Wigston College

A level Chemistry - Transition Pack

Topic	Score
Balancing equations	
Ionic formulae	
Writing equations	
Laboratory equipment	

Topic	Score
Rearranging equations and units	
Significant figures and decimal places	
Moles and mass	
Moles and concentration	

Total	

Name: ……

Introduction

This pack contains a range of activities and resources to prepare you to start A level in Chemistry in September. It is aimed to be used after you complete your GCSE, throughout the remainder of the summer term and over the summer holidays to ensure you are ready to start your course in September.

Contents **Page**

The Periodic Table of the Elements

(1)	(2)											(3)	(4)	(5)	(6)	(7)	(0)
1																	18
1 **H** hydrogen 1.0	2											13	14	15	16	17	2 **He** helium 4.0
3 **Li** lithium 6.9	4 **Be** beryllium 9.0											5 **B** boron 10.8	6 **C** carbon 12.0	7 **N** nitrogen 14.0	8 **O** oxygen 16.0	9 **F** fluorine 19.0	10 **Ne** neon 20.2
11 **Na** sodium 23.0	12 **Mg** magnesium 24.3	3	4	5	6	7	8	9	10	11	12	13 **Al** aluminium 27.0	14 **Si** silicon 28.1	15 **P** phosphorus 31.0	16 **S** sulfur 32.1	17 **Cl** chlorine 35.5	18 **Ar** argon 39.9
19 **K** potassium 39.1	20 **Ca** calcium 40.1	21 **Sc** scandium 45.0	22 **Ti** titanium 47.9	23 **V** vanadium 50.9	24 **Cr** chromium 52.0	25 **Mn** manganese 54.9	26 **Fe** iron 55.8	27 **Co** cobalt 58.9	28 **Ni** nickel 58.7	29 **Cu** copper 63.5	30 **Zn** zinc 65.4	31 **Ga** gallium 69.7	32 **Ge** germanium 72.6	33 **As** arsenic 74.9	34 **Se** selenium 79.0	35 **Br** bromine 79.9	36 **Kr** krypton 83.8
37 **Rb** rubidium 85.5	38 **Sr** strontium 87.6	39 **Y** yttrium 88.9	40 **Zr** zirconium 91.2	41 **Nb** niobium 92.9	42 **Mo** molybdenum 95.9	43 **Tc** technetium	44 **Ru** ruthenium 101.1	45 **Rh** rhodium 102.9	46 **Pd** palladium 106.4	47 **Ag** silver 107.9	48 **Cd** cadmium 112.4	49 **In** indium 114.8	50 **Sn** tin 118.7	51 **Sb** antimony 121.8	52 **Te** tellurium 127.6	53 **I** iodine 126.9	54 **Xe** xenon 131.3
55 **Cs** caesium 132.9	56 **Ba** barium 137.3	● 57–71 lanthanoids	72 **Hf** hafnium 178.5	73 **Ta** tantalum 180.9	74 **W** tungsten 183.8	75 **Re** rhenium 186.2	76 **Os** osmium 190.2	77 **Ir** iridium 192.2	78 **Pt** platinum 195.1	79 **Au** gold 197.0	80 **Hg** mercury 200.6	81 **Tl** thallium 204.4	82 **Pb** lead 207.2	83 **Bi** bismuth 209.0	84 **Po** polonium	85 **At** astatine	86 **Rn** radon
87 **Fr** francium	88 **Ra** radium	● 89–103 actinoids	104 **Rf** rutherfordium	105 **Db** dubnium	106 **Sg** seaborgium	107 **Bh** bohrium	108 **Hs** hassium	109 **Mt** meitnerium	110 **Ds** darmstadtium	111 **Rg** roentgenium	112 **Cn** copernicium		114 **Fl** flerovium		116 **Lv** livermorium		

Key
atomic number
Symbol
name
relative atomic mass

● 57 **La** lanthanum 138.9	58 **Ce** cerium 140.1	59 **Pr** praseodymium 140.9	60 **Nd** neodymium 144.2	61 **Pm** promethium 144.9	62 **Sm** samarium 150.4	63 **Eu** europium 152.0	64 **Gd** gadolinium 157.2	65 **Tb** terbium 158.9	66 **Dy** dysprosium 162.5	67 **Ho** holmium 164.9	68 **Er** erbium 167.3	69 **Tm** thulium 168.9	70 **Yb** ytterbium 173.0	71 **Lu** lutetium 175.0
● 89 **Ac** actinium	90 **Th** thorium 232.0	91 **Pa** protactinium	92 **U** uranium 238.1	93 **Np** neptunium	94 **Pu** plutonium	95 **Am** americium	96 **Cm** curium	97 **Bk** berkelium	98 **Cf** californium	99 **Es** einsteinium	100 **Fm** fermium	101 **Md** mendelevium	102 **No** nobelium	103 **Lr** lawrencium

Balancing equations

Balancing chemical equations is the stepping stone to using equations to calculate masses in chemistry. There are loads of websites that give ways of balancing equations and lots of exercises in balancing.

https://www.bbc.co.uk/bitesize/guides/zg2h4qt/revision/6

Some of the equations to balance may involve strange chemicals- don't worry about that, the key idea is to get balancing right.

