Year 10 Combined Science – Atoms and the periodic table – Unit Plan 2021-22

Unit: Elements, compounds and the periodic table	
Term delivered: Autumn 02	**Length of unit: 6 weeks**

Content:

- Elements, mixtures and compounds
- The structure of the atom
- The formation of ions
- Recap of the three types of bonding and properties

Assessment objectives:

- Recognise particle diagrams and be able to name elements, compounds and common mixtures
- Explain how and why ions form
- Know the structure and properties of differently bonded compounds

Reading across the curriculum: BBC news – how can graphene transform the future https://www.bbc.co.uk/news/av/science-environment-19918703

Key definitions/common misconceptions

- A compound is a substance made up of more than one type of atom chemically joined together
- A formulation is a mixture designed as a useful product
- **See in unit plan specific phrases that must be used when describing bonding**

Command words (opportunity to practice command words highlighted in red):

- Calculate – use numbers in the question to work out the answer
- Describe – recall some facts, events and processes in an accurate way
- Explain – make something clear or give the reasons for it happening

Practical skills:

- Group 1 elements demo – risk assessments and patterns shown in results

Mathematical skills:

- Interpret data from graphs and tables

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- Calculate Rf values from chromatograms
- Use percentages
- Represent models in 2D and 3D

LO	Lesson Title Key Terminology	Previous Knowledge Retrieval	Knowledge/ Outcomes	Teaching Strategies and Resources (suggested)	Practical skills	Maths Skills	Independent /remote learning
1	**Particle model recap** **5.1.1.1** Particle Element Compound	Particle diagrams Properties of solids, liquids and gases	• Draw particle diagrams for solids, liquids and gases • Know different materials have different sized particles • Compare the particle diagrams for elements, compounds and mixtures • Identify from formula and name if a substance is an element or compound	Recap from year 7 and 8 Carefully draw particle diagrams to ensure they fill half the space and all particles are the same size White board quiz to identify different substances			FSL Nuclear model https://www.youtube.com/watch?v=Yf-WhHZuqes&list=PL9IouNCPbCxULWXCO9jt0PsuAbxYpw2_1&index=8
2	**Structure of the atom** **5.1.1.4** Nucleus Shells Isotope	Using the periodic table Identifying atoms	• Know the mass, charge and location of subatomic particles • Describe the atom as a positively charged nucleus surrounded by negatively charged electrons • Explain that the mass of the atom is in the nucleus • Represent the radius of an atom in standard form ($1x10^{-10}$ m) and the radius of the nucleus is $1x10^{-14}$	This should be revision from year 9 Video clip: BBC Bitesize –Structure of an atom Video clip: BBC Bitesize –Atomic structure Video clip: BBC Bitesize –How mass and atomic numbers explain atomic structure		Use standard form	Electron shells https://www.youtube.com/watch?v=xK4Nnwp9I8M&list=PL9IouNCPbCxULWXCO9jt0PsuAbxYpw2_1&index=11

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			• Calculate the number of protons, neutrons and electrons in an atom • Draw electron shell diagrams for the first 20 elements • Know isotopes are elements with the same number of protons but different numbers of neutrons				
3	**RFM 4.1.1.6** Isotope Abundance Atom	Counting the number of atoms	• Define what is meant by an isotope • Use the relative abundance of isotopes to calculate atomic mass (HT) • Calculate relative formula masses from atomic masses	YouTube: Relative Atomic Mass		Calculate relative abundance	
4	**Conservation of mass 4.3.1.1** Conservation Mass	Isotopes	• Know what is meant by conservation of mass • Explain what is meant by a closed system • Give examples of practicals that demonstrate conservation of mass • Explain why mass can be lost but conservation of mass conserved e.g. product is a gas	Demos for conservation of mass – lead nitrate and potassium iodide – closed system no mass change Marble chips and HCl – non enclosed system, mass lost as gas Heat Mg in a crucible – mass gain as oxygen is added	Practical demos showing conservation of mass		Conservation of mass https://www.youtube.com/watch?v=hVVpSx7hA1Q
5	**Development of the model atom 5.1.3.3** Dalton Rutherford Johnson Bohr	Particles of an atom	• Describe the discoveries made by Dalton, Thompson, Rutherford, Bohr and Chadwick • Describe Geiger and Marsden's alpha scattering experiment and the implications of this (HT) • Compare the nuclear model with the plum pudding model • Explain why scientific theories change over time	Nobel Prizes and Laureates Atomic Structure Timeline Model the plum-pudding model, nuclear model and atomic model. Create a timeline for the history of the atomic model. **Comparison question – plum pudding model and nuclear model**		Represent models in 2D and D form	https://classroom.thenational.academy/lessons/development-of-the-atomic-model-6crp2t

