OASB Science Department
Chemistry Paper 1 Revision Pack (Double – FT)

Topic	Tier	RG Page	Learning statement
Elements & Compounds	F	88	Describe and draw a model of the three states of matter
Elements & Compounds	F	94	Use the particle model to explain melting, boiling, freezing and condensing
Elements & Compounds	F	94	Identify a substance's state using its melting and boiling point
Elements & Compounds	F	88	Classify a substance as an element or compound
Elements & Compounds	F	88	Identify the symbol for the first 20 elements
Elements & Compounds	F	88	Name common compounds from their formula
Mixtures	F	89	Use key terms (soluble, insoluble, solute, solvent and solution) correctly to describe a substance dissolving
Mixtures	F	89	Explain how to separate given mixtures (filtration, crystallisation, simple distillation, fractional distillation, chromatography)
Structure of an atom	F	213	Describe the plum pudding model of the atom
Structure of an atom	F	213	Describe the current (nuclear) model of the atom giving the relative charge and mass of the subatomic particles
Structure of an atom	F	90	Recall the radius of an atom and it's nucleus
Structure of an atom	F	91	Calculate protons, neutrons and electrons for an atom linking to mass and atomic number
Structure of an atom	F	91	Draw the electronic structure and work out the electronic configuration for a given atom
Structure of an atom	F	91	Define an 'isotope'
Structure of an atom	F	91	Link isotopes to relative atomic mass to explain why this is an average
Structure of an atom	F	103	Calculate the relative atomic mass of an element given the percentage abundance of its isotopes
Structure of an atom	F	103	Calculate the relative formula mass of a substance
Metals in the periodic table	F	92	Describe how Mendeleev has arranged the periodic table
Metals in the periodic table	F	100	Explain why something is classified as a metal or non-metal
Metals in the periodic table	F	100	Describe the uses of metals
Metals in the periodic table	F		Define a 'chemical reaction' and give examples
Metals in the periodic table	F	100	Explain what an alloy is and how it's properties differ from a pure metal
Groups in the periodic table	F	92	Describe the key properties (state, easy to cut, appearance) of group 1
Groups in the periodic table	F	92	Describe and explain how the reactivity changes as you move down group 1 (oxygen, chlorine, water)
Groups in the periodic table	F	93	Describe the key properties (molecular mass, boiling and melting point) of group 7
Groups in the periodic table	F	93	Describe and explain how the reactivity changes as you move down group 7
Groups in the periodic table	F	92	Describe the key properties (boiling point, density, reactivity) of group 0
Groups in the periodic table	F	92	Describe and explain how the reactivity changes as you move down group 0
Types of bonding	F	96	Describe the structure and properties of giant ionic structures
Types of bonding	F	96	Link the structure of giant ionic structures to its properties
Types of bonding	F	98	Describe the structure and properties of simple covalent structures
Types of bonding	F	99	Describe the structure and properties of giant covalent structures (including diamond, graphite and silica)
Types of bonding	F	100	Compare and contrast giant carbon structures (diamond, graphite, graphene and fullerene – Buckminster fullerenes and nanotubes as examples)
Types of bonding	F	101	Describe how a substance bonds metallically
Types of bonding	F	101	Link the structure of giant metallic structures to their properties
Describing chemical reactions	F		Write a word equation for a given reaction
Describing chemical reactions	F		Write a balanced symbol equation for a given reaction
Describing chemical reactions	F	95	Include appropriate state symbols in an equation
Describing chemical reactions	F	102	Compare the mass of reactants and products when looking at a word equation, linking this to the theory of 'conservation of mass' (metal and oxygen, thermal decomposition of metal carbonates)
Describing chemical reactions	F		Calculate 'uncertainty' for a given set of measurements
Reactions of metals	F	115	Describe the reaction of given metals with oxygen
Reactions of metals	F	115	Describe the reaction of given metals with water
Reactions of metals	F	116	Describe the reactions of given metals with acids (magnesium, zinc and iron with hydrochloric and sulphuric acid)

Reactions of metals	F	115	Predict products from given reactants
Reactivity of metals	F	114	Use evidence to rank metals in order of reactivity
Reactivity of metals	F	115	Predict what would happen in a displacement reaction between two substance
Acids & alkalis	F	116	Identify the ions produced by different acids and alkalis
Acids & alkalis	F	116	Describe the pH scale and how to test pH using universal indicator or a pH probe
Acids & alkalis	F	116	Describe neutralisation reactions (alkalis and bases, metal carbonates and acid)
Acids & alkalis	F	117	Deduce the formulae of salts from their given ions
Acids & alkalis	F	117	Explain the method for producing soluble salts
Acids & alkalis	F	117	**RP Making Salts:** Prepare a pure dry sample of a soluble salt from an insoluble oxide or carbonate
Acids & alkalis	F	116	Recall the ionic equation for neutralisation
Chemical tests & calculations	F		Link changes in mass to the word equation for a reaction
Chemical tests & calculations	F	103	Calculate the relative formula mass of a substance
Electrolysis	F	118	Link reactivity to how metals are extract from their ore
Electrolysis	F	118	Describe how electrolysis is carried out
Electrolysis	F	118	Explain the electrolysis of molten compounds eg. Lead bromide
Electrolysis	F	118	Predict what is produced at each electrode
Electrolysis	F	118	Explain how electrolysis can be used to extract metals from their ores
Electrolysis	F	118	Explain how electrolysis can be used to determine the presence of hydrogen in an aqueous solution
Electrolysis	F	119	**RP Electrolysis:** Investigate what happens when aqueous solutions are electrolysed (including the development of a hypothesis)
Exo/Endothermic reactions	F	120	Explain how energy is conserved in reactions
Exo/Endothermic reactions	F	120	Define and give examples and uses of exothermic and endothermic reactions
Exo/Endothermic reactions	F	120	Evaluate data to decide whether a reaction is exothermic or endothermic
Exo/Endothermic reactions	F		**RP Temperature Changes:** Investigate the variables that affect temperature changes in reacting solutions
Exo/Endothermic reactions	F	124	Define activation energy
Exo/Endothermic reactions	F	120	Use reaction profiles to show energies of reactants and products and link to exothermic and endothermic and draw simple reaction profiles for endothermic and exothermic reactions.
Volumes and concentrations	F		Calculate the mass of solute in a given volume of solution

Lesson 1: Elements, compounds and Separating Mixtures

	Topic:	**Solubility**
1	What do we call a substance that doesn't dissolve?	Insoluble
2	What do we call a substance that does dissolve?	Soluble
3	What is the substance that dissolves called?	Solute
4	What is the liquid the substance dissolves in called?	Solvent
5	What do we call a mixture of a solvent and solute together?	Solution
6	What do we call more than one type of atom together but not chemically joined?	Mixture
7	What do we call more than one type of atom chemically joined together?	Compound
8	What do we call a substance with only one type of atom?	Element

	Topic:	**Separating Mixtures**
1	What does **filtration** separate?	An insoluble solid from a liquid
2	What is **simple distillation** used to separate?	Two liquids of different boiling points.
3	What does crystallisation separate?	A soluble solid from a liquid
4	What technique is used to separate ethanol from water?	Distillation
5	What two states of change happen in distillation?	Evaporation and condensation
6	What technique is used to separate two or more different coloured solvents?	Chromatography
7	What does crystallisation separate?	A soluble solid from a liquid

Notes

Chemistry Revision: Elements & Compounds

Key Knowledge

Definitions:

Element - _____

Compound -_____

Melting -_____

Boiling - _____

Freezing -_____

Condensing -_____

How many elements are in the periodic table? Approximately ____.

Particle model – the atoms are represented as _____.

Solid	Liquid	Gas

The stronger the forces between particles the _____ the melting and boiling point, so _____ energy is needed to break the bonds between particles.

Temperature	*Solid, liquid or gas?*
Lower than its melting point	
Between the melting and boiling point	
Higher than its boiling point	

Mastery Matrix Points. Revision guide page number: 88 + 94

Describe and draw a model of the three states of matter
Use the particle model to explain melting, boiling, freezing and condensing
Identify a substance's state using its melting and boiling point
Classify a substance as an element or compound
Identify the symbol for the first 20 elements
Name common compounds from their formula

Understanding and Explaining

Element	Melting point (°C)	Boiling point (°C)
Copper	1083	2567
Magnesium	650	1107
Oxygen	-218.4	-183
Carbon	3500	4827
Helium	-272	-268.6
Sulphur	112.8	444.6

1. Describe how the movement and rearrangement of particles changes during
   a. Melting:
   b. Boiling:
   c. Freezing:
   d. Condensing:
2. Use the table to answer these questions.
   a. What state (solid, liquid or gas) would each of the elements be at room temperature (25°C)? See table above.
      Copper: Carbon:
      Magnesium: Helium
      Oxygen: Sulphur:
   b. Which 4 elements would be a gas at 2000°C?
3. Are these elements or compounds?
   a. Sodium chloride
   b. Oxygen gas
   c. KI
   d. Co
   e. CO
4. Write the symbols for these elements.

