

GCSE

Edexcel GCSE in Science

Patterns in Properties

(Concept approach)

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Support material

Edexcel GCSE in Science
Patterns in Properties
(Concept approach)

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Scheme of work for Topic 5: Patterns in Properties

LESSON 1: Get it sorted							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a5.5 C1a 5.6 C1a 5.7 C1a5.10	9E Reactions of metals and metal compounds.	Different elements have different properties related to their position in the periodic table.	<p>Starter</p> <p>Quiz to recall KS3 knowledge of metallic and non-metallic properties and give examples of them.</p> <p>Main</p> <p>Find where all the elements named in the starter are in the periodic table (PT) and colour code them as metals (on left and middle) and non-metals on right. Students given cards with the physical properties of alkali metals, halogens, noble gases transition metals including lesser known elements on PT or use ICT or data books to find details from the name of the element. Write melting point and atomic mass on PT and find patterns.</p> <p>Plenary</p> <p>Establish why the periodic table is organised in periods and groups. Students draw or are given a PT outline: refer again to periodic table, name alkali metals, halogens, noble gases and transition metals and mark these on own PT. Indicate that groups of elements also react in similar ways.</p>	<p>Large periodic table on wall of classroom or shown on whiteboard.</p> <p>www.chemicool.com/ has a periodic table with colour coded groups.</p> <p>Periodic table, colouring pencils.</p> <p>Worksheet could be made available on school network and ICT used to find properties.</p> <p>www.webelements.com/ is good for information on each individual element.</p> <p>Useful resource: www.philipallan.co.uk/images/527-T2.pdf</p>	<p>Use the periodic table to find the symbol of an element.</p> <p>Identify and recall the position of metals and non-metals in the periodic table.</p> <p>Locate the positions in the periodic table of:</p> <ul style="list-style-type: none"> alkali metals the halogens the noble gases transition metals. <p>Using secondary data explore why elements are arranged in rows (periods) and columns (groups).</p>	<p>C:</p> <p>1.1 1.2 2.1a</p> <p>PS:</p> <p>1.1 1.2 1.3 2.1 2.2 2.3</p> <p>WO:</p> <p>1.1 1.2 2.1 2.2</p>	
<p>Homework: Students to use the internet to find out more about the PT. Suggest the following two sites: www.chemicool.com/ periodic table with colour coded groups and http://periodic.lanl.gov/ colour coded periodic table: with layers of information available from homepage under mystery symbols. Each page is worthwhile and few are above the level needed. Page seven shows Mendeleev's 1872 periodic table. Page four shows elements with symbol names and atomic numbers. Page one explains why the PT is useful.</p>							

Scheme of work for Topic 5: Patterns in Properties

LESSON 2: More about transition metals							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a 5.7 C1a 5.3	9E Reactions of metals and metal compounds.	Different elements have different properties related to their position in the periodic table.	<p>Starter</p> <p>Focus on the colour of transition metals and the colour of their compounds.</p> <p>Main</p> <p>Pick out any metals familiar to students. Use web elements or periodic table software or data books to find physical properties of first row of transition metals in particular iron, copper, silver, gold. Plot graphs of melting point and density, and hardness if possible, for first row and silver and gold.</p> <p>Use a research site to find uses of transition metals and link uses to properties: iron, copper, silver, gold.</p> <p>Plenary</p> <p>Show that atomic mass increases steadily across the transition metal periods.</p> <p>Illustrate that the transition metals have atomic numbers in sequence, as well as atomic mass increasing.</p>	<p>Samples of as many transition metals as available and a solution or the solid compound containing the element.</p> <p>Large wall periodic table or IEW periodic table http://periodic.lanl.gov/ Page four shows elements with symbols names and atomic number.</p> <p>www.webelements.com/</p>	<p>Locate the positions in the periodic table of: transition metals.</p> <p>Interpret data to describe the properties of iron, copper, silver and gold, and explain their uses.</p>	<p>C: 2.1</p> <p>WO: 2.2</p>	<p>Check HAZCARDS for any metals and solutions being demonstrated.</p>
<p>Homework: Students to look up information about the reactivity of copper, silver and gold to find three things that these three elements have in common and at least two differences. Then find at least three ways that iron is different from copper, silver and gold.</p>							

