Year 12 Preparation: Questions

Year 12 Chemistry Students: Complete all the question in this booklet and mark them using the mark scheme.

Please bring in evidence of this being completed

<u>This must be brought to your first Chemistry lesson in September</u>

Structure:

Information 

Questions 

Example 

Answers 

Within the first two weeks back you will have a test on the below Topics;

The three types of bonding and the properties arising from them	Calculating percentage by mass
Electronic structure and configuration (s, p, d, etc.)	No. of protons, neutrons and electrons
Calculating Relative Atomic Mass (Shown as M_r at A level)	Yields
Balancing Equations	Manipulating equations regarding number of moles and Avogadro's Number
Calculating Empirical Formula	Calculating moles

Topics highlighted in red are A Level Chemistry and new content. Those in blue are covered in GCSE.

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Structure and bonding

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Bonding, structure and the properties of matter walkthrough

Which structure type?

Determine the structures for the following:

a) Na

b) NaCl

c) Bromine

d) Graphite

e) Na_2O

f) H_2O

g) Mg

h) Ar

i) Neon

j) Diamond

k) SiO_2

Explain the following statements:

a) Magnesium chloride has a high melting point. .....

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..... (3)

b) Copper conducts electricity. .....

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..... (3)

c) Methane has a low boiling point. .....

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..... (3)

Explain the following statements:

d) Aluminium oxide conducts electricity when molten but not as a solid. .....

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..... (3)

e) Helium has a very low boiling point. .....

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..... (3)

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Proton, neutron and electron number

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Proton, neutron and electron number walkthrough

Practice

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1. Complete the table

Element	Protons	Neutrons	electrons	Atom or ion
Li		4	3	
	28		26	Ion
Mg				
Sc			21	
	7		10	
	10			
Br^{-1}	35			
	15	16		
$Cr(V)^{+5}$	24			Ion
Ti				
	26			Atom
Be^{+2}				

Practice

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2. A student has a K atom. Calculate the number of neutrons it contains
3. A student has a Mg^{+2} ion. Calculate the number of neutrons it contains
4. A student has an element with 6 protons and 7 neutrons. Identify the element and state if it is an isotope of that element
5. A student has a sample with two isotopes in it. 60% of the sample is N^{14} and the rest is N^{16}. Calculate the relative atomic mass of nitrogen in the sample.
6. A student has a sample with three isotopes in it. 22% of the sample is Cu^{60}, 18% of the sample is Cu^{61} and the rest is Cu^{62}. Calculate the relative atomic mass of copper in the sample to 1d.p.

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Calculating empirical formula

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Empirical formula walkthrough

Empirical formulae calculation:

1. A substance contains $43.7\ g$ of phosphorus and $56.3\ g$ of oxygen, its M_r is 284. Calculate the empirical and molecular formula of the substance.
2. Find the empirical formula for the compound with a composition by mass of C 86.0% and H 14.0%.
3. 3.21 g of sulfur reacts completely with oxygen to produce 6.41 g of an oxide of sulfur. Calculate the empirical formula of the oxide of sulfur.
   (Relative atomic masses: S = 32.1, O = 16.0).
4. In an experiment, 1.27 g of hot copper reacts with iodine vapour to form 3.81 g of copper iodide. Calculate the empirical formula of copper iodide.
   (Relative atomic masses: Cu = 63.5, I = 126.9).
5. Find the empirical formula for the compound with a composition by mass of C 52.2%, H 13.0% and O 34.8%.
6. 3.36 g of iron join with 1.44 g of oxygen in an oxide of iron. What is the empirical formula of the oxide?

Empirical formulae calculation:

Q1.

Scientists found that a compound contained per 100g:

22.8% sodium; 21.8% boron; and 55.4% oxygen.

Use the percentages to calculate the simplest ratio of atoms of each element in the compound and therefore the formula (known as the empirical formula of the compound)

Relative atomic masses (A_r): B = 11; O = 16; Na = 23

To gain full marks you **must** show all your working.

