UNIVERSITY COLLEGE BIRMINGHAM

Summer Preparation Work

Making the jump to

A-level chemistry

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OCR A A-level Chemistry

Chemistry is a fantastic subject in which we learn about the chemicals in the world around us and how they react and behave. We learn to see patterns and to predict outcomes of new reactions. We learn about it through both theory and practical work.

Here are the units that will be covered in your first year.

Foundations in chemistry

- Atoms, compounds, molecules and equations
- Amount of substance
- Acid–base and redox reactions
- Electrons, bonding and structure

Periodic table and energy

- The periodic table and periodicity
- Group 2 and the halogens
- Qualitative analysis
- Enthalpy changes
- Reaction rates and equilibrium (qualitative)

Core organic chemistry

- Basic concepts
- Hydrocarbons
- Alcohols and haloalkanes
- Organic synthesis
- Analytical techniques (IR and MS)

A character quality that will be crucial in order to achieve well in chemistry, is RESILIENCE. This means that you don't get put off easily if things get a bit difficult. You persevere. You look up. You find out. You make sure you don't let it beat you!

The ideas below should all have been covered and understood at GCSE. If for any reason, you didn't cover them or understand them, then **look them up in a text book or on the internet** and get yourself up to speed.

This first set of tasks will help us to identity any gaps in you may have in some important skills needed for A-level Chemistry. Do your best and don't be afraid to look up how to is complete the tasks – this demonstrates good initiative and work ethic!

a) Explain how to work out the Mr (relative molecular mass) of a compound
b) Explain how to rearrange an equation like a = $\frac{b}{c}$
c) Draw a dot and cross diagram of the bonding in NaCl
d) Draw a dot and cross diagram of the bonding in water, H_2O
e) Explain why sodium chloride has the formula NaCl (1 x Na and 1 x Cl) whereas calcium chloride has the formula $CaCl_2$ (1 x Ca and 2 x Cl)
f) Explain how to work out how many protons, electrons and neutrons there are in an isotope of an element. E.g. in ^{81}Br (atomic number = 35)

1. If $n = \frac{m}{Ar}$ Rearrange for Ar? ……

2. If $a = b \times c$ Rearrange for c? ……

3. If $n = \frac{v}{1000} \times c$ Rearrange for c? ……

4. Write these numbers in **standard form**:

   a. 0.00016 ……

   b. 3200 ……..

   c. 6324000000 ……

   d. 0.065 ……

And these as decimals

   e. 1.22×10^{-3}……

   f. 3.44×10^{4} ……

   g. 3.63×10^{-1} ……

   h. 8.42×10^{2} …….

5. Give your answers to the calculations to the stated number of decimal places.

   a. 6/9 (3dp) ……

   b. 37-8.4544 (3dp) ……

   c. 37 – 8.4544 (2dp) ……

   d. 37 – 8.4544 (1dp) ……

6. Give the answers to the calculations to the stated number of significant figures.

   a. 44/9 (4sf) ……

   b. 500/6 (2sf) ……

   c. 66/3.5 (3sf) ……

   d. 66/3.5 (1sf) ……

7. What is the Mr of each of these compounds?

   a. CO_2 ……

   b. C_2H_5OH ……

   c. NaCl ……

8. How many moles….?

   a. 6g of ^{12}C ……

   b. 4g of O ……

   c. 1g of CO_2 ……

   d. 6g of H_2 ……

9. Balance these equations:

a. _____ $NaOH$ + _____ H_2SO_4 → ____ Na_2SO_4 + ____ H_2O

b. ____ SO_2 + ____ O_2 → _____SO_3

c. ____ $Ca(OH)_2$ + ____ HNO_3 → ____ $Ca(NO_3)_2$ + ____ H_2O

d. ____ Mg + ____ O_2 → ____ MgO

e. _____$Cl2$ + $NaOH$ → ____ $NaOCl$ + ___ $NaCl$ + ___ H_2O

f. ___ C_2H_6 + ____ O_2 → ____ CO_2 + _____ H_2O

g. ___ C_3H_8O + ____ O_2 → ____ CO_2 + _____ H_2O

h. ___ C_4H_8O + ____ O_2 → ____ CO_2 + _____ H_2O

10. Use the table of ions to write down a chemical formula for each of the compounds.

	+3	+2	+1		-1	-2	-3
	Al^{3+}	Ca^{2+}	Li^{+}		Cl^{-}	SO_4^{2-}	PO_4^{3-}
		Mg^{2+}	Na^{+}		Br^{-}	CO_3^{2-}	
		Cu^{2+}	K^{+}		OH^{-}	O^{2-}	
		Zn^{2+}	H^{+}		NO_3^{-}		
			NH_4^{+}				

1. Sodium hydroxide …….
2. Copper carbonate ……
3. Zinc sulphate …….
4. Lithium oxide …….
5. Potassium carbonate …….
6. Ammonium sulphate …….
7. Magnesium nitrate …….
8. Aluminium chloride …….
9. Potassium phosphate …….
10. Sodium hydrogen carbonate …….
11. Aluminium nitrate……
12. Aluminium oxide …….