Scheme of work for Topic 5: Patterns in Properties

LESSON 3: Testing for transition metals							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a 5.4 C1a 5.23	9E Reactions of metals and metal compounds.	Different elements have different properties related to their position in the periodic table. The names of simple chemical compounds can be predicted from their formulae.	<p>Starter</p> <p>Demonstrate the effect of adding dilute sodium hydroxide solution to a solution made by dissolving a transition metal compound such as chromium nitrate.</p> <p>Main</p> <p>Investigate a variety of known and unknown solids and solutions to find out what transition metal is in some of the unknown compounds.</p> <p>Plenary</p> <p>Write word and formula equations for the reactions using the chlorides rather than the sulphates. Extend the work with iron (II) and iron (III) sulphates if appropriate to the ability of the class.</p>	<p>Experiment sheet 5.7 covers this experiment and is useful here.</p> <p>Copper sulphate, labelled copper compound, etc for iron(II)sulphate, iron (III) nitrate and zinc sulphate solutions.</p> <p>Small amounts of the above solids, potassium chloride and sodium chloride labelled A–F respectively.</p> <p>Dropping bottle of NaOH 0.1M.</p> <p>Ammonia solution.</p> <p>Royal Society of Chemists Classic Chemistry Experiments <i>80 Testing salts</i> supports this activity.</p>	<p>Interpret data such as the colours formed by transition metals with sodium hydroxide solution to identify iron, copper and zinc.</p> <p>Represent chemical reactions in this unit by word equations and balance simple formulae equations for these reactions.</p>	<p>C: 2.1</p> <p>WO: 2.2</p>	<p>Check HAZCARDS for all chemicals used</p> <p>Students must wear eye protection.</p>
<p>Homework: Students to complete word equations for different transition metal chlorides and sulphates with sodium hydroxide. Higher level students could complete balanced equations in addition to word equations. Teacher will need to produce worksheets or use an exercise from a textbook.</p>							

Scheme of work for Topic 5: Patterns in Properties

LESSON 4: What atoms are made of?							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a 5.11 C1a 5.14	9E Reactions of metals and metal compounds.	All chemical elements are made up of atoms which consist of nuclei and electrons. Different elements have different properties related to their position on the periodic table.	Starter The atomic structure of the first 10 elements and how the nucleus and the electron shell is built up linking the number of outer electrons to the group. Main Completing diagrams of atoms to show rings of electrons from sodium to argon and the numbers of protons and neutrons. Note: Although this pushes at the edge of the details in the specification it gives the rationale to the pattern. It helps students understand the structure of the periodic table for forthcoming lessons; linking the shells of electrons to the periods and the number of electrons in the outer shell to the groups. Plenary Linking the information about numbers of protons and outer electrons to the position of the element in the periodic table Comment that sodium chloride is very different to potassium chloride, the former being table salt the latter a poison, (injections of KCl are used to kill people).	www.chemicalelements.com for a periodic table with only your chosen data on it, and brief but vital information on each group. www.webelements.com/ contains useful links between elements and their atomic structure. Game: Atom@tak will reinforce work on structure of atoms and periodic table and is available from www.chemsoc.org/networks/learnnet/atomatak.htm	Explain that an atom consists of positive protons and neutrons in a nucleus surrounded by negative electrons. Explain that all atoms of the same element have the same number of protons.	C: 2.1 WO: 2.2	
Homework: Students to find and note the definitions for atomic mass and atomic number. Explain why atomic number is the same as the number of electrons for an element.							

