GASES, MOLES AND VOLUMES

Answer all the questions below and then check your answers.

Use the equation box opposite to help you answer the questions below.

volume of gas = number of moles x $24dm^3$

or

$$\text{volume of gas} = \frac{\text{mass of gas}}{M_r \text{ of gas}} \times 24dm^3$$

1. What is room temperature and pressure (RTP)?

2. What volume will 1 mole of any gas occupy at RTP?

3. Complete the table below:

A_r information C=12 O=16 H=1 N=14

gas	A_r / M_r	Volume occupied at RTP/dm^3
Carbon dioxide (CO_2)		
Butane (C_4H_{10})		
Nitrogen (N_2)		

4. What volume will 0.5 moles of methane occupy at RTP?

5. What volume will 4g of hydrogen gas (H_2) occupy at RTP?

6. What volume will 40g of helium gas occupy at RTP?

7. What volume will 0.5 mol of carbon monoxide (CO) occupy at RTP?

8. Hydrogen gas burns according to the equation below:

$$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$$

a. What volume of oxygen gas is needed to completely burn 8g of hydrogen gas ?

9. Methane burns according to the equation below:

$$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(l)}$$

a. What volume of carbon dioxide is produced at R.T.P from the complete combustion of 64g of methane?

Answers

Answer all the questions below and then check your answers.

1. What is room temperature and pressure (RTP)? 20°C, 1 atmosphere pressure

2. What volume will 1 mole of any gas occupy at RTP? 24 dm^3

3. Complete the table below:

A_r information C=12 O=16 H=1 N=14

$$\text{volume of gas} = \text{number of moles} \times 24dm^3$$

or

$$\text{volume of gas} = \frac{\text{mass of gas}}{M_r \text{ of gas}} \times 24dm^3$$

gas	A_r / M_r	Volume occupied at RTP/dm^3
Carbon dioxide (CO_2)	44	24
Butane (C_4H_{10})	58	24
Nitrogen (N_2)	28	24

4. What volume will 0.5 moles of methane occupy at RTP?

V= n x 24 v = 0.5 x24 = 12dm^3

5. What volume will 4g of hydrogen gas (H_2) occupy at RTP?

n= mass/A_r = 4g/2 =2 moles v = 2 x24 = 48dm

6. What volume will 40g of helium gas occupy at RTP?

n= mass/A_r = 40g/4 =10 moles v = 10 x24 = 240dm^3

7. What volume will 0.5 mol of carbon monoxide (CO) occupy at RTP?

$v = 0.5 \times 24 = 12 dm^3$

8. Hydrogen gas burns according to the equation below:

$$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$$

4g of hydrogen 32g of oxygen 36g of water

a. What volume of oxygen gas is needed to completely burn 8g of hydrogen gas ?

A_r of hydrogen is 2. 4g of hydrogen need 32g of oxygen, since from equation they react in the ratio 2:1. So 8g of hydrogen will need 64g of oxygen, this is 2 moles or 48 dm^3 of oxygen

9. Methane burns according to the equation below:

$$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(l)}$$

a. What volume of carbon dioxide is produced at RTP from the complete combustion of 64g of methane?

M_r of methane is 16. So moles of methane present : $n = mass/A_r = 64/16 = 4$ moles of methane burn. From the equation 1 mole of methane produces 1 mole of carbon dioxide. 64g of methane is 4 moles, so this will produce 4 moles of carbon dioxide. 1 mole occupies 24 dm^3, so 4 moles will occupy 96 dm^3