Science KS4: Blended Learning Booklet

Stewards Academy

C8 Chemical Analysis

Name:

Form:

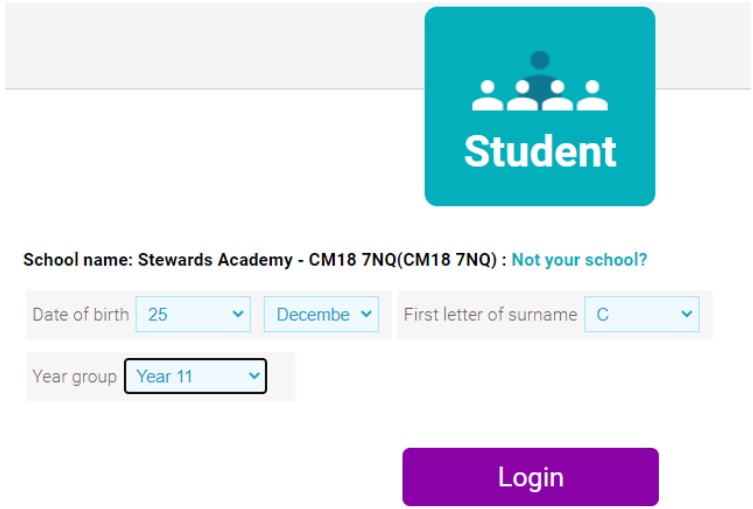
Aim to complete four lessons each week. Watch the videos and follow the four part lesson plan

All video clips are online using the ClassCharts link. Upload all work onto ClassCharts for feedback.

The online textbook has all the key information and vocabulary to help you with this unit

To log on to the online textbook:

- https://connect.collins.co.uk/school/portal.aspx
- Type in “stewards” and select Stewards Academy
- Login using your date of birth,
  initial of your surname and your
  academic year



Contents

Contents

(T) = Triple scientists only

Big Picture – Year 10 Overview

Science

Unit Test

End of Year Exams

Nest Year

IR emission and absorption (T)

Colour, lenses, images and magnification (T)

The electro-magnetic spectrum

Sound waves and seismic waves (T)

Properties of waves

UNIT P6

Unit Test

Spectroscopy and other instrumental methods (T)

Tests for gases, metals, hydroxides and anions (T)

Pure substances and chroma-tography

Polymers and poly-merisation (T)

Waves

I will be able to describe characteristics of waves that can be measured. **I will** be able to measure reflection and refraction of waves and explain why they occur. **I will** be able to place visible light withing the electromagnetic spectrum. ***I will*** *be able to sound waves can reveal structures (T).* ***I will*** *be able to explain how lenses work (T)*

Hydrocarbons & Chemical analysis

I will be able to describe the properties of hydrocarbons. ***I will*** *be able to describe the properties of alkenes, alcohols, carboxylic acids and polymers (T).* **I will** be able to use techniques to produce and identify a pure substance. ***I will*** *be able to identify positive and negative ions and evaluate different analysis techniques (T).*

Meiosis and reproduction

Genetics and gene disorders

The work of Gregor Mendel (T)

Unit Test

UNIT C7 & C8

Crude oil, hydrocarbons and fractional distillation

Combustion and cracking of alkanes

Alkenes, alcohols and carboxylic acids (T)

DNA structure and protein production (T)

Genetics

I will be able to explain how we inherit our characteristics as a result of our genes which are made of DNA. **I will** be able to explain how the DNA is replicated and packaged in a specialised way to form the sex cells. ***I will*** *be able to describe the work by Gregor Mendel around plant genetics*

I will be able to explain how forces affect motion and how an understanding of these forces can make driving safer. ***I will*** *be able to explain the effects of forces on levers and in creating pressure (T).* I will be able to explain the effects of forces applied to springs.