Scheme of work for Topic 5: Patterns in Properties

LESSON 5: Exploding metals — group 1: The alkali metals							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a 5.7 C1a 5.15 C1a 5.16 C1a 5.17 C1a 5.18 C1a 5.23	9F Patterns of reactivity. 9E Reactions of metals and metal compounds.	Different elements have different properties related to their position in the periodic table. Atoms join together to form molecules and compounds. The names of simple chemical compounds can be predicted from their formulae.	Starter Demonstration: Properties of alkali metals and reactions with water for Li, Na and K. Refer to heat produced and collect and test for hydrogen from lithium and water. Use the terms exothermic to describe the reaction that gives out heat and endothermic as the opposite, ie taking in heat. Main Write short description of observations. Write word and balanced equations for the reactions. Use evidence from observing reactions to write word equation for rubidium reacting with water and predict the reactivity. Video clip or software: other alkali metals react with water. Teacher-led student role play of chemical reaction, showing need for specific numbers of each type of atom. Plenary Relate the pattern of reactivity to the position in the periodic table and, if appropriate, link to distance of outer electron shell from nucleus.	Li, Na and K in small cubes, freshly cut and under oil, large trough of water, long forceps, universal indicator, gloves for teacher, splints and Bunsen flame. RSC Classic Chemistry Demonstrations 72. Use a video clip on Multimedia Science School, or software showing other group 1 elements reacting. www.theodoregray.com/ Follow links to sodium party.	Locate the positions in the periodic table of the alkali metals. Recall the variations in reactivity of the alkali metals with an increasing atomic number as shown by their reactivity with water. Recall that chemical reactions happen at different rates. Recall that some chemical reactions give out heat (exothermic) and some take in heat (endothermic). Recall that there is usually a gradual change in properties of the elements from the top to the bottom of each group. Represent chemical reactions in this unit by word equations and balance simple formulae equations for these reactions.	C: 1.1 2.1	Follow HAZCARDS for alkali metals. Wear eye protection and ensure safety screen is in place for demonstrations.
Homework: Students to draw cartoon version, from role play, of the balanced equation, showing the regrouping of atoms to form new products. Find ways to show a larger atomic number alkali metal as more reactive than a smaller atomic number alkali metal.							

Scheme of work for Topic 5: Patterns in Properties

LESSON 6: A noble family							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a 5.7 C1a 5.21 C1a 5.3	9F Patterns of reactivity.	All chemical elements are made up of atoms which consist of nuclei and electrons. Different elements have different properties related to their position in the periodic table.	<p>Starter</p> <p>Discussion: Which group did not appear at all on Mendeleev's table and why?</p> <p>Use video footage or the web to introduce the idea of laser light shows. What are the gases used for laser/coloured light shows?</p> <p>Main</p> <p>Use textbooks and web resources to investigate: What are the gases involved in coloured light? What are their other uses? What are their physical properties? When were they discovered? As an extension investigate what is common about their atomic structure and their chemical inertness.</p> <p>Plenary</p> <p>Show the patterns of electrons in the atoms of the noble gases from helium to argon and, for extension, refer more generally to krypton and xenon to explain why they do not react.</p>	<p>Modern and Mendeleev's periodic table.</p> <p>www.webelements.com/ contains useful links between elements and their atomic structure.</p> <p>Also www.lasertainment.com/ Alan Jervis Video clips: 44 or 45 info@dragonfly-training.co.uk</p> <p>www.laserium.com/Inside.html</p> <p>www.vidicom-tv.com/tohiburg.htm</p> <p>www.theodoregray.com/PeriodicTable/</p>	<p>Locate the positions in the periodic table of the noble gases.</p> <p>Describe the noble gases as chemically inert compared with other elements.</p> <p>Interpret data to describe the properties of helium, neon, argon, and explain their uses.</p>	<p>C: 2.1a 2.2 2.3</p> <p>ICT: 1.1 2.1</p> <p>PS: 2.1 2.2 2.3</p> <p>WO: 2.2</p>	
<p>Homework: Students to explain why helium not hydrogen is used in air ships, even though hydrogen is less dense and could lift a lot more or require a smaller balloon.</p> <p>Find the maximum number of electrons that can be in each shell around the nucleus and investigate this relationship to the noble gases and the row or period in the periodic table (extension for more-able students).</p>							