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6	**Structure of the periodic table 5.1.2.1** Metals Non-metals Mendeleev	Groups and periods	• Identify elements as halogens, alkali metals, noble gases and transition metals • Know where on the periodic table metals and non-metals are found • Link the period and group number to the number of shells and outer electrons • Explain the electron arrangement of transition metals position the elements in the transition metal block	Video clip: BBC Bitesize – Groups and periods in the periodic table YouTube: How the elements are laid out in the periodic table YouTube: Mendeleev and the Periodic Table			https://classroom.thenational.academy/lessons/electron-configuration-and-the-periodic-table-61jp4c
7	**Developing the periodic table 5.1.2.2** Mendeleev Prediction Development	Properties of metals and non-metals	• Describe the steps in the development of the periodic table • Explain why Mendeleev left gaps in the table • Explain how testing a prediction can support or refute a scientific idea • Explain how and why the ordering of the elements has changed over time	Create a timeline for the history of the periodic table. Royal Society of Chemistry – Periodic Table (interactive) University of Nottingham – The Periodic Table of Videos			Developing periodic table https://www.youtube.com/watch?v=x3azcCq08IA&list=PL9IouNCPbCxULWXCO9jt0PsuAbxYpw2_1&index=12
8	**Assessment**						
9	**Metals and non-metals 5.1.2.3** Physical Chemical Properties	Acids and alkalis pH scale	• Recall physical properties of metals and non-metals • Locate metals and non-metals on the periodic table • Know non-metal oxides are acidic and metal oxides are basic • Explain a test to show the pH of metal and non-metal oxides		Test metal and non-metal oxides dissolved in water for pH		https://classroom.thenational.academy/lessons/transition-elements-c4u3cr

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		indicators	• Describe some chemical properties of metals and non-metals • Name compounds formed when metals and non-metals react • Link properties of metals and non-metals to their uses				
10	**Ions** **5.1.2.3** Positive Negative Ions	Electron shell diagrams Structure of the periodic table	• Know that metals form positive ions and non-metals form negative ions • Explain how atomic structure links to position of element in the table • Draw the electron structure for ions • Explain why ions form • Predict the symbol for an ion based on its position in the periodic table	Draw the formation of ions to include square brackets and charges Link ions to position in periodic table			https://classroom.thenational.academy/lessons/ionic-bonding-introduction-70wk4c
11	**Group 1 elements** **5.1.2.5** Alkali Reactivity Properties	Chemical and physical reactions Size of atoms Electron shell diagrams	• Know group 1 elements are called alkali metals because when they react with water they form an alkaline solution • Know all group 1 elements have 1 electron in their outer shell • Describe the reaction of Na, Li and K with O_2, Cl_2 and H_2O • Explain why the reactivity of the alkali metals increases as you go down the group in terms of its ability to form ions • Write word and balanced symbol equations for the reactions between alkali metals and water, chlorine and oxygen • Link properties and reactivity of metals to their number of shells and outer electrons (HT)	Students should be able to describe what they would literally see when alkali metals react with O_2, Cl_2 and H_2O. e.g. colour change, bright light etc. **Extended writing** Describe the trends in properties in Group 1. Explain how properties of the elements in Group 1 depend on the outer shell of electrons of the atoms. Write symbol equations for the reaction of group 1 elements with water and oxygen	Demo of group 1 metals in water Make observation		FSL links Group 1 https://www.youtube.com/watch?v=aORsI-2dwnY&list=PL9IouNCPbCxULWXCO9jt0PsuAbxYpw2_1&index=15 https://www.youtube.com/watch?v=QAUwi0LQgZ

