

## Questions

Q1.

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

- ☐ **A** 2 moles of water,  $\text{H}_2\text{O}$
- ☐ **B** 1.5 moles of ammonia,  $\text{NH}_3$
- ☐ **C** 1 mole of hydrogen gas,  $\text{H}_2$
- ☐ **D** 0.5 moles of methane,  $\text{CH}_4$

(Total for question = 1 mark)

Q2.

The human body contains around 0.025 g of iodine molecules,  $\text{I}_2$ . Which of the following shows the number of iodine **atoms** in 0.025 g of  $\text{I}_2$ ?

The Avogadro constant is  $6.02 \times 10^{23} \text{ mol}^{-1}$ .

- ☐ **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  $6.0 \times 10^{23} \text{ mol}^{-1}$ . Therefore the number of **atoms** in 1 mol of carbon dioxide is

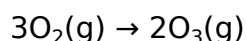
- ☐ **A**  $2.0 \times 10^{23}$
- ☐ **B**  $6.0 \times 10^{23}$
- ☐ **C**  $1.2 \times 10^{24}$

☐ **D**  $1.8 \times 10^{24}$

(Total for question = 1 mark)

Q4.

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



In an experiment, a volume of  $300 \text{ cm}^3$  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  $\text{cm}^3$ , was

☐ **A** 200

☐ **B** 210

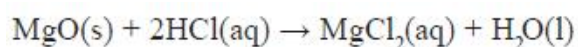
☐ **C** 290

☐ **D** 300

(Total for question = 1 mark)

Q5.

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



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

☐ **A** 0.0010

☐ **B** 0.0050

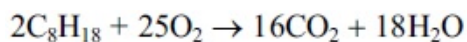
☐ **C** 0.010

☐ **D** 0.020

(Total for question = 1 mark)

Q6.

The equation for the complete combustion of octane is



(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<sup>3</sup>. 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<sup>3</sup>
- ☐ **B** 300 dm<sup>3</sup>
- ☐ **C** 3000 dm<sup>3</sup>
- ☐ **D** 6000 dm<sup>3</sup>

**(Total for question = 2 marks)**

Q7.

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

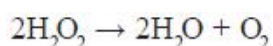
[Relative atomic masses: H = 1; C = 12; O = 16; F = 19; Ne = 20]

- ☐ **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:



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<sup>3</sup> of hydrochloric acid of concentration 1.50 mol dm<sup>-3</sup>.

400 cm<sup>3</sup> of hydrogen gas was formed, the volume being measured at room temperature and pressure.

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

$$\text{Mg} = 24.0 \text{ g mol}^{-1}$$

$$\text{Cl} = 35.5 \text{ g mol}^{-1}$$

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

**(1)**

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

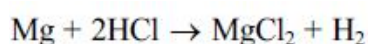
**(1)**

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

[Molar volume of any gas at room temperature and pressure = 24 000 cm<sup>3</sup> mol<sup>-1</sup>]

**(1)**

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



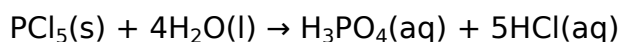
**(1)**

(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,  $\text{PCl}_5$ , reacts with water according to the equation



If 1.04 g of phosphorus pentachloride (molar mass =  $208 \text{ g mol}^{-1}$ ) is reacted completely with water and the solution made up to  $1 \text{ dm}^3$ , the concentration of the hydrochloric acid in  $\text{mol dm}^{-3}$  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,  $\text{C}_2\text{H}_4$ ?

DATA

- The molar mass of  $\text{C}_2\text{H}_4$  is  $28 \text{ g mol}^{-1}$
- The Avogadro constant is  $6.0 \times 10^{23} \text{ mol}^{-1}$

- ☐ **A**  $1.0 \times 10^{22}$
- ☐ **B**  $6.0 \times 10^{22}$
- ☐ **C**  $1.2 \times 10^{23}$
- ☐ **D**  $3.6 \times 10^{23}$

**(Total for question = 1 mark)**

Q13. The Avogadro constant is  $6.0 \times 10^{23} \text{ mol}^{-1}$ . The number of **atoms** in 1 mol of dinitrogen tetroxide,  $\text{N}_2\text{O}_4$ , is

- ☐ **A**  $3.6 \times 10^{24}$
- ☐ **B**  $1.8 \times 10^{24}$
- ☐ **C**  $6.0 \times 10^{23}$
- ☐ **D**  $1.0 \times 10^{23}$

**(Total for Question = 1 mark)**