Stewards Academy

Science KS4: Blended Learning Booklet

C1 Atomic structure & the periodic table

Name:

Form:

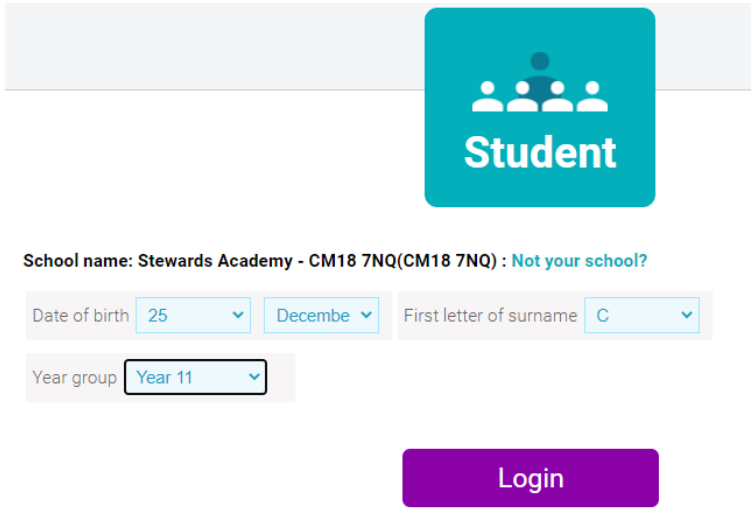
Aim to complete four lessons each week. Watch the videos and follow the four part lesson plan

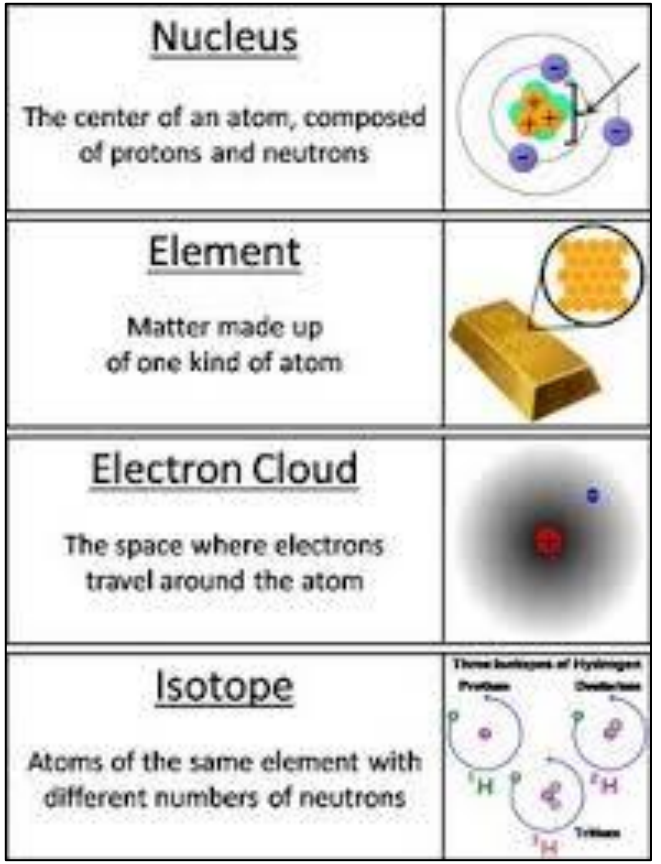
All video clips are online using the ClassCharts link. Upload all work onto ClassCharts for feedback.

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 9 Overview

Science

Specific latent heat

Particle motion in gases (T)

End of Year Exam

Nest Year

Specific heat capacity

Changing state

Density

UNIT P3

End of Unit Test

Volumes and concentrations (T)

Percentage yield (T)

Amounts of substance (moles)

Apparent changes in mass

Matter

I will be able calculate the specific heat capacity of water and be able to describe the difference between the specific latent heat of vaporization and the specific latent heat of fusion. **I will** be able to explain the effect heat energy has on gas particles *and how this is related to volume (T).*

I will be able to explain and apply the law of conservation of mass. **I will be** able to explain how we measure amounts of substances and how we can use these values to in calculations. ***I will be** able to determine chemical yields (T)*

Chemical Quantities

Osmosis and active transport

Enzymes and digestion

Plants and minerals

Heart and circulatory system

Gas exchange

End of Unit Test

UNIT C3

Conservation of mass

UNIT B3

I will be able to explain *the principles behind static electricity (T)* and the key concepts in electricity. **I will** investigate and be able to describe the characteristics of electrical components. **I will** be able to explain how electricity is used safely in the home

Electricity

End of Unit Test

Electricity in the home

Investigating resistance

Circuit components

Series and parallel circuits

Static electricity (T)

UNIT P2

Moving materials

I will be able to explain the difference between diffusion and active transport. **I will** be able to explain why some organisms need organ systems and different organisms move things in different ways. **I will** be able to explain how enzymes work.

I will be able to explain what happens when substances change state and why some substances need a lot of energy for a change of state to occur. **I will** be able to describe different types of chemical bond and how they give different substances different properties.

