Questions

Q1.

Which of the following contains the greatest number of hydrogen atoms?

☒ **A** 2 moles of water, H_2O

☒ **B** 1.5 moles of ammonia, NH_3

☒ **C** 1 mole of hydrogen gas, H_2

☒ **D** 0.5 moles of methane, CH_4

(Total for question = 1 mark)

Q2.

The human body contains around 0.025 g of iodine molecules, I_2. Which of the following shows the number of iodine **atoms** in 0.025 g of I_2?

The Avogadro constant is 6.02×10^{23} mol^{-1}.

☐ **A** $\frac{0.025}{126.9} \times 6.02 \times 10^{23}$

☐ **B** $\frac{0.025}{253.8} \times 6.02 \times 10^{23}$

☐ **C** $\frac{253.8}{0.025} \times 6.02 \times 10^{23}$

☐ **D** $\frac{126.9}{0.025} \times 6.02 \times 10^{23}$

(Total for question = 1 mark)

Q3.

The Avogadro constant is 6.0×10^{3} mol^{-1}. Therefore the number of **atoms** in 1 mol of carbon dioxide is

☒ **A** 2.0×10^{23}

☒ **B** 6.0×10^{23}

☒ **C** 1.2×10^{24}

☒ **D** 1.8×10^{24}

(Total for question = 1 mark)

Q4.

Oxygen gas, O_2, can be converted into ozone, O_3, by passing it through an electric discharge.

$$3O_2(g) \rightarrow 2O_3(g)$$

In an experiment, a volume of 300 cm^3 of oxygen was used but only 10% of the oxygen was converted into ozone. All volumes were measured at the same temperature and pressure.

The **total** volume of gas present at the end of the experiment, in cm^3, was

☒ **A** 200

☒ **B** 210

☒ **C** 290

☒ **D** 300

(Total for question = 1 mark)

Q5.

Magnesium oxide reacts with dilute hydrochloric acid according to the following equation.

$$MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$$

How many **moles** of magnesium oxide, MgO, are required to neutralize 20 cm^3 of 0.50 mol dm^{-3} hydrochloric acid, HCl?

☒ **A** 0.0010

☒ **B** 0.0050

☒ **C** 0.010

☒ **D** 0.020

(Total for question = 1 mark)

Q6.

The equation for the complete combustion of octane is

$$2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$$

(a) The mass of 10 mol of octane is

(1)

☒ **A** 0.66 kg

☒ **B** 1.14 kg

☒ **C** 2.10 kg

☒ **D** 2.28 kg

(b) The volume of 1 mol of any gas (measured at room temperature and pressure) is 24 dm^3. Hence the volume of oxygen (measured at room temperature and pressure) required for the complete combustion of 10 mol of octane is

(1)

☒ **A** 240 dm^3

☒ **B** 300 dm^3

☒ **C** 3000 dm^3

☒ **D** 6000 dm^3

(Total for question = 2 marks)

Q7.

Which of the following gas samples occupies the greatest volume at the same temperature and pressure?

[Relative atomic masses: H = 1; C = 12; O = 16; F = 19; Ne = 20]

☒ **A** 1 gram of ethane

☒ **B** 1 gram of oxygen

☒ **C** 1 gram of fluorine

☒ **D** 1 gram of neon

(Total for question = 1 mark)

Q8.

Hydrogen peroxide decomposes on heating as follows:

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

What mass of hydrogen peroxide is required to give 16 g of oxygen gas?

☒ **A** 8.5 g

☒ **B** 17 g

☒ **C** 34 g

☒ **D** 68 g

(Total for question = 1 mark)

Q9.

0.400 g of magnesium ribbon reacted with exactly 22.2 cm^3 of hydrochloric acid of concentration 1.50 mol dm^{-3}.

400 cm^3 of hydrogen gas was formed, the volume being measured at room temperature and pressure.

In the calculations that follow, use the following molar masses:

Mg = 24.0 g mol^{-1}
Cl = 35.5 g mol^{-1}

(a) Calculate the amount (in moles) of magnesium used.

(1)

(b) Calculate the amount (in moles) of hydrochloric acid used.

(1)

(c) Calculate the amount (in moles) of hydrogen produced.

[Molar volume of any gas at room temperature and pressure = 24 000 cm^3 mol^{-1}]

(1)

(d) Show that the calculated amounts of magnesium, hydrochloric acid and hydrogen are consistent with the following equation for the reaction

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

(1)

(e) Calculate the maximum mass of magnesium chloride that would be formed in this reaction. Give your answer to **three** significant figures.

(3)

(Total for Question = 7 marks)

Q10. Phosphorus(V) chloride, PCl_5, reacts with water according to the equation

$$PCl_5(s) + 4H_2O(l) \rightarrow H_3PO_4(aq) + 5HCl(aq)$$

If 1.04 g of phosphorus pentachloride (molar mass = 208 g mol^{-1}) is reacted completely with water and the solution made up to 1 dm^3, the concentration of the hydrochloric acid in mol dm^{-3} is

☒ **A** 0.001

☒ **B** 0.005

☒ **C** 0.025

☒ **D** 0.250

(Total for Question = 1 mark)

Q11.

A sample of gas was prepared for use in helium-neon lasers. It contained 4 g of helium and 4 g of neon. What is the ratio of helium atoms to neon atoms in the sample?

☒ **A** 1 : 1

☒ **B** 2.5 : 1

☒ **C** 1 : 5

☒ **D** 5 : 1

(Total for question = 1 mark)

Q12.

What is the number of **atoms** in 2.8 g of ethene, C_2H_4?

DATA

- The molar mass of C_2H_4 is 28 g mol^{-1}
- The Avogadro constant is 6.0×10^{23} mol^{-1}

☒ **A** 1.0×10^{22}

☒ **B** 6.0×10^{22}

☒ **C** 1.2×10^{23}

☒ **D** 3.6×10^{23}

(Total for question = 1 mark)

Q13. The Avogadro constant is 6.0×10^{23} mol^{-1}. The number of **atoms** in 1 mol of dinitrogen tetroxide, N_2O_4, is

☒ **A** 3.6×10^{24}

☒ **B** 1.8×10^{24}

☒ **C** 6.0×10^{23}

☒ **D** 1.0×10^{23}

(Total for Question = 1 mark)