### Year 10 Chemistry CORE Learning Cycle 3 Overview

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Commented [TR1]: Need an overarching question about what this learning cycle will be about e.g. “How does the properties of a substance affect its use in the modern world?”
Line of enquiry one: Can we use vegetable oils for other useful products as well as cooking?

Intentions for learning from AQA:
- Some fruits, seeds and nuts are rich in oils that can be extracted. The plant material is crushed and the oil removed by pressing or in some cases by distillation. Water and other impurities are removed.
- Vegetable oils have higher boiling points than water and so can be used to cook foods at higher temperatures than by boiling. This produces quicker cooking and different flavours but increases the energy that the food releases when it is eaten.
- Oils do not dissolve in water. They can be used to produce emulsions. Emulsions are thicker than oil or water and have many uses that depend on their special properties. They provide better texture, coating ability and appearance, for example in salad dressings, ice creams, cosmetics and paints.
- Emulsifiers have hydrophilic and hydrophobic properties.
- Vegetable oils that are unsaturated contain double carbon–carbon bonds. These can be detected by reacting with bromine water.

Vegetable oils that are unsaturated can be hardened by reacting them with hydrogen in the presence of a nickel catalyst at about 60 °C. Hydrogen adds to the carbon–carbon double bonds.

Lesson 1: Vegetable oil has a higher boiling point than water:

Key words: Boiling points, distillation.

Learning Intentions:
Students should develop an understanding that:
- Vegetable oils are extracted from fruits, seeds and nuts by crushing and distillation.
- Vegetable oils have a higher boiling point than water which makes them useful for cooking foods at a higher temperature.
- Vegetable oils that are unsaturated can be detected using the bromine water test.

Success Criteria:
- Recall where vegetable oils come from.
- Describe how vegetable oils are extracted.
- Explain why vegetable oils are used for cooking.
- Describe the test for unsaturated hydrocarbons.

Feedback Focus:
Knowledge input | Check | Development | REACH | Improvement

Details:
Teacher assessed exam question.

Lesson 2: Water and oils mix easily:

Key words: Emulsify, hydrophilic, hydrophobic, hydrogenated.

Learning Intentions:
Students should develop an understanding that:
- Vegetable oils do not dissolve in water, but they do form thick substances called emulsions with emulsifiers.
- Emulsions are used as they provide better texture, coating ability and appearance.
- Vegetable oils with double bonds can be hardened in the presence of hydrogen and a nickel catalyst to form margarines.

Success Criteria:
- Recall that vegetable oils do not dissolve in water.
- Explain what an emulsifier is.
- Recall and label the structure of an emulsifier.
- Describe the process of hydrogenation and give reaction conditions.
- Explain why hydrogenation is a beneficial process for scientists to do

Feedback Focus:
Knowledge input | Check | Development | REACH | Improvement

Details:
Act on teacher feedback and improve work. Self-assess exam question.

Commented [TR2]: May be good links to make with similarities in composition of veg oils and crude oils & biofuels

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Commented [TR3]: This is two teacher assessed pieces of work within the first two lessons – will you be ok to keep up with this? Could they peer assess the re-draft instead?
Line of enquiry two: How do electrons affect reactivity?

Intentions for learning from AQA GCSE specification:

- All substances are made of atoms. A substance that is made of only one sort of atom is called an element. There are about 100 different elements. Elements are shown in the periodic table. The groups contain elements with similar properties.
- Atoms of each element are represented by a chemical symbol, eg O represents an atom of oxygen, and Na represents an atom of sodium.
- Atoms have a small central nucleus, which is made up of protons and neutrons and around which there are electrons.
- The relative electrical charges are as shown: Name of particle Charge Proton +1 Neutron 0 Electron –1
- In an atom, the number of electrons is equal to the number of protons in the nucleus. Atoms have no overall electrical charge.
- Elements in the same group have the same number of electrons in their highest energy level (outer electrons) and this gives them similar chemical properties.
- Noble gases are stable and have a full outer shell of electrons.
- Chemical reactions can be represented by word equations or by symbol equations.

Lesson 3: Elements with full outer shells are unreactive.

Key words: Electrons, properties, unreactive.

Learning Intentions:
Students should develop an understanding that:
- Elements are arranged in groups by the number of electrons on their outer shell.
- Elements in the same group have similar properties.
- Noble gases are stable and have a full outer shell of electrons.

Success Criteria:

- Draw the electronic structure of the first 20 elements using atomic number.
- Calculate the number of each subatomic particle in specific elements using atomic number and mass number.
- Write word equations for reactions of group 1 metals and water.

Feedback Focus:
Knowledge input | Check | Development | REACH | Improvement

Details:
Peer-assessed electronic structures and word equations. Act on feedback.

Lesson 4: Molecules are held together by ionic bonds.

Key words: Molecule, covalent, ionic, conservation.

Learning Intentions:
Students should develop an understanding that:
- Two non-metallic elements are joined by a covalent bond. They are called molecules.
- Compounds formed from metals and non-metals are transferring electrons and forming an ionic bond.
- No atoms are lost or made during a chemical reaction so mass of reactants is equal to mass of product.

Success Criteria:

- Draw ionic and covalent bonds for different elements.
- Explain how ionic and covalent bonds form between different elements.
- Balance symbol equations.
- Calculate unknown masses of reactants and products using law of conservation of mass.

Feedback Focus:
Knowledge input | Check | Development | REACH | Improvement

Details:
Teacher assessment balanced equations and exam question.