Chemical Bonds

End of Unit Test

Nano particles (T)

Giant covalent structures

Bond properties

States of matter

Chemical bond formation

UNIT C2

Translocation

Transpiration

I will be able to explain how plants are adapted to survive and get what they need from the environment. **I will** be able to explain how factors affect photosynthesis . **I will** be able to describe how water moves through a plant and how other substances diffuse in/out of plant cells

Photosynthesis

Diffusion

Increasing food production

Investigating photo-synthesis

UNIT B2

End of Unit Test

Energy Resources

Energy transfer (T)

Specific heat capacity

Work done & Power

I will be able **to** use a model to represent and atom and explain how the model of an atom was developed. **I will** be able to explain how we can use radioactive atoms in carbon dating and why some elements are more reactive than others based on their atomic structure. ***I will be** able to describe properties of transition metals (T)*

I will be learning about the connections between energy and power, and energy and temperature. **I will** be able explain how energy is transferred and describe how different energy resources have an impact on the environment

Energy

Energy

Atomic Structure

Atoms, element compounds & mixtures

Sub-atomic structure

The periodic table

Groups 1,9, & 0

Transition metals (T)

End of Unit Test

UNIT P1

I will be able to describe how scientists have developed their understanding cell structure and function. **I will** be able to explain how a fertilized egg develops into a complex organism. **I will** be able to explain how organisms get their energy from food. ***I will be** able to explain how microorganisms are grown in the lab and how their growth is affected by disinfectants and antibiotics (T).*

Cell Biology

UNIT C1

End of Unit Test

Microbes and antibiotics (T)

Respiration

Stem cells

Cell division and differentiation

Structure and function of cells

UNIT B1

Year 9

ZOOM IN...

MY LEARNING JOURNEY:

Subject: Atoms & Periodic Table Year: 9 Unit: C1

AIMS

Students will learn about the structure of atoms and use a range of different models to describe both the atoms themselves and the physical and chemical properties of the elements and compounds they form. Students will also learn how the periodic table was constructed.
This unit will support students future learning by providing an opportunity to learn how models can be used to represent abstract ideas such as atoms. They will explain how these models have evolved over time. They will discover that atoms can exist as isotopes and that some atoms are more reactive than others.

DEVELOPING COURAGE

- **C** Learn how to identfy and handle chemicals
- **O** To investiagete the sub atomic world
- **U** Understand how atoms are the building blocks of everything
- **R** Learn the basic rules that underpin all of chemistry
- **A** How organised and predictable chemicals are
- **G** The periodic table is built on scientists sharing their ideas
- **E** Modelling atoms

UP NEXT

Properties of matter

- Chemical bonds
- Chemical properties
- Chemical structure
- Technolgy of nanoparticles

CAREERS

- Synthetic Chemist
- Chemical Engineer
- Cleaner.

PREVIOUS LEARNING

Pupils will have some knowledge of what an element, mixture and compound is; and should be able to link the properties of some elements to their function. They should have an idea of atomic structure and that atoms can be classified based on their properties and are grouped accordingly on the periodic table. .

WHAT WE KNOW/ REMEMBER

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

RECOMMENDED READING

1. The Secret Life of the Periodic Table by B. Still,
2. The Atom: the building block of everything by J. Challanor,
3. A Beginners Guide to the Periodic Table by G Arbuthnott

PERSONAL OBJECTIVES

- .....
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Lesson 1: C1.1 – Elements and Compounds

Connection

Have a look at the topic overview and the C1 zoom in.

Populate what you know and your personal objectives.

Link to periodic Table song https://www.youtube.com/watch?v=VgVQKCcfwnU

Activation

LI: Identify symbols of elements on the periodic table. Recognise compounds from their formula and identify the elements in a compound.

1. https://www.youtube.com/watch?v=nsbXp64YPRQ
2. Make a note of the title and the LI
3. Read pages 14-15
4. Define “element” and “compound”
5. Draw and label figure 1.3

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

Consolidation

Complete and self-assess the relevant past paper question for this topic - From the C1 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: C1.1 - Elements and Compounds

Connection

1 NA
2 NA
3 NA

Demonstration

1 Element, compound, compound
2 Beryllium and chlorine
3 Potassium and bromine
4 Lead and iodine
5 Sodium oxide
6 The element iron and the compound carbon dioxide.
7 Hydrogen reacts with oxygen to form water.

The oxygen had to be chemically removed from substance D. So substance D is a compound - zinc oxide.

Lesson 2: C1.2 Atoms, formulae and equations

Connection

Q1. What does “compound’ mean?

Q2. Identify the elements found in iron sulfide

Q3. Substance X reacted with hydrogen to produce copper and water. Explain whether substance X is an element or a compound.

Activation

LI: Explain that atoms join together to form molecules.
Explain how formulae represent elements and compounds.

1. https://www.youtube.com/watch?v=dxY3svHNu4M&feature=emb_logo (TIP: Have your periodic tables in front of you)
2. Make a note of the title and the LI
3. Read pages 16-17
4. Define “**balanced**” & “**molecule**”
5. Draw and label fig 1.8. Use keywords from the section “Atoms and molecules” to describe the difference between the molecule of an element and the molecule of a compound.

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 DIP file

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

Extension

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

Answers: C1.2 – Atoms, Formulae and Equations

Connection

1 substance containing two or more elements chemically combined in fixed proportions
2 iron and sulfur
3 hydrogen reacts with oxygen to form water. Substance X provides the oxygen therefore X is a compound – copper oxide.