Forces

DNA, genes and the human genome

UNIT B6

Unit Test

Forces and energy in springs

Moments, levers and pressure (T)

Momentum and road safety

Mass and Weight

Forces, speed and acceleration

UNIT P5

Energy Changes & Reaction Rates

I will be able to describe, explain and represent energy changes in chemical reactions and link them to bond energies and the particle theory. ***I will*** *be able to explain how dells produce a voltage and how fuel cells work (T).* **I will** be able to measure and calculate the rate of a reaction and describe factors that can affect rate. ***I will*** *be able to apply Le Chatelier's principle to reactions in equilibrium (T).*

Unit Test

Exo and endo thermic reactions

Reaction profiles

Cells, batteries and fuels cells (T)

Measuring rates of reaction

Factors affecting rates of reaction

Catalysts and collision theory

Reversible reactions and energy changes

Factors affecting equilibrium

UNIT C5 & C6

I will be able to explain how conditions in the body, processes and organ systems are coordinated and controlled. **I will** be able to describe how hormones control sexual development and human reproduction, *as well as how hormones enable plants to respond to stimuli (T)*

Homeostasis

Unit Test

Plant hormones (T)

Human reproduction and IVF

The endocrine system and the kidneys (T)

The nervous system *and the eye (T)*

Homeostasis

UNIT B5

Unit Test

Nuclear fission and fusion (T)

Hazards and uses of radiation

I will be able to reconise an atomic isotope and explain how one isotope can turn into another through three different forms of radioactive decay. **I will** be able to represent radioactive decay using a nuclear equation.

Atomic structure

Titration (T)

Electrolysis

Oxidation and reduction)

Unit Test

UNIT P4

Atomic structure

Radioactive decay

Nuclear equations

Neutralisation

Chemical changes

I will be able to describe why some metals are more reactive than others, **I will** be able to describe how neutralization occurs and how salts are formed. **I will** be able to explain how some metals are extracted by electrolysis rather than oxidation

I will be able to describe how lifestyle choices can affect the risk of catching a non-communicable disease. **I will** be able to explain how communicable diseases are spread and how we can control their spread. ***I will*** *be able to describe how plants are affected by and protected from disease causing organisms (T).*

Health

Metal reactivity

UNIT C4

Unit Test

Plant diseases & defenses (T)

Protecting the body

Malaria

Pathogens

Health and disease

UNIT **B4**

Year 10

ZOOM IN...

MY LEARNING JOURNEY:

Subject: Chemical Analysis Year: 11 Unit: C8

AIMS

Students will learn the properties of pure substances and how to test for them. They will learn how to differentiate between mixtures and compounds and will be able to describe how mixtures can be separated. They will learn about formulated mixtures. Students will investigate several different methods used to identify substances within a mixture including chromatography. Students will also carry out chemical tests to identify unknown substances and to interpret observations from chemical tests.

DEVELOPING COURAGE

C The ability to test for substances keeps us safe
O To carry out a forensic chromatogram
U Atoms are combined as compounds or mixtures
R Carry out the practical and analyse the results carefully
A Appreciate the shill of a forensic scientist
G Share scientific understanding with others
E Carrying out the gas tests

UP NEXT

The atmosphere

- Proportion of gases
- How the atmospehere evolved
- Climate change
- Carbon footprint
- Atmospheric pollutants

CAREERS

- Chemical Engineer
- Forensic Scientist
- Hazardous Waste Chemist
- Toxicologist

PREVIOUS LEARNING

Pupils will have some knowledge about how substances such as sandy, salty water can be separated. They will have carried out basic chromatography, made salts and tested for gases. They will also be familiar with using basic laboratory instruments to make measurements.

WHAT WE KNOW/ REMEMBER

- .....
- .....
- .....
- .....
- .....

RECOMMENDED READING

1. Prepper's Water Survival Guide Paperback by Daisy Luther,
2. Forensic Science: by DK Eyewitness,
3. Chemistry: A Very Short Introduction by Peter Atkins.

PERSONAL OBJECTIVES

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Lesson 1: C8.1 – Key Concept: Pure substances

Connection

Have a look at the topic overview and the C8 zoom in.

Populate what you know and your personal objectives.