Empirical formula = _____

(Total 5 marks)

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Using Avogadro's number

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Moles and Avogadro's number

Using Avogadro's constant

<u>More complex Avogadro's constant calculations</u>

1. How many atoms are there in 10 moles of oxygen molecules (O_2)?
2. How many atoms are there in 2 moles of nitrogen molecules (N_2)?
3. How many atoms are there in 2.6 moles of chlorine molecules (Cl_2)?
4. How many atoms are there in 4.2 moles of hydrogen molecules (H_2)?
5. How many atoms are there in 5.5 moles of methane molecules (CH_4)?

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Balancing equations

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Balancing chemical equation walkthrough

Balancing equations

6. ____ KNO_3 + ____ H_2CO_3 ⟶ ____ K_2CO_3 + ____ HNO_3

7. ____ B_2Br_6 + ____ HNO_3 ⟶ ____ $B(NO_3)_3$ + ____ HBr

8. ____ BF_3 + ____ Li_2SO_3 ⟶ ____ $B_2(SO_3)_3$ + ____ LiF

9. ____ $(NH_4)_3PO_4$ + ____ $Pb(NO_3)_4$ ⟶ ____ $Pb_3(PO_4)_4$ + ____ NH_4NO_3

10. ____ $SeCl_6$ + ____ O_2 ⟶ ____ SeO_2 + ____ Cl_2

Remember
Carbonates - CO_3^{2-}
Nitrates - NO_3^-
Sulphates - SO_4^{2-}
Phosphates - PO_4^{3-}
Ammonium ions NH_4^+

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Calculating moles

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Calculating moles walkthrough

Calculating Moles

1. How many moles of methane (CH_4) are there in 160g?
2. How many moles of $CaCO_3$ are there in 25g?
3. How many moles of NH_3 are there in 3.4g?
4. There are 7 moles of carbon dioxide (CO_2) what is the mass?
5. A solution of NaOH has a volume of $75cm^3$ and a concertation of $0.5mol/dm^3$. Calculate the number of moles
6. A solution of HCl has a volume of $50cm^3$ and a concertation of 0.75 $moldm^{-3}$. Calculate the number of moles
7. Carbon dioxide gas contains 5 moles. Calculate the volume of gas present in dm^3
8. In a reaction 5 dm^3 of N_2 reacts with 6 dm^3 of O_2. Calculate the volume of NH_3. The equation is: $N_{2(g)} + 2O_{2(g)} \rightarrow 2NO_{2(g)}$
9. In a reaction 4 dm^3 of H_2 reacts with 2 dm^3 of N_2. Calculate the volume of NH_3. The equation is: $3H_{2(g)} + N_{2(g)} \rightarrow 2NH_{3(g)}$

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Percentage yield

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Percentage yield

Percentage yield practice

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1. A student obtained 6g of an element but expected 10.1g
   Calculate the percentage yield of the reaction to 2.d.p
2. A student obtained 5.7g of an element but expected 6.8g
   Calculate the percentage yield of the reaction to 2.d.p
3. The student starts with 6g of calcium (Ca). They obtained 10.6g of calcium sulfate ($CaSO_4$). Calculate the percentage yield of the reaction $Ca + H_2SO_4 \rightarrow CaSO_4 + H_2$
4. A student starts with 15g of methane (CH_4). They obtain 20g of water (H_2O). Calculate the percentage yield
   $CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$
5. A student starts with 10g of ethane (C_2H_6). They obtain 25g of carbon dioxide (CO_2). Calculate the percentage yield
   $2C_2H_6 + 6O_2 \rightarrow 6H_2O + 4CO_2$
6. Calculate the mass of magnesium (Mg) needed to obtain 27g of magnesium sulfate ($MgSO_4$) assuming there is an 80% yield of magnesium sulfate ($MgSO_4$) to 1.d.p
   $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

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Electron configuration

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Electronic configuration 1

Electronic configuration 2

Electron configuration practice

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1. Write the full electron configuration for the following elements
   a) Sodium (Na)
   b) Nitrogen (N)
   c) Argon (Ar)
   d) Helium (He)
   e) Iron (Fe)
   f) Potassium (K)
   g) Manganese (Mn)
   h) Oxygen (O)