Stoichiometry – 2021 O Level

1. Nov/2021/Paper_11/No.11

The relative atomic mass of chlorine is 35.5.

What is the mass of 2.0 mol of chlorine gas?

A 17.75 g **B** 35.5 g **C** 71 g **D** 142 g

2. Nov/2021/Paper_11/No.12

Methane burns in oxygen.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

10 cm^3 of methane is reacted with 25 cm^3 of oxygen.

What is the total volume of gas that would be measured after the reaction?

(Assume all volumes of gases are measured at room temperature and pressure.)

A 10 cm^3 **B** 15 cm^3 **C** 30 cm^3 **D** 35 cm^3

3. Nov/2021/Paper_11/No.13

An aqueous solution is made by dissolving 3.4 g of sodium hydroxide, NaOH, to make 500 cm^3 of solution.

What is the concentration, in mol / dm^3, of this sodium hydroxide solution?

A 0.0068 **B** 0.085 **C** 0.17 **D** 6.8

4. Nov/2021/Paper_11/No.25

In order to decide which would be the better nitrogenous fertiliser, a student calculates the percentage by mass of nitrogen in both ammonium sulfate and ammonium nitrate.

Which row gives the correct results?

	percentage by mass of nitrogen in ammonium sulfate	percentage by mass of nitrogen in ammonium nitrate
A	10.6	17.5
B	10.6	35.0
C	21.2	35.0
D	21.2	17.5

5. Nov/2021/Paper_12/No.11

The relative atomic mass of chlorine is 35.5.

What is the mass of 2.0 mol of chlorine gas?

A 17.75 g **B** 35.5 g **C** 71 g **D** 142 g

6. Nov/2021/Paper_12/No.12

When gases react, the volume of gaseous reactants may be different from the volume of gaseous products.

For which reaction is the percentage change in the volume of gas largest? (Assume each reaction goes to completion.)

A $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

B $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$

C $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

D $2C_2H_6(g) + 7O_2(g) \rightarrow 6H_2O(g) + 4CO_2(g)$

7. Nov/2021/Paper_12/No.13

Sodium carbonate reacts with dilute hydrochloric acid.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

A sample containing 0.0800 mol of sodium carbonate is added to a solution containing 0.100 mol of hydrochloric acid.

Which volume of carbon dioxide is produced, measured at room temperature and pressure?

A 0.96 dm^3 **B** 1.20 dm^3 **C** 1.92 dm^3 **D** 2.40 dm^3

8. Jun/2021/Paper_11/No.9

The empirical formula of compound X is CH_2 and the relative molecular mass, M_r, of X is 70.

What is the molecular formula of X?

A CH_2 **B** C_2H_4 **C** C_5H_{10} **D** C_nH_{2n}

9. Jun/2021/Paper_11/No.10

A chemist wants to make calcium nitrate. They start with 8.00 g of pure calcium oxide and an excess of dilute nitric acid. They produce 12.65 g of pure, dry anhydrous calcium nitrate crystals.

What is the percentage yield of calcium nitrate?

[relative atomic masses, A_r: Ca, 40; N, 14; H, 1; O, 16]

A 54.0 **B** 63.2 **C** 67.1 **D** 86.8

10. Jun/2021/Paper_11/No.11

The relative formula masses of four compounds are given.

A student has a 1.0 g sample of each compound.

Which sample contains the highest number of moles of oxygen atoms?

	compound	relative formula mass
A	Al_2O_3	102
B	CuO	80
C	H_2SO_4	98
D	HNO_3	63

11. Jun/2021/Paper_12/No.10

The names and formulae of three nitrogen compounds are shown.

ammonia	hydrazine	hydroxylamine
NH_3	N_2H_4	NH_2OH

Which compound has the highest relative molecular mass, M_r, and in which compound is the percentage by mass of hydrogen the greatest?

	highest M_r	greatest percentage by mass of hydrogen
A	N_2H_4	NH_3
B	N_2H_4	N_2H_4
C	NH_2OH	NH_3
D	NH_2OH	N_2H_4

12. Jun/2021/Paper_12/No.11

The relative formula masses of four compounds are given.

A student has a 1.0 g sample of each compound.

Which sample contains the highest number of moles of oxygen atoms?

	compound	relative formula mass
A	Al_2O_3	102
B	CuO	80
C	H_2SO_4	98
D	HNO_3	63

13. Jun/2021/Paper_12/No.12

10 cm^3 of propane is burned in 70 cm^3 of oxygen in a closed container.

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$$

What is the total volume of gas present after the reaction?

(Assume all volumes of gases are measured at room temperature and pressure.)

A 30 cm^3 **B** 50 cm^3 **C** 70 cm^3 **D** 90 cm^3

14. Jun/2021/Paper_12/No.13

When a mixture of sodium chloride and sodium hydrogencarbonate is heated, the reaction shown takes place.

$$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$$

Sodium chloride is unchanged on heating.

When 6.0 g of the mixture is heated, the loss in mass is 1.5 g.

What is the percentage by mass of sodium hydrogencarbonate in the mixture?

[relative molecular mass, M_r: $NaHCO_3$, 84; Na_2CO_3, 106; CO_2, 44; H_2O, 18]

A 34% **B** 48% **C** 68% **D** 95%

15. Jun/2021/Paper_22/No.2e

(e) A sample of oxygen has a volume of 11.5 dm^3 at room temperature and pressure.

(i) The temperature of the sample is decreased.

The pressure remains constant.

Describe and explain, using kinetic particle theory, what happens to the volume of the sample.

.....

..... [1]

(ii) The pressure of the sample is decreased.

The temperature remains constant.

Describe and explain, using kinetic particle theory, what happens to the volume of the sample.

.....

..... [1]

(iii) Calculate the mass of oxygen in the 11.5 dm^3 sample at room temperature and pressure.

Give your answer to **two** significant figures.

mass ..... g [2]

16. Jun/2021/Paper_22/No.7a

Sulfamic acid, NH_2SO_3H, is a white crystalline solid.

It reacts with aqueous sodium nitrite to make nitrogen gas, as shown in the equation.

$$NH_2SO_3H(s) + NaNO_2(aq) \rightarrow N_2(g) + H_2O(l) + NaHSO_4(aq)$$

(a) An excess of sulfamic acid reacts with a 20.0 cm^3 sample of 0.150 mol/dm^3 $NaNO_2(aq)$.

Calculate the maximum volume, in dm^3, of nitrogen formed, measured at room temperature and pressure.

volume of nitrogen ..... dm^3 [2]