Demonstration

1 C **&** Cl_2 elements as one type of atom
CO_2 & SO_3 compounds as two types of atom
2 a carbon and oxygen, sulfur, chlorine, sulfur and oxygen, carbon, carbon and hydrogen
b 2, 1, 1, 2, 1, 2
c 3, 8, 2, 4, 60, 14
3 Magnesium, sulfur, oxygen and carbon, hydrogen
4 LiCl, $MgCl_2$, K_2O
5 $2Na + Cl_2 \rightarrow 2NaCl$
6 $4Al + 3O_2 \rightarrow 2Al_2O_3$
7 $N_2 + 2O_2 \rightarrow 2NO_2$ D = 1, E = 2, F = 2 **1** C Cl_2 elements as one type of atom

Lesson 3: C1.3 – Mixtures

Connection

Q1. State what the 'formula' of a substance tells us.
Q2. H_2SO_4 is the chemical formula for sulfuric acid.
i) How many different atoms are there in the acid?
Iii How many atoms are there in the molecule overall?
Q3. Write the word ad balanced symbol equation for the reaction of magnesium with water

Activation

LI: Understand that all substances are either elements, compounds or mixtures. Explain that mixtures can be separated.

1. https://www.youtube.com/watch?v=wuJ1xyqo2Hk&feature=emb_logo
2. Make a note of the title and the LI
3. Read pages 18-19
4. Define "mixture" & "chromatography"
5. Draw and label figure 1.10 (page 19). Identify 4 processes for separating mixtures.

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 DIP file

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

Extension

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

Answers: C1.3 - Mixtures

Connection

1 The chemical formula of a substance tells us which elements are there in a compound and the proportion of each element.
2 i) 3 elements (hydrogen, sulfur and oxygen)
ii) 7 atoms in total (2 hydrogen, 1 sulfur and 4 oxygen atoms)
3
Word equation
Magnesium + oxgen → magnesium oxide

Balanced Symbol equation
$Mg + O_2 \rightarrow 2MgO$

Demonstration

1 Filter paper in a filter funnel, with a flask beneath
2 Can be separated by dissolving and filtering
3 Chromatography
4 Distillation
5 Dissolve the mixture in water, filter off the sand. Evaporate off the alcohol to leave copper sulfate solution. Crystallise the copper sulfate from the solution to get pure crystals.
6 (bottom) d, b, a, c (top)

Lesson 4: C1.4 – Changing ideas about atoms

Connection

Q1. State the method used to separate a mixture of sand, water and salt.
Q2. Give the name of the process used to separate the pigments found in a food dye.
Q3. Give examples of two mixtures – one that can be separated by using simple distillation and one by fractional distillation.

Activation

LI: Describe how atomic models have changed over time. Explain why the atomic model has changed over time.

1. https://www.youtube.com/watch?v=sG6QoLxwIw4
2. Make a note of the title and the LI
3. Read pages 20 - 21
4. State the idea about materials that the Greek philosopher Democritus came up with.
5. Describe John Dalton's model of the atom almost 2000 years later.

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 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

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

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Purple questions to GCSE Level 9

Answers: C1.4 - Changing ideas about atoms

Connection

1 filtration, evaporation
2 chromatogrpahy
3 simple distillation: water and ethanol
Fractional distillation: crude oil

Demonstration

1 Dalton did not know about negative electrons which were discovered much later. So positive charge was not considered either.

2 In the Dalton model there were no sub-atomic particles, the atom was the smallest particle

3 He had more evidence and was able to do theoretical calculations

4 An exact amount of energy, no more, no less

5 Democritus (400BC, atoms), Dalton (1803, atoms), J. J. Thompson (1897, electron scattering expt), Geiger, Marsden and Rutherford (1909, nucleus), Rutherford (1911, nucleus positively charged and much of atom is empty space), N. Bohr (1913, orbits), J Chadwick (1932, neutron).

6 Needed different experimental evidence and the neutron was not charged

Lesson 5: C1.5 – Modelling the atom

Connection

Q1. Name the scientist that came up with the idea of the 'plum pudding' model of the atom.
Q2. Name the experiment used by Geiger, Marsden and Rutherford to collect evidence for the existence of a nucleus.
Q3. State the developments to the atomic model that were added by Bohr and Chadwick.

Activation

LI: Describe the atom as a positively charged nucleus surrounded by negatively charged electrons. Explain that most of the mass of an atom is in the nucleus.

1. https://www.youtube.com/watch?v=0ASldDQmIOQ
2. Make a note of the title and the LI
3. Read pages 22-23
4. Define "electron shell"
5. Draw and label figure 1.15 and answer the question in the table 22-23
6. Copy the table on page

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

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 DIP file

Answers: C1.5 - Modelling the atom

Connection

1 J J Thompson

2 Alpha scattering experiment

3 Bohr: idea of electron orbits Chadwick: existence of the neutron particle

Demonstration

1 Positive

2 2

3 That it is very small (and in constant motion around the nucleus)

4 Nucleus is made of protons and neutrons held together with no empty space, so a small radius. The electrons are in energy levels away from the nucleus with space in between so the radius of the atom is much larger.

5 There are more electrons in the potassium atom than in the lithium atom so they will take up more space around the nucleus. (The answer to this question does not yet need to refer to successive energy levels)

6 As more positive charges are added they have greater attraction or pull on the negative charges which move towards the nucleus making the overall radius smaller

Lesson 6: C1.6 – Relating charges and masses

Connection

Q1. What particles is the nucleus of an atom made up of?