Activation

LI: describe, explain and exemplify processes of separation

1. https://www.youtube.com/watch?v=-OtJI-R-4rU&t=241s
2. Make a note of the title and the LI
3. Read pages 264-265
4. Define “Mixture”, “Element” and “Compound” using the glossary
5. Name five methods of physical separation
6. Describe for each method when it is appropriate to use that method using the section “What can we separate?”
7. Describe how the purity of a substance affects the MP and BP using section “Pure and impure substances”

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C8 DIP file

Demonstration

Attempt questions 1-7.
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C8.1 – Key Concept: Pure substances

Connection

1 NA
2 NA
3 NA

Demonstration

1 Dissolve the mixture in water. The salt will dissolve but the sand won't. Filter to remove the sand. Heat the salt solution to concentrate and leave to crystallise.
2 Use chromatography. The colours will separate.
3 The magnesium is added until there is excess. It is easy to filter off the excess magnesium. Also, if there was any sulfuric acid left in solution, it would be more difficult to purify the magnesium sulfate.
4 Filter so that the sediment and grit was removed. Then fractionally distill the ethanol / water mixture.
5 Sam. Impurities produce a wide range of melting points. Sam's sample had the least variation and smallest range in melting point.
6 Akira had the purest sample since the boiling point was lower than Ben's and closer to the data book value.
7 a Yes it was. The boiling point of water is 100 °C. Impurities raise the boiling point.
b Evaporate / distill the water / crystallise the solid.
c It was not pure. It melted over a wide range and not sharply.

Lesson 2: C8.2 – Formulations

Connection

Q1. What separating technique should be used to separate mud and water?

Q2. What separation technique should be used to separate crude oil?

Q3. How does a substances purity affect its MP and BP?

Activation

LI: identify formulations, given appropriate information

1. https://www.youtube.com/watch?v=B1KtW0Iv3r0
2. Make a note of the title and the LI
3. Read pages 266-267
4. Define "Formulation" using the glossary
5. Name three products that need to be formulated
6. Name the elements that make up the formulation of fertiliser
   - Give the reason each element is needed

Demonstration

Attempt questions 1-6.
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C8 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C8.2 – Formulations

Connection

1 Filtration
2 Fractional distillation
3 If a substance is impure it will have a lower melting point than the pure substance, It will also have a higher boiling point than a pure substance

Demonstration

1 Most mass: salt. Least mass: protein
2 If the components are not in the correct proportions, it will affect the properties of the cement e.g. setting time, strength etc. This could be dangerous since it is used in building.
3 Gold has many uses each requiring different properties. If they are not precisely prepared, electrical circuits may not work etc.
4 They contain the same percentage of nitrogen. NPK 4:1:3 contains 12.5 % P and 37.5 % K. NPK 4:2:2 contains 25 % P and 25 % K.
5 E. It has too much active ingredient and too little filler.C. It has too little lubricant and too much filler.
6 Oil and solvent are harmful to the environment and to the user. Water based paints were formulated to limit the harm caused. They are as good or better than solvent based paints.

Lesson 3: C8.3 – Chromatography

Connection

Q1. Name three products that need to be formulated?

Q2. What is potassium used for in fertiliser?

Q3. Explain how NPK fertiliser with a ratio of 4:2:3 is made

Activation

LI: interpret chromatograms and determine Rf values

1. https://www.youtube.com/watch?v=TdJ57SQ6GAQ
2. Make a note of the title and the LI
3. Read pages 268-269
4. Define "mobile phase", "stationary phase" and "R_f" using the glossary
5. Draw and label figure 8.5
6. Copy the equation for the R_f value
7. Draw and label figure 8.7

Demonstration

Attempt questions 1-6.
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in **blue pen**

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C8 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C8.3 – Chromatography

Connection

1 alloys, paints, fertilisers
2 potassium helps plants withstand draught and disease
3 four parts nitrogen is added to two parts phosphorus and three parts potassium

