| **lesson/week** | **1** | **2** | **3** | **4** |
| --- | --- | --- | --- | --- |
| 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.orMake 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 productsWrite 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 cellelectrolytic cellchemical 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. |