|  **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 8-10ViewYouTube: 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-metalsViewYouTube 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 CuSO4Discuss 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.CovalenceNon-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 – VSEPRUse 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.
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| 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
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| 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 |