Q2. Draw/Describe the structure of an atom

Q3. Explain why the radius of the nucleus is much smaller than the overall radius of the atom

Activation

LI: describe the structure of atoms and recall the relative masses and charges of protons, neutrons and electrons.

1. https://www.youtube.com/watch?v=EMDrb2LqL7E
2. Make a note of the title and the LI
3. Read pages 24-25
4. Define “atomic number” and “mass number”
5. Draw and label fig 1.16 The structure of a helium atom
6. Label the nucleus and the particles found in the helium nucleus (on the same diagram)
7. Label the electrons on the helium atom. (on the same diagram)

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 DIP file

Demonstration

Attempt questions 1-9
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Extension

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

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

Answers: C1.6 – Relating charges and masses

Connection

1 neutrons and protons

2 nucleus containing neutral neutrons and positive protons
negative electrons orbiting in shells around the nucleus

3 Nucleus is made of protons and neutrons held together with no empty space, so a small radius. The electrons are in energy levels away from the nucleus with space in between so the radius of the atom is much larger.

Demonstration

1. 3

2 The neon atom has 10 positively charged protons and 10 negatively charged electrons i.e. the same number of each. So the charge cancels out.

3 Li

4 20

5 9 protons, 9 electrons and with mass of 19 must be 10 neutrons

6 17 protons as it has 17 electrons and with mass 35 must be 18 neutrons

7

Mg atom	12	12	12	12	0
Mg ion	12	12	10	12	+2

8 A Mg atom has equal numbers of protons and electrons so is neutral.

A Mg ion has 12 protons and 10 electrons so two less negative charges so is charged positively

9 10

Lesson 7 C1.7 – Sub-atomic particles

Connection

Q1. What is the atomic number of an element mean?

Q2. Write the meaning of mass number

Q3. If calcium loses 2 electrons it becomes a positively charged ion. Write out the number of protons, electrons and neutrons for a Calcium ion. Write down its charge

Activation

LI: Use the definitions of atomic number and mass number

1. https://www.youtube.com/watch?v=jNmNyy2BX4g&feature=emb_logo
2. Make a note of the title and the LI
3. Read pages 26-27
4. Copy out the table on page 26 – you can use the elements already on the table or replace them with other elements from the periodic table.

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 DIP file

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

Extension

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

Answers: C1.7 - **Sub-atomic particles**

Connection

1 atomic number is the number of protons in the atom of an element

2 mass number is the sum of the protons and neutrons in an atom

3 Calcium ion:
Protons: 20
Electrons: 18
Neutrons: 20
Charge: +2

Demonstration

1 Al 13 27 13 13 14

2 15 15 16

3 $^{35}_{17}Cl$

4 6 protons**,** 6 electrons, 7 neutrons

5 Similar as they each have 1 proton and 1 electron. Different as they have 1, 2 or 3 neutrons.

6 27.7

Lesson 8: C1.8 – Electronic structure

Connection

Q1. Why is a sodium atom neutral?

Q2. Sodium has a mass number of 23. How many neutrons does it have?

Q3. Write out a balanced equation for the reaction of potassium with chlorine.

Activation

LI: Explain how electrons occupy shells in an order

1. https://www.youtube.com/watch?v=0hsh0VoFsts
2. Make a note of the title and the LI
3. Read pages 28-29
4. Write out the Keywords
5. Read and Produce your own set of study notes from the section with the heading: "Electron patterns and groups"

Demonstration

Attempt questions 1-8
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 C1 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: C1.8 - Electronic structure

Connection

1 It has 11 protons (positive charges) and 11 electrons (negative charges) so the charges cancel each other out.

2 Neutron number = mass number – atomic number
so 23 – 11 = 12 neutrons

3 $2K + Cl_2 = 2KCl$

Demonstration

1 H is ring with 1 electron. Li is two rings, first with 2 electrons, second with 1 electron

2 2,5

3 a Shell pattern 2,8,1

b Sodium / Na

c Group 1

4 2,7

5 Ca / Calcium. 20 neutrons

6 2,8,8

7 Group number is the same as the number of electrons in the outer shell, except for group 0 which have complete outer shells.

8 a 13

b 13

c Group 3

Lesson 9: C1.9 – The periodic table

Connection

Q1. Write out the maximum number of electrons that the first three electron shells can hold.

Q2. Which atom has the electronic structure described in Q1?

Q3. Explain why Carbon is in the 2nd row of the periodic table and the 4th column of the periodic table in terms of its electronic structure.

Activation

LI: Explain how the electronic structure of atoms follows a pattern

1. https://www.youtube.com/watch?v=-qwDLW6fq8Q
2. https://www.youtube.com/watch?v=IdS9roW7IzM
3. Make a note of the title and the LI
4. Make a list of the key words
5. Read pages 30-31
6. Draw and label Fig 1.22 on page 30

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 DIP file

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

Extension

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

Answers: C1.9 - **The periodic table**

Connection

1 1st shell: 2; 2nd shell: 8

2 Argon

3 Carbon has 2 electron shells therefore it is in the 2nd row or period. Carbon has 4 electrons in its outermost shells therefore it is in the 4th column or group 4

Demonstration

1 Aluminium
2 Chlorine
3 2,8,6; Sulfur, Group 6, Period 3
4 Group 7, Period 3
5 F: 2,7; Cl: 2,8,7; They have 7 electrons in the outer shell
6 Oxygen, Sulfur

Lesson 10: C1.10 – Developing the periodic table

Connection

Q1. Which element has an atomic number 15.

