| **Lesson/Week** | **1** | **2** | | **3** | **4** |
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| 1 | **Subtopic 1.1**  Types of materials. Physical properties.  Nanomaterials.  **SHE:** Discuss the risks and benefits of using materials composed of nanoparticles. | Physical properties – uses of materials  View YouTube aerogel | | **?Class practical design**:  Learn how to deconstruct a problem and design an investigation.  Which of paper, plastic, glass, aluminium retains heat more effectively when used as a coffee cup. | Perform practical, analyse results, evaluate procedure (in class)  **Homework:** Write report to be assessed. (formative). |
| 2 | **Class SHE investigation:**  Other factors that influence choice of material for coffee cups. | Physical properties – separation of components of mixtures.  **? Practical**: Separation of mixture  - compare two brands of red food colouring using chromatography  or  - distil sea water | | **Subtopic 1.2**  Revise atomic structure 8-10  ViewYouTube: How the proton, electron and neutron were discovered.  Atomic number, mass number & exercises | Isotopes & representation.  **?** Use mass spectra to determine isotopic composition of element. |
| 3 | Relative atomic mass.  Exercises:Calculations of RAM | **? Practical:** Flame tests  Comparison of flame colours with emission spectra.  Energy shells, subshells & orbitals. | | Write electron configuration of first 38 elements using subshell notation.  Exercises/interactive PT – writing configurations. | **Subtopic 1.3**  Concept of the mole.  View YouTube ‘’A mole is a unit’’  Calculations/visualisations to demonstrate size of the Avogadro number.  Compare weighed samples of 1 mole of atoms. |
| 4 | Undertake calculations using  and rearrangements.  Discuss significant figures | ***Summative* Investigation 1**  **Practical Design**  Effect of increasing temperature on the cleaning ability of a Solid Oxygen Bleach.  **Part A:** Deconstruct problem and design investigation. | | **Subtopic 1.4**  **?**Arrange element cards in patterns according to properties of elements and some compounds.  **?**Plot graphs of:  - valence electrons vs atomic number  - ionisation energy vs atomic number  - atomic radius vs atomic number  - melting point vs atomic number |  |
| 5 | Structure of the PT:  - atomic number, no. valence electrons, no. energy shells occupied  - s, p, d, f blocks  - metals, non-metals  ViewYouTube PT  **SHE:** Discuss the importance of international agreement on chemical symbols. | Exercises: position of element from configuration and vice versa.  **?Demonstration** or YouTube:  - Li, Na, K, Mg, Ca, Ba in water  - Appearance of halogens  - Solubility of Gp 2 sulfates in water | | Trends in atomic radii, valencies and electronegativities across periods and down groups.  Exercise:Predict properties of unknown elements from position in PT. | ***Summative* Investigation 1**  **Practical Design**  Oxygen Bleach.  **Part B:** Carry out procedure and record results | |
| 6 | **Subtopic 2.1**  Information about lattice type and bonding between atoms can be deduced from physical properties of materials.  Exothermic/endothermic changes of state.  **? Practical**: Test physical properties of a range of materials and classify into four types. | Discuss results and note combinations of elements in each classification.  Exercises: Use data/position of elements on PT to classify materials. | | **Subtopic 2.2**  Bonding introduction:   * Energy is released when bonds are formed. Energy is needed to break bonds. * Primary bonding: metallic, ionic, covalent.   Type of bonding can be predicted from position of elements in PT. | Bonding between metallic atoms.  **?** Model metallic lattice.  Explain physical properties in terms of model for metallic bonding.  ***Summative* Investigation 2**  Introduce **SHE** Investigation**:** Mining of a Metal | |
| 7 | Bonding between atoms of metal and non-metal – transfer of electrons to form ions.  Predict charges on ions from position in PT/electron configuration.  Exercise: Write electronic configuration of monatomic ions of elements 1-38.  **?** Play ion bingo. | **(Subtopic 6.2)**  Concepts of oxidation and reduction in terms of electron transfer.  Write half-equations/overall equation for reactions of metallic and non-metallic atoms.  Oxidisers and reducers. | | Write formulae for ionic compounds –  empirical formulae.  Explain physical properties in terms of model for ionic bonding.  **Subtopic 2.3**  Moles of ions. Undertake calculations using and rearrangements. | **? Practical:**  Empirical formula of magnesium oxide  OR  Percentage Cu in CuSO4  Discuss results.  Evaluate procedure. | |
| 8 | Formative test for homework. | **(Subtopic 4.3)**  Simple mass-mass stoichiometry for reactions between metallic and non-metallic elements.  Exercises. | | Bonding between non-metallic atoms – sharing electrons to form covalent bonds.  Electron-dot diagrams.  Covalence  Non-polar and polar covalent bonds. | Multiple bonds.  Exercises: Covalent bonds between a variety of non-metallic atoms.  YouTube: Fullerenes | |
