| **lesson/week** | **1** | **2** | **3** | **4** |
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| 1 | **Solutions**  **Subtopic 4.1**  View YouTube: How to make a homemade lava lamp.  Polar and non-polar solvents   * revise molecular polarity * identify examples of polar & non-polar solvents   **?** surfing scientist: making lava lamp | Solubility of polar and non-polar substances in water.  **?** Compare the solubilities of methane, HCl and ammonia in water. | Solubility of polar substances in water depends on the size of the molecules.  **?** Compare solubilities of first six alcohols in water and cyclohexane. | Compounds with non-polar and polar or ionic components facilitate the mixing of polar and non-polar substances.  **? Practical:**  Use detergent/soap to mix oil and water.  or  Make mayonnaise. |
| 2 | **Subtopic 4.2**  **SHE:** Explore the effects of dissolved solids on water quality and how they can be minimised in industry.  Dissociation of soluble ionic compounds in water;   * ion-dipole interactions * write equations for dissociation. | Ionic compounds that are insoluble in water:   * solubility table * preparing insoluble compounds by precipitation * write ionic equations for precipitation reactions. | **? Practical:**  Prepare ionic compounds by precipitation:   * note characteristic colours of precipitates of particular ions * write ionic equations for precipitation reactions..   Formation of a scum when soap is used in hard water. | **? Practical** (problem solving):  Identify ions present in unlabelled solutions using precipitation reactions. |
| 3 | **Subtopic 4.3**  Concentration of solutions:   * concentration in mol L-1 * use of C = n/V and rearrangements * conversion between concentration in mol L-1 and g  L-1. | Volumetric glassware – volumetric flask.  **? Practical:**  Prepare a standard solution of 0.05 M (approx.) sodium carbonate solution and keep for later use. | Stoichiometry (mass-volume) for precipitation reactions. | **Subtopic 4.4**  Reactions (e.g. dissociation,) may be exothermic or endothermic.  Energy changes involved in the dissociation and subsequent hydration of ions.  Undertake calculations involving:  *q = mCΔT.* |
| 4 | Energy change in a reaction depends on the amount of substance that reacts.  **? Practical:**  Measure q for dissociation of different masses of the same ionic compound (e.g. ammonium chloride). | Determine energy change per mole of solute, q/n.  Evaluate procedure. | Use of +/- to indicate endothermic/exothermic reactions.  Write thermochemical equations for dissociation of ionic compounds in water. | ***Summative* SAT**:  Determine enthalpy of solution of NaCl and answer questions on ionic solutions and concentration. |
| 5 | **Acids and Bases**  **Subtopic 5.1**  **SHE:** Explore examples of how advertising can influence the use of scientific knowledge and have unintended consequences, e.g. drinking vinegar, acid facial peels.  Acid/base in terms of loss/gain of H+.  Write half-equations for acids donating H+ and bases accepting H+.  Identify proton transfer in acid-base reaction. | Acid-base indicators.  **? Practical:**  Prepare colour table for range of indicators with acids and bases. | Monoprotic and polyprotic acids.  **? Practical:**  Add 0.1 M HCl and 0.1 H2SO4 dropwise to 20 drops of 0.1 M NaOH containing universal indicator:   * note colour changes during addition   compare number of drops needed to neutralise NaOH. | **Subtopic 5.2**  Oxides of metals are basic.  Write equations for reactions with water of specified oxides.  Oxides of non-metals are acidic.  Write equations for reactions with water of specified oxides of non-metals. |
| 6 | Structural formulae of specified oxides and oxyacids.  Expansion of octet. | Acids ionise in water – write equations.  **? Demonstration:**  Test conductivity of:   * pure water and then conductivity of a aqueous solution of HCl * pure ethanoic acid and then a solution of ethanoic acid * compare conductivity of solutions of ethanoic, hydrochloric and sulfuric acids.   Strong acids ionise completely in water. Weak acids ionise partially in water. | **? Practical:**  Reactions of HCl and H2SO4 with a variety of metal oxides, hydroxides and carbonates:   * note observations (colour, fizzing, temperature changes) * test gases * name products * write full equations for the reactions.   Neutralisation reactions are exothermic. | Write ionic equations for reactions in above practical + more exercises in writing ionic equations for acid-base reactions. |