Hydrogen		Carbon		Sodium		Sulfur	
Helium		Nitrogen		Magnesium		Chlorine	
Lithium		Oxygen		Aluminium		Argon	
Beryllium		Fluorine		Silicon		Potassium	
Boron		Neon		Phosphorus		Calcium	

5. Name these compounds.

1. LiO	6. $CuCl_2$	11. HCl
2. $AlCl_3$	7. H_2O	12. CaBr
3. $MgCl_2$	8. H_2SO_4	13. K_2O
4. FeS	9. KNO_3	14. Al_2O_3
5. NaCl	10. LiOH	15. CO_2

Chemistry Revision: Mixtures

Mastery Matrix Points. Pg 88

Use key terms (soluble, insoluble, solute, solvent and solution) correctly to describe a substance dissolving
Explain how to separate given mixtures (filtration, crystallisation, simple distillation, fractional distillation, chromatography)
Explain the difference in difficulty of separating compounds compared to mixtures

Key Knowledge

Mixture – _____

Soluble – _____
Insoluble –_____
Solute – _____
Solvent – _____

Filtration

Used to separate: _____

Equipment list:

Crystallisation

Used to separate: _____

Equipment list:

Simple distillation

Used to separate: _____

Equipment list:

Chromatography

Used to separate: _____

Equipment list:

Fractional distillation

Used to separate: _____

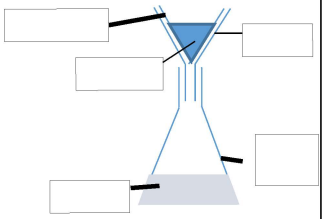
Equipment list:

Understanding and Explaining

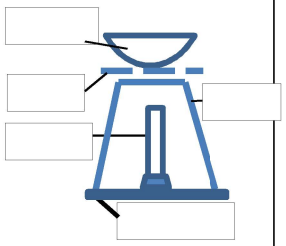
1. Mixtures can be separated by physical processes, these processes do not involve _____ _____

2. Explain why compounds cannot be separated by physical processes.
   _____
   _____

3. Label the apparatus and state which separation process it is.
   The separation process is called _____

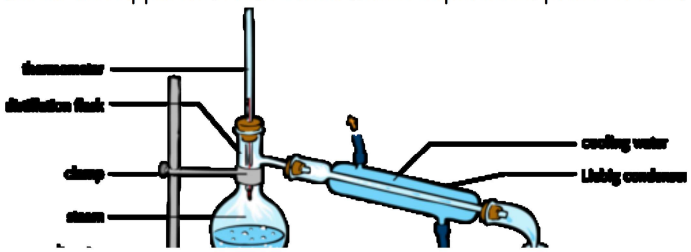


Label the apparatus and state which separation process would be used to separate copper sulphate crystals from a copper sulfate solution.
The separation process is called _____



4. Describe the process of paper chromatography and how you could use it to see if a food dye is pure.

5. Label the apparatus and state which separation process it is.



Guided Exam Question

1. Ammonium nitrate (NH_4NO_3) is produced by reacting ammonia with nitric acid.
   A student measured the mass of ammonium nitrate that dissolves in 100 cm3 of water at different temperatures. Table 3 shows the student's results

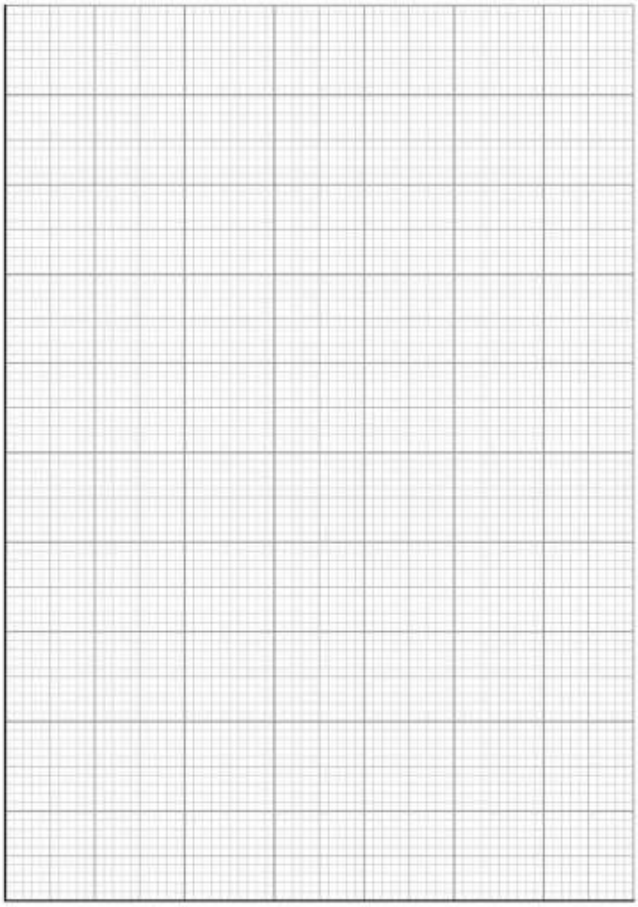
Table 3

Temperature in °C	0	20	40	60	80	100
Mass of ammonium nitrate in g that dissolves in 100 cm^3 water	119	190	286	321	630	1 024

1.1. Use **Table 3** to plot a graph of the solubility of ammonium nitrate **on Figure 9**.

[4 marks]

Figure 9



1.2. At 20 °C, 190 g of ammonium nitrate dissolves in 100 cm^3 of water. Predict the amount of ammonium nitrate that dissolves at 30°C. [1 mark]

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1.3 Farmers use ammonium nitrate as a fertiliser. Farmers want to slow down the rate at which ammonium nitrate fertiliser dissolves in the water in the soil. Suggest why they spread the fertiliser in the form of small beads instead of a fine powder. [2 marks]

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Independent Exam Question

2.1 Rock salt is a mixture of sand and salt. Salt dissolves in water. Sand does not dissolve in water. Some students separated rock salt.

This is the method used.
1. Place the rock salt in a beaker.
2. Add 100 cm3 of cold water.
3. Allow the sand to settle to the bottom of the beaker.
4. Carefully pour the salty water into an evaporating dish.
5. Heat the contents of the evaporating dish with a Bunsen burner until salt crystals start to form.

2.2 Suggest one improvement to step 2 to make sure all the salt is dissolved in the water.

[1 mark]

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2.3 The salty water in step 4 still contained very small grains of sand. Suggest one improvement to step 4 to remove all the sand.

[1 mark]

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2.4 Suggest one safety precaution the students should take in step 5.

[1 mark]

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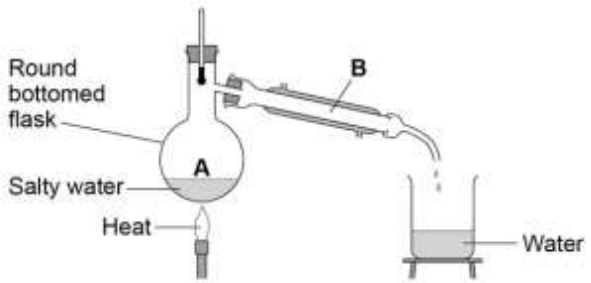
Figure 3



Another student removed water from salty water using the apparatus in Figure 3.

2.5 Describe how this technique works by referring to the processes at A and B.

[2 marks]

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2.6 What is the reading on the thermometer during this process?

[1 mark]

…… °C

Lesson 2: Summary of an atom and types of bonding

Structure of the atom

1	What is the charge, relative size and location of a proton?	Charge: 1+, Size = 1, Location = Nucleus
2	What is the charge, relative size and location of a neutron?	Charge: 0, Size = 1, Location = Nucleus
3	What is the charge, relative size and location of an electron?	Charge: -1, Size = 1/2000, Location = Shells
4	What 3 things did the alpha scattering experiment prove?	1) Nucleus of atom is positive (causing deflection and reflection of positive alpha particles) 2) Mass of nucleus is concentrated in the centre 3) Most of the atom is empty space
5	Define "atomic number"	Number of protons in an atom (smaller number)
6	Define "atomic mass number"	Sum of protons and neutrons in an atom (larger number)
7	Describe Thompson's 'Plum Pudding' model of an atom.	Ball of positive charge with electrons embedded throughout

Types of bonding

1	Which type of bonding occurs between metals and non-metals?	Ionic
2	Which type of bonding occurs between non-metals?	Covalent
3	Which type of bonding occurs between metals?	Metallic
4	When electrons leave the shells of an atom, they are said to be ……?	Delocalised
5	Define graphene?	A single layer of graphite
6	Define a fullerene?	Molecules of carbon that have a hollow shape
7	What is Buckminster Fullerene?	Spherical carbon shape with 60 carbon atoms

Notes

Chemistry Revision: Structure of an Atom

Key Knowledge

Definitions:

Plum pudding model: Thomson thought _____ contained tiny _____ surrounded by _____

Isotope: _____

Ion: _____

Relative atomic mass: _____ _____

Radius of an atom = nm
= m

Radius of a nucleus is _____ times smaller than the atomic radius, about _____m.

What order were the parts of the atom discovered?