Balance the equations below.

1. …..C + …..O_2 ⟶ …..CO

2. …..Ba + …..H_2O ⟶ …..$Ba(OH)_2$ + …..H_2

3. …..C_2H_6 + …..O_2 ⟶ …..CO_2 + …..H_2O

4. …..HCl + …..$Mg(OH)_2$ ⟶ …..$MgCl_2$ + H_2O

5. …..N_2 + …..O_2 ⟶ …..NO

6. …..Fe_2O_3 + …..C ⟶ …..Fe + …..CO_2

7. …..CH_3CH_2OH + …..[O] ⟶ …..CH_3COOH + …..H_2O

8. …..HNO_3 + …..CuO ⟶ …..$Cu(NO_3)_2$ + H_2O

9. …..Al^{3+} + …..e^- ⟶ …..Al

10. …..$[Fe(H_2O)_6]^{3+}$ + …..CO_3^{2-} ⟶ …..$Fe(OH)_3(H_2O)_3$ + …..CO_2 + …..H_2O

(10 marks)

Score	/10

Constructing ionic formulae

The ability to determine the formulae for an ionic substance is an essential skill for a chemist so at A-level you will be expected to write the ionic formulae quickly.

For now, take your time and try to get the following formulae right.

1. For each of the following ionic salts, determine the cation and anion present and use these to construct the formula of the salt.

	Ionic salt	**Positive ion (cation)**	**Negative ion (anion)**	**Formula**
a	Magnesium oxide			
b	Sodium sulfate			
c	Calcium hydroxide			
d	Aluminium oxide			
e	Copper(I) oxide			

(5 marks)

2. When an acid is added to water it dissociates to form H^+ ions (which make it acidic) and an anion. These acidic hydrogen atoms can be used to determine the charge on the anion.

Deduce the charge on the anions in the following acids. The acidic H atoms, H^+, have been underlined for you. (5 marks)

a. $\underline{H}_2SO_3$

b. $\underline{H}NO_3$

c. $\underline{H}_3PO_4$

d. HCOO$\underline{H}$

e. $\underline{H_2}CO_3$

Score	/10

Writing equations from text

The following questions contain a written description of a reaction. In some cases the products may be missing as you will be expected to predict the product using your prior knowledge.
For more advanced equations you may be given some of the formulae you need.

For each one, write a balanced symbol equation for the process.

1. The reaction between silicon and nitrogen to form silicon nitride Si_3N_4.

.....

2. The neutralisation of sulfuric acid with sodium hydroxide.

.....

3. The preparation of boron trichloride from its elements.

.....

4. The reaction of nitrogen and oxygen to form nitrogen monoxide.

.....

5. The combustion of ethanol (C_2H_5OH) to form carbon dioxide and water only.

.....

6. The formation of silicon tetrachloride ($SiCl_4$) from SiO_2 using chlorine gas and carbon.

.....

7. The extraction of iron from iron(III) oxide (Fe_2O_3) using carbon monoxide.

.....

8. The complete combustion of methane.

.....

9. The formation of one molecule of ClF_3 from chlorine and fluorine molecules.

.....

10. The reaction of nitrogen dioxide with water and oxygen to form nitric acid.

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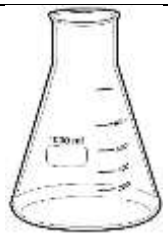
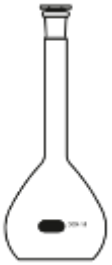
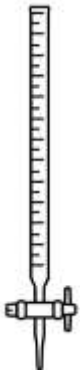
Score	/10

Laboratory equipment

Practical work is a key aspect in the work of a chemist.

At A-level, you will be expected to plan your own practical work, so it is important that you are familiar with the common laboratory equipment available to you.

For each piece of equipment, state its name and its use.