Q2. What is the pattern of electrons in the atom of the element with an atomic number of 7? Identify the element, its group and its period.

Q3. Why are both the elements in Q1 and 2 in the same group?

Activation

LI: Describe the steps in the development of the periodic table

1. https://www.youtube.com/watch?v=fPnwBITSmgU
2. Make a note of the title and the LI
3. Read pages 32 - 33
4. Copy out the table on page 32 with the heading **"Dobereiner triads"** and state why Dobereiner grouped the elements this way.
5. Describe the order of John Newland's grouping of elements and the meaning behind his **'law of octaves'**

Demonstration

Attempt questions 1-8
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 C1 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: C1.10 - Developing the periodic table

Connection

1 phosphorous

2 Electronic structure: 2,5
Nitrogen: period 2, group 5

3 Both phosphorous and nitrogen have 5 electrons in the outermost shell

Demonstration

1 That every 8 elements there was often a pattern of behaviour

2 Not all the elements had been discovered.

3 Gallium

4 The chemical behaviour of some elements that were grouped together was very different because order was originally based on atomic weight. Mendeleev swapped elements so that their chemical behaviour was similar.

5 He predicted the atomic 'weight' and density, which were very close in the discovered element, germanium. It fitted in the space in the table that he predicted. The evidence from this discovery supported his predictions.

6 a 20.

b Mn and Cu, Nb and Rh Re and Pt and Hg

7 $^{40}_{18}$Ar and $^{39}_{19}$K. The relative atomic mass of $^{40}_{18}$Ar suggests it should be placed after $^{39}_{19}$K.

8 Disagree – it is possible to keep on adding protons to the nucleus to create increasingly heavy elements / there may be extreme conditions in which "new" elements exist, e.g. in a supernova. Agree – all stable elements have been discovered.

Lesson 11: C1.11 – Comparing metals and non-metals

Connection

Q1. Why did Doberiener group lithium, sodium and potassium together?

Q2. In what order did John Newlands place elements in on his table?

Q3. Why did Newlands call his theory the 'Law of Octaves'?

Activation

LI: Describe some physical and chemical properties of metals and non-metals

1. https://www.youtube.com/watch?v=Oz8GpDVz5ag
2. Make a note of the title and the LI
3. Read pages 34-35
4. Copy out the table on page 34

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 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: C1.11 - **Comparing metals and non-metals**

Connection

1 The three elements had similar properties
2 ordered by their atomic weights
3 Newlands observed that a pattern of similar properties every 8 elements. Oct is the prefix for the number 8.

Demonstration

1 Shiny, malleable (also strong)
2 Dull, brittle
3 Test it with universal indicator – it should go yellow/orange
4 Magnesium nitrate (plus hydrogen)
5 If UI goes blue it is an alkaline oxide which means it was a metal oxide
If UI goes red it is an acidic oxide which means it was a non-metal oxide
6 Non-metal
7 Low melting point and density suggest that X is non-metallic. However, only metals are malleable and good conductors of electricity (although graphite is a good conductor it is not malleable and has a very high melting point). Therefore X is a metal and the oxide will be basic.

Lesson 12: C1.12 – Metals and non-metals

Connection

Q1. Write down three physical properties of metals.

Q2. In terms of chemical properties explain why is copper used for saucepans

Q3. Predict the products of magnesium and sulfuric acid

Activation

LI: Explain differences between metals and non-metals based on physical and chemical properties.

1. https://www.youtube.com/watch?v=Rc2JBp91V7o
2. Make a note of the title and the LI
3. Read pages 36-37
4. What determines whether an element is a metal or a non-metal? (Read First paragraph)
5. Write the heading "Positions of elements in the periodic table" and draw and label fig 1.34
6. Explain why Mg forms a positive ion using the paragraph under this heading.

Demonstration

Attempt questions 1-5
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 C1 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: C1.12 – **Metals and non-metals**

Connection

1 electrical conductors, heat conductors, shiny, dense etc
2 it does not react easily with oxygen and water
3 magnesium sulfate and hydrogen gas

Demonstration

1 Non-metal
2 Metal
3 Aluminium has an electron pattern 2,8,3, so it loses 3 electrons to make a stable ion. Metals lose electrons to make ions.
4 Element number 8 has an electron pattern 2,6, so it gains 2 electrons to make a stable ion. Non-metals gain electrons to make ions.
5 It has only one space left to fill with an electron to be a stable ion, non-metals gain electrons. It can gain an electron from potassium (a metal that loses one electron to form a stable ion) to form potassium fluoride.
6 The atom with 3 electrons (Li) has a pattern 2,1. The 1 outer electron is transferred to the atom with a pattern 2,7 (F). This has one space to fill. Both are now stable ions and form a compound of formula LiF

Lesson 13: C1.13 – Key Concept: The outer electrons

Connection

Q1. Find element 17. Is it a metal or a non-metal?

Q2. Draw the structure of magnesium and state whether it is a metal or a non-metal

Q3. Explain your answer to Q2

Activation

LI: Recognise when atoms share or transfer electrons

1. https://www.youtube.com/watch?v=xK4Nnwp9I8M
2. Make a note of the title and the LI
3. Read pages 38-39
4. Copy the electronic shell diagram for Argon (Ar) and explain why noble gases are unreactive
5. Draw the electron transfer diagram from lithium (Li) to fluorine (F) and the electron sharing diagram for hydrogen on page 38.
6. Write down three things (bullet points) that can happen to electrons in the outer shells because they are less stable than noble gases.

