

Chemistry Summer Assignment

The compulsory element should take no longer than **2 hours** to complete, although an extension task is also provided. Your summer assignment for each course must be submitted in the **relevant first lesson in September**. Failure to do so will automatically place you on your **first warning** during the induction period. Your grade will be reported home in September.

This assignment includes questions that assess the chemistry content and skills required for A level that you will already have covered in your GCSE chemistry.

The questions below will be marked and graded with the following boundaries: 90% A* / 80% A/70% B/ 60% C/ 50% D/ 40% E. The extension questions begin on page 8.

1) a) What is the difference between an element and a compound? (1)

b) All substances are made up of three types of particle: atoms, molecules or ions. Explain what atoms, molecules and ions are. (3)

c) Identify each of the following particles as an atom, molecule or ion:

NH₃

O²⁻

S₄²⁻

F₂

O

O₂

NO³⁻

H₂O

Cl

H⁺

(10)

2) Write the formula of the following substances. Some are ionic, some are atomic and some are molecular.

Lithium oxide

Calcium nitrate

Methane

Ammonium Sulphate

Ammonia

Nitrogen

Argon

Iron (III) hydroxide

(8)

3) Balance the following equations:

a) $\text{Fe} + \text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$ _____ (1)

b) $\text{PCl}_3 + \text{H}_2\text{O} \rightarrow \text{P}(\text{OH})_3 + \text{HCl}$ _____ (1)

c) ammonia + oxygen \rightarrow nitrogen + water

(2)

d) ethane + oxygen \rightarrow carbon dioxide + water

(2)

4) Complete the following calculations, giving your answers to three significant figures:

a) $32420 + 762891 =$ _____

b) $12000 \div 1000 =$ _____

c) $0.06438 + 0.0004378 =$ _____

d) $180 \div 90 =$ _____ (4)

5) The following results are accurately measured values from experiments. Complete the sum and give the answer to the most number of significant figures that you think gives an answer that is trustworthy.

a) $1.4567 + 2.3 =$ _____

b) $10.5 - 0.145 =$ _____

c) $3.000 - 0.056 =$ _____

d) $8.693.457 + 1.2367 =$ _____ (4)

6) Rearrange the following equations to give the letter shown as the subject:

a) What does c equal if $q = mcT$ _____

b) What does T equal if $G = H - TS$ _____

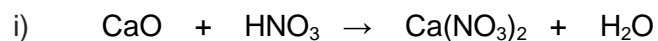
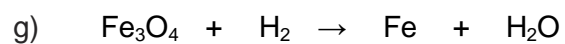
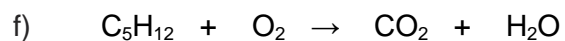
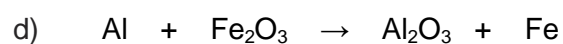
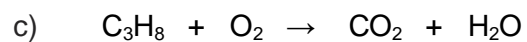
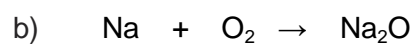
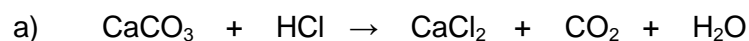
c) What does q equal if $E = 3pq/2r$ _____

d) What does n equal if $PV = nRT$ _____

e) What does c equal if $2a = 3(b - 2c)$ _____

f) What does T equal if $F = mc + Rk/T$ _____ (6)

7) Balance these equations:



Element	A_r
Aluminium (Al)	27
Bromine (Br)	80
Calcium (Ca)	40
Carbon (C)	12
Chlorine (Cl)	35.5
Copper (Cu)	63.5
Fluorine (F)	19

Element	A_r
Hydrogen (H)	1
Iodine (I)	127
Iron (Fe)	56
Magnesium (Mg)	24
Nitrogen (N)	14
Oxygen (O)	16

Element	A_r
Phosphorus (P)	31
Potassium (K)	39
Silver (Ag)	108
Sodium (Na)	23
Sulfur (S)	32
Zinc (Zn)	65

8) What mass of hydrogen is formed when 2 g of calcium reacts with hydrochloric acid?



9) What mass of carbon dioxide is made when 22 g of propane is burned in oxygen?



10) What mass of iodine is produced when 7.1 g of chlorine reacts with potassium iodide?