	Name: Use:		Name: Use:
	Name: Use:		Name: Use:
	Name: Use:		Name: Use:
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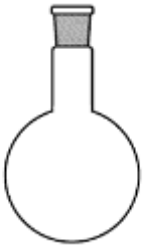	Name: Use:		Name: Use:

Score	/10

Rearranging equations and converting units

1. The amount of substance in moles (n) in a solution can be calculated when the concentration given in mol/dm^3 (c) and volume (v) in dm^3 are known by using the equation:

$$n = cv$$

a. Rearrange this equation making c the subject of the equation. (1 mark)

b. Rearrange this equation making v the subject of the equation. (1 mark)

2. The density of a substance can be calculated from its mass (m) and volume (v) using the equation:

$$density = \frac{mass(g)}{volume\ (cm^3)}$$

a. Rearrange this equation so that the mass of a substance can be calculated given its density and volume. (1 mark)

b. Determine the units for density (1 mark)

3. A block of iron has a length of 1.2 cm. Calculate its length in metres (1 mark)

4. The width of the classroom is 7200 cm. Calculate its length in metres. (1 mark)

5. A reaction reaches completion after 4.5 minutes. Convert this time into seconds. (1 mark)

6. The stop clock reads 2 min 34 s. Convert this time into seconds. (1 mark)

7. A paper reports that 0.0265 kg of copper oxide was added to an excess of sulfuric acid. Convert this mass of copper oxide into grams. (1 mark)

8. A packet of aspirin tablets states that each tablet contains 75 mg of aspirin. Calculate the minimum number of tablets that contain a total of 1 g of aspirin. (1 mark)

Score	/10

Significant figures, decimal places and rounding

For each of the numbers in questions 1–6, state the number of significant figures and the number of decimal places.

		Significant figures	Decimal places
1	3.131 88		
2	1000		
3	0.000 65		
4	1006		
5	560.0		
6	0.000 480		

(6 marks)

Round the following numbers to (i) 3 significant figures and (ii) 2 decimal places.

1. 0.075 84

2. 231.456

(4 marks)

Score	/10

Moles and mass

From this point on you need to be using an A level periodic table, not a GCSE one. You can find one at the back of this pack.

One mole of a substance is equal to **6.02×10^{23} atoms**, **ions** or **particles** of that substance. This number is called the **Avogadro constant**.

The value of the Avogadro constant was chosen so that the relative formula mass of a substance weighed out in grams is known to contain exactly 6.02×10^{23} particles. We call this mass its **molar mass**.

We can use the equation below when calculating an amount in moles:

$$\text{amount of substance (mol)} = \frac{\text{mass (g)}}{\text{molar mass (g mol}^{-1}\text{)}}$$

Use the equation above to help you answer the following questions.

1. Calculate the amount of substance, in moles, in: (3 marks)

a. 32 g of methane, CH_4 (molar mass, 16.0 g mol^{-1})

b. 175 g of calcium carbonate, $CaCO_3$

c. 200 mg of aspirin, $C_9H_8O_4$

2. Calculate the mass in grams of: (3 marks)

a. 20 moles of glucose molecules (molar mass, 180 g mol^{-1})

b. 5.00×10^{-3} moles of copper ions, Cu^{2+}

c. 42.0 moles of hydrated copper sulfate, $CuSO_4 \cdot 5H_2O$

3. 3.09 g of a transition metal carbonate was known to contain 0.0250 mol.

a. Determine the molar mass of the transition metal carbonate. (1 mark)

b. Choose the most likely identity for the transition metal carbonate from the list below:

$CoCO_3$ **$CuCO_3$** **$ZnCO_3$** (1 mark)

4. 4.26 g of a sample of chromium carbonate was known to contain 0.015 mol.

Which of the following is the correct formula for the chromium carbonate? (2 marks)

$CrCO_3$ **$Cr_2(CO_3)_3$** **$Cr(CO_3)_3$**

Score	/10

Moles and concentration

To calculate the concentration of a solution we use the equation:

$$\text{concentration (mol dm}^{-3}\text{)} = \frac{\text{amount of substance (mol)}}{\text{volume (dm}^3\text{)}}$$

Use the equation to help you complete each of the statements in the questions below.

1. 1.5 mol of NaCl dissolved in 0.25 dm^3 of water produces a solution with a concentration of _____mol dm^{-3}. (1 mark)
2. 250 cm^3 of a solution of HCl(aq) with a concentration of 0.0150 mol dm^{-3} contains _____moles. (1 mark)
3. A solution with a concentration of 0.85 mol dm^{-3} that contains 0.125 mol has a volume of _____dm^3. (1 mark)

In this question you will need to convert between an amount in moles and a mass as well as using the equation above.

4. 5.0 g of $NaHCO_3$ dissolved in 100 cm^3 of water produces a solution with a concentration of mol dm^{-3}.

(2 marks)

5. 25.0 cm^3 of a solution of NaOH(aq) with a concentration of 3.8 mol dm^{-3} contains g of NaOH.

(2 marks)

6. The volume of a solution of cobalt(II) chloride, $CoCl_2$, with a concentration of 1.3 mol dm^{-3} that contains 2.5 g of $CoCl_2$ is cm^3.

(3 marks)

Score	/10