Consolidation

Complete and self assess the relevant past paper question for this topic - From theC1 DIP file

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

Extension

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

Answers: C1.13 – Key Concept: The outer electrons

Connection

1 non-metal
2 See fig 1.34 on page 37
3 magnesium has the electron pattern 2, 10, 2 so it loses 2 electrons to become stable. Metals lose electrons to become positive ions.

Demonstration

1 Two from Ne, Ar, Kr, Xe
2 One
3 Two
4 Two
5 Both lithium and sodium have one outer electron to lose. In sodium the electron is further away from the 'pull' of the nucleus than is the outer electron of lithium. So the outer electron of sodium is more easily lost. Sodium is therefore more reactive than lithium.
6 Chlorine is more reactive than bromine or iodine. This is because the spare space in the outer shell of electrons is nearer to the nucleus so incoming electrons have a 'greater pull' from the nucleus than the electrons transferring into a bromine or iodine atom. It is however less reactive than fluorine as the incoming electrons are even nearer to the nucleus in the smaller atom of fluorine.

Lesson 14: C1.14 – Exploring Group 0

Connection

Q1. How many electrons does oxygen have in its outer shell?

Q2. Predict the number of outer shell electrons in Sulfur

Q3. Predict how many electrons are shared by two Chlorine atoms. Explain your answer.

Activation

LI: Predict and explain the trends of the noble gases

1. https://www.youtube.com/watch?v=VhiieTJWYHs
2. Make a note of the title and the LI
3. Read pages 40-41
4. Write down the order of Group 0 elements from your periodic table or page 40
5. Note down two things that all noble gases have in common
6. Copy down the table of boiling points and describe the boiling point trend of noble gases.

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

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 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: C1.14 – **Exploring Group 0**

Connection

1 oxygen
2 6. It is in group 6 with oxygen as both elements have 6 electrons in their outer shell
3 Two. Each chlorine atom has 7 electrons in the outer shell, which means each has a space for 1 electron. Sharing two electrons achieves stability for each atom in the outer shell.

Demonstration

1 Neon 10, Argon 18. Argon has the higher atomic mass.
2 –62 ^{o}C (temperature greater than –107 ^{o}C)
3 As the atomic mass goes up the boiling point increases.
4 The diameter increases from helium to radon as extra electron shells are added. As the diameter increases, so does the boiling point, because the larger the diameter the more energy needed to move atoms away from each other.
5 One ring with 2 electrons. The outer shell has no more space to accept electrons, and it is a stable configuration so it doesn't want to lose electrons either.
6 Ar is 2,8,8. The atom has no spaces to accept electrons so is unreactive. Argon atoms have a larger diameter and have more electrons. Therefore the forces between argon atoms is greater. More energy is needed to overcome these stronger forces so the boiling point is higher.
7 a $Xe + 2F_2 \rightarrow XeF_4$
b Noble gases are unreactive because they have a full outer shell which makes them stable.

Lesson 15: C1.15 – Exploring Group 1

Connection

Q1. Explain why the noble gases are unreactive.

Q2. Explain why helium stays as a gas at lower temperatures compared to krypton.

Q3. Explain why argon has a higher boiling point than helium.

Activation

LI: Predict the properties of group 1 elements from trends down the group.

1. https://www.youtube.com/watch?v=dZGDUKQa_6g
2. Make a note of the title and the LI
3. Read pages 42-43
4. Describe the reactions of group 1 metals with water and oxygen.
5. Write down the word and symbol equation for the reaction of sodium with water.
6. Draw and label fig 1.45

Demonstration

Attempt questions 1-8
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 C1 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: C1.15 – **Exploring Group 1**

Connection

1 complete outer shells
2 the helium atom is much smaller than the krypton atom so they are able to move about more easily at lower temperatures
3 Argon atoms are larger and contain more electrons than helium. The forces between argon atoms is much stronger so argon requires more energy to reach its boiling point.

Demonstration

1 Less dense than water.
2 Hydrogen
3 Test with universal indicator which turns blue.
4 Down the group the elements are more reactive.
5 Rubidium reacts violently with water. Reactivity increases down Group 1.
6 They have one electron in their outer shell, which if they lose they become a more stable ion.
7 One electron ring with two electrons, square bracket around the ring, positive charge top right hand side outside bracket.
8 a $4K + O_2 \rightarrow 2K_2O$
b Potassium ion, K^+: 2,8,8 Oxide ion, O^{2-}: 2,8
c KOH / potassium hydroxide.

Lesson 16: C1.16 – Exploring Group 7

Connection

Q1. Explain why lithium floats on water.
Q2. Identify the gas given off in the reaction of lithium with water

Q3. Write a word and balanced symbol reaction for lithium with water.