*The following exam questions are **high demand**, challenging questions. Give them your best attempt – show us your **resilience!***

Q1.

This question is about Group 1 elements.

(a) Give **two** observations you could make when a small piece of potassium is added to water.

1 _____

_____

2 _____

_____

(2)

(b) Complete the equation for the reaction of potassium with water.

You should balance the equation.

$$K \quad + \quad H_2O \rightarrow \qquad +$$

(2)

(c) Explain why the reactivity of elements changes going down Group 1.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

Sodium reacts with oxygen to produce the ionic compound sodium oxide.

Oxygen is a Group 6 element.

(d) Draw a dot and cross diagram to show what happens when atoms of sodium and oxygen react to produce sodium oxide.

Diagram

(4)

(e) Why is oxygen described as being reduced in the reaction between sodium and oxygen?

_____

_____

(1)

(f) Explain why sodium oxide has a high melting point.

_____

_____

_____

_____

_____

_____

(3)

(Total 16 marks)

Q2.

This question is about groups in the periodic table.

The elements in Group 1 become more reactive going down the group.

Rubidium is below potassium in Group 1.

(a) Rubidium and potassium are added to water.

Predict **one** observation you would see that shows that rubidium is more reactive than potassium.

_____

_____

(1)

(b) Explain why rubidium is more reactive than potassium.

_____

_____

_____

_____

_____

_____

(3)

(c) Complete the equation for the reaction of rubidium with water.

You should balance the equation.

$$Rb + H_2O \rightarrow \quad +$$

(3)

The noble gases are in Group 0.

(d) Which is a correct statement about the noble gases?

Tick (✓) **one** box.

The noble gases all have atoms with eight electrons in the outer shell.	☐
The noble gases have boiling points that increase going down the group.	☐
The noble gases have molecules with two atoms.	☐
The noble gases react with metals to form ionic compounds.	☐

(1)

(e) The table below shows information about the three isotopes of neon.

Mass number	**Percentage abundance (%)**
20	90.48
21	0.27
22	9.25

Calculate the relative atomic mass (A_r) of neon.

Give your answer to 3 significant figures.

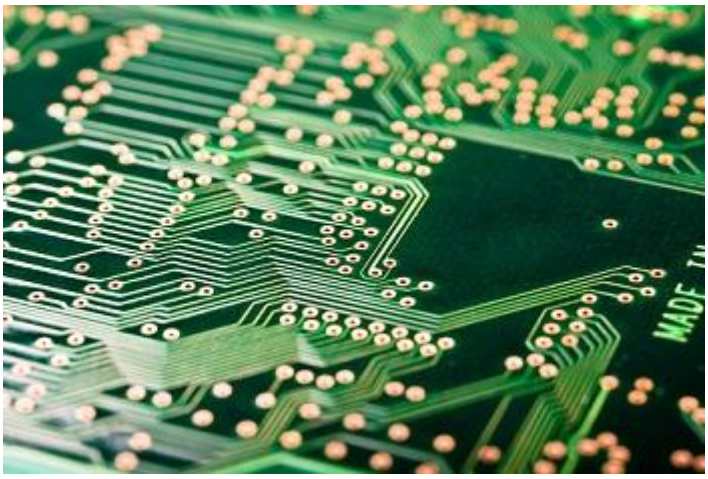
Relative atomic mass (3 significant figures) = _____

(3)

(Total 11 marks)

Q3.

Etching is a way of making printed circuit boards for computers.



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Printed circuit boards are made when copper sheets are etched using iron(III) chloride solution. Where the copper has been etched, only plastic remains.

(a) Copper is a good conductor of electricity.

Explain why.

_____

_____

_____

_____

(2)

(b) Iron(III) chloride can be produced by the reaction shown in the equation:

$$2\ Fe + 3\ Cl_2 \rightarrow 2\ FeCl_3$$

(i) Calculate the maximum mass of iron(III) chloride ($FeCl_3$) that can be produced from 11.20 g of iron.

Relative atomic masses (A_r): Cl = 35.5; Fe = 56.

_____

_____

_____

_____

_____

Maximum mass of iron(III) chloride = _____ g

(3)

(ii) The actual mass of iron(III) chloride ($FeCl_3$) produced was 24.3 g.

Calculate the percentage yield.

(If you did not answer part (b)(i) assume that the maximum theoretical mass of iron(III) chloride ($FeCl_3$) is 28.0 g. This is **not** the correct answer to part (b)(i).)

_____

_____

Percentage yield = _____%

(1)

(Total 6 marks)

Further Reading Task

Show us that you are prepared to read ahead. Below are some websites you can access that you will become familiar with over the next two years!

www.chemguide.com

https://www.physicsandmathstutor.com

www.alevelchemistry.co.uk

Use these websites to find out what a **functional group** is. Make a list of all the functional groups you will learn about in A level chemistry with diagrams to show their chemical structure.