



Oxford Cambridge and RSA

GCSE Chemistry A (Gateway Science)
J248/04 Chemistry A C4-C6 and C7 (Higher Tier)

Question Set 16

1 (a) A student dissolves 0.6 g of zinc sulfate in 250 cm³ of water.

(i) Calculate the volume of the water in dm³.

Answer = dm³ [1]

(ii) Use your answer to part (a)(i) to help you calculate the concentration of the zinc sulfate in g/dm³.

Answer = g/dm³ [1]

(b) Zinc reacts with sulfuric acid. Zinc sulfate and hydrogen gas, H₂, are made.



(i) Calculate the amount of **hydrogen gas**, in mol, that could be made from 3.27 g of **zinc**.

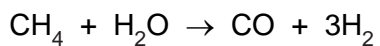
Answer = mol [2]

(ii) Use your answer to part (b)(i) to calculate the **volume** of hydrogen gas produced at room temperature and pressure.

One mole of any gas occupies 24 dm³ at room temperature and pressure.

Answer = dm³ [2]

(c) Hydrogen can be made by reacting methane with steam.



The **atom economy** for this process is 17.6%.

Hydrogen can also be produced by the decomposition of ammonia.

This reaction requires a catalyst.



- (i) Calculate the atom economy for the production of hydrogen from ammonia.
Give your answer to **3** significant figures.

Answer =% **[3]**

- (ii) Suggest other factors, apart from atom economy, that must be considered when deciding which reaction pathway to choose for the manufacture of hydrogen. **[3]**

Total Marks for Question Set 16: 12

Resource Materials

The Periodic Table of the Elements

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (0) | | | | | | | | | | |
|--|-------------------------------------|--------------------------------------|----------------------------------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|---------------------------------------|-------------------------------------|---------------------------------------|------------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|------------------------------------|------------------------------------|
| | 1 | 2 | Key atomic number Symbol name relative atomic mass | | | | | | 18 | | | | | | | | | |
| | 1 H hydrogen 1.0 | 2 He helium 4.0 | | | | | | | | | | | | | | | | |
| | 3 Li lithium 6.9 | 4 Be beryllium 9.0 | | | | | | 9 F fluorine 19.0 | | | | | | | | | | |
| | 11 Na sodium 23.0 | 12 Mg magnesium 24.3 | | | | | | 17 Cl chlorine 35.5 | | | | | | | | | | |
| | 19 K potassium 39.1 | 20 Ca calcium 40.1 | 21 Sc scandium 45.0 | 22 Ti titanium 47.9 | 23 V vanadium 50.9 | 24 Cr chromium 52.0 | 25 Mn manganese 54.9 | 26 Fe iron 55.8 | 27 Co cobalt 58.9 | 28 Ni nickel 58.7 | 29 Cu copper 63.5 | 30 Zn zinc 65.4 | 31 Ga gallium 69.7 | 32 Ge germanium 72.6 | 33 As arsenic 74.9 | 34 Se selenium 79.0 | 35 Br bromine 79.9 | 36 Kr krypton 83.8 |
| | 37 Rb rubidium 85.5 | 38 Sr strontium 87.6 | 39 Y yttrium 88.9 | 40 Zr zirconium 91.2 | 41 Nb niobium 92.9 | 42 Mo molybdenum 95.9 | 43 Tc technetium | 44 Ru ruthenium 101.1 | 45 Rh rhodium 102.9 | 46 Pd palladium 106.4 | 47 Ag silver 107.9 | 48 Cd cadmium 112.4 | 49 In indium 114.8 | 50 Sn tin 118.7 | 51 Sb antimony 121.8 | 52 Te tellurium 127.6 | 53 I iodine 126.9 | 54 Xe xenon 131.3 |
| | 55 Cs caesium 132.9 | 56 Ba barium 137.3 | 57-71 lanthanoids | 72 Hf hafnium 178.5 | 73 Ta tantalum 180.9 | 74 W tungsten 183.8 | 75 Re rhenium 186.2 | 76 Os osmium 190.2 | 77 Ir iridium 192.2 | 78 Pt platinum 195.1 | 79 Au gold 197.0 | 80 Hg mercury 200.6 | 81 Tl thallium 204.4 | 82 Pb lead 207.2 | 83 Bi bismuth 209.0 | 84 Po polonium | 85 At astatine | 86 Rn radon |
| | 87 Fr francium | 88 Ra radium | 89-103 actinoids | 104 Rf rutherfordium | 105 Db dubnium | 106 Sg seaborgium | 107 Bh bohrium | 108 Hs hassium | 109 Mt meitnerium | 110 Ds darmstadtium | 111 Rg roentgenium | 112 Cn copernicium | 114 Fl flerovium | 116 Lv livermorium | | | | |

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