

Triple - Chemistry - Key Stage 4

Quantitative Chemistry

Volumes of gases

Mrs. Begum



Periodic Table of Elements

Key:

relative atomic mass → **1**

Name → hydrogen

Atomic symbol → **H**

Atomic (proton number) → 1

| | | | | | | | | | | | | | | | | | |
|--------------------------------------|------------------------------------|---------------------------------------|--|--------------------------------------|---|---------------------------------------|--------------------------------------|---|---|--|--|---------------------------------------|--|--|--|---|--|
| 1 H hydrogen 1 | | | | | | | | | | | | | | | | | 4 He helium 2 |
| 7 Li lithium 3 | 9 Be beryllium 4 | | | | | | | | | | | 11 B boron 5 | 12 C carbon 6 | 14 N nitrogen 7 | 16 O oxygen 8 | 19 F fluorine 9 | 20 Ne neon 10 |
| 23 Na sodium 11 | 24 Mg magnesium 12 | | | | | | | | | | | 27 Al aluminium 13 | 28 Si silicon 14 | 31 P phosphorus 15 | 32 S sulfur 16 | 35.5 Cl chlorine 17 | 40 Ar argon 18 |
| 39 K potassium 19 | 40 Ca calcium 20 | 45 Sc scandium 21 | 48 Ti titanium 22 | 51 V vanadium 23 | 52 Cr chromium 24 | 55 Mn manganese 25 | 56 Fe iron 26 | 59 Co cobalt 27 | 59 Ni nickel 28 | 63.5 Cu copper 29 | 65 Zn zinc 30 | 70 Ga gallium 31 | 73 Ge germanium 32 | 75 As arsenic 33 | 79 Se selenium 34 | 80 Br bromine 35 | 84 Kr krypton 36 |
| 85 Rb rubidium 37 | 88 Sr strontium 38 | 89 Y yttrium 39 | 91 Zr zirconium 40 | 93 Nb niobium 41 | 96 Mo molybdenum 42 | [97] Tc technetium 43 | 101 Ru ruthenium 44 | 103 Rh rhodium 45 | 106 Pd palladium 46 | 108 Ag silver 47 | 112 Cd cadmium 48 | 115 In indium 49 | 119 Sn tin 50 | 122 Sb antimony 51 | 128 Te tellurium 52 | 127 I iodine 53 | 131 Xe xenon 54 |
| 133 Cs caesium 55 | 137 Ba barium 56 | 139 La* lanthanum 57 | 178 Hf hafnium 72 | 181 Ta tantalum 73 | 184 W tungsten 74 | 186 Re rhenium 75 | 190 Os osmium 76 | 192 Ir iridium 77 | 195 Pt platinum 78 | 197 Au gold 79 | 201 Hg mercury 80 | 204 Tl thallium 81 | 207 Pb lead 82 | 209 Bi bismuth 83 | [209] Po polonium 84 | [210] At astatine 85 | [222] Rn radon 86 |
| [223] Fr francium 87 | [226] Ra radium 88 | [227] Ac* actinium 89 | [267] Rf rutherfordium 104 | [270] Db dubnium 105 | [269] Sg seaborgium 106 | [270] Bh bohrium 107 | [270] Hs hassium 108 | [278] Mt meitnerium 109 | [281] Ds darmstadtium 110 | [281] Rg roentgenium 111 | [285] Cn copernicium 112 | [286] Nh nihonium 113 | [289] Fl flerovium 114 | [289] Mc moscovium 115 | [293] Lv livermorium 116 | [293] Ts tennessine 117 | [294] Og oganesson 118 |

* The lanthanides (atomic numbers 58 - 71) and the Actinides (atomic numbers 90 - 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.