Demonstration

1 Because there is no dark blue spot in the food.
2 You would have to obtain some different samples of known green food colours and spot them along with the unknown food colour. If they match, then the food colour has been identified.
3 56/70 = 0.80
4 0.68 × 90 = 61.2 mm
5 A – A single substance but not the same substance as in B or C. It doesn't contain the pure drug.
B – Contains two substances – a mixture. One of these is the drug. The other is not in A or C. So the drug is not pure.
C – Contains one substance, the pure drug.
6 Pure drug: 7.1/9.2 = 0.77
Spot A: 4.2/9.2 = 0.46
Spot B: 5.3/9.2 = 0.58

Lesson 4: C8.4 – Investigate how paper chromatography can be used in forensic science to identify an ink mixture used in a forgery

Connection

Q1. During simple chromatography, what part is the stationary phase?

Q2. When separating a nail polish. Why can you not use water as the solvent?

Q3. What causes different substances to a have different Rf values?

Activation

LI: make and record measurements used in paper chromatography

1. https://www.youtube.com/watch?v=pnTGNAfu6GE
2. Make a note of the title and the LI
3. Read pages 270-271
4. Draw and label figure 8.9
5. Copy the equation for the Rf value.

Demonstration

Attempt questions 1-11.
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in **blue pen**

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C8 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C8.4 – Investigate how paper chromatography can be used in forensic science to identify an ink mixture used in a forgery

Connection

1 The paper is the stationary phase

2 nail polish does not dissolve in water.

3 different materials are attracted to the paper at different strengths. If it is strongly attracted then it will not move as far.

Demonstration

1 The ink contains dyes which would move up the paper with the solvent. This would interfere with the other spots.
2 Capillary tube.
3 The dyes in the ink spots are soluble in the solvent. If the solvent covers the ink spots, the dyes would just dissolve in the solvent.
4 It should be left as long as possible to allow good separation. However, the paper needs to be removed before the solvent front reaches the top.
5 Red, blue and green.
6 Yellow.
7 Rf = 6.7/12.5 = 0.54
8 Jo: Rf = 4.5/10 = 0.45 Alex: Rf = 5.6/12.5 = 0.45
9 Sam: Rf = 4.2/12.4 = 0.339 Jo: 0.339 x 10 = 3.39 = 3.4 cm.
10a The distance for the yellow spot is too large. Jo's solvent front did not travel as far so the value should be less than Alex and Sam's.
b Repeat the experiment and remeasure the distance. Calculate the Rf and compare it to Sam and Alex's Rf value.
11 Dyes in the ink have different solubilities in different solvents. Therefore they will be carried different distances up the chromatography paper. This will alter their Rf value.

Lesson 5: C8.5 – Test for gases

Connection

Q1. What is the equation for the Rf value?

Q2. when separating different inks. The solvent moved 60mm. A red ink moved 20mm and a blue ink moved 45mm. What is the Rf value for each ink?

Q3. Name three mistakes you could make during paper chromatography?

Activation

LI: recall the tests for four common gases

1. https://www.youtube.com/watch?v=V7jhc_S5WL0
2. Make a note of the title and the LI
3. Read pages 272-273
4. Draw and label 8.10 – and write in words the test for hydrogen
5. Draw and label 8.11 – and write in words the test for oxygen
6. Draw and label 8.12 – and write in words the test for carbon dioxide
7. Draw and label 8.13 – and write in words the test for chlorine
8. https://www.youtube.com/watch?v=rWeO1q0gHJE

Demonstration

Attempt questions 1-7
In 10 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C8 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C8.5 – Test for gases

Connection

1 $\boldsymbol{R_f = \frac{distance\ moved\ by\ the\ substance}{distance\ moved\ by\ the\ solvent}}$

2

Red Ink: $\boldsymbol{R_f = \frac{20mm}{60mm} = \frac{1}{3}}$

Blue Ink: $\boldsymbol{R_f = \frac{45mm}{60mm} = \frac{3}{4}}$

3

- Use ink to draw the line instead of pencil
- Fill the solvent above the pencil line
- Use the wrong solvent