Activation

LI: describe the reaction of halogens with alkali metals and write word and symbol equations for the reactions

1. https://www.youtube.com/watch?v=fyA7qtPq7QY
2. Make a note of the title and the LI
3. Read pages 44-45
4. Copy down the word and balanced symbol reaction of potassium with chlorine

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 DIP file

Demonstration

Attempt questions 1-8
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: C1.16 – **Exploring Group 7**

Connection

1 Lithium is less dense than water
2 hydrogen
3 Lithium + water -> Lithium hydroxide + hydrogen

Demonstration

1 $2Na + Br_2 \rightarrow 2NaBr$
2 LiF
3 35 liquid 254 solid
4 The picture shows a dark solid.
5 As the molecular mass increases, the boiling point increases.
6 Chlorine and bromine, they are higher in the group and more reactive so will displace iodine from a solution of potassium iodide.
7 $Cl_2 + 2KI \rightarrow 2KCl + I_2$
8 a Solid.
b $Cl_2 + 2NaAt \rightarrow At_2 + 2NaCl$
c Astatine will not react with sodium iodide. Astatine is less reactive than iodine.

Lesson 17: C1.17 – Reaction trends and predicting trends

Connection

Q1. Give the balanced equation between potassium and chlorine

Q2. Describe the trend in boiling points of the halogens as the molecular mass increases

Q3. Predict the products for the reaction between bromine and potassium chloride. Explain your answer.

Activation

LI: Compare the trends between group 1 and group 7 elements

1. https://www.youtube.com/results?search_query=compare+group+1+and+group+7+trends
2. Make a note of the title and the LI
3. Read pages 46-47
4. Draw and label Fig 1.50 Write the heading “Opposite trends” and make bullet points/study notes form the paragraphs below this heading.

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C1 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: C1.17 – **Reaction trends and predicting trends**

Connection

1 $K + Cl_2 \rightarrow 2KCl$
2 Boiling point increases with increase in molecular mass
3 no reaction occurs because bromine is less reactive than chlorine so it will be able to displace chlorine from its compound.

Demonstration

1 It is lower down in the group. Its outer electron is further away from the nucleus than the outer electron of sodium (so experiences less 'pull' from the nucleus), so is lost more easily.

2 Astatine has more electron shells than chlorine. The electron to be captured is therefore further from the nucleus so the attraction is less.

3 Neon has a stable outer shell of electrons, so neither gains or loses them so is unreactive.

4 Sodium only has to lose one electron to react whereas aluminium needs to lose three electrons.

5 Rubidium will react violently with water, acid and oxygen, as it is further down Group 1 than potassium so will lose its outer electron more easily. It will form an alkaline oxide as it is a metal.

6 Strontium will react vigorously with acid, with greater vigour than calcium, as it is lower down the group, and so loses its electrons more easily, as there is less 'pull' on them by the nucleus.

7 a $H_2 + Cl_2 \rightarrow 2HCl$

b Fluorine will react more violently because it is more reactive than chlorine. Reactivity decreases down Group 7.

Lesson 18: C1.18 – Transition metals

Connection

Q1. Explain why potassium is more reactive than lithium.

Q2. Explain why bromine is less reactive than chlorine.

Q3. Explain why potassium is more reactive than zinc.

Activation

LI: Compare the properties of transition metals

1. https://www.youtube.com/watch?v=ia2slLs5Qkk
2. Make a note of the title and the LI
3. Read pages 48-49
4. Look at the green section of the periodic table on page 48. Can you identify the symbol for Nickel?

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 C1 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: C1.18 – **Transition metals**

Connection

1 The outer shell electron is further away from the nucleus in potassium than in lithium. So the 'pull' of the nucleus on the outer shell electron is less in potassium causing it to lose its outer shell electron more easily than lithium.

2 Halogens need to gain an electron so the closer the outer shell is to the nucleus the stronger the attractive force of the nucleus. Bromine is less reactive as its outer shell is further away from the nucleus so the attractive force is not as strong as in chlorine

3 As you go across the period the outer electrons increase by 1. Zinc is a transition metal and needs to lose 2 electrons compared to potassium in group 1 which needs to lose only one electron to be stable.

Demonstration

1 a melting point goes up to Fe then down as the atomic number increases

b density increases as atomic number increases

2 Zinc is predicted have melting point of about 600 ^{o} C and a density of 9 g/dm^3

3 They remain unchanged at the end of the reaction so can be used again.

4 Iron(III) ions (Fe^{3+}) were reduced to iron(II) (Fe^{2+}) ions.

5 3

6 CuO – Cu^{2+} (and O^{2-}) Cu_2O – Cu^{+} (and O^{2-})

C1 - Revision

Connection

Q1. Where are transition metals found?

Q2. Give 2 uses of transition metals as catalysts

Q3. Transition metal ions are coloured. Give 4 examples

Activation

LI: Create a topic summary sheet

1. Fold an A3 sheet so it is divided into 8 sections
2. Look back over your lessons and group them into 8 main headings
3. Summarise the key points into each section, use keywords and diagrams and symbols rather than sentences

Consolidation

Look though the relevant past paper questions for this topic - From the C1 DIP file – see if you can complete any additional questions

Extension

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

Demonstration

est yourself by working with the person sitting next to you by talking though each box on your summary sheet and seeing how many key facts you can remember.

Connection Answers

1 In the middle of the periodic table between groups 2 and 3

2 Iron is used on the Haber process to make ammonia. Nickle is used to harden oils to make margarine.

3 copper – blue, iron II – pale green, iron III orange/brown. nickel - green

C1 Periodic table DART activity

Scientists Say: Periodic table

This is a chart that shows all the known chemical elements. The table is made up of over a hundred squares. Each square represents one element. A square contains one or two letters that stand for the element's name, and numbers that tell about that element's properties.