Subatomic particles

Name	*Relative mass*	*Charge*
Proton		
Neutron		
Electro n		

Using the periodic table:

To find the number of protons you…

To find the number of electrons you…

To find the number of neutrons you…

Mastery Matrix Points, Pg 90

Describe the plum pudding model of the atom
Describe the current (nuclear) model of the atom giving the relative charge and mass of the subatomic particles
Recall the radius of an atom and it's nucleus
Calculate protons, neutrons and electrons for an atom linking to mass and atomic number
Draw the electronic structure and work out the electronic configuration for a given atom
Define an 'isotope'
Isotopes to relative atomic mass to explain why this is an average
Calculate the relative atomic mass of an element given the percentage abundance of its isotopes
Calculate the relative formula mass of a substance

Understanding and Explaining

1. Draw a diagram of the structure of the atom using the nuclear model.

2. Describe what the atomic number and mass number on the periodic table tell us.
   The atomic number tells us _____
   Whereas, the mass number tells us _____

3. Describe the alpha scattering experiment, its results and why the results led to a change in the theory of the atom.
   Most of the _____. Therefore, it was concluded that _____
   _____
   Some of the _____. Therefore, it was concluded that _____
   _____
   A very small amount of the _____. Therefore, it was concluded that _____
   _____

4. Atomic theory: Niels Bohr stated that _____,
   otherwise the electrons would _____

5. Calculate the relative formula mass of carbon dioxide.

6. *Calculate the relative atomic mass of neon if the abundances of the atoms are: Ne^{20} 90.92%, Ne^{21} 0.26%, Ne^{22} 8.82%.

Chemistry Revision: Types of Bonding

Key Knowledge

Ionic bond – _____

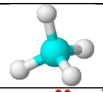
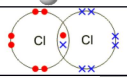
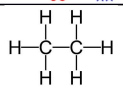
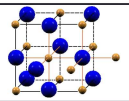
Covalent bond – _____

Metallic bond – _____

Alloy – _____

Lattice structure (definition and picture) –

Ways of showing bonding and their drawbacks:

Name of model	*Example*	*Limitations*
Ball and stick		
Dot and cross		
2D models		
3D models		

Examples of simple covalent molecules –

Examples of giant covalent molecules –

Uses of fullerenes –

Mastery Matrix Points pg 96-100

Describe the structure and properties of giant ionic structures
Link the structure of giant ionic structures to its properties
Describe the structure and properties of simple covalent structures
Describe the structure and properties of giant covalent structures (including diamond, graphite and silica)
Describe how a substance bonds metallically
Link the structure of giant metallic structures to their properties

Understanding and Explaining

1. Describe and explain the properties of **simple covalent** molecules.

Property	*Explanation*

2. Describe and explain the properties of **ionic** compounds.

Property	*Explanation*

3. Describe and explain the properties of **metallic** structures.

Property	*Explanation*

4. Describe and explain the properties of each of these giant covalent structures.

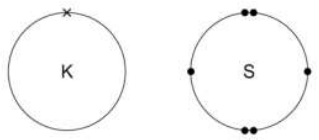
Name	*Structure*	*Properties*	*Explanations*
Diamond			
Graphite			
Graphene			
Fullerenes			
Polymers			

5. Explain why alloys are harder and stronger than pure metals, use a particle diagram to support your explanation.

Guided Exam Question

3. **Figure 1** shows the outer electrons in an atom of the Group 1 element potassium and in an atom of the Group 6 element sulfur.

Figure 1



3.1. Potassium forms an ionic compound with sulfur.
Describe what happens when two atoms of potassium react with one atom of sulfur.
Give your answer in terms of electron transfer.
Give the formulae of the ions formed.

[5 marks]

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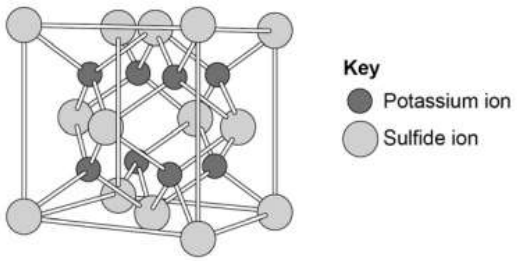
3.2. The structure of potassium sulfide can be represented using the ball and stick model in Figure 2.

Figure 2



The ball and stick model is not a true representation of the structure of potassium sulfide. Give one reason why.

[1 mark]

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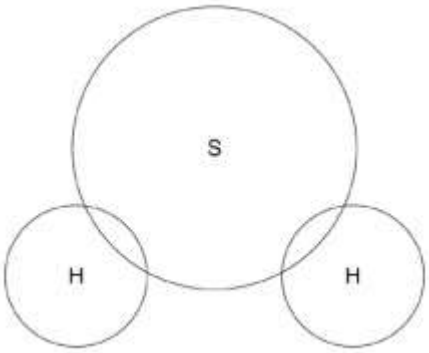
Independent exam questions

3.3. Sulfur can also form covalent bonds.
Complete the dot and cross diagram to show the covalent bonding in a molecule of hydrogen sulfide.
Show the outer shell electrons only.

[2 marks]



3.4. Calculate the relative formula mass (Mr) of aluminium sulfate, $Al_2(SO_4)_3$

Relative atomic masses (Ar): oxygen = 16; aluminium = 27; sulfur = 32

[2 marks]

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Relative formula mass =……..

3.5. Covalent compounds such as hydrogen sulfide have low melting points and do not conduct electricity when molten.
Draw one line from each property to the explanation of the property.

[2 marks]

Property	Explanation of property
	Electrons are free to move
Low melting point	There are no charged particles free to move
	Ions are free to move
	Weak intermolecular forces of attraction
Does not conduct electricity when molten	Bonds are weak
	Bonds are strong

3.6. Ionic compounds such as potassium sulfide have high boiling points and conduct electricity when dissolved in water. Draw one line from each property to the explanation of the property.

[2 marks]

Property	Explanation of property
	Electrons are free to move
High boiling point	There are no charged particles free to move
	Ions are free to move
	Weak intermolecular forces of attraction
Conduct electricity when molten	Bonds are weak
	Bonds are strong

3.7. Describe and explain how the reactivity of the group 1 alkali metals changes as you go down the group. Refer to electrostatic attraction in your answer.

[4 marks]

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Lesson 3: The periodic table and reaction of metals.

		The periodic table
1	How are elements arranged in the periodic table?	In order of atomic number (lowest to highest)
2	What does the column (group) in the periodic table tells us?	Number of electrons in the outer shell
3	What did Mendeleev do when creating the modern periodic table?	Left gaps to make the pattern fit
4	Name the groups in the periodic table (1, 7, 0)	1 = Alkali metals, 7 = Halogens, 0 = Noble gases
5	What happens to reactivity as you move down group 7?	They become less reactive - it is harder to gain an electron
6	What happens to reactivity as you move down group 1?	They become more reactive - it is easier to lose their outer electron.
7	What is the name of the elements found in the middle of the periodic table that are not part of a group?	Transition metals

		Reaction of metals
1	metal + oxygen ->	metal oxide
2	metal + water ->	metal hydroxide + hydrogen gas
3	metal + acid ->	metal salt + hydrogen gas
4	Define oxidation (in terms of oxygen)	Addition of oxygen to an element
5	Define reduction (in terms of oxygen)	Removal of oxygen from a compound
6	What is the law of conservation of	No atoms are lost or made

	mass?	during a reaction (mass of reactants = mass of products)
7	acid + alkali (or base) ->	salt + water

Notes

Chemistry Revision: Periodic Table

Key Knowledge

PERIODIC TABLE BEFORE MENDELEEV:
The periodic table was arranged in order of _____ and some elements were _____.
The properties were not the same in the _____.

MENDELEEV'S CHANGES:

1. _
   _
2. _
   _

This meant that the elements in the same group had similar _____.

Later the discovery of _____ explained why the order of atomic weight had not worked properly.

MODERN PERIODIC TABLE:
In the periodic table, the elements are arranged in order of _____.

Periods are the _____ of the periodic table, which show that the properties repeat. Elements in the same period have the same number of _____ _____.

Groups are the _____ of the periodic table, which have similar properties within them. Elements in the same group have the same number of _____ in their outer shell.

Mastery Matrix Points

Describe how Mendeleev has arranged the periodic table

Understanding and Explaining

1. Explain why elements in the same groups did not have similar properties before Mendeleev's changes to the periodic table.

2. Describe and explain Mendeleev's contribution to the modern periodic table.

3. Describe what has been added to the periodic table since Mendeleev made his changes.

4. Sulfur and sodium are in the same period of the periodic table. Suggest one similarity and one difference about their electronic structure.
   Similarity:

   Difference:

5. Lithium and sodium are in the same group of the periodic table. Suggest one similarity and one difference about their electronic structure.
   Similarity:

   Difference:

Chemistry Revision: Reactivity of metals

Key Knowledge

Metals are found on the _____ of the periodic table.
Non-metals are found on the _____ of the periodic table.

