

Appendix: Teaching timetable and associated language focused activities.

Week	Topic	Summary content	Vocabulary relevant to the chemical language assessment	Language activity	Informed by
1 October	Atomic structure Elements and compounds	Development of ideas of atomic structure  Explanation of the Bohr model  Determining number of protons, electrons and neutrons  Chemical reactions to illustrate chemical change, explore understanding of elements and compounds and chemical reactions.	atom, molecule, element, compound, combustion, neutral	Chemical language assessment (CLA)  Personal Glossaries  FOCUS	Pyburn et al. (2013)  Wellington and Osborne (2001).  ZPD (Vygotsky, 1962)
2	Relative atomic mass (RAM)  Amount of substance.  Empirical formula	Develop understanding of relative atomic/molecular mass.  Calculate RAM from percentage abundance data  Calculate amount of substance in moles from mass.  Undertake practical experiments to determine the empirical formula of magnesium oxide and copper oxide	atom, molecule, element compound, mole relative atomic mass, reduction	Affixes  FOCUS	Development of "word attack" skills (Herron, 1996)  Sutton (1992)  DDL (Johns, 1991)
3	Electron configurations  Bonding and structure	Electron configurations of the first 20 elements determined using $1s^2$ , $2s^2$ etc.  Introduced to ionic and covalent bonding, giant lattices and molecular structures.	atom, molecule, element compound, covalent, immiscible, insoluble, electron, $H_2O/OH_2$	Mini-whiteboards	Social constructivism and ZPD (Vygotsky, 1962)

		Practical experiments investigate the physical properties of ionic and covalent compounds.			
4	States of matter intermolecular forces  Shapes of molecules	Kinetic theory discussed as a basis for changes in state.  Occurrence of different intermolecular forces discussed.  Shapes of molecules explored e.g tetrahedral, octahedral.	atom, molecule, element, compound, solid, liquid, gas, kinetic energy, intermolecular forces, dipoles, hydrogen bonding	Word association.  FOCUS	Social constructivism  (Vygotsky, 1962)  DDL (Johns, 1991)  Word games (Herron, 1996)
5	The Periodic Table	Historical development of the Periodic Table and trends in main groups discussed.  Practical experiments explore trends in group 1 and group 7.	atom, molecule, element compound, inert	Word origins	Telling the scientific story (Sutton 1992)
6	Acids and bases  Volumetric analysis	Students introduced to the pH scale and Brønsted Lowry acid base theory.  Reactions of acids and bases explored.	acid, base, neutralisation, weak, strong, solution, salt, dissociates	Word explanations	social constructivism  (Vygotsky, 1962)
7	Mid-term review  Concentration calculations  Equilibrium	Content covered reviewed with a formative test.  titration experiments undertaken and amount of substance from concentration covered.  Principles of physical and chemical dynamic equilibria illustrated with practical experiments (Iodine and cobalt	acid, base, neutralisation, weak, strong,	Extending meaning of <i>pressure</i> .  FOCUS	social constructivism, ZPD (Vygotsky, 1962)

		chloride).			
8	Oxidation states Rate of reaction	Determining oxidation states of elements in different compounds Factors affecting rate of reaction. Practical assessment laboratory report – effect of temperature / concentration on the reaction of marble chips and acid.	atoms, elements, molecules, compound, acid, base, neutralisation, reduction	Picturing words	Social constructivism (Vygotsky, 1962) Word games (Herron, 1996)
9	Enthalpy changes	exothermic and endothermic reactions investigated and enthalpy changes calculated. Hess's Law used to calculate enthalpy changes	Combustion, exothermic, bonds	CLA	Pyburn et al. (2013)
10 December	Crude oil Revision	introduction of crude oil and fractional distillation	Combustion, insoluble, synthesis, molecules, intermolecular forces	FOCUS and DDL to improve student writing.	Johns (1991)

Table 1 Summary of the teaching sequence for the Core Foundation Chemistry module from October to December with the language focused activities and their theoretical basis indicated.

Week	Topic	Summary content	Vocabulary relevant to the CLA	Language activity	Informed by
11 January	Organic chemistry naming compounds	Separation of crude oil revisited and naming of organic compounds explained.	atom, molecule, element, compound	word origins - benzene	The scientific story – Sutton (1992)
12	Organic chemistry	Practical – aspirin hydrolysis	Solution, synthesis, terminated, initiated	none	
13	Alkanes, alkenes and aromatics	Structure and halogenation of alkanes, alkenes and aromatics including mechanisms	atom, molecule, element, compound, polarity, dipole, electrophile, Br <sub>2</sub> /2Br	multiple contexts – saturated FOCUS	DDL (Johns, 1991)

14	The Victorian Pharmacy	Practical - Reactions of alcohols and carbonyls Identifying unknown (Victorian) chemicals	atom, molecule, element, compound, reduction, solution	Key word glossary	Wellington and Osborne (2001) ZPD (Vygotsky, 1962)
15	carboxylic acids, esters, fats and polymers	structure and reactions to esters, triglycerides and polymers (addition/condensation) impact of diet and heart disease	Intermolecular forces, insoluble, saturated	Key word glossary	Wellington and Osborne (2001) ZPD (Vygotsky, 1962)
16	electrochemistry	Practical – electrolysis of brine constructing electrochemical cells and calculating cell potentials and cell equations	atom, molecule, element, compound, cell	Directed Activity Related to Text (DART)	Wellington and Osborne (2001)
17	Born-Haber cycles	Born-Haber cycles to calculate lattice enthalpy trends in lattice enthalpy	NaCl (aq)/(l), salt, atom, ion, element, compound, complex	Word explanations	Social constructivism (Vygotsky, 1962) Word games (Herron, 1996)
18	Thermodynamics	Introduction to entropy and Gibbs free energy equation Revision	Exothermic, spontaneous	Mini-whiteboards	Social constructivism ZPD (Vygotsky, 1992)
		EASTER VACATION – 5 weeks			
19	Acids and bases	Calculating pH from hydrogen ion concentration Determining $K_a$ and $pK_a$ Calculating pH of a weak acid	atom, molecule, element, compound, acid, base, solution, weak, salt	multiple contexts – strong and weak <b>FOCUS</b>	DDL (Johns, 1991)
20 May	Equilibria	Dynamic equilibrium and Le Châtelier's principle Calculating $K_c$	Exothermic, molecule, decomposes	CLA	Pyburn et al. (2013)

Table 2 Summary of the teaching sequence for the Advanced Chemistry module from January to May with the language focused activities and their theoretical basis indicated

## References

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