Scheme of work for Topic 5: Patterns in Properties

LESSON 7: Halogens							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a 5.7 C1a 5.3 C1a 5.19	9F Patterns of reactivity.	All chemical elements are made up of atoms which consist of nuclei and electrons. Atoms join together to form molecules and compounds. Different elements have different properties related to their position in the periodic table.	Starter Demonstration: Appearance of Cl, Br and I and their reaction with heated iron. Demonstrate aluminium and iodine. Reinforce the exothermic nature of the reaction but also the need for energy to start the reaction. Main Write a short description of observations. Write word and balanced equations for the reactions. Use evidence from observing reactions to predict reactivity of the element below iodine and above chlorine. Plenary Link to patterns in atomic structure, eg examine the rings of electrons for the halogen atoms to explain reactivity down the group. Give the formulae of diatomic molecules of the halogens.	www.theodoregray.com/ PeriodicTable/ Royal Society of Chemists Classic Chemistry Demonstrations 76 or Microscale Chemistry ISBN 1-870343-49-2 Experiment No.26.	Locate the positions in the periodic table of the halogens. Interpret data to describe the properties of chlorine and iodine and explain their uses. Recall the variation in colour, physical states at room temperature and the trends in boiling points of the halogens.	C: 2.1 WO 2.2	Fume cupboard and screen essential. Follow HAZCARDS. Wear eye protection.
Homework: Teacher to produce worksheet or use an appropriate textbook on writing formulae to reinforce combination of elements including reactions of diatomic non-metals with metals.							

Scheme of work for Topic 5: Patterns in Properties

LESSON 8: Competition among the halogens							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a 5.22 C1a 5.20 C1a 5.23 C1a 5.24	9F Patterns of reactivity.	Different elements have different properties related to their position in the periodic table. Atoms join together to form molecules and compounds. The names of simple chemical compounds can be predicted from their formulae.	Starter Explain the displacement experiment to be done. Show how to distinguish between iodine and bromine in solution using a small amount of suitable cycloalkane, eg cyclohexane. Main Displacement of a less reactive halide by a more reactive halogen to obtain an order of reactivity. Write short descriptions of observations. Write word and balanced equations for the reactions on experiment sheet 5.8: Halogen displacement Plenary Use evidence from observing reactions to predict the reactivity of astatine and fluorine. If extension work is required, examine the rings of electrons for the halogen atoms to explain reactivity down group. Explain the use of -ide and -ate endings for halogens.	See experiment sheet 5.8 (Halogen displacement) to support this work.	Explain that elements in the same group of the periodic table have similar chemical properties, as exemplified by the halogens. Describe the variation in the reactivity of the halogens as the group is descended, as shown by displacement reactions with solutions of other halides. Represent chemical reactions in this unit by word equations and balance simple formulae equations for these reactions. Explain the use of the endings -ide and -ate in the names of common chemical compounds.	C: 2.1	Fume cupboard essential. Follow HAZCARDS. Wear eye protection.
Homework: Students to research to find -ide and -ate endings on food and sanitary packaging materials. What is the pattern, if any, of the other part of the chemical name?							