The reactivity series (with 8 metals and 2 non-metals):

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Metal displacement reactions are when
……
……

Oxidation

Definition 1 –

Reduction

Definition 1 –

Ore –

Low reactivity metals are extracted from their ore by…….
High reactivity metals are extracted by……

Mastery Matrix Points

Explain why something is classified as a metal or non-metal
Use evidence to rank metals in order of reactivity
Predict what would happen in a displacement reaction between two substance
Link reactivity to how metals are extract from their ore
Describe the reaction of given metals with oxygen
Describe the reaction of given metals with water
Describe the reactions of given metals with acids (magnesium, zinc and iron with hydrochloric and sulphuric acid)
Predict products from given reactants

Understanding and Explaining

1. Complete the positive tests for each of the gases:

Gas	Description of test	Positive test result

2. Describe the reactions below.

Metal	*Reaction with room temperature water*	*Reaction with dilute acid*
Potassium		
Sodium		
Lithium		
Calcium		
Magnesium		
Zinc		
Iron		
Copper		

3. Explain why metals such as gold do not need to be extracted from an ore.

4. Explain how metals such as copper and iron are extracted from their ores.

Guided Exam Question

4.1 An atom of aluminium has the symbol $^{27}_{13}A$

Give the number of protons, neutrons and electrons in this atom of aluminium. [3 marks]

Number of protons _____

Number of neutrons _____

Number of electrons _____

4.2 Why is aluminium positioned in Group 3 of the periodic table?

[1 mark]

.....

.....

.....

5.1 In 1866 John Newlands produced an early version of the periodic table.

Part of Newlands' periodic table is shown below.

Column	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca	Cr	Ti	Mn	Fe

Newlands' periodic table arranged all the known elements into columns in order of their atomic weight.

Newlands was trying to show a pattern by putting the elements into columns.

Iron (Fe) does **not** fit the pattern in column 7.

Give a reason why.

_____

_____

(1)

5.2 In 1869 Dmitri Mendeleev produced his version of the periodic table.

Why did Mendeleev leave gaps for undiscovered elements in his periodic table?

_____

_____

(1)

5.3 Newlands and Mendeleev placed the elements in order of atomic weight.

Complete the sentence.

The modern periodic table places the elements in order of

_____ .

(1)

5.4 Lithium, sodium and potassium are all in Group 1 of the modern periodic table.

Explain why.

_____

_____

_____

_____

(2)

Independent Exam Questions

6.1 A student investigated the reactivity of three different metals.

This is the method used.

1. Place 1 g of metal powder in a test tube.
2. Add 10 cm^3 of metal sulfate.
3. Wait 1 minute and observe.
4. Repeat using the other metals and metal sulfates.

The student placed a tick in the table below if there was a reaction and a cross if there was no reaction.

	Zinc	**Copper**	**Magnesium**
Copper sulfate	✓	x	✓
Magnesium sulfate	x	x	x
Zinc sulfate	x	x	✓

(a) What is the dependent variable in the investigation?

Tick **one** box.

Time taken ☐

Type of metal ☐

Volume of metal sulfate ☐

Whether there was a reaction or not ☐

(1)

6.2 Give **one** observation the student could make that shows there is a reaction between zinc and copper sulfate.

_____

_____

(1)

6.3 The student used measuring instruments to measure some of the variables.

Draw **one** line from each variable to the measuring instrument used to measure the variable.

Variable	**Measuring instrument**
	Balance
	Measuring cylinder
Mass of metal powder	
	Ruler
	Burette
Volume of metal sulfate	
	Theromometer
	Test tube

(2)

6.4 Use the results shown in table above to place zinc, copper and magnesium in order of reactivity.

Most reactive _____

↕

_____

Least reactive _____ **(1)**

6.5 Suggest **one** reason why the student should **not** use sodium in this investigation.

_____

_____ **(1)**

6.6 Which metal is found in the Earth as the metal itself?

Tick **one** box.

Calcium ☐

Gold ☐

Lithium ☐

Potassium ☐

(1)

Lesson 4: Describing chemical reactions and groups in the periodic table
(Some key knowledge points are repeated!)

		Groups in the periodic table
1	The rows of the periodic table are called..	Periods
2	Where are non-metals found in the periodic table?	Right
3	State 3 properties of group 7	Non-metal, highly reactive, diatomic
4	What happens to reactivity as you move down group 7?	They become less reactive
5	Give 4 properties of metals	*High melting point *Good thermal and electrical conductors *Ductile *Malleable
6	Give 4 properties of non-metals	*Low melting point *Poor thermal and electrical conductors *Brittle
7	Give 5 properties of the alkali metals	*Highly reactive *Low melting and boiling points *Low density *Shiny when cut *Soft
8	What happens to reactivity as	They become more reactive

	you move down group 1?	

Notes

Chemistry Revision: Describing Chemical Reactions

Mastery Matrix Points

Write a word equation for a given reaction
Write a balanced symbol equation for a given reaction
Include appropriate state symbols in an equation

Key Knowledge

Rules for chemical equations:

- ✓ Use an ____, **never** an equals sign.
- ✓ Show the reactants on the ____ hand side.
- ✓ Show the products on the ____ hand side.
- ✓ Use only words for a _____equation and symbols for a _____ equation.
- ✓ All lower case for word equations and correct case for symbols.

State symbols:

Solid –

Liquid -

Gas –

Aqueous (dissolved)-

(*Note:* Most salts are usually aqueous).

General word equations

metal + oxygen →

metal + acid →

metal oxide + acid →

metal hydroxide + acid →

metal carbonate + acid →

metal + halogen →

metal + water →

Acid	*Formula*
Hydrochloric acid	
Sulfuric acid	
Nitric acid	

Understanding and Explaining

1. Complete word equations for these reactions.
   CHALLENGE: Write balanced symbol equations for each reaction and **include state symbols.**

a) magnesium + hydrochloric acid →

b) calcium carbonate + hydrochloric acid →

c) potassium + water →

d) sodium + sulfuric acid →

e) sulfuric acid + copper oxide →

f) magnesium + oxygen →

g) sodium hydroxide + hydrochloric acid →

h) zinc + hydrochloric acid →

Chemistry Revision: Groups in the Periodic Table

Key Knowledge

Group 1 is called the _____

The properties of group 1 are

-

-

-

As you go down group 1, the reactivity ……..

Group 1 elements all have ____ _____ in their outer shell.

Group 7 is called the _____

Properties of group 7

-

-

-

As you go down group 7, the reactivity ……..

Group 7 elements all have ____ _____ in their outer shell.

As you go down group 7, the melting point and boiling point……

Group 0 is called the _____

Properties of group 0

-

-

-

As you go down group 0 the boiling points ……..

Group 0 elements all have ____ _____ in their outer shell, apart from helium which has _____.

Mastery Matrix Points

Describe the key properties (state, easy to cut, appearance) of group 1
Describe and explain how the reactivity changes as you move down group 1 (oxygen, chlorine, water)
Describe the key properties (molecular mass, boiling and melting point) of group 7
Describe and explain how the reactivity changes as you move down group 7
Describe the key properties (boiling point) of group 0
Describe and explain how the reactivity changes as you move down group 0

Understanding and Explaining

1. Describe the reactions below.

Reactants	Product made (name and formula)	Observations during the reaction
Lithium + water		
Sodium + water		
Potassium + water		
Lithium + chlorine		
Sodium + chlorine		
Potassium + chlorine		
Lithium + oxygen		
Sodium + oxygen		
Potassium + oxygen		

2. **Describe** and **explain** how the reactivity of group 1 changes as you go down the group.

3. **Explain** why group 7 elements have similar reactions when reacting with metals and non-metals.

4. **Describe** the reactions below.

Reactants	Product made (name and formula)	Is the product a covalent molecule or ionic lattice?
sodium + chlorine		
hydrogen + chlorine		
copper + bromine		
Sulfur + bromine		
lithium + iodine		
phosphorus + iodine		

5. Explain why group 0 elements are unreactive.

6. Explain why the boiling point of group 0 increases as you go down the group.

7. Explain why the reactivity of halogens decreases as you go down the group.

Guided Exam Question

7.1. The elements in Group 1 of the periodic table are metals.
The elements in Group 1 are called the alkali metals. Why are they called the alkali metals?

[2 marks]

……
……
……
……

7.2. Explain the increase in reactivity of elements further down the group.

[4 marks]

……
……
……
……
……
……
……
……

7.3. Lithium oxide is an ionic compound. Draw a dot and cross diagram to show how lithium and oxygen combine to form lithium oxide. Only show the electrons in the outer shell of each atom. Give the charges on the ions formed.

[4 marks]

……
……
……
……
……
……
……
……

Independent Exam Question

8. In 1869 there were 60 known elements.

Mendeleev arranged the elements in order of their atomic mass (atomic weight).

He realised that elements with similar properties occurred at regular intervals.

8.1. Suggest why one of the groups that is on today's periodic table was not in Mendeleev's periodic system. [1 mark]

……
……
……

8.2. Explain the arrangement of the first 20 elements in today's periodic table. You should answer in terms of atomic structure.

[2 marks]

……
……
……
……
……

8.3. A student put some potassium bromide solution in a test tube. She added a few drops of chlorine solution and observed the result. She repeated the process using different potassium halide salts and different halogens.

Table 2 shows the student's results.

Table 2

Solution of halogen	Potassium chloride solution	Potassium bromide solution	Potassium iodide solution
Chlorine		Orange colour forms	Brown colour forms
Bromine	No reaction		Brown colour forms
Iodine	No reaction	No reaction	

Give the order of reactivity of the halogens from the results in Table 2. Explain how you used the results to show this order of reactivity.

