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| **Minor Award Name** | Food Chemistry |
| **Minor Award Code** | FN2748 |
| **Level** | 5 |

**Suggested resources to support delivery:**

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| **Theme/Topic** | **Type** | **Relevance** | **Author/Source** | **Web Link** |
| Explain the terms atom, element, molecule, compound, atomic number, mass number, mole | Website/powerpoint | Introduction to the core concepts of chemistry, including supporting documentation. Vital for students to understand subatomic components and be able to grasp how properties are changed when those components are changed. | Boundless.com | <https://www.boundless.com/chemistry/textbooks/boundless-chemistry-textbook/atoms-molecules-and-ions-2/history-of-atomic-structure-32/early-ideas-about-atoms-193-3697/>  <https://www.boundless.com/chemistry/textbooks/boundless-chemistry-textbook/atoms-molecules-and-ions-2/the-structure-of-the-atom-34/overview-of-atomic-structure-202-11405/> |
| Relate the properties of compounds to types of bonding | Website | Comparison list of ionic versus covalent bonding. May need to involve electronegativity to explain polar covalent bonding. |  | <http://hyperphysics.phy-astr.gsu.edu/hbase/chemical/bond2.html>  <http://chemistry.about.com/od/moleculescompounds/a/Covalent-Compound-Or-Molecular-Compound-Properties.htm> |
| Explain chemical solutions, different types of chemical solutions and their importance | Website/YouTube video | Includes explanations and examples of both, important to stress this is not a change of state, as that requires a change in amount of heat in the substance. | Sparknotes | <http://www.sparknotes.com/testprep/books/sat2/chemistry/chapter5section14.rhtml>  <https://www.youtube.com/watch?v=QeNn3sY1bu4> |
| Describe acid and base, and oxidation and reduction reactions and their importance in food science | Website | Good overview of the different definitions of acids and bases, important to be precise when asking for a definition, which definition you are asking for, | UC Davis website | <http://chemwiki.ucdavis.edu/Physical_Chemistry/Acids_and_Bases/Acid> |
| Explain heat of reactions including the different types of heat of reactions | Website | Heat of reaction explanation and resources including sample calculations explaining exothermic versus endothermic and practice problems. | UC Davis website | <http://chemwiki.ucdavis.edu/Physical_Chemistry/Thermodynamics/State_Functions/Enthalpy/Heat_of_Reaction> |
| Examine the importance of water, water treatment, effluent treatment and water analysis in the food industry | Fact and Worksheet. Website | Fact and worksheet from the EPA outlining water treatment with a series of questions on the back. | Irish websites | <https://www.epa.ie/media/Lesson%204%20Treating%20Our%20Water.pdf>  <http://www.water.ie/water-supply/how-is-my-drinking-water-treated/>  <http://www.water.ie/water-supply/how-is-my-wastewater-treated/> |
| Illustrate the chemical structure of lipids, proteins and carbohydrates | Websites | Web pages including diagrams of all related biomolecules and explanations of the differences. Particular note should be taken in the differences between different protein structures. | Chemguide.co.uk | <https://www.boundless.com/biology/textbooks/boundless-biology-textbook/biological-macromolecules-3/lipids-55/lipid-molecules-298-11431/>  <http://www.chemguide.co.uk/organicprops/aminoacids/proteinstruct.html>  <http://www.rsc.org/Education/Teachers/Resources/cfb/carbohydrates.htm> |
| Interpret the information in the periodic table of the elements and the table of the electronegativity values | Website.  PDF/ | Trends explained with linked examples  Electronegativity table included. | UC Davis wiki. | <http://chemwiki.ucdavis.edu/Inorganic_Chemistry/Descriptive_Chemistry/Periodic_Trends_of_Elemental_Properties/Periodic_Trends>  <http://www.sciencegeek.net/tables/Electronegativity.pdf> |
| Prepare standardized solutions of different concentration | PDF and YouTube video. | Explanation of the process of preparing a standard solution. | Creative Chemistry | <http://www.creative-chemistry.org.uk/alevel/module1/documents/N-ch1-49.pdf>  <http://www.moatecs.com/Department/Science/Science%20PDf/Tritations%20Question%201/TO%20PREPARE%20A%20STANDARD%20SOLUTION%20OF%20SODIUM%20CARBONATE.pdf>  <https://www.youtube.com/watch?v=HV6DgqGVNCk> |