Scheme of work for Topic 5: Patterns in Properties

LESSON 9: Reviewing the periodic table							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a 5.9 C1a 5.22 C1a 5.12 C1a 5.13	9F Patterns of reactivity. 9E Reactions of metals and metal compounds.	All chemical elements are made up of atoms which consist of nuclei and electrons. Different elements have different properties related to their position in the periodic table.	Starter Demonstration: Reaction between heated sodium and chlorine. Main Use software, (eg New Media 'Periodic table') to locate different metals and non metals, identify the increasing atomic number relationship across the periods, link transition metals to high density and low reactivity and Group 1 to high reactivity increasing with the increasing atomic number. Confirm the opposite relationship for the halogens. Use Activity sheet 5.9 (patterns in the periodic table) simplified blank periodic table templates (omitting period 1) to show the patterns of increasing reactivity for metals and non-metals. Plenary Review the history of the periodic table and Mendeleev's great risk of predicting the properties of unknown elements.	Software, New Media 'Periodic Table'. See www.rod.beavon.clara.net for a very short history of Döbereiner's triads. See www.woodrow.org for a very long history of Mendeleev's development of the periodic table, with mention of Newland's octaves.	Recall that elements with similar properties appear in the same vertical column (group). Explain that elements in the same group of the periodic table have similar chemical properties. Understand that the periodic table is an example of how a scientific theory can predict the discovery of new elements. Use secondary data to explore how the periodic table was devised, with reference to atomic number.	C: 1.1 1.2 1.3 2.1 2.2 2.3 WO: 1.1 1.2 2.2 ICT: 1.1 2.1	Fume cupboard and screen essential. Follow HAZCARDS. Wear eye protection.
Homework: Use questions on the following website www.wpbschoolhouse.btinternet.co.uk/page03/3_34ptable/PThistoryQ.htm .							

Scheme of work for Topic 5: Patterns in Properties

LESSON 10: Finding which metal is in the compound							
Spec. code	Links and concept building from KS3	Learning objectives	Teaching activities	Resources	Learning outcomes	Key skills	Safety issues
C1a 5.1 C1a 5.2 C1a 5.4	9E Reactions of metals and metal compounds.	Different elements have different properties related to their position in the periodic table. Atoms join together to form molecules and compounds.	Starter Demonstrate a flame test for potassium to show the care needed to clean the wire. Demonstration sheet 5.10: How to do a flame test. Main Investigate a variety of known and unknown solids and solutions to find out what metals are in the unknown compounds. Place this in the context of a forensic investigation. Plenary Compare the physical and chemical differences between the alkali metals in Group 1 and transition metals.	Concentrated hydrochloric acid in small beakers for cleaning wires. Flame test apparatus. Dropping bottle of NaOH 0.1M. Labelled solutions of: ☒sodium chloride ☒potassium chloride ☒calcium chloride ☒lithium chloride. The following solutions labelled as unknowns A to G: ☒sodium chloride, ☒potassium chloride, ☒calcium chloride, ☒copper chloride, ☒zinc chloride ☒lithium chloride ☒iron(III) chloride. Royal Society of Chemistry: Classic Chemistry <i>Experiments 80 Testing salts supports</i> this activity. Experiment sheet 5.7 (testing for transition metals) may be helpful.	Explain how to use flame tests to identify the presence of a particular metal. Interpret data such as the colours formed by transition metals with sodium hydroxide solution to identify iron, copper and zinc. Use given analytical data to identify substances found at a crime scene based on substances covered in this topic area.	C: ☒1.1 ☒2.1 WO: ☒1.1 ☒1.2 ☒2.2 PS: ☒1.1 ☒1.2 ☒2.1 ☒2.2	Follow HAZCARDS. Wear eye protection.
Homework: Completion of report from lesson to determine what A-G were and provide appropriate equations for reactions with sodium hydroxide solution.							

Experiment 5.7: Testing for transition metals

What you will learn from this experiment

In this experiment you will learn how to find which metal is present in a transition metal compound or an unknown solution.

What you will know when you finish this experiment

- 1 The colours of the hydroxides of different transition metals.
- 2 The unusual nature of zinc hydroxide.
- 3 The interesting reaction of copper hydroxide with ammonia solution.

