Atoms, molecules and stoichiometry – 2022 Nov AS Chemistry 9701

1. Nov/2022/Paper_11/No.1

Which sample contains the same number of the named species as the number of molecules in 35.5 g of chlorine?

A atoms in 16 g of sulfur

B atoms in 23 g of sodium

C ions in 74.5 g of potassium chloride

D molecules in 88 g of carbon dioxide

2. Nov/2022/Paper_11/No.2

Mixture R consists of one mole of C_3H_6 and one mole of C_4H_6.

What is the minimum number of moles of oxygen molecules needed for complete combustion of mixture R?

A 6.5   B 7   C 10   D 20

3. Nov/2022/Paper_11/No.8

The carbonate of an s-block element is reacted with an excess of hydrochloric acid.

0.833 g of the carbonate releases 200 cm^3 of gas, measured under room conditions.

What is the identity of the metal carbonate?

A Na_2CO_3 B K_2CO_3 C $MgCO_3$ D $CaCO_3$

4. Nov/2022/Paper_12/No.2

Sodium peroxide, Na_2O_2, is used to absorb carbon dioxide from the atmosphere and release oxygen in closed environments such as space capsules and submarines.

$$2Na_2O_2 + 2CO_2 \rightarrow 2Na_2CO_3 + O_2$$
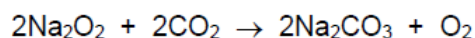
Which mass of sodium peroxide would be required to remove 2.4 dm^3 of carbon dioxide from the atmosphere at room temperature and pressure?

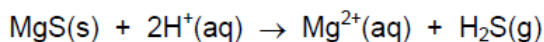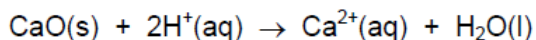A 2.4 g   B 3.9 g   C 7.8 g   D 15.6 g

5. Nov/2022/Paper_12/No.3

In which species are the numbers of protons, neutrons and electrons all different?

A $^{27}_{13}Al$ **B** $^{35}_{17}Cl^-$ **C** $^{32}_{16}S^{2-}$ **D** $^{39}_{19}K^+$

6. Nov/2022/Paper_12/No.4

Calcium oxide and magnesium sulfide each react with acid.

$$CaO(s) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + H_2O(l)$$

$$MgS(s) + 2H^+(aq) \rightarrow Mg^{2+}(aq) + H_2S(g)$$

A mixture of these two compounds, X, reacts with exactly 0.125 mol of dilute hydrochloric acid.

The amount of hydrogen sulfide formed is 0.0250 mol.

What was the mass of calcium oxide in mixture X?

A 1.4 g **B** 2.1 g **C** 2.8 g **D** 4.2 g

7. Nov/2022/Paper_22/No.1(d)

(d) There are many naturally occurring hydrated compounds that contain the anion PO_4^{3-}.

(i) Name the anion PO_4^{3-}.

.... [1]

(ii) Struvite is a soft hydrated mineral with $M_r = 245.3$. The anhydrous form of the mineral has the formula NH_4MgPO_4.

Calculate the number of molecules of water of crystallisation in struvite.

Give your answer to the nearest integer. Show your working.

number of molecules of water of crystallisation = ... [2]