[2 marks]

Order……
……

Explanation……
……
……
……
……
……

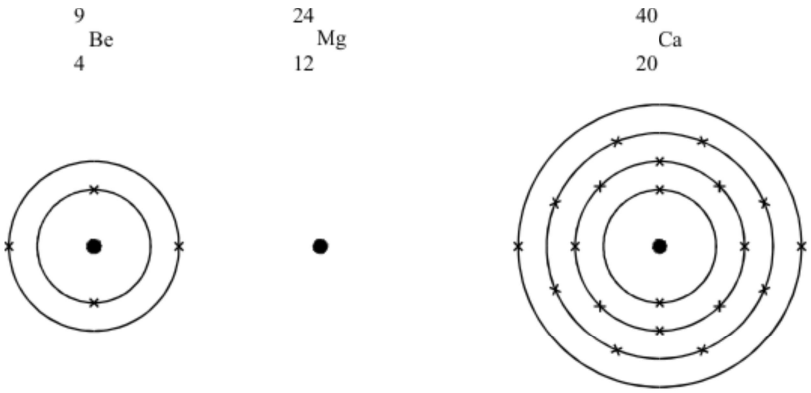
8.4. Write a balanced ionic equation for the reaction of chlorine with bromide ions in solution.

[3 marks]

……

8.5. Explain the order of reactivity of Group 7 elements. Include information about atomic structure. [2 marks]
……
……
……
……
……
……

9. 1 Three elements in Group 2 of the periodic table are beryllium (Be), magnesium (Mg) and calcium (Ca). Their mass numbers and proton numbers are shown below. The electronic structure is shown for beryllium and calcium.



(a) In a similar way, draw the electronic structure for magnesium.

(3)

Lesson 5: Acids and Alkalis and calculations

		Acids and Alkalis
1	Which ions make a solution alkaline?	OH- (hydroxide)
2	Which ions make a solution acidic?	H+
3	Give 3 ways to measure the pH of a substance	Litmus paper, universal indicator, pH probe
4	What pH and colour is universal indicator in an strongly ACIDIC solution?	pH 1 - 3 (red)
5	What pH and colour is universal indicator in an strongly ALKALINE solution?	pH10-14 (purple)
6	What pH and colour is universal indicator in a weak ACID?	pH 4-6 (orange/yellow)
7	What pH and colour is universal indicator in a weak ALKALI?	pH8-9 (blue)

		Indicators and neutralisation reaction
1	Name the type of salt produced when a metal reacts with hydrochloric acid	Metal chloride
2	Name the type of salt produced when a metal reacts with sulfuric acid	Metal sulfate
3	Name the type of salt produced when a metal reacts with nitric acid	Metal nitrate
4	What colour is methyl orange in acid and alkali?	Red (acid), orange (alkali)
5	What colour is phenolphthalein in acids and alkali?	Colourless (acid), pink (alkali)
6	Relative formula mass (Mr)=	The sum of the relative atomic masses of the atoms
7	Relative atomic mass (Ar)=	(mass x percentage) + (mass x percentage)/ 100

Notes

Chemistry Revision: Acids and Alkalis

Mastery Matrix Points

Identify the ions produced by different acids and alkalis
Describe the pH scale and how to test pH using universal indicator or a pH probe
Describe neutralisation reactions (alkalis and bases, metal carbonates and acid)
Deduce the formulae of salts from their given ions
Explain the method for producing soluble salts
Required practical 1: Prepare a pure dry sample of a soluble salt from an insoluble oxide or carbonate
Recall the ionic equation for neutralisation

Key Knowledge

Insoluble metal hydroxide - base or alkali?
Soluble metal hydroxide - base or alkali?
Metal oxide - base or alkali?
Metal carbonate - base or alkali?

What ions do acids produce in aqueous solutions?

What ions do alkalis produce in aqueous solutions?

pH Scale – Label strong acid, weak acid, neutral, weak alkali, strong alkali:

pH	*Description*	*Colour in universal indicator*
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

Ionic equation for neutralisation:

Complete the general word equations:
acid + metal oxide →

acid + metal hydroxide →

acid + metal carbonate →

Understanding and Explaining

1. Explain why using a pH probe to measure the pH of a chemical may give more precise results than using an indicator, such as universal indicator.

2. Complete the word equations. *Then turn to symbol equations.

Copper carbonate + sulfuric acid → _____

Iron carbonate + hydrochloric acid → _____

Zinc carbonate + nitric acid → _____

Iron oxide + hydrochloric acid → _____

Copper hydroxide + nitric acid → _____

Copper oxide + hydrochloric acid → _____

3. Complete the table to show the chemical formula of these salts.

Name	*Formula*	*Name*	*Formula*
Sodium sulfate		Zinc sulfate	
Lithium chloride		Zinc nitrate	
Magnesium chloride		Potassium sulfate	

4. Describe the method and equipment needed to prepare a dry sample of a soluble salt, such as producing copper sulfate from copper oxide and sulfuric acid (pg 117).

Step 1: Add the copper _____ to warm solution of sulphuric acid
Step 2: Do this until _____.
Step 3:
Step 4:
Step 5:

Chemistry Revision: Calculations

Mastery Matrix Points

Link changes in mass to the word equation for a reaction
Calculate the relative formula mass of a substance

Key Knowledge

Law of conservation of mass: in a chemical reaction, the _____ mass of the _____ is _____ to the total mass of the _____

Example of a symbol equation for the conservation of mass:

Some reactions *appear* to have a change in mass e.g. _____

Relative atomic mass (A_r) = (percentage x _____) + (percentage x _____) / _____

Relative formula mass (M_r) is the _____ of the relative _____ _____ of each atom

How to calculate relative formula mass:

Understanding and Explaining

1. Calculate the mass of magnesium in this experiment.

Magnesium	+	Oxygen	------>	Magnesium Oxide
? g	+	16.0 g	----->	40.3 g

2. Explain why the mass appears to decrease during this reaction.

magnesium + hydrochloric acid → magnesium chloride + hydrogen

3. Relative atomic mass calculations:
   a) Calculate the relative atomic mass of beryllium if its 85% ^{9}Be and 15% ^{10}Be.
   b) Calculate the relative atomic mass of sodium if its 73% ^{23}Na and 27% ^{24}Na.
   c) Calculate the relative atomic mass of phosphorus it is 90% ^{31}P, 5% ^{30}P and 5% ^{29}P.

4. Calculate the relative formula masses for:
   a) Carbon monoxide CO
   b) Oxygen O_2
   d) Water H_2O
   e) Carbon dioxide CO_2
   f) Sodium hydroxide NaOH
   g) Sodium Chloride NaCl
   h) Fe_2SO_4

Guided Exam Question

9. 1 Calamine lotion is used to treat itching. The main ingredients are two metal oxides.

One of the metal oxides has a relative formula mass (M_r) of 81.

The formula of this metal oxide is MO.
(M is **not** the correct symbol for the metal.)

The relative atomic mass (A_r) of oxygen is 16.

Calculate the relative atomic mass (A_r) of metal M.

_____

_____

_____

Relative atomic mass (A_r) = _____

(2)

9.2 Use your answer to part (a)(i) and the periodic table on the Data Sheet to name metal M.

The name of metal M is _____ .

(1)

9.3 The formula for ammonia is NH_3. What does the formula tell you about each molecule of ammonia?

_____

_____

_____

_____

(3)

9.4 Ammonia is used to make nitric acid (HNO_3). Calculate the formula mass (Mr) for nitric acid. (Show your working).

_____

_____

_____

_____

_____

(3)

Independent exam questions

9.5 Two gases react as shown in the balanced symbol equation.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Complete the word equation for this reaction.

hydrogen + ... → .....

(2)

10.1 Sando-K is a medicine. It is given to people whose bodies contain too little of a particular element.

Sando-K is a mixture of two compounds. The formulae of the two compounds are given below.

$KHCO_3$ **KCl**

Name all the elements in these compounds.

.....

.....

.....

.....

(3)

10.2 .Most water contains dissolved compounds.

The concentrations of these dissolved compounds are higher in sea water than in drinking water.

Draw a ring around the correct answer to complete the sentence.

Pure water can be obtained from sea water by

distillation.
filtration.
neutralisation.

(1)

10. 3 What is the boiling point of pure water? ..... °C

(1)

10. 4 A student wanted to find out how much solid was dissolved in sea water.

This is the method the student used:

- measure the mass of an empty evaporating basin
- measure 25 cm^3 of sea water and pour it into the evaporating basin
- heat the evaporating basin gently until all of the water has evaporated
- measure the mass of the evaporating basin containing the solid residue.

What piece of apparatus would be suitable for measuring 25 cm^3 of sea water?

.....

(1)

10. 5 The results the student obtained using 25 cm^3 of sea water are:

mass of empty evaporating basin = 23.21 g
mass of evaporating basin and dry solid residue = 24.04 g

Calculate the mass of solid dissolved in 1000 cm^3 of the sea water.

.....

.....

.....