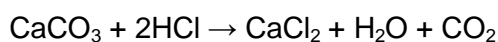
11) What mass of aluminium oxide is produced when 135 g of aluminium is burned in oxygen?



12) What mass of magnesium oxide is formed when 6 g of magnesium reacts with oxygen?

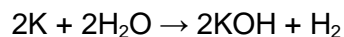


13) What mass of carbon dioxide is formed when 2 kg of calcium carbonate reacts with hydrochloric acid?



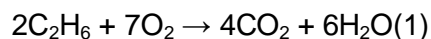
(1)

14) What mass of hydrogen is produced when 195 mg of potassium is added to water?



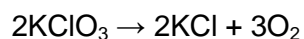
(1)

15) What mass of oxygen is needed to react with 4.5 g of ethane (C₂H₆)?



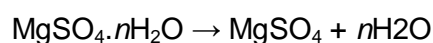
(1)

16) What mass of oxygen is formed when 735 g of potassium chlorate decomposes?

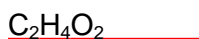


(1)

17) When 12.3 g of MgSO₄.nH₂O is heated gently until no further change in mass occurs, to remove the water of crystallisation, 6.0 g of anhydrous magnesium sulfate (MgSO₄) remained. Work out the relative formula mass (*M_r*) of the MgSO₄.nH₂O, and so the value of *n*.



18) Write the empirical formula of each of the following substances (8 marks)



(8)

19) Find the empirical formula of each of the following substances using the data about composition by mass.

a) Ca 20%; Br 80%

(1)

b) Fe 77.8%; O 22.2%

c) Al 0.364 g; Cl 1.436 g

(1)

d) C 13.6%; F 86.4%

(1)

e) C 3.31 g; H 0.69 g

(1)

f) Na 43.4%; C 11.3%; O 45.3%

(1)

g) Ca 0.642 g; H 0.032 g; C 0.385 g; O 1.541 g

(1)

h) 2.67 g of copper reacts with sulfur to form 4.01 g of copper sulfide

(1)

(1)

Extension Work

Relative atomic mass (A_r)

If there are several isotopes of an element, the relative atomic mass will take into account the proportion of atoms in a sample of each isotope.

For example, chlorine gas is made up of 75% of chlorine-35 $^{35}_{17}\text{Cl}$ and 25% of chlorine-37 $^{37}_{17}\text{Cl}$.

The relative atomic mass of chlorine is therefore the mean atomic mass of the atoms in a sample, and is calculated by:

$$A_r = \left(\frac{75.0}{100} \times 35\right) + \left(\frac{25.0}{100} \times 37\right) = 26.25 + 9.25 = 35.5$$

1. What is the relative atomic mass of Bromine, if the two isotopes, ^{79}Br and ^{81}Br , exist in equal amounts?
2. Neon has three isotopes. ^{20}Ne accounts for 90.9%, ^{21}Ne accounts for 0.3% and the last 8.8% of a sample is ^{22}Ne . What is the relative atomic mass of neon?
3. Magnesium has the following isotope abundances: ^{24}Mg : 79.0%; ^{25}Mg : 10.0% and ^{26}Mg : 11.0%. What is the relative atomic mass of magnesium?

Harder:

4. Boron has two isotopes, ^{10}B and ^{11}B . The relative atomic mass of boron is 10.8. What are the percentage abundances of the two isotopes?

5. Copper's isotopes are ^{63}Cu and ^{65}Cu . If the relative atomic mass of copper is 63.5, what are the relative abundances of these isotopes?

Moles

A mole is the amount of a substance that contains 6.02×10^{23} particles.

The mass of 1 mole of any substance is the relative formula mass (M_r) in grams.

Examples:

One mole of carbon contains 6.02×10^{23} particles and has a mass of 12.0 g

Two moles of copper contains 12.04×10^{23} particles, and has a mass of 127 g

1 mole of water contains 6.02×10^{23} particles and has a mass of 18 g

The amount in moles of a substance can be found by using the formula:

Amount in moles of a substance = mass of substance / relative formula mass

Fill in the table.

Substance	Mass of substance	Amount/moles	Number of particles
Helium			18.12×10^{23}
Chlorine	14.2		
Methane		4	
Sulfuric acid	4.905		