| **week** | **Lesson 1** | **Lesson 2** | **Lesson 3** | **Lesson 4** |
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| **1** | Lessons lost: * return to school
* assemblies, etc.
 | **Subtopic 1.3 Volumetric Analysis**Revise:* concentration units and conversions
* stoichiometry problems.
 | ExercisesRevise volumetric glassware and titration procedure. |
| **2** | **Practical:**1. Prepare standard solution of Iron(II) ammonium sulfate
2. Dilute commercial H2O2 solution.
 | Standardise KMnO4 solution.Use standardised solution to determine concentration of H2O2 in commercial product. | Analyse results - calculationsEvaluate procedure:* systematic and random errors
* accuracy and precision.
 | **Subtopic 1.4 Chromatography**View Interactive Lab PrimerDiscuss concepts of chromatography |
| **3** | TLC and RfInterpret chromatograms. | **Practical:**Identification of the analgesic component of an over-the-counter medication. | **Investigation (1) - Volumetric Analysis**:Demonstrate that tartaric acid is diprotic. |  |
| **4** | GLC and HPLCInterpret chromatograms. | **[Subtopic 2.2: Equilibrium]**Revise reversible reactions.Introduce concept of equilibrium and Le Châtelier’s Principle (changes in concentration). | Ion exchange chromatography.**[Subtopics 4.3, 4.2]**Aluminosilicates and zeolites.Use of zeolites in water softeners.Cation exchange in soils.Availability of nutrient cations to plants.Effect of acidic/saline conditions on soil fertility.Release of toxic cations into soil water by acidic conditions. |  |
| **5** | **Subtopic 1.5: AAS**View VEA Chemical Analysis I.Discuss concepts.Importance in assessment of metal ores in mining. | Using AAS to identity elements in a sample.Using AAS to determine concentration of element in a sample:* construct calibration graphs (revise volumetric glassware, dilution calculations)
* use calibration graphs (interpolation, concentration conversions, systematic and random errors).
 | Exercises: Analyse AAS dataCalculations. | **[Subtopic 4.1]**PhotosynthesisRespirationCarbon cycleFossil fuelsCombustion of carbon-based fuels. |
| **6** | **Subtopic 1.1: Global Warming and Climate Change**Action of greenhouse gases in maintaining steady atmospheric temperatures.Anthropogenic sources of GH gases.Exercise: Plot data for trends in global concentration of CO2. Discuss trend. | View (sections of) **An Inconvenient Truth**Discuss causes and consequences of global warming.Discuss thawing of permafrost and impact. | Role of oceans in maintaining steady concentrations of CO2 in the atmosphere (revise equilibrium).Ocean acidification and effects on ocean calcifying organisms: coral reefs.Revise pH and calculations from Stage 1. |  |
| **7** | **Subtopic 1.2: Photochemical Smog**Formation of nitrogen oxides:* natural processes **[Subtopic 4.3]**
* combustion in air.

Formation of ozone from NOx. | Interpret graphs showing concentrations of NOx, ozone, hydrocarbons in air over a city.Harmful effects of photochemical smog. | Use of catalytic converters to reduce NOx from motor vehicles.**[Subtopic 2.1]*** Energy profile diagrams
* Effect of catalyst on reaction rate.
 | Review exercises. |
| **8** | **SAT 1: Test** | **Subtopic 3.1: Introduction**Revise structural formulae, systematic naming of hydrocarbons from Stage 1. | Physical properties of organic compounds:* revise secondary interactions from Stage 1
* consider the polarities of various functional groups.
 | Exercises: Predict/explain physical properties of compounds given their structural formulae. |
| **9** | **Subtopic 3.2: Alcohols**OccurrenceSystematic nomenclatureClassification as primary, secondary, tertiary. | Oxidation products of alcohols.**Practical:**Test a range of primary, secondary, tertiary alcohols with acidified potassium dichromate solution. | Alcohols as fuels:* combustion products
* complete and incomplete combustion