Mass dissolved in 1000 cm^3 = ... g

(2)

Lesson 6: Electrolysis

		Electrolysis
1	Define 'electrolysis'	A substance is decomposed (broken down) using electricity
2	Why can electrolysis only occur if an ionic substance is molten or aqueous?	The ions are free to move
3	What is the name of the negative and positive electrode? (PANCAKE)	Positive: Anode (PA) Negative: Cathode (NCAke)
4	Which ions are attracted to the anode and which to the cathode?	Anode = negative Cathode = positive
5	Define "electrolyte"	Ions in a solution that are free to move and can conduct electricity
6	What happens at the anode?	Electrons transferred from the ion to the anode and the non-metal forms
7	What happens at the cathode?	Electrons transferred from the cathode to the ion and a metal is formed

Notes

Chemistry Revision: Electrolysis (pg 118-119)

Key Knowledge

Electrolysis –

Electrolyte -

Cathode –

Anode -

Electrolysis works with a molten or dissolved compound because…

In the electrolysis of aqueous solutions, at the negative electrode (_____), hydrogen is produced if the metal
is _____ reactive than hydrogen.

At the positive electrode (_____), _____ is produced unless the solution contains halide ions when the halogen is produced.
This happens because in the aqueous solution water molecules break down producing _____ions and _____ions that are discharged.

Mastery Matrix Points

Describe how electrolysis is carried out
Explain the electrolysis of molten compounds eg. Lead bromide
Predict what is produced at each electrode
I can explain how electrolysis can be used to extract metals from their ores
I can explain how electrolysis can be used to determine the presence of hydrogen in an aqueous solution
Required practical 3: Investigate what happens when aqueous solutions are electrolysed (including the development of a hypothesis)

Understanding and Explaining

1. Describe how electrolysis works.

Passing an electric current through _____ causes the ions to move to the electrodes. Positively charged ions move to the _____electrode (the _____), and negatively charged ions move to the _____electrode (the _____). Ions are _____ at the electrodes producing elements.

2. Describe and explain the electrolysis of molten lead bromide.

3. Explain why electrolysis is used for the extraction of metals such as aluminium (rather than reduction by heating with carbon, which is used to extract other metals like iron).

4. Describe and explain the electrolysis of molten aluminium oxide.

5. Why is cryolite is used in the electrolysis of aluminium oxide?

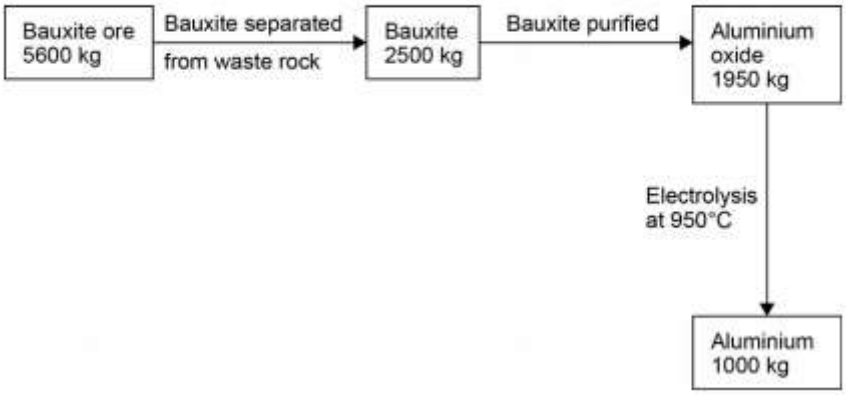
6. Write a method to show how you would investigate what happens in the electrolysis of sodium chloride solution. Include a diagram.

Guided Exam Question

11. Aluminium is produced from an ore called bauxite. Bauxite contains aluminium oxide.

Look at Figure 7.

Figure 7



11.1. Calculate the percentage of bauxite that is converted into aluminium oxide.

[2 marks]

……

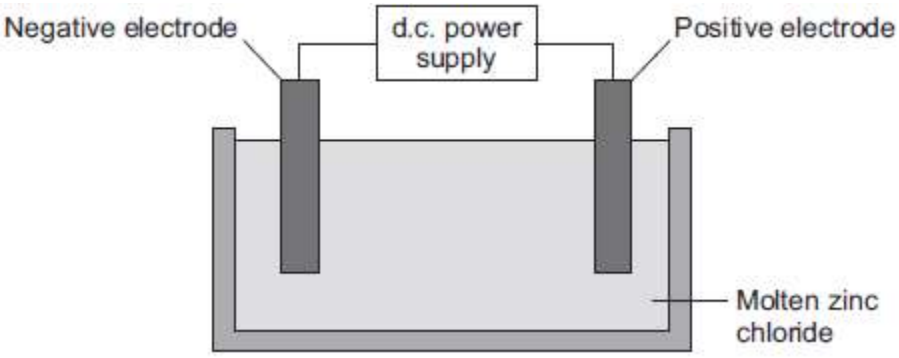
……

……

Percentage = ……

12.1. This question is about zinc.

Zinc is produced by electrolysis of molten zinc chloride, as shown in the figure below.



Why must the zinc chloride be molten for electrolysis?

……

……

(1)

12.2 Describe what happens at the negative electrode.

……

……

……

……

……

(2)

Independent Exam Question

13.1. A student investigates a potassium salt, X.

She finds that salt X:

• has a high melting point

• does not conduct electricity when it is solid

• dissolves in water and the solution does conduct electricity.

What is the type of bonding in salt X?

[1 mark]

Tick one box.

Covalent ☐

Giant molecular ☐

Ionic ☐

Metallic ☐

13.2. What is the name given to solutions that conduct electricity?

[1 mark]

……

……

13.3. Why does a solution of salt X in water conduct electricity?

[1 mark]

……

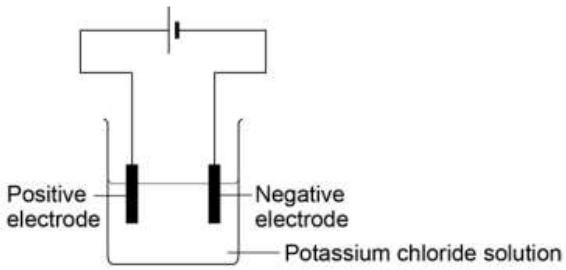
……

……

13.4. The student electrolyses a solution of potassium chloride.

Figure 1 shows the apparatus she uses.

Figure 1



When the current is switched on, bubbles of hydrogen gas are given off at the negative electrode. Explain why hydrogen is produced and not potassium.

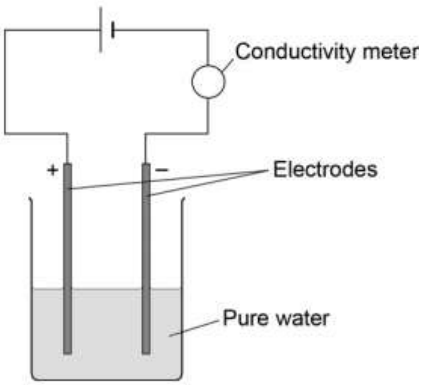
[2 marks]

……

.....
.....

13.5. The student then compares the relative conductivity of different concentrations of potassium chloride. **Figure 2** shows the apparatus she uses.

Figure 2



This is the method used.

1. Add potassium chloride solution to the water one drop at a time.

2. Stir the mixture.

3. Record the reading on the conductivity meter.

Table 1 shows the student's results.

Table 1

Number of drops of potassium chloride solution	Relative conductivity of solution
0	0
1	90
2	180
3	270
4	360
5	450
6	540

13.6. When there is no potassium chloride in the beaker no electrical charge flows.

Suggest why pure water does not conduct electricity.

[2 marks]

.....
.....
.....
.....
.....
.....

13.7. Describe the relationship shown in **Table 1.**

[2 marks]

.....
.....
.....
.....
.....

Lesson 7: Exothermic and Endothermic reactions

		Exothermic and Endothermic reactions
1	Which type of reaction releases energy into the surroundings?	Exothermic
2	Which type of reaction absorbs energy from the surroundings?	Endothermic
3	In an exothermic reaction, what has more energy in it? The products or the reactants?	Reactants
4	In an endothermic reaction, what has more energy in it? The products or the reactants?	Products
5	Define "activation energy"	Minimum amount of energy that particles must collide with to react
6	Give three examples of endothermic reactions	1.Thermal decomposition reactions 2.Citric acid + sodium hydrogen carbonate 3.Sports injury packs
7	Give two examples of exothermic reactions	Self-heating cans Hand warmers

Notes

Chemistry Revision: Exot

Key Knowledge

Conservation of energy in chemical reactions –

Exothermic –

Exothermic Examples:

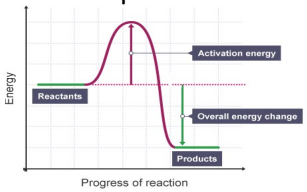
Endothermic –

Endothermic Examples:

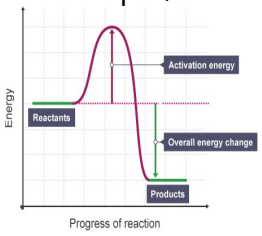
Activation energy –

BENDOMEX –

Reaction profile - exothermic reaction:



Reaction profile - endothermic reaction:



Mastery Matrix Points

Explain how energy is conserved in reactions
Define and give examples and uses of exothermic and endothermic reactions
Evaluate data to decide whether a reaction is exothermic or endothermic
Required practical 4: Investigate the variables that affect temperature changes in reacting solutions
Define activation energy
Use reaction profiles to show energies of reactants and products and link to exothermic and endothermic and draw simple reaction profiles for endothermic and exothermic reactions.

