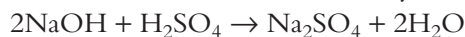


# Self-test Questions

## Topic 1 (HL)

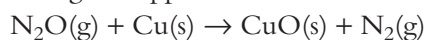
1 Sulfuric acid neutralises sodium hydroxide as follows:



20.00 cm<sup>3</sup> of a sodium hydroxide solution require 35.00 cm<sup>3</sup> of a 0.110 mol dm<sup>-3</sup> solution of sulfuric acid for neutralisation. What is the concentration of the sodium hydroxide solution?

- A 0.193 mol dm<sup>-3</sup>
- B 0.126 mol dm<sup>-3</sup>
- C 0.385 mol dm<sup>-3</sup>
- D 0.0314 mol dm<sup>-3</sup>

2 2.10 g of copper react with excess N<sub>2</sub>O as follows:

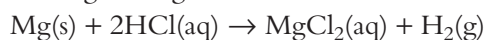


What volume of nitrogen gas is produced, measured at 15°C and 1.10 × 10<sup>5</sup> Pa?

Relative atomic masses: O = 16.00, Na = 22.99, Cu = 63.55; R = 8.31 J K<sup>-1</sup> mol<sup>-1</sup>

- A 7.19 × 10<sup>-4</sup> m<sup>3</sup>
- B 7.41 × 10<sup>-4</sup> m<sup>3</sup>
- C 3.74 × 10<sup>-5</sup> m<sup>3</sup>
- D 1.58 × 10<sup>-3</sup> m<sup>3</sup>

3 0.250 g of magnesium react with 50.0 cm<sup>3</sup> of 0.600 mol dm<sup>-3</sup> hydrochloric acid:



What volume of hydrogen gas is produced, measured at STP?

Relative atomic masses: H = 1.01, Mg = 24.31, Cl = 35.45; Molar volume of an ideal gas at STP = 22.7 dm<sup>3</sup> mol<sup>-1</sup>

- A 341 cm<sup>3</sup>
- B 681 cm<sup>3</sup>
- C 0.453 cm<sup>3</sup>
- D 233 cm<sup>3</sup>

4 What mass of Na<sub>2</sub>CO<sub>3</sub>·10H<sub>2</sub>O is required to make 100.0 cm<sup>3</sup> of a 0.200 mol dm<sup>-3</sup> solution?

Relative atomic masses: H = 1.01, C = 12.01, O = 16.00, Na = 22.99

- A 57.2 g
- B 21.2 g
- C 5.72 g
- D 2.12 g

5 An organic compound has a relative molecular mass of 192.28. The percentage composition by mass is C (74.97%), H (8.39%), O (16.64%). What is the molecular formula of the compound?

Relative atomic masses: H = 1.01, C = 12.01, O = 16.00

- A C<sub>6</sub>H<sub>8</sub>O
- B C<sub>8</sub>H<sub>10</sub>O<sub>2</sub>
- C C<sub>11</sub>H<sub>12</sub>O<sub>3</sub>
- D C<sub>12</sub>H<sub>16</sub>O<sub>2</sub>

- 6 100.0 cm<sup>3</sup> of fluorine gas (at STP) are reacted with 1.00 g of sulfur:  

$$\text{S(s)} + 3\text{F}_2(\text{g}) \rightarrow \text{SF}_6(\text{g})$$
 What volume of SF<sub>6</sub> is produced, measured at STP?  
 Relative atomic masses: F = 19.00, S = 32.07; Molar volume of an ideal gas at STP = 22.7 dm<sup>3</sup> mol<sup>-1</sup>
- A 100 cm<sup>3</sup>  
 B 33.3 cm<sup>3</sup>  
 C 300 cm<sup>3</sup>  
 D 708 cm<sup>3</sup>
- 7 10.00 g of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>·5H<sub>2</sub>O were dissolved in water and made up to a total volume of 250.0 cm<sup>3</sup>. 25.00 cm<sup>3</sup> of this solution were transferred to another flask, and made up to a total volume of 50.00 cm<sup>3</sup>. What is the concentration of this final solution?  
 Relative atomic masses: H = 1.01, O = 16.00, Na = 22.99, S = 32.07
- A 0.1611 mol dm<sup>-3</sup>  
 B 0.1265 mol dm<sup>-3</sup>  
 C 0.08057 mol dm<sup>-3</sup>  
 D 0.3223 mol dm<sup>-3</sup>
- 8 Calcium carbonate reacts with hydrochloric acid according to the equation:  

$$\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$$
 0.500 g of limestone (**impure** calcium carbonate) are put into 100.0 cm<sup>3</sup> of 2.00 mol dm<sup>-3</sup> hydrochloric acid. 110 cm<sup>3</sup> of carbon dioxide are produced, measured at STP. What is the percentage CaCO<sub>3</sub> in the limestone?  
 Relative atomic masses: H = 1.01, C = 12.01, O = 16.00, Cl = 35.45, Ca = 40.08; Molar volume of an ideal gas at STP = 22.7 dm<sup>3</sup> mol<sup>-1</sup>
- A 3.00%  
 B 4.85%  
 C 95.2%  
 D 97.0%
- 9 25.0 cm<sup>3</sup> of 0.200 mol dm<sup>-3</sup> lead nitrate solution reacted with 20.0 cm<sup>3</sup> of 0.300 mol dm<sup>-3</sup> potassium iodide solution:  

$$\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \rightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$$
 What mass of lead iodide was formed?  
 Relative atomic masses: N = 14.01, O = 16.00, K = 39.10, I = 126.90, Pb = 207.19
- A 1.16 g  
 B 1.38 g  
 C 2.31 g  
 D 2.77 g
- 10 V<sub>2</sub>O<sub>5</sub> may be obtained by heating NH<sub>4</sub>VO<sub>3</sub>:  

$$2\text{NH}_4\text{VO}_3(\text{s}) \rightarrow \text{V}_2\text{O}_5(\text{s}) + 2\text{NH}_3(\text{g}) + \text{H}_2\text{O}(\text{l})$$
 If 2.53 kg of V<sub>2</sub>O<sub>5</sub> were produced and this was a yield of 89.4%, how much NH<sub>4</sub>VO<sub>3</sub> was heated?  
 Relative atomic masses: H = 1.01, N = 14.01, O = 16.00, V = 50.94
- A 3.64 kg  
 B 3.25 kg  
 C 2.91 kg  
 D 1.82 kg