How you may be assessed

- 1 The details of your observations.
- 2 How you mix the solutions.
- 3 Your ability to evaluate your results and draw conclusions.

What you do

- 1 Into test tubes pour about 1 cm depth of solution of each transition metal compound.
- 2 Add a few drops of sodium hydroxide solution.
- 3 Record your observations in the table below.
- 4 Add more sodium hydroxide solution to about half way up the test tube.
- 5 Record your observations in the table.
- 6 Repeat steps 1 to 5 using ammonia solution instead of sodium hydroxide solution.

Table for observations

	With a little sodium hydroxide solution	With a lot of sodium hydroxide solution	With ammonia solution
Copper sulphate solution			
Zinc sulphate solution			
Iron sulphate solution			

Experiment 5.7: Testing for transition metals

Notes for teachers and technicians

Aim

The aim of this investigation is to find which metal is present in a transition metal compound or an unknown solution.

Previous skills, knowledge and understanding required

Safe ways of working with hazardous chemicals.

Skills, knowledge and understanding

Students will learn:

- 1 How to make and record observations.
- 2 To write word and formula equations for the changes observed.

Equipment and chemicals required

- 1 0.01 M copper sulphate solution
- 2 0.01 M zinc sulphate solution
- 3 0.01 M iron(II) sulphate solution
- 4 0.01 M iron(III) sulphate solution
- 5 Dropper bottles containing 0.01 M sodium hydroxide solution
- 6 Dropper bottles containing 0.01 M ammonia solution
- 7 Test tubes and racks.

Health and safety issues

Check HAZCARDs for all chemicals being used.

Links with key stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- SC3. 3.b About the displacement reactions that take place between metals and solutions of other metals
- 9E Reactions of metals and metal compounds.

Experiment 5.8: Halogen displacement

What you will learn from this experiment

In this experiment you will learn how to distinguish between solutions of chlorine, bromine and iodine.

What you will know when you finish this experiment

- 1 Which halogen displaces which halide.
- 2 The order of reactivity of chlorine, bromine and iodine.

How you may be assessed

- 1 The details of your observations.
- 2 How you mix the solutions.
- 3 Your ability to evaluate your results and draw conclusions.

What you do

- 1 Into three test tubes pour about 1 cm depth of sodium chloride solution.
- 2 Into one test tube add about 1 cm of chlorine water, into a second test tube add 1 cm of bromine water and to the third add 1 cm of iodine water.
- 3 Record your observations in the table.
- 4 Add a few drops of cyclohexane and observe what happens.
- 5 Record any colour changes.
- 6 Pour contents of test tubes into waste collection beaker in fume cupboard.
- 7 Repeat steps 1 to 6 using sodium bromide solution.
- 8 Repeat steps 1 to 6 using sodium iodide solution.

Table for observations

	Chlorine water	Bromine water	Iodine water
Sodium chloride solution			
Sodium bromide solution			
Sodium iodide solution			

Experiment 5.8: Halogen displacement

Notes for teachers and technicians

Aim

The aim of this investigation is to find the order of reactivity in the halogens by using displacement reactions.

Previous skills, knowledge and understanding required

Safe ways of working with hazardous chemicals.

Skills, knowledge and understanding

Students will learn:

- 1 How to make and record observations.
- 2 How to write word and formula equations for the changes they observe.

Equipment and chemicals required

- 1 0.01 M chlorine water.
- 2 0.01 M bromine water.
- 3 0.01 M iodine dissolved in potassium iodide solution labelled iodine water.
- 4 0.1 M sodium iodide solution.
- 5 0.1 M sodium bromide solution.
- 6 0.1 M sodium chloride solution.
- 7 Dropper bottles containing cyclohexane.
- 8 Test tubes and racks.
- 9 Large beaker labelled 'for waste'.

Health and safety issues

Check HAZCARDs for all chemicals being used.

Provide a large beaker to collect waste to allow organic material to be separated and disposed of safely.