Understanding and Explaining

1. Are these exothermic or endothermic reactions?

Initial Temp (°C)	Final Temp (°C)	Exothermic or endothermic?
56	80	
45	22	
65	65	
70	21	

Initial Temp (°C)	Final Temp (°C)	Exothermic or endothermic?
99	200	
23	26	
30	10	
18	25	

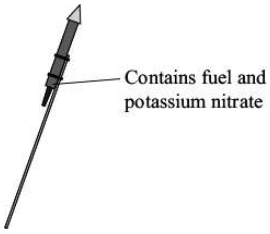
2. Complete the paragraph by selecting the correct key word:
In chemical reactions, atoms are rearranged as old bonds are broken and new _____ are made. For bonds to be broken, reacting particles must _____ with enough _____. The minimum amount of energy that the particles must have for the reaction to take place is called the _____ _____. The energy changes in a chemical reaction can be shown using an _____ _____ _____ or _____ profile.
reaction **energy level diagram** **bonds** **energy** **collide** **activation energy**

3. Link the reaction to the descriptions by matching two descriptions to each name.

	Temperature of the surroundings decreases
Exothermic -	More energy is needed to make new bonds than break old bonds.
	Temperature of the surroundings increases.
Endothermic -	More energy is needed to break old bonds than make new bonds.

4. What can be used to reduce the activation energy needed for a reaction? Show what this looks like on a reaction profile.

14.1 Firework rockets contain fuel and potassium nitrate.



The potassium nitrate provides oxygen for the fuel to react.

The table shows how a student worked out the relative formula mass (M_r) of potassium nitrate.

Some of the numbers are missing.

Relative atomic masses (A_r): N = 14; O = 16; K = 39.

Name of atom (symbol)	**Number of atoms**	A_r	**Mass**
potassium (K)	1	39	39
nitrogen (N)	1	14	14
oxygen (O)		16	
		The M_r of potassium nitrate =	101

14.1 The mass of oxygen is not shown in the table.

Draw a ring around the correct mass of oxygen.

16 **32** **48**

(1)

14.2 Draw a ring around the number of oxygen atoms in the formula of potassium nitrate.

1 **2** **3**

(1)

14.3 When the fuel reacts with the oxygen an *exothermic* reaction takes place.

What does *exothermic* mean?

_____

_____

_____

_____

(2)

14.4 The fuel contains carbon. Carbon reacts with oxygen to make carbon dioxide.

Which **two** statements in the table explain why carbon dioxide is a gas at room

temperature?

Tick (✓) the **two** statements.

Statement	**Tick (✓)**
It has a giant structure	
It has a low boiling point.	
It is made of small molecules.	
It is made of ions.	

(2)
(Total 6 marks)

15.1 The word equation below shows a reaction used in an industrial process.

chromium oxide + aluminium → chromium + aluminium oxide

The reaction is highly exothermic.

What is an exothermic reaction?

_____

_____

(2)

15.2 Name the products of this reaction.

_____

(1)

15. 3 In the reaction one substance is reduced.

Name the substance which is reduced.

_____

(1)

15.4 What happens to the substance when it is reduced?

_____

_____

(1)

Independent Exam Question

16.1 This question is about energy changes in chemical reactions.

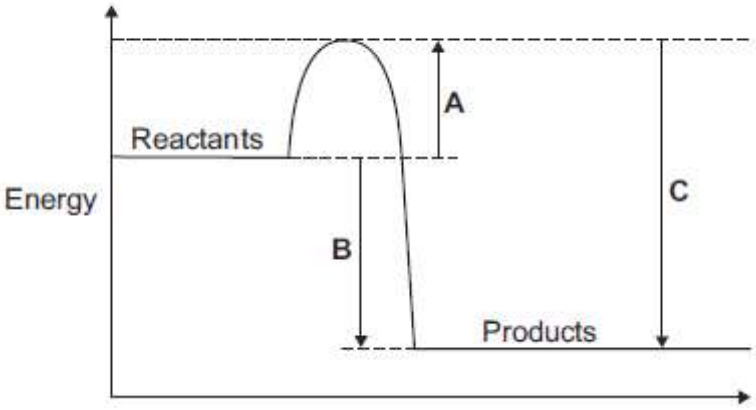
Complete the word equation for the combustion of hydrogen.

hydrogen + oxygen ⟶ _____

(1)

16.2 **Figure 1** shows a simple energy level diagram.

Figure 1



Which arrow, **A**, **B** or **C**, shows the activation energy?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

(1)

16.3 What type of reaction is shown by the energy level diagram in **Figure 1**? Give a reason for your answer.

Type of reaction _____

Reason _____

_____ **(2)**

16. 4 Alcohols are used as fuels.

A group of students investigated the amount of energy released when different alcohols are burned.

The students used the apparatus shown in **Figure 2**.

16.4 **Figure 3** shows the start temperature and the final temperature of the water.

Figure 2

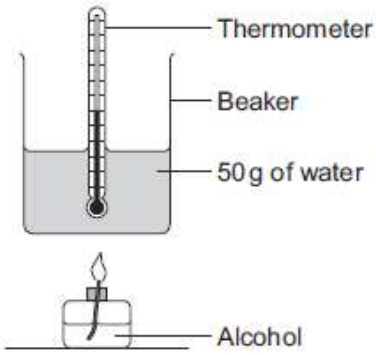
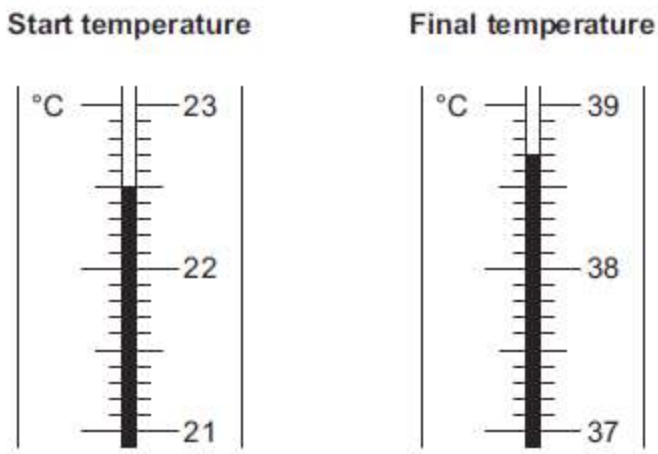


Figure 3



Write the start temperature and the final temperature of the water in **Table 1**.
Work out the increase in temperature to complete **Table 1**.

Table 1

Start temperature of the water in °C	
Final temperature of the water in °C	
Increase in temperature in °C	

(3)

16.5 The students worked out the heat energy released by burning 1 g of each alcohol.
The students used the equation:

Heat energy released = m × 4.2 × increase in temperature

Look at **Figure 2**. What is the value of m?

m = _____ g

(1)

Lesson 8: Rates of reaction and collision theory

		Rates of reaction and collision theory
1	What are the two equations for calculating mean rate of reaction?	mean ROR = quantity of reactant used/time take or quantity of product formed/time taken
2	If the mass of the product or reactant is given in grams, which unit should you use for the rate?	g/s
3	If the volume of the product or reactant is given in cm3, which unit should you use for the rate?	cm3/s
4	What does a steep gradient on a graph tell us about the rate of a reaction?	The rate of reaction is fast
5	What does a flat line (0 gradient) on a graph tell us about the rate of a reaction?	The reaction has stopped
6	What has a higher surface area? A powder or lumps of a substance	Powder because more particles are exposed and able to successfully collide
7	State 4 factors that affect rate of reaction	Pressure (in gases), concentration, temperature, a catalyst

Notes

Chemistry Revision: Rates of reaction and collision theory

Mastery Matrix Points

Calculate the mass of solute in a given volume of solution
Describe how the rate of a chemical reaction can be found
Use collision theory to explain how factors affect the rate of reactions.

Key Knowledge

Conservation of mass:

In some situations, it may *appear* that mass it lost- when might this be?

How to calculate the mean rate of reaction:

1)

2)

Name the 4 factors that affect the rate of reaction:

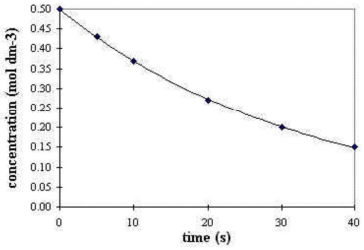
1)
2)
3)
4)

How to convert:

cm^3 to dm^3 -

dm^3 to cm^3 -

Sketch a graph to show 2 reactions, A and B. Reaction A is faster than reaction B.



Understanding and Explaining

1. Describe how you can measure the amount of reactant used in a chemical reaction:

2. Describe how you can measure the amount of products formed:

3. Describe how you can measure the time it takes for a reaction mixture to change colour:

4. Describe how the following factors affect the rate of reaction:
   a) temperature:

   b) concentration:

   c) surface area:

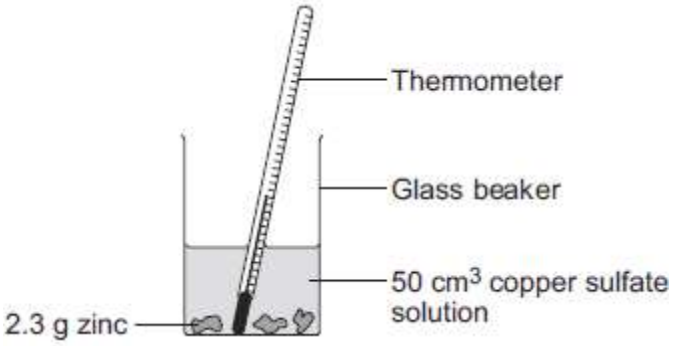
   d) catalyst

5. Calculate the mean rate of reaction of 24cm3 of hydrogen gas is produced in 2 minutes.

17. 1 A student investigated the temperature change when zinc reacts with copper sulfate solution.

