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Change history record

This section summarises the changes to this document since the last version.

Version	Description of change	Date of issue
1.0	Final version – Rebrand Update	October 2021
2.0	STEM Learning	May 2022