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		Word and symbol equations		YouTube: Group 1 as an example of Groups in the periodic table YouTube: Alkali metals in water, accurate!			Y&list=PL9IouNCPbCxULWXCO9jt0PsuAbxYpw2_1&index=16
12	**Group 7 Elements 5.1.2.6** Halogen Displacement Reactivity	Displacement reactions (year 8) Reactivity series	• Know group 7 elements are known as halogens and all have 7 electrons in their outer shell • Describe the reactions of Cl_2, Br_2 and I_2 with metals and non-metals • Explain how bp and reactivity changes linked to the number of electron shells • Construct balanced symbol equations for the reactions of metals and halogens • Explain how group 7 elements form ions with a -1 charge	Make predictions on how reactive group 7 metals are Video clip: BBC Bitesize –Reactivity of group 1 and 7 elements YouTube: Halogens	Demonstrate the reactions of chlorine, bromine and iodine with iron wool. Carry out displacement reactions using KCl, KBr, KI with waters of the corresponding halogens.	Interpret data from tables	Group 7 https://www.youtube.com/watch?v=kNPthLiM8T4&list=PL9IouNCPbCxULWXCO9jt0PsuAbxYpw2_1&index=17 https://www.youtube.com/watch?v=fyA7qtPq7QY&list=PL9IouNCPbCxULWXCO9jt0PsuAbxYpw2_1&index=18
13	**Group 0 metals + summary 4.1.2.4** Noble gases Unreactive	Melting and boiling	• Know elements in group 0/8 have a full outer shell of electrons • Explain that a full outer shell of electrons makes the atoms unreactive and thus exist as single atoms	YouTube: Noble gases - the gases in group 18		Interpret data from tables and from graphs	Group 0 https://www.youtube.com/watch?v=VhiieTJWYHs&list=PL9Iou

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	Trends	changes in state	• Describe the increase in boiling point with RAM • Compare the trends in physical and chemical properties of group 1 and group 7 elements • Describe data in graphs and tables on the properties of group 1, 7 and 0 elements • Make predictions on boiling points or atomic size when given data in tables or on graphs	Compare the properties and reactivity of different groups in the periodic table			NCPbCxULWXCO9jt0PsuAbxYpw2_1&index=13
14	**Ionic bonding 5.2.1.2** Ions Dot and cross diagram Electrostatic attractions	Chemical and physical properties Formation of ions	• Draw dot and cross diagrams to represent ionic bonding • Predict the formula of compounds based on dot and cross diagrams • Explain that an ionic bond is an electrostatic force of attraction between positive and negative ions • Be able to explain the formation of ionic bonds in words – describing the movement of electrons and formation of ions • Recognise diagrams of solids of ionic bonding • Explain the limitations of dot and cross, ball and stick diagrams	**Key definition: an ionic bond is an electrostatic force of attraction between positive and negative ions** Video clips: BBC Bitesize Ionic compounds and the periodic table YouTube: What are ions?	Use magnesium ribbon to produce magnesium oxide. Draw the dot and cross diagram for this reaction.	Represent 2D and 3D forms of objects	Ionic bonding https://www.youtube.com/watch?v=Biq-e9hsbiI&list=PL9IouNCPbCxXmFgiKCM60Sglh-qOG_vlE&index=2
15	**Properties of ionic compounds 4.2.2.3** Melting point Boiling point Molten	Electron shell diagrams	• Describe and explain the properties of giant ionic compounds e.g. high p and bp linked to energy required to break bonds • Explain when ionic compounds conduct electricity • Apply knowledge to exam style questions	• Ionic compounds have high melting points due to the **strong electrostatic forces that require lots of energy to break** • Ionic compounds conduct electricity when molten or dissolved because they have **free IONS to carry the current**		2D and 3D forms of objects	Properties of ionic compounds https://www.youtube.com/watch?v=leVxy7cjZMU&list=PL9IouNCPbCxXmFgiKCM60Sglh-