The student used a different concentration of copper sulfate solution for each experiment.

The student used the apparatus shown below.



The student:
- measured 50 cm^3 copper sulfate solution into a glass beaker
- measured the temperature of the copper sulfate solution
- added 2.3 g zinc
- measured the highest temperature
- repeated the experiment using copper sulfate solution with different concentrations.

The equation for the reaction is:

$$Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$$

zinc + copper sulfate solution ⟶ copper + zinc sulfate solution

The thermometer reading changes during the reaction.

Give **one** other change the student could **see** during the reaction.

_____

_____

(1)

17.2 Suggest **one** improvement the student could make to the apparatus.

Give a reason why this improves the investigation.

Improvement _____

_____

Reason _____

_____

(2)

17.3 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

The student's results are shown in the table.

Table

Experiment number	Concentration of copper sulfate in moles per dm^3	Increase in temperature in °C
1	0.1	5
2	0.2	10
3	0.3	12
4	0.4	20
5	0.5	25
6	0.6	30
7	0.7	35
8	0.8	35
9	0.9	35
10	1.0	35

Describe **and** explain the trends shown in the student's results.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 9 marks)

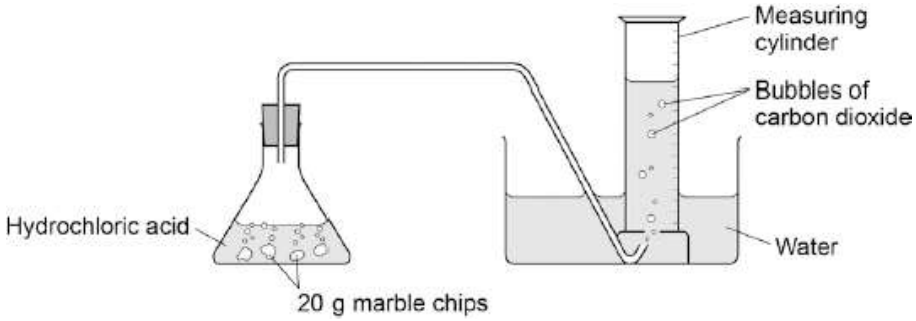
Independent Questions:

18. 1 Marble chips are mainly calcium carbonate ($CaCO_3$).

A student investigated the rate of reaction between marble chips and hydrochloric acid (HCl).

Figure 1 shows the apparatus the student used.

Figure 1



Complete and balance the equation for the reaction between marble chips and hydrochloric acid.

_____ + _____ → $CaCl_2$ + _____ + _____

(2)

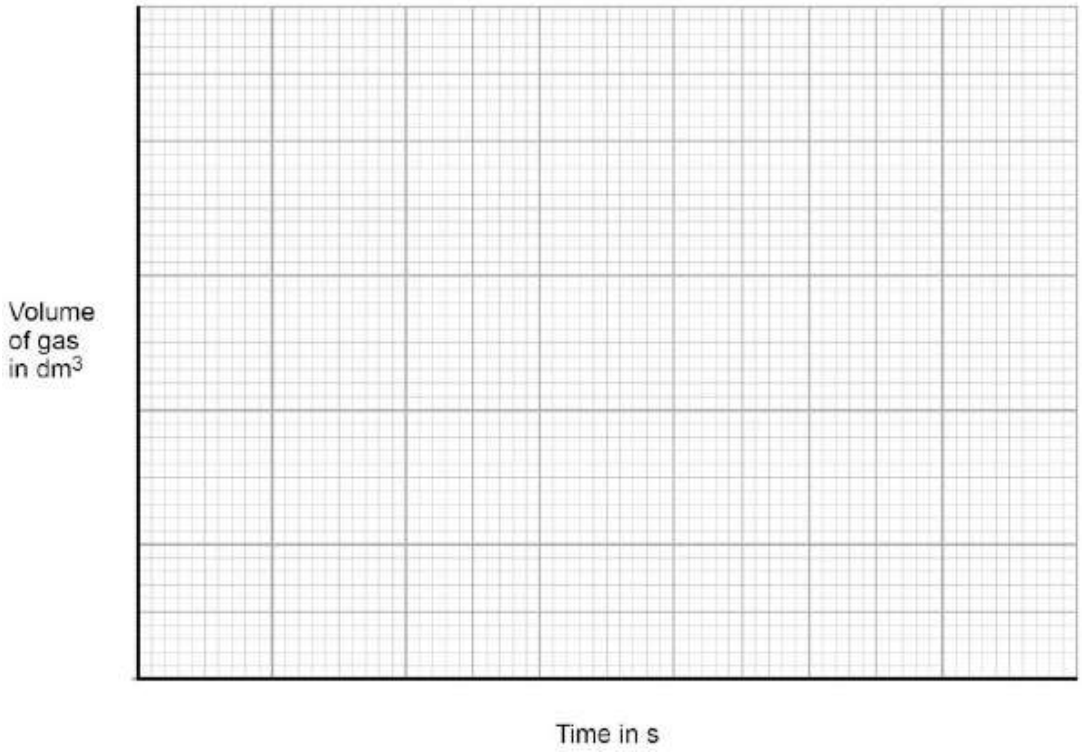
18.2 The table below shows the student's results.

Time in s	Volume of gas in dm^3
0	0.000
30	0.030
60	0.046
90	0.052
120	0.065
150	0.070
180	0.076
210	0.079
240	0.080
270	0.080

On **Figure 2**:

- Plot these results on the grid.
- Draw a line of best fit.

Figure 2



(4)

18. 3 Sketch a line on the grid in **Figure 2** to show the results you would expect if the experiment was repeated using 20 g of smaller marble chips.

Label this line **A**.

(2)

18. 4 Explain, in terms of particles, how and why the rate of reaction changes during the reaction of calcium carbonate with hydrochloric acid.

_____

_____

_____

_____

_____

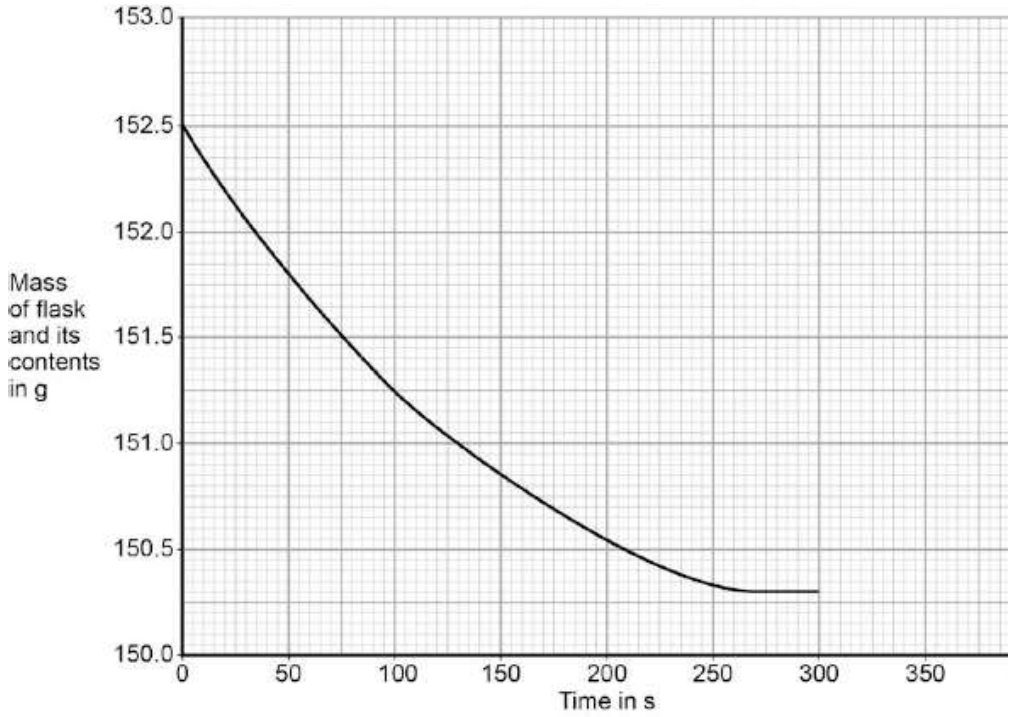
_____

(4)

18.5 Another student investigated the rate of reaction by measuring the change in mass.

Figure 3 shows the graph plotted from this student's results.

Figure 3



Use **Figure 3** to calculate the mean rate of the reaction up to the time the reaction is complete.

Give your answer to three significant figures.

_____

_____

_____

_____

_____

_____

Mean rate of reaction = _____ g / s

(4)

18.6 Use **Figure 3** to determine the rate of reaction at 150 seconds.

Show your working on **Figure 3**.

Give your answer in standard form.

_____

_____

_____

_____

_____

Rate of reaction at 150 s = _____ g / s

(4)