**There’s more to a cell than just Biology!**

**Integrated Stage 1 Biology and Chemistry Program 5**

This course would be suitable for students who have a keen interest in Science, but would like to do an integrated approach to learning Chemistry and Biology. Students interested in doing Stage 2 Chemistry, would likely do a second semester of Chemistry, building on the concepts covered in this course. Biology students would also be suitably prepared for Biology at stage 2.

*This course has been designed to enable students to get 10 credits for Biology and 10 credits for Chemistry- a separate LAP for each subject. The course would be delivered over 8-10 lessons a week, based on 50 minute lesson. Double would be advisable for practical activities.*

| **Content**  | **Possible Activities** | **Summative Assessment** |
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| **Week 1**Introduction to the courseAssessment TasksProperties of Substances | Brainstorm all the different materials that are usefulConsider the properties of these materials- mp, bp, solubility, SA: Vol. Know the meaning of these and how they apply to use of substances. Consider the characteristics a materials has in relation to its function- is there a pattern?Consider new materials and their applications in biology and chemistry – watch a video on nano-robots and their applications in medicine. What are the benefits and risks of this technology?SIS: Practical: Test physical properties of a range of materials.  |  |
| **Week 2**Elements found in living thingsStructure of the AtomPeriodic Table | SHE: Model of the atom- how did scientists develop the current model? What are the limitations of the current model? Could it still change?Teach students electron configuration using subshell notation using common elements found in living systems. (could expand this to the first 38)Practise electron configurations of common elements found in biological systems. |  |
| **Week 3**Trends in the periodic tableSimple calculations related to information on the periodic table.Location of different types of elements on the PT. | Use an interactive periodic table [www.rsc.org/periodic-table](http://www.rsc.org/periodic-table)Atomic mass, mass number and the relationship to the sub-atomic particlesIdentify the position of an atom given its electron configuration.Identify the s,p,d,f, blocksLocate metals, non-metals and metalloids on the table.Plot graphs of various properties if elements- predict the elements characteristics and possible uses.SIS: Practical: Flame Tests. Consider the risks associated with this experiment. | **Chemistry: SAT: Classification of Substances into structure types.** |
| **Week 4**Cell StructureFunction and Properties of the cell membrane | SIS: Look at cells under a microscope, view electron micrographs of cells, interactive online cell worksheetsLabel diagrams of different cell types- prokaryotes and eukaryotes, organelles etc.Model the cell membrane. Discuss the chemical characteristics of phospholipids and proteinsSIS: Practical: use dialysis tubing to demonstrate the semi-permeable nature of the cell membrane (could be done as a practise design task) | **Biology: IF: Factors that affect transport of substances****Practical Investigation, design.** |
| **Week 5**Cell structure continuedPolarity | Review cell structure and the components.When is a substance polar? Or is it just a bond that is polar?Discuss the polarity of excretion products from animals from ocean ecosystems, as an example, , look at the properties of the molecules, molecule shape SIS: Practical: Compare the solubilities of sugars/alcohols and link to their polarity (could also be done using known data) |  |
| **Week 6**Interactions between moleculesAntibodies- their specificity and structure, function. | Hydrophilic/hydrophobic nature of cell membranesSecondary interactions- consider Hydrogen bonding- in water and DNALook at the chemical structure of DNA (will link to week 7)Specificity and complementary nature of binding between biological recognition molecules. |  |
| **Week 7**Polymers: macromolecules in cells | Discuss the components of a polymer- the repeating units, the reactions to synthesis and breakdown, use biological molecules as examples: nucleic acids, proteins, lipids, polysaccharidesSIS: Practical: Make plastic from potato starch (good task for students)Useful polymers- benefits and limitations | **Chemistry: IF: Practical investigation, Breakdown of Polymers in the Environment.** |
| **Week 8-9**The chemistry of polymersConsider Proteins (link to the antibody) | Protein synthesis- formation of the peptide bond (as an example of polymerisation)Watch simple videos on Protein SynthesisDiscuss the chemistry of polymerisation, identify repeating units and write simple equationsSHE: Discuss the importance of polymers for humans- consider the economic, social and environmental aspects of this chemistry and its potential uses |  |
| **Week 10-11**Photosynthesis and Respiration | Look at electron micrographs of chloroplast and mitochondriaThe reactions involved in these processes- the overall reaction (is this good chemistry?) and show the pathway of these metabolic processes. SIS: Practical: fermentation – another possible opportunity to do a formative design practical. Focus on the identification of how errors effect data. | **Biology: IF: Practical: Design practical to determine the effect of a factor on photosynthesis** |
| **Week 12**Nucleic Acids: structure, function and chemistry | Review the chemical nature of DNA (from earlier weeks). Model the DNA molecule using a molecular kit or candyLook at the chemical properties of DNA, how do these enable DNA to function?Model DNA replication (if time allows) | **Chemistry SAT: Supervised Task- 70 minutes. Test of all topics.** |
| **Week 13**Hydrocarbons- organic chemistry | Importance of hydrocarbonsAs fuels: combustion reactions, write equations.Introduce the concept of the mole and use combustion equations to do mass-mass stoichiometry.Draw organic molecules, learn how to name, draw and identify Use modelling kitsSIS: Practical: compare mp and bp of hydrocarbons, and other properties (e.g. solubility, viscosity etc.). Focus on constant variables and presentation of data in chemistry practicals. |  |
| **Week 14**Organic Chemistry | Alcohols- link to anaerobic respirationSIS: Practical: Solubility of alcohols  | **Chemistry: IF: SHE Task Are there viable alternatives to hydrocarbons?** |
| **Week 15**Organic Chemistry- class time for assessment task | Other functional groups |  |
| **Week 16 -17**Hydrocarbons and the environmentHuman activities that affect the environment; benefits and limitationsBiology- class time for assessment task | Benefits and limitations of the use of hydrocarbons as a fuelEvidence that combustion of hydrocarbons has impacted environmentsDifferent ecosystems may be affected differently- discuss and explain why?SIS: Practical: Fractional distillation of crude oil. Risks and safety should be considered.SIS: Practical: production of BiodieselSHE: How would you test the quality of this product? Is Biodiesel better than crude oil based diesel? | **Biology: IF: SHE Task** **Human Impacts, Ecosystems and Society.** |
| **Week 18**Recycling of MatterCarbon Cycle | Draw the carbon cycle, show how humans have altered the natural cycleDiscuss the molecule: C02Importance of the recycling of matter through ecosystems- what would happen if there were no decomposers?Link decomposition of living matter to the formation of oil.What are the conditions required for decomposition to occur? To produce oil? Consider the chemistry involved. | **Biology SAT: Supervised Task- 70 minutes. Test of all topics.** |