Place this large beaker in fume cupboard.

Links with key stage 3 (KS3)

This experiment builds on the following skills, knowledge and understanding from KS3:

- SC3. 3.b About the displacement reactions that take place between metals and solutions of other metals
- 9F Patterns of reactivity.

Activity 5.9: Patterns in the periodic table

What you will learn from this activity

The patterns and trends in and across the periodic table.

What you will know when you finish this activity

- 1 Atomic number increases across each period from left to right.
- 2 The lower down a group the higher the atomic number of the element.
- 3 Atomic mass follows a similar pattern to atomic number.
- 4 Group 1 alkali metals increase in reactivity down the group.
- 5 Group 7 halogens increase in reactivity up the group.
- 6 Less reactive metals are in the middle the transition metals.
- 7 Metallic nature increases to the left and non-metallic nature increases to the right of the periodic table.

How you may be assessed

You may be assessed on concluding and evaluating skills.

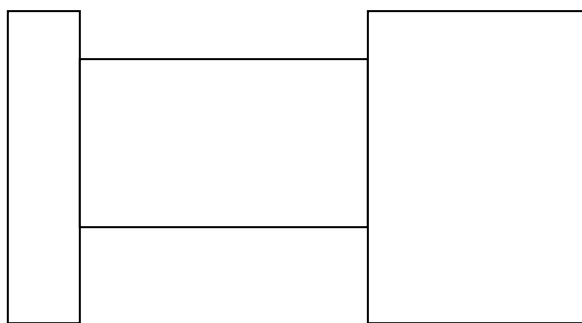
What you do

Use the simplified periodic table blanks to act as templates.

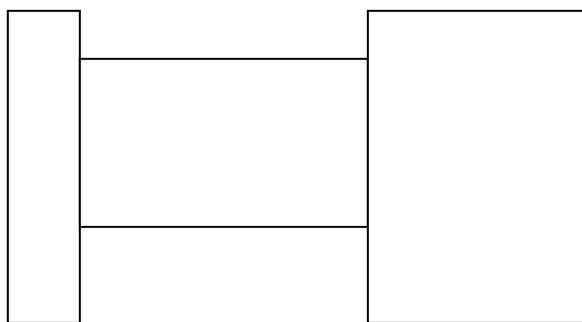
Draw arrows and labels on the templates to show the trends in:

- 1 atomic number and atomic mass
- 2 reactivity of alkali metals
- 3 reactivity of halogen non-metals
- 4 the pattern of metallic and non-metallic nature of the arrangement of elements.

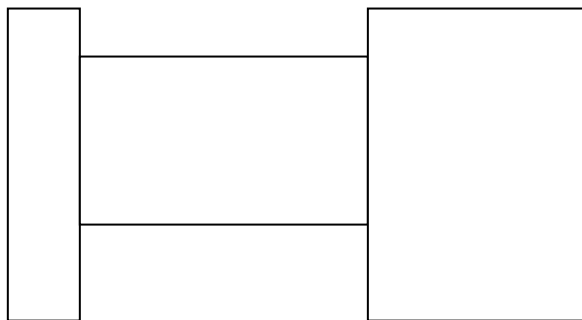
Activity 5.9: Patterns in the periodic table



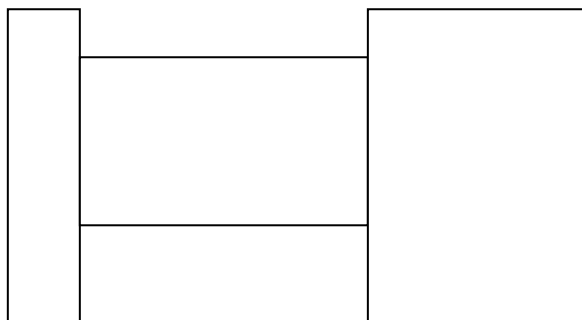
1 Atomic number and atomic mass.