| 7 | Stoichiometric calculations for reactions between acids and bases – mass-volume and volume-volume problems  Exercises: Stoichiometry problems | Exercises:   * writing equations. * stoichiometry problems.   Introduce **SHE** Investigation  ***Summative* Investigation 1**  Acids and the Environment | **Subtopic 5.3**  Use and definition of pH.  Undertake calculations using:  pH = -log[H+]  [H+][OH-] = 10-14 | Volumetric glassware – volumetric pipette and burette.  **? Practical:**  Use glassware to measure out 20.0 mL samples of water and weigh on sensitive balances.  Discuss results:   * errors * resolution of instruments   need for several trials |
| 8 | Introduce titration procedure.  **? Demonstration:**  Titration of NaOH and HCl | **? Practical:**  Students use their standard solutions of 0.05 M sodium carbonate (prepared in week 3) to standardise sulfuric acid solution. | Complete titration.  Work through calculations.  Discuss sources of error and effect on experimental value. | Formative test on acid-base concepts. |
| 9 | **Redox**  Practical demonstrations of colourful and noisy redox reactions such as fireworks, elephant’s toothpaste and gun cotton.  **Subtopic 6.1**  Redox in terms of :   * combination with oxygen * transfer of electrons (revisit redox in terms of electron transfer S1) | Revisit (Term 1) reactions of Gp1 and 2 metals with water:   * some metals lose their electrons more readily than other metals * very reactive metals react with water   Write equations for the reactions of Ca, K, Na with water and Mg with steam.  Watch YouTube clips of Alkali Metals: discussion of trends down a group. | Less active metals will not react with water but will react with dilute acids.  **? Practical:**  Add Mg, Zn, Fe, Cu to dilute HCl:   * note observations * test gas * write equations for reactions * write half-equations for reactions. | Some metals will react with the ions of other metals.  **? Practical:**  Add Mg, Zn, Fe, Cu, Pb to nitrate solutions of these metals:   * observations * write equations and half-equations for reactions. * pattern. |
| 10 | Metal activity series.  Metals reduce the ions of less active metals. **SHE:** Explore the costs of corrosion prevention on hulls of ships.  Use activity series to predict if a reaction will occur between a metal and a solution of ions of another metal.  **? Practical:**  Make Christmas tree shape of Cu and place in a solution of silver nitrate. | **? Practical:**  Reactions of a range of common oxidising and reducing agents eg KMnO4, H2O2, ClO-. K2Cr2O7, I-, Fe2+, Fe3+.........   * note observations   deduce products  Write half-equations for common oxidising and reducing agents. | Combine half-equations to write overall equation. | Formative test on electrochemical concepts. |
| 11 |  | ***Summative* SAT 2: Test** | Similarity of reactions involving complete and partial electron transfer – concept of oxidation number.  Use ON to:   * determine if a reaction is a redox reaction * indicate oxidation/reduction   Use structure of molecules (revise) and bond polarity (revise) to deduce ON of atoms in CO2, H2O, NH3, SO2, SO3 etc | Determine ON of atoms in elements, monatomic ions, molecules and polyatomic ions. identify oxidiser/reducer |
| 12 | **Subtopic 6.3 (part 1)**  Electrochemistry: conversion between chemical and electrical energy.  Galvanic cell  electrolytic cell  chemical E electrical E  **? Demonstration:**  Construct Galvanic cell:   * observations * direction of electron flow * anode/oxidation & cathode/reduction * half-equations and overall equation * function of salt bridge | **? Practical:**  Given metal strips (Mg, Zn, Fe, Cu) and appropriate solutions:   * predict which combination will produce highest voltage * construct cells to test prediction * draw/label cell diagrams (anode/cathode and their charges, direction of electron and ion flow) * identify oxidiser and reducer * half-equations for reaction at each electrode * overall cell reaction |  |  |
| 13 | ***Summative* Practical** **Design Investigation**  Investigate the effect of one factor on the production of electricity by a galvanic cell.  Plan and perform investigation, and write report, in class time. |  |  | **SHE:** Discuss the advances in design of galvanic cells over time and the impact on peoples’ lives. |