**[Subtopic 4.1]**Advantages/disadvantages of using ethanol as a fuel in place of fossil fuels.Renewable fuels. | **[Subtopic 4.1]**Revise enthalpy and calculations from Stage 1.Calculate quantities of heat evolved per mole, per gram, and per litre for complete combustion of alcohols.Use of calorimetry to determine enthalpy of combustion. |
| **10** | **Practical:**Compare the enthalpies of combustion of the first six alcohols. |  | **Subtopic 3.6: Amines**Occurrence.Role of amines in the nervous systemSystematic nomenclature. | Classification as primary, secondary, tertiary.Amines as bases.Consider lignocaine and use in protonated form. |
| **11** | **Subtopic 3.3: Aldehydes and Ketones**Occurrence Systematic nomenclatureFormation from appropriate alcohols. | Oxidation products of aldehydes in acidic and alkaline conditions.Use of acidified dichromate solution and Tollens’ to distinguish between aldehydes and ketones.  | **Practical:** Prepare propanal and test product with Tollens’reagent. |  |
| **12** | **Subtopic 3.4: Carbohydrates**OccurrenceDefinitionClassification as mono, di, polysaccharides.Functions of carbohydrates in nature. | Solubility of mono and disaccharides in water.Condensation of monosaccharides to form di and polysaccharides.Hydrolysis of di and polysaccharides. | Equilibrium in solution between ring and chain forms of glucose.**Demonstration:**Tollens’ test on a solution of glucose.Discuss results in terms of equilibrium and Le Châtelier’s Principle. | **[Subtopic 4.1]****Practical:**Fermentation of a carbohydrate to produce ethanol. |
| **13** | **Subtopic 3.5: Carboxylic Acids**Occurrence Systematic nomenclatureFormation from appropriate alcohols. | **Practical:**Investigate odours of a range of carboxylic acids.RCOOH as weak acids:* ionisation in water
* reaction with bases.
 | **Practical:*** Reaction of hydrochloric and ethanoic acids with magnesium, metal oxides and hydroxides, metal carbonates and hydrogencarbonates.
* Explain differences in reactivities.
 | Consider drugs with carboxyl groups (Aspirin, penicillin). Desirability of using the drug in the form of the carboxylate salt. |
| **14** | **Subtopic 2.1: Rates of Reaction**Measuring rate by change in concentration, change in mass of system, volume of gas evolved etc.**Demonstration:**Follow the reaction of marble chips with HCl solution over time.* Graph results.
* Interpret graph.
 | Collision theory used to explain the effect on rate of reaction of changes in:* concentration of reactant
* pressure (gaseous systems)
* temperature
* surface area
* presence of catalyst.

Revise energy profile diagrams and catalytic converters.Discuss photocatalysis (UV light on nanoparticles of TiO2 on surfaces) to remove undesirable solvent vapours from the air. | **Practical:**Effect of changing temperature OR reactant concentration on the rate of reaction of sodium thiosulfate and HCl. | Analyse results.Evaluate procedure.**Introduce Investigation (2): Practical Design**Effect of changing a reaction condition on the rate of fermentation of a carbohydrate. |
| **15** | **SAT 2: Test** | **Investigation (2): Practical Design****Planning lesson (in pairs)** | **Subtopic 2.2: Equilibrium and Yield**Revise concepts already introduced:* reversible reactions
* dynamic nature

Graphs representing changes in concentrations of reactants and products as a system reaches equilibrium. | Introduce *Kc*.Calculations involving *Kc* fo homogeneous systems. |
| **16** | Revise Le Châtelier’s Principle introduced earlier.Consider effect of changes in:* concentration
* pressure (gaseous systems)
* temperature.

**Practical:** Effect of changes in concentration on the equilibrium concentration of Fe (SCN)2+ in solution. | View film clips of effects of pressure and concentration changes on equilibrium systems.Interpret graphs representing the effect of changes in equilibrium system with concentration, pressure, temperature changes. | **[Subtopic 4.2]**Use of chlorine, hypochlorous acid and hypochlorites in water treatment – effect of pH on the equilibrium.**Revise:****[Subtopics 1.4, 4.2, 4.3]**Cation exchangeAvailability of nutrients in soil.Ion chromatography.Use of zeolites in water softeners.**[Subtopic 1.1]**Role of oceans in removing CO2 from the atmosphere/ocean acidification. | **Subtopic 2.3: Optimising Production**Interpret flow charts.Desirable features: high rate, high yield, safe processes, minimum impact on the environment, minimum costs.Discuss compromises to achieve maximum yield in minimum time.Advantages/disadvantages of using catalysts. |
| **17** | Examples:Choose from production of ammonia, sulfuric acid, nitric acid. | **Investigation (2): Practical Design** |  | **Subtopic 3.7: Esters**Occurrence Systematic nomenclatureFormation from appropriate alcohol and acid – Condensation. |
| **18** | Formation of polyesters Hydrolysis of esters under acidic and alkaline conditions. | **Practical:**Preparation of an ester. |  | **Subtopic 3.9: Triglycerides**Formation from 1,2,3-propanetriol and fatty acid.Saturated/unsaturated triglycerides:* sources
* physical state.
 |
| **19** | **Practical:**Use bromine solution to test various triglycerides for saturation.Conversion of liquid triglycerides into triglycerides with higher melting point.Discuss production of margarine. | Alkaline hydrolysis of triglycerides.Formation of amphiphilic particles.Explain uses of amphiphilic particles:* to remove grease (soaps and detergents – include effect of hard water)
* to stabilise mayonnaise and ice cream
* in Nano sized micelles to deliver hydrophobic drugs.
 | **Subtopic 3.8: Amides**Formation by condensation of amine and carboxylic acid.Formation and properties of polyamides.Consider nylon. | Hydrolysis of amides under acidic and alkaline conditions. |
| **20** | **Subtopic 3.10: Proteins**Amino acids* general formula
* acidic and basic properties
* self-ionised form.
 | Condensation to form protein chain.Protein chains and secondary interactions:* within the chain
* between the chain and water.
 | Effect of changes in pH and temperature on the spatial arrangement of the protein chain and hence of its function.Role of enzymes in life processes. |  |
| **21** | **Subtopic 4.1**Revise material introduced earlier in the year:* fuels
* carbon cycle and reactions
* fossil and renewable fuels.