2 Reactivity of alkali metals.



3 Reactivity of halogen non-metals.



4 The pattern of metallic and non-metallic nature of the arrangement of elements.

Activity 5.9: Patterns in the periodic table

Notes for teachers and technicians

Aim

Identify patterns in the periodic table.

Skills, knowledge and understanding

Students may be assessed on their conclusion and evaluation skills.

Previous skills, knowledge and understanding required

The ability to present information neatly.

Materials required

Coloured pencils or felt pens may be an advantage.

Delivery strategies

Use the sheet as a reinforcement and gatherer of information covered in the topic. It could then be used to form a set of slides using a presentation package.

Links with key stage 3 (KS3)

This activity builds on the following skills, knowledge and understanding from KS3:

- Sc1 2j Identify and describe patterns or relationships in data
- basic ICT skills if a presentation is made.

Resources

- www.chemsoc.org/networks/learnnet/atomatak.htm
- www.chemicalelements.com/
- <http://chemlab.pc.maricopa.edu/periodic/foldedtable.html>
- www.chemicool.com/

Demonstration 5.10: How to do a flame test

What you will learn from this demonstration

How to make and use a flame test wire.

What you will know after you see this demonstration

- 1 How to ensure a flame test wire is free of contamination.
- 2 That sodium compounds are in most things and can mask flame colours.
- 3 That potassium compounds give a pale lilac colour to a flame, which is best seen through blue glass.
- 4 That dipping the clean flame test wire into concentrated hydrochloric acid and then into the solid to be tested helps.
- 5 Once you have a clean flame test wire you can detect a variety of metals using the same technique, for example, sodium, lithium and copper.

Demonstration 5.10: How to do a flame test

Notes for teachers and technicians

Aim

In this demonstration students will find out how to work with simple apparatus to analyse a number of metals in compounds.

Skills, knowledge and understanding

This demonstration will enable students to gain the following skills and understanding:

- 1 softening glass and working with very hot materials
- 2 using concentrated acid with safety
- 3 working in a very clean manner.

Previous skills, knowledge and understanding required

Working safely with dangerous chemicals.

Equipment and chemicals required

- 1 10 cm glass rod.
- 2 5 cm nichrome wire.
- 3 Bunsen burner.
- 4 Concentrated hydrochloric acid.
- 5 Watch glass.
- 6 Potassium chloride.
- 7 Piece of blue glass.
- 8 Safety glasses/goggles.

Health and safety issues

Check HAZCARD for using concentrated hydrochloric acid.

Delivery strategies

Demonstrate the technique to ensure students appreciate that dirty flame test wires will ruin any analysis because the contaminant may mask the colour, if any, of the metal in the compound.

- 1 Soften one end of the glass rod and push the nichrome wire into it whilst holding in the flame.
- 2 Allow it to cool.
- 3 Set a Bunsen to a clear flame.
- 4 Heat the wire and observe a yellow flame colour.
- 5 Pour a few ml of concentrated hydrochloric acid onto a watch glass.
- 6 Dip hot wire into acid in watch glass.
- 7 Reheat and repeat the process until no colouration occurs.
- 8 Reinforce not putting a dirty wire into the acid until it is fairly clean as this will only contaminate the acid.

Demonstration 5.10: How to do a flame test

- 9 Wet a hot or cool wire with acid then use this to get a crystal of potassium chloride to stick to the wire. Emphasise that only a small amount of test material is needed.
- 10 Bring the crystal to just touch the edge of the clear blue flame and note the colouration running up the flame.
- 11 Show that this colour can be seen through blue glass, which masks the yellow of the sodium normally present in trace amounts of potassium chloride.

Links with key stage 3 (KS3)

This demonstration builds on the following skills, knowledge and understanding from KS3:

- Sc4.5d That differences in temperature can lead to a transfer of energy
- 8I Heating and cooling.

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