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16	**Writing formula (HT)** Formula Charge Compound	State symbols	• Identify the charges on ions • Use the charge of ions to construct symbol formula • Predict the charge on an ion based on the formula of a compound • Write symbol equations based on word equations provided				
17	**Assessment**	Properties of metals Conductors and insulators Hydrocarbons as covalent molecules (covered in yr 9)					
18	**Metallic bonding 5.2.1.5** Delocalised electrons Metal ions		• Describe that metals form giant structures • Draw and recognise diagrams of metallic bonding • Explain how metal ions are held together • Explain that electrons are delocalised and thus can carry charge throughout the structure • Explain that in metals the atoms are arranged in layers but in alloys the layers are distorted • Compare the strength of metals and alloys	Draw a diagram of metallic bonding • Metallic compounds conduct electricity because they have **delocalised electrons to carry the current**		Use data from tables to link the properties of metals to their uses	Metals https://www.youtube.com/watch?v=A-wTpLPICd0&list=PL9IouNCPbCxXmFgiKCM60Sglh-qOG_vIE&index=13
19	**Covalent bonding 5.2.1.4** Covalent Shared Electrons		• Recognise substances made of small molecules from their formula including • Draw dot and cross diagrams for covalent molecules including – H_2, O_2, N_2, CH_4, H_2O, NH_3, HCl • Deduce molecular formula from models and diagrams • Compare the ball and stick model with structural models	**Know that a covalent bond is a shared pair of electrons** Model simple covalent substance using molecular model kits. Demo giant covalent structures using molecular model kits.			Covalent bonding https://www.youtube.com/watch?v=lenvZEcMc60&list=PL9IouNCPbCxXmFgiKCM60Sglh-qOG_vIE&index=5

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		Alkanes and alkenes		Video clip: BBC Bitesize Covalent bonding and the periodic table			
20	**Properties small covalent molecules 5.2.2.4** Intermolecular forces Covalent bond	Test for unsaturation State symbols Test for CO_2 and H_2O	• Know that covalent bonds are strong but intermolecular forces are weak • Know that the strength of intermolecular forces increases with the size of the molecules • Explain why small covalent molecules have low boiling points • Explain why pure water does not conduct electricity • Describe and explain the trends in melting and boiling points for covalent compounds	• Small covalent compounds have low melting points due to the **weak intermolecular forces that require little energy to over come** • Covalent compounds do not conduct electricity **because they have no free ions OR electrons to carry the current** Video clip YouTube: Properties of covalent compounds		Describe the patterns and trends in boiling and melting points of molecules,	Properties of small molecules https://www.youtube.com/watch?v=DECGNyC-x_s&list=PL9IouNCPbCxXmFgiKCM60Sglh-qOG_vlE&index=8
21	**Diamond & Graphite 5.2.3.1** Diamond Graphite Graphene	Comparing the three types of bonding	• Recognise giant covalent structures from bonding and structural diagrams • Know in diamond that each carbon atom forms four strong covalent bonds • Explain why diamond is hard, has a high melting point and does not conduct electricity	• **Giant covalent structures have very high melting points as they are held together by strong covalent bonds that need a lot of energy to break them** •		Visualise and represent 2D and 3D shapes	Graphite https://www.youtube.com/watch?v=dEZItwgZeFU&list=PL9IouNCPbCxXmFgiKCM60Sglh-

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		Properties of the periodic table	• Know in graphite each carbon atom forms three covalent bonds with other carbon atoms forming layers of hexagonal rings • Know one electron from each carbon atom is delocalised • Explain the properties of graphite in terms of its structure and bonding • Describe the structure of graphene and why it is useful in electronics	• **explain the properties and structure of diamond, silicon dioxide and graphite** BBC Bitesize Properties and structure of graphite			qOG_vlE&index=10
22	**Graphene and fullerenes 5.2.3.3** Graphene Fullerene Nanotechnology	Identifying elements and commpounds	• Know graphene is a single layer of graphite • Explain the properties of graphene in terms of structure and bonding • Explain why graphene is useful in electronics • Know fullerenes are molecules of carbon atoms with hollow shapes – hexagonal rings of carbon atoms • Know the first fullerene discovered was Buckminster fullerene with the formula C_{60} • Describe carbon nanotubules as cylindrical fullerenes • Link the structure of nanotubes to their uses in nanotechnology and electronics	Video clips: BBC Bitesize Discovery and uses of graphene YouTube: Bucky Balls, Graphene and Nano Tubes			Graphene and fullerenes https://www.youtube.com/watch?v=6jCJXhusI2M&list=PL9IouNCPbCxXmFgiKCM60Sglh-qOG_vlE&index=11 Nanoparticles https://www.youtube.com/watch?v=-6eTx9YhJPI&list=PL9IouNCPbCxXmFgiKCM60Sglh-qOG_vlE&index=14
23	**Assessment**						

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