Biofuels:* production of ethanol (revise) and biodiesel
* biofuels/fossil fuels and global warming.
 | **Practical:**Prepare a sample of biodiesel. |  | **SAT 3: Test** |
| **22** | Advantages/disadvantages of using carbon-based fuels for energy.Revise:* combustion (complete/incomplete)
* calorimetry/enthalpy of combustion
* thermochemical calculations.
 | Writing thermochemical equations.Compare fuels (including calculations of energies released per mole, per gram, per litre). | Revise galvanic cells from Stage 1.Photovoltaic cells.Advantages/disadvantages of direct energy generation. | Fuel cells* structure
* half-equations for various fuels
* advantages/disadvantages compared with other galvanic cells.
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| **23** | **Subtopic 4.2**Different methods for treating water.Use of aluminium ions and polymers to remove suspended clay particles from water. | Revise:* hard water
* use of zeolites in water softeners
* use of chlorine and some compounds for disinfection.

Reverse osmosis process.Desalination by reverse osmosis and thermal distillation. | Discuss issues associated with use of Adelaide desalination plant.**Introduce Investigation (3) SHE:** **Industrial wastewater**.Class time for initial research and discussion with teacher |  |
| **24** | **Subtopic 4.3: Soil**Why plants need nutrients in soluble form.Revise:* natural and anthropogenic nitrogen-fixing processes.

Why fertilisers may be needed to improve the productivity of some soils. | Process and consequences of eutrophication. | Silicon dioxide, silicates and aluminosilicatesFormula of anion from formula of silicate of aluminosilicate. | Revise:* cation exchange
* impact of acidic and saline conditions on the nutrient value of soils.
 |
| **25** | **Subtopic 4.4**Revise work on addition polymers from Stage 1, and on condensation polymers from Topic 3.7, 3.8. View VEA Addition Polymers. | View VEA Condensation Polymers Advantages/disadvantages of:* synthetic polymers
* producing polymers from fossil source or from renewable materials.
 | Properties of organic polymers:* revise secondary interactions from Stage 1
* effect of cross-linking and secondary interactions on rigidity, strength, elasticity, behaviour on heating.

 | Thermoplastic and thermoset polymers:* structure
* effect of heat
* impact on ability to be recycled.

Impact of disposal of plastics on the environment.Biodegradability. |
| **26** | Occurrence of metals – depends on metal reactivity.Stages in the production of metals form their ores – energy requirements.Method of reduction is related to the reactivity of the metal and availability of energy.Depending on metal reactivity may use:* electrolysis of molten salt
* electrolysis of aqueous solution
* heat and a reducing agent.
 | Revise electrolysis from Stage 1.Compare reduction methods for the production of:* Group 1 and 2 metals, and aluminium
* zinc
* iron or copper.
 | Compare environmental impacts of producing aluminium from bauxite with zinc from zinc ore.Discuss phytomining and bioleaching. | Consider production of Zn to revise:* amphiphilic particles (froth flotation)
* reactions of metallic oxides with acids
* displacement of a metal from solution by a more reactive metal
* electrolysis of aqueous solutions.
 |
| **27** | Need for the recycling of materials.Discuss energy requirements for recycling aluminium cans and for producing cans from bauxite. | Difficulties in recycling:* thermosetting plastics (revise)
* composite materials.
 | **Revision** | **Revision** |
| **28** | **Revision** | Revision | **SAT 4: Test** |  |
| **29** |  |  |  |  |