Commented [TR4]: You’re missing bits from the spec on 1.1.1 on atoms?

Commented [TR5]: This doesn’t seem to be mentioned in the specification section above? Can only find it additional and further additional parts of the specification.

Commented [TR6]: Only need to know if electrons are shared or transferred dot and cross diagrams seem to be an additional chemistry thing.
Line of enquiry three: How can the properties of metals be altered to make them more useful?

Intentions for learning from AQA GCSE specification:

- Ores contain enough metal to make it economical to extract the metal. The economics of extraction may change over time.
- Ores are mined and may be concentrated before the metal is extracted and purified.
- Unreactive metals such as gold are found in the Earth as the metal itself but most metals are found as compounds that require chemical reactions to extract the metal.
- Metals that are less reactive than carbon can be extracted from their oxides by reduction with carbon, for example iron oxide is reduced in the blast furnace to make iron.
- Metals that are more reactive than carbon, such as aluminium, are extracted by electrolysis of molten compounds. The use of large amounts of energy in the extraction of these metals makes them expensive.
- Copper can be extracted from copper-rich ores by heating the ores in a furnace (smelting). The copper can be purified by electrolysis. The supply of copper-rich ores is limited.
- New ways of extracting copper from low-grade ores are being researched to limit the environmental impact of traditional mining. Copper can be extracted by phytomining, or by bioleaching.
- Copper can be obtained from solutions of copper salts by electrolysis or by displacement using scrap iron.
- Aluminium and titanium cannot be extracted from their oxides by reduction with carbon. Current methods of extraction are expensive because: ■ there are many stages in the processes ■ large amounts of energy are needed.
- We should recycle metals because extracting them uses limited resources and is expensive in terms of energy and effects on the environment.
- Iron from the blast furnace contains about 96% iron. The impurities make it brittle and so it has limited uses.
- Most iron is converted into steels. Steels are alloys since they are mixtures of iron with carbon. Some steels contain other metals. Alloys can be designed to have properties for specific uses. Low-carbon steels are easily shaped, high-carbon steels are hard, and stainless steels are resistant to corrosion.
- Most metals in everyday use are alloys. Pure copper, gold, iron and aluminium are too soft for many uses and so are mixed with small amounts of similar metals to make them harder for everyday use.
- The elements in the central block of the periodic table are known as transition metals. Like other metals they are good conductors of heat and electricity and can be bent or hammered into shape. They are useful as structural materials and for making things that must allow heat or electricity to pass through them easily.
- Copper has properties that make it useful for electrical wiring and plumbing.
- Low density and resistance to corrosion make aluminium and titanium useful metals.
Lesson 5: All metals are found as pure substances.

Key words: Ores, phytomining, bioleaching.

Learning Intentions:
Students should develop an understanding that:
- High percentage metals ores are mined and concentrated before extraction of metal.
- Plants and bacteria can be used to extract metal ores.

Success Criteria:
- Recall how specific metals are found in the Earth’s crust.
- Recall what an ore is.
- Describe the processes of phytomining and bioleaching.

Feedback Focus:
Knowledge input | Check | Development | REACH | Improvement
Details:
Redraft and improve work using teacher feedback.

Lesson 6: Extracting metals is more expensive than recycling them.

Key words: Reduction, electrolysis, recycling.

Learning Intentions:
Students should develop an understanding that:
- Metals which are more reactive than carbon are extracted by electrolysis of molten compounds, which is very expensive.
- Metals which are less reactive than carbon are extracted by reduction with carbon.
- Extracting metals is more expensive in terms of energy and effects on the environment in comparison to recycling.

Success Criteria:
- Describe the process of electrolysis and reduction.
- Explain why extracting metals is more expensive than recycling.
- Explain the limitations with extracting aluminium, titanium and copper.
- Predict a reaction method of a metal based on its position in the reactivity series.

Feedback Focus:
Knowledge input | Check | Development | REACH | Improvement
Details:
Act on teacher feedback to improve 6 mark exam question. Peer-assessment of alloy question.

Lesson 7: Metals can be made harder.

Key words: Brittle, alloys, malleable, ductile, low density, resistant to corrosion.

Learning Intentions:
Students should develop an understanding that:
- Metals can be converted into alloys with a specific set of properties for their use.
- Transition metals are found in the central block of the periodic table and have a sea of free electrons which makes them good electrical conductors.

Success Criteria:
- Explain why metals conduct electricity.
- Explain why metals are mixed small amounts of similar metals.
- Describe what happens to the structure of metals when alloys are formed.

Feedback Focus:
Knowledge input | Check | Development | REACH | Improvement
Details:
Act on teacher feedback to improve 6 mark exam question. Peer-assessment of alloy question.

Lesson 8: Copper can be extracted like other metals.

Key words: Smelting, blast furnace.

Learning Intentions:
Students should develop an understanding that:
- Copper-rich ores are heated in a furnace in a process called smelting.
- Electricity is passed through solutions containing copper compounds to purify them.

Success Criteria:
- Recall how copper is extracted.
- Describe how the separation of high grade ores is different to low grade ores.
- Evaluate why iron can be used instead of carbon to extract copper.
- Compare and contrast the properties of iron vs steel.
- Case study of iron & steel?

Feedback Focus:
Knowledge input | Check | Development | REACH | Improvement
Details:
Teacher assessment of 6 mark exam question.
Feedback Focus:
Knowledge input | Check | Development | REACH | Improvement

Details:
Teacher assessment of evaluation.