The location of each square in the table tells many things about each element. First, the elements are organized by atomic number, or how many protons they have. Those on top of the chart have the fewest protons. An element's place also shows how likely it is to react. It also shows how its electrons are arranged.

During the mid-1800s, many chemists looked for patterns that explained how elements interacted. Back then, scientists didn't know about the protons, neutrons and electrons that make up atoms. But they did understand that elements had different atomic weights. An atomic weight is the average weight of one atom of an element.

In 1869, the Russian chemist Dimitri Mendeleev lined up the 63 known elements in order by their atomic weights. He saw trends in the elements' properties that varied over specific intervals, or periods. Other scientists were working on their own periodic tables, but Mendeleev published his table first.

The periodic table continued to grow as scientists discovered more elements. These include the noble gases, identified in 1890. This is a group of elements such as helium that don't like to react with other elements. Starting in the 1940s, scientists found many new elements by colliding atoms or pieces of atoms.

At the end of 2018, chemists **confirmed four elements** that had never been observed before. That brought the number of known elements to 118 and completed the 7th row of the table.

In a sentence

The year 2019 marks the 150th anniversary of the periodic table, first conceived in 1869.

Source : Article obtained from the website: science news for students
https://www.sciencenewsforstudents.org/article/scientists-say-periodic-table

Questions

1. When was the periodic table first conceived?
2. Who was the main scientist involved in the development of the periodic table?
3. When were the noble gases identified?

4. Explain how Mendeleev ordered the elements in the periodic table
5. Explain why there were gaps left by Mendeleev in the periodic table
6. A new element is discovered that is found to be very unreactive. Suggest what group of elements it belongs to

7. A scientist states "the periodic table is finished" explain whether you would agree with this statement.
8. Would it be better if the elements were ordered by atomic mass instead of atomic number
9. Propose an alternative method for ordering the elements in the periodic table

DART C1 The Periodic Table: Answers

1.1869

2. Dimitri Mendeleev

3.1890

4. Mendeleev ordered elements by their atomic mass

5. Mendeleev left gaps in the periodic table as he predicted there were elements yet to be discovered with atomic mass to fill those gaps

6. group 0 or Noble gases as other Noble gases are also unreactive and elements in the same group share chemical properties

7. unlikely – new elements have been discovered as recently as 2018

8. There are some elements with the same atomic mass however it is impossible for different elements to have the same atomic number. Therefore it is more practical to order by atomic number

Nb. Ordering by atomic number is in contradiction to Mendeleevs original design who ordered by atomic mass. When he first designed his periodic table, no two discovered elements shared the same atomic mass

9. Any reasonable ordering or elements

Examples could include ordering by a particular property e.g. melting point, boiling point etc

Nb. Students will not have knowledge of bonding, reactivity etc yet

Attainment Band :	C1 Atomic Structure and the Periodic Table (AQA)
	Knowledge and Understanding
Yellow Plus/ Yellow	Use symbol equations to describe chemical reactions. Use balanced equations to describe reactions. Explain why the scattering experiment led to a change in the atomic model. Complete data tables showing the atomic numbers, mass numbers and numbers of sub-atomic particles from symbols. Explain how Mendeleev was able to make predictions of as yet undiscovered elements such as eka-silicon. Explain how the electronic arrangement of transition metal atoms put them into a period. Explain that non-metals need to gain or share electrons during reactions and that metals need to lose electrons during reactions. Predict the relative reactivity across the periods and give reasons. Explain the trend down Group 0 of increasing boiling point in terms of atomic mass. Explain the trend down the group of increasing reactivity by electron structure. Predict displacement reaction outcomes of halogens other than chlorine, bromine and iodine. Explain the trend of increasing reactivity in terms of electron structure. Use ratios
Blue	Recall the names of the first 20 elements in the periodic table and the elements in Groups 1 and 7. Use word equations to describe chemical reactions. Explain that early models of atoms developed as new evidence became available. Calculate the numbers of sub-atomic particles in ions and isotopes given the atomic and mass numbers. Explain why the modern periodic table has the elements in order of atomic number. Explain how the electronic arrangement of atoms follows a pattern up to the atomic number 20. explain that atoms of metals have 1, 2 or 3 electrons in their outer shell. Explain that non-metals have 4, 5, 6, 7 or 8 electrons in their outer shell. Explain the trend down Group 0 of increasing boiling point. Predict and explain the relative reactivity down the groups. Describe the order of reactivity and explain the displacement of halogens. Predict the properties of 'unknown' elements from their position in the group. With some guidance use ratios
Green	Name compounds from their formula. Describe how to separate mixtures of elements and compounds. Explain that early models of the atom did not have shells with electrons. Draw a diagram of a small nucleus containing protons and neutrons with orbiting electrons at a distance. Describe how Mendeleev was able to leave spaces for elements that had not yet been discovered. Describe the pattern of the electrons in shells for the first 20 elements. Describe a number of physical properties of metals and non-metals. Explain that non-metals are on the right-hand side of the periodic table. Describe the unreactivity of the noble gases. Predict the reactions with water of Group 1 elements lower than potassium. Recall the colours of the halogens and the order of reactivity of chlorine, bromine and iodine. Explain that a stable outer shell of electrons makes noble gases unreactive. With help use ratios.
White	Some elements of the above have been achieved