| 9 | Covalent bonding in molecular and continuous substances.  Molecular and empirical formulae.  Moles of molecules.  Undertake calculations using  and rearrangements. | | Physical properties of continuous covalent substances in terms of model.  **Demonstration**: Physical properties of graphite. | **Subtopic 3.1**  Shapes of molecules – VSEPR  Use balloons to determine shapes of CH4, NH3, H2O, HF, CO2, COCl2.  Use lollies and toothpicks to model molecular shapes. | Exercises: Predicting shapes of molecules.  **? Demonstration:** Water from burette deflected by charged rod. | |
| 10 | ***Summative* SAT 1: Classification of substances into structure types**  Investigation including the identification of unknown substances from their physical properties. | | Introduce molecular polarity.  Exercises: Predicting polar and non-polar molecules. | **Subtopic 3.2**  Explain properties of molecular compounds in terms of strong bonds within molecules and weak interactions between molecules.  Introduce secondary interactions. | Dispersion forces.  **?** Compare boiling points of:   * noble gases down group * halogens down group * alkanes with increasing no. C atoms. | |
| 11 | Dipole-dipole interactions.  Compare melting/boiling points of substances in terms of secondary interactions.  **?** Plot graph(s) of boiling points of hydrides down Groups 4, 5, 6, 7. | | Hydrogen bonding between molecules of HF, H2O, NH3.   * Draw diagrams of hydrogen bonding between above molecules. * Explain boiling points of above molecules in terms of hydrogen bonding.   **? Demonstration:** Drop a ball into cylinders of 1-propanol, 1,2-propanediol and 1,2,3-propanetriol to investigate the effect of increasing the number of O-H bonds in a molecule on the strength of hydrogen bonding between the molecules. | **Subtopic 4.3**  Water is a common solvent – most school chemistry involves reactions between aqueous solutions of substances.  Calculate concentrations of solutions in g L-1, % (w/v)  **?** Look at a variety of product labels and do calculations based on concentrations specified. | Revision of topics | |
| 12 | **Subtopic 3.3**  Hydrocarbons   * importance (combustion, feedstock) * write equations for combustion of hydrocarbons | | Hydrocarbons   * physical properties (revise secondary interactions)   ViewYouTube: fractional distillation | **?** Plot boiling points of alkanes vs no. C atoms.  **? Practical:**  Compare sootiness of flame of small and long-chain hydrocarbons (Bunsen flame and candle) | **? Practical:**  Compare physical properties of petrol, kerosene, car oil:   * miscibility in water and ethanol * volatility * viscosity | |
| 13 | Families of hydrocarbons: alkanes, alkenes (alkynes)  Alkenes undergo addition reactions.  **? Demonstration:** Compare behaviour of cyclohexane and cyclohexene with bromine water or iodine solution. | | **SHE:** Prepare answers to questions, in groups, about the advantages and disadvantages of using hydrocarbons in modern society. | Representation of hydrocarbons.  **?** Use model kits to model hydrocarbons.  Systematic nomenclature of hydrocarbons. | Discuss empirical, molecular and structural formulae with respect to organic compounds. | |
| 14 | **?** Use model kits to model structural isotopes of hydrocarbons.  Writing extended, condensed and skeletal representations of hydrocarbons.  Importance of systematic nomenclature. | | ***Summative* SAT 2: Test topics 1, 2 and 3** | Exercises: Drawing structural formulae from systematic names and deducing systematic names from structural formulae.  Use a variety of representations (extended, condensed, skeletal). | Functional groups affect physical properties and give characteristic chemical properties to organic compounds.  Introduce hydroxyl, amino, carboxyl groups.  Compare boiling points of an alkane, alcohol and carboxylic acid of similar molar masses. | |
| 15 | ? **Practical:**  Prepare a range of esters and compare their odours with the parent carboxylic acids. | | Organic polymers  **? Practical:**  Make a polymer (e.g. slime if they haven’t already) | **SHE:** Explore how the development of new polymer materials has impacted on peoples’ lives.  Monomers, repeating units  **?** (Homework assignment) Collect information about common plastics, including monomers, properties, uses and recycling possibilities. | Identify repeating unit in a range of different polymers.  Discuss polarity of any functional groups and the effect they might have on properties. | |
| 16 | Polymers formed from addition reactions.  Draw structural formulae of addition polymers formed from given alkene monomers, and vice versa. | | Properties of organic polymers depend on interactions between chains:   * revise primary and secondary interactions * thermoplastic/thermosetting polymers   **?** Model polymers using paper clips – compare tangling of chains of different lengths, ability of chains with and without cross-links to slip over each other. | Uses of organic polymers related to properties.  Discuss homework assignment from Week 15.  Additives. | Modern polymers.  Sources of raw materials.  Biodegradable/non-biodegradable polymers.  View Film/YouTube | |