Task 1

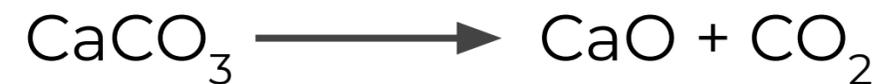
Calculate the volume of gas in:

1. 4 g of H_2
2. 8 g of CH_4
3. 3.55 g of Cl_2
4. 0.002 g of He
5. 8.8 g of CO_2
6. 2 g of Ar
7. 1 g of N_2
8. 16 g of O_2



Task 2

1. What volume of carbon dioxide is produced when 125 g of calcium carbonate is thermally decomposed?



| | |
|--|--|
| Balance symbol equation | |
| Calculate M_r of CaCO_3 | |
| Moles of CaCO_3 | |
| Work out the ratio | |
| Calculate the volume of carbon dioxide | |



Task 3

1. What volume of oxygen is produced when 0.34 g hydrogen peroxide is left to decompose?



2. What volume of nitrogen is needed to produce 6.8 g of ammonia?



3. What volume of chlorine is needed to produce 4.68 g sodium chloride?



4. What volume of oxygen is required to produce 2 g sodium oxide? Answer in cm^3 .



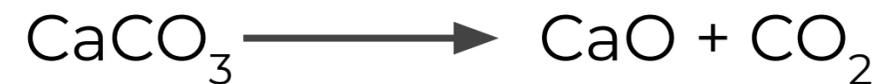
Task 1 answers

1. 4 g of H₂. **moles = $4/2 = 2$. Volume = $2 \times 24 = 48 \text{ dm}^3$**
2. 8 g of CH₄. **moles = $8/16 = 0.5$. Volume = $0.5 \times 24 = 12 \text{ dm}^3$**
3. 3.55 g of Cl₂. **moles = $3.55/71 = 0.05$. Volume = $0.05 \times 24 = 1.2 \text{ dm}^3$**
4. 0.002 g of He. **moles = $0.002/8 = 0.00025$. Volume = $0.00025 \times 24 = 0.006 \text{ dm}^3$**
5. 8.8 g of CO₂. **moles = $8.8/44 = 0.2$ Volume = $0.2 \times 24 = 4.8 \text{ dm}^3$**
6. 2 g of Ar. **moles = $2/40 = 0.05$ Volume = $0.05 \times 24 = 1.2 \text{ dm}^3$**
7. 1 g of N₂. **moles = $1/28 = 0.036$. Volume = $0.036 \times 24 = 0.86 \text{ dm}^3$**
8. 16g of O₂. **moles = $16/32 = 0.5$ Volume = $0.5 \times 24 = 12 \text{ dm}^3$**



Task 2 answers

1. What volume of carbon dioxide is produced when 125 g of calcium carbonate is thermally decomposed?

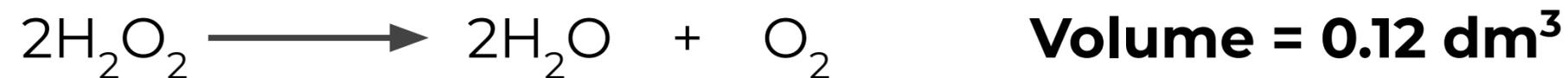


| | |
|--|--|
| Balance symbol equation | $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$ |
| Calculate M_r of CaCO_3 | $\text{CaCO}_3 = 100$ |
| Moles of CaCO_3 | $125 / 100 = 1.25$ |
| Work out the ratio | Ratio 1 : 1 Moles of $\text{CO}_2 = 1.25$ |
| Calculate the volume of carbon dioxide | Volume = $1.25 \times 24 = 30 \text{ dm}^3$ |



Task 3 answers

1. What volume of oxygen is produced when 0.34 g hydrogen peroxide is left to decompose?



2. What volume of nitrogen is needed to produce 6.8 g of ammonia?



3. What volume of chlorine is needed to produce 4.68 g sodium chloride?



4. What volume of oxygen is required to produce 2 g sodium oxide? Answer in cm^3 .