Demonstration

1 Hydrogen + oxygen → water
2 Three conditions for combustion – source of ignition, fuel and oxygen. When the splint goes into oxygen this increases the The splint is the fuel, the glow is the ignition source and the increase in oxygen increase the combustion.
3 Calcium hydroxide + carbon dioxide → calcium carbonate + water
4 As more CO2 is bubbled through the cloudy limewater the calcium carbonate reacts to form calcium hydrogen carbonate which is soluble in water and so the solution goes clear again
5 (pale) Green
6 Bromine
7 Iodine

Lesson 6: C8.6 – Flame tests

Connection

Q1. Describe the test for hydrogen

Q2. Describe the test for oxygen

Q3. Describe why carbon dioxide turns lime water cloudy

Activation

LI: identify the colours of flames of ions

1. https://www.youtube.com/watch?v=n1ixjhzwr_E
2. Make a note of the title and the LI
3. Read pages 274-275
4. Define “cation” and “anion” using the glossary
5. Write down the method for conducting a flame test
6. Draw and label figure 8.15

Demonstration

Attempt questions 1-9
In 10 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C8 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C8.6 – Flame tests

Connection

1 Hydrogen burns rapidly with a ‘pop’ sound.
2 a glowing splint inserted into a test tube of the gas. The glowing splint relights in oxygen
3 Limewater is calcium hydroxide. When carbon dioxide is passed through limewater, the product formed is calcium carbonate.

Demonstration

1 Blue
2 It needs to be clean to avoid contamination from other metal compounds. It needs to be moistened so that the metal compound sticks to the wire.
3 Copper chloride (any ionic compound including copper).
4 It could be contaminated with a different ionic compound which is interfering with the test.
5 Calcium carbonate - red. Copper(II) chloride - green. Potassium chloride - lilac.
6 Flame colours may be contaminated from previous tests. Some metals do not give colours. Different metal ions may give very similar colours.
7 Potassium chloride will give a lilac flame and calcium chloride a red flame.
8a Calcium carbonate / $CaCO_3$.
b $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$
9 a Sodium.
b Sodium chloride.
c $2Na(s) + Cl_2(g) \rightarrow 2\ NaCl(s)$

Lesson 7 C8.7 – Metal hydroxides

Connection

Q1. What colour does calcium burn with?

Q2. What is the definition of an ion?

Q3. Metals form what type of ion and why?

Activation

LI: recognise the precipitate colour of metal hydroxides

1. https://www.youtube.com/watch?v=hVBsrwJFBTY&t=48s
2. Make a note of the title and the LI
3. Read pages 276-277
4. Define “precipitate” using the glossary
5. Draw and label figure 8.18
6. Draw and label figure 8.19
7. Draw and label figure 8.20 describing how a precipitate forms

Demonstration

Attempt questions 1-7
In 10 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C8 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C8.7 – Metal hydroxides

Connection

1 orange - red
2 An ion is an atom that has either lost or gained electrons
3 metals form cations which are positive because they lose their negative outer electrons

Demonstration

1 Add sodium hydroxide solution to copper(II) sulfate solution in a test tube. A gelatinous blue precipitate of copper(II)hydroxide is formed.
2 The metal ion is iron(II) / Fe2+. The precipitate is iron(II)hydroxide.
3 Calcium ions / Ca2+
4 A: Copper sulfate. Copper forms a blue precipitate with NaOH.
B: Magnesium sulfate. Magnesium forms a white precipitate with NaOH.
5 $MgCl_2(aq) + 2NaOH(aq) \rightarrow Mg(OH)_2(s) + 2NaCl(aq)$
6 Fe(III) is Fe^{3+}. To balance charge, it needs $3OH^-$ ions to make $Fe(OH)_3$.
7 $FeCl_3(aq) + 3NaOH(aq) \rightarrow Fe(OH)_3(s) + 3NaCl(aq)Fe^{3+}(aq) + 3OH^-(aq) \rightarrow Fe(OH)_3(s)$