| Perform different types of titrations such as acid and base, oxidation and reduction, and complexometric to include their use in quantitative analysis in food chemistry | Website/PDF | Guidelines and instructions about different types of titration with examples given of each one.  Several examples given of each one. | IUPAC | <http://generalchemistrylab.blogspot.ie/2011/12/types-of-titrations.html>  <http://www.iupac.org/publications/analytical_compendium/Cha06sec4.pdf>  <http://www.titrations.info/>  <http://www.hach.com/asset-get.download.jsa?id=24124425653> |
| Calculate the pH of weak and strong acidic and basic solutions | Website/Powerpoint | Worked examples of each calculation and examples of how this ties into the practical’s. | Boundless.com/ wiki UC Davis | <http://chemwiki.ucdavis.edu/Analytical_Chemistry/Quantitative_Analysis/Titration/Titration_of_a_Weak_Base_with_a_Strong_Acid>  <https://www.boundless.com/chemistry/textbooks/boundless-chemistry-textbook/acid-base-equilibria-16/acid-base-titrations-119/strong-acid-weak-base-titrations-484-1267/> |
| Calculate heats of reaction | Worksheet | Heat of reaction calculations with worked solutions. | Chem Team | <http://www.chemteam.info/Thermochem/HessLawIntro2.html>  <http://sayers-oneill-chemistry.wikispaces.com/file/view/WS5+Heat+of+Reaction+and+Hess.doc> |
| Carry out laboratory procedures including the preparation of a written scientific report outlining the procedure and results | Tutorial website. | Guide for writing practical reports | University lab writing tutorial. | <http://writingcenter.unc.edu/handouts/scientific-reports/> |
| Relate the electronic structure of the atom to the periodic table of the elements | Worksheet | Worksheet for calculating electronic structure and website outlining why relative charge alters and what can be deduced simply from the atoms placement in the periodic table. | Chem Guide | <http://www.chemguide.co.uk/atoms/properties/elstructs.html>  <http://www.d70schools.org/teachersites/lib/redirect.php?res_id=12055> |
| Explain metallic, ionic and covalent bonding and the role of electrons in chemical bonding | Website/YouTube video. | Chemical bonding explained. Also includes a YouTube video with explanations/animations of both. | visionlearning | <http://www.visionlearning.com/en/library/Chemistry/1/Chemical-Bonding/55>  <https://www.youtube.com/watch?v=QXT4OVM4vXI>  <https://www.youtube.com/watch?v=LK2fIn_U0MY> |
| Outline different ways of expressing concentration of solutions | Website | Step by step instructions for expressing concentration. Offers different recommendations for use. | Chem Wise | <http://www.chem.wisc.edu/deptfiles/genchem/sstutorial/Text11/Tx113/tx113.html> |
| Write chemical formulae and balanced chemical equations for common chemical reactions | Worksheets | Worksheets on balancing chemical equations. Practice being the key element in succeeding here. | Chemistry.com | <https://www.google.ie/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0CCEQFjABahUKEwjGlpyMzu_IAhVFHQ8KHVjPBt0&url=http%3A%2F%2Fsciencespot.net%2FMedia%2Fblncact.pdf&usg=AFQjCNGuLq4ZWzvQ1xaZy3QXtYyDIwAWZg&bvm=bv.106379543,d.ZWU>  <http://chemistry.about.com/od/chemicalequations/a/How-To-Balance-Equations.htm> |
| Demonstrate a competency in basic numerical calculations of importance in basic chemistry | Website | Titration calculation worksheets for practice. | Guch Brinkster | <http://misterguch.brinkster.net/PRA002.doc> |
| Outline the chemistry of acid and bases to include pH, acid and base strength, indicators and pH meters | Website | Basic tutorial on how to use a pH metre. | UFI | <http://webserver.mbi.ufl.edu/~rowland/protocols/phmeter.pdf> |
| Use the concept of oxidation number to balance oxidation reduction equations | Website/worksheets | Outline of methods for balancing redox equations and explanation of oxidation numbers. Vital for students to practise this extensively as it is often found to be a difficult topic. | Various | <http://www.okemosschools.net/education//page/download.php?fileinfo=T3hpZGF0aW9uTnVtYmVyc1dvcmtzaGVldDEucGRmOjo6L3d3dzcvc2Nob29scy9taS9va2Vtb3MvaW1hZ2VzL2RvY21nci84Njk4ZmlsZTcxNzA3LnBkZg==&sectiondetailid=1>  <http://www.chemteam.info/Redox/WS-redox-titration-problems.html>  <https://www.boundless.com/chemistry/textbooks/boundless-chemistry-textbook/aqueous-reactions-4/oxidation-reduction-reactions-48/redox-titrations-248-1533/> |
| Outline the importance of the properties of hardness and softness of water in the food industry | Website | Outlines differences between hard and soft water. Attention should be paid to the economic costs associated with lime scale and the costs of removal of hardness from water. | Dublin City | <http://www.diffen.com/difference/Hard_Water_vs_Soft_Water>  <http://www.dublincity.ie/main-menu-services-water-waste-and-environment-your-drinking-water-water-quality/frequently-asked> |
| Differentiate between the common homologous series of carbon compounds stating functional groups and properties | Website/YouTube | Introduction to organic chemistry focused on functional groups. Association can be made between saturated and unsaturated hydrocarbons and fats. | YouTube | <https://instruct.uwo.ca/chemistry/020/workentin/Organic%20Unit%201-%20Functional%20Groups.pdf>  <https://www.youtube.com/watch?v=nMTQKBn2Iss> |
| Outline industrial processes used in the production of common organic compounds and prepare one of these compounds in the laboratory | Website/experiment. | Complete experiment outlining the production of esters from alcohols and acids. Includes naming conventions of the same. | RSC | <http://www.rsc.org/learn-chemistry/resource/res00001743/making-esters-from-alcohols-and-acids?cmpid=CMP00005257> |
| Distinguish between different types of fatty acids and their effect on the properties of food | Website | Discussion articles on the differences between fatty acids. Key points such as saturated versus unsaturated can be covered in organic chemistry, this can also tie in hydrogenated or trans fats. | Various | <http://www.fattyacidshub.com/fatty-acids/types-of-fatty-acids/>  <http://www.preservearticles.com/201106188166/differences-between-saturated-and-unsaturated-fatty-acids.html>  <http://davidson.weizmann.ac.il/en/online/askexpert/chemistry/what-difference-between-saturated-and-unsaturated-fat-and-what-are-trans-fats-eyal> |
| Distinguish between monosaccharides, disaccharides and polysaccharides giving examples and properties | Website | Guide illustrating the differences between different types of saccharide, including examples of each one. | UCLA Chemistry | <http://hubpages.com/education/Biomoleculescarbohydrates>  <http://www.chem.ucla.edu/harding/ec_tutorials/tutorial55.pdf> |
| Describe types of protein and their constituent amino acids | PDF | Outlines amino acid structure. Should refer to essential versus non-essential amino acids and structure of protein while discussing. | IA State | <http://www.public.iastate.edu/~duahn/teaching/Biomodulation%20and%20Protein/Amino%20Acids%20and%20peptide%20bond.pdf> |
| Outline the physical and chemical properties of fats, carbohydrates and proteins, important in food chemistry | Journal | Explains differences between macronutrients including caloric values. | Oxford Journal | <http://www.oxfordjournals.org/our_journals/tropej/online/mcnts_chap3.pdf> |
| Carry out laboratory procedures which test for the different types of macronutrients in food | Website | Plan for procedure on how to test for different food macronutrients | SEP Lessons | <http://www.seplessons.org/node/362>  <http://www.mrothery.co.uk/bio_web_prac/practicals/2Food%20Tests.doc> |

**Useful Organisations:**

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| **Name** | **Contact Information** |
| Boundless | [www.boundless.com](http://www.boundless.com) |
| Royal Chemistry Society | [www.rsc.org](http://www.rsc.org) |

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| **MOOCs (Massive Online Open Courses)** | |
| Free access to online courses  Search regularly for new courses and new start dates | <https://www.mooc-list.com/>  <https://www.mooc-list.com/course/organic-chemistry-i-saylororg?static=true>  <https://www.mooc-list.com/course/principles-chemical-science-wma?static=true>  <https://www.mooc-list.com/course/crash-course-chemistry-allversity?static=true> |