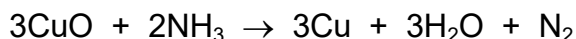


10 The equation for the reaction between copper(II) oxide, CuO, and ammonia is given.



[M_r : CuO, 80; NH₃, 17; H₂O, 18; N₂, 28]

[A_r : Cu, 64]

Which statements about this reaction are correct?

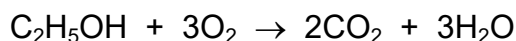
- 1 80.0 g of copper(II) oxide reacts exactly with 17.0 g of ammonia.
- 2 4.0 g of copper(II) oxide reacts with excess ammonia to produce 3.2 g of copper.
- 3 The mass of water produced in this reaction is greater than the mass of nitrogen.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

11 How many atoms are present in 1.00 mol of argon?

A 2.06×10^{23} **B** 3.02×10^{26} **C** 6.02×10^{23} **D** 6.32×10^{20}

10 The equation for the combustion of ethanol is shown.



The relative molecular mass, M_r , of ethanol is 46.

Which statement about the reaction is correct?

- A** 4.6 g of ethanol produces 4.4 g of carbon dioxide.
- B** 92 g of ethanol produces 88 g of carbon dioxide and 108 g of water.
- C** 138 g of ethanol reacts with 32 g of oxygen.
- D** 184 g of ethanol produces 216 g of water.

12 Calcium carbonate decomposes when heated strongly.



How many gaseous molecules are produced when 10.0 g of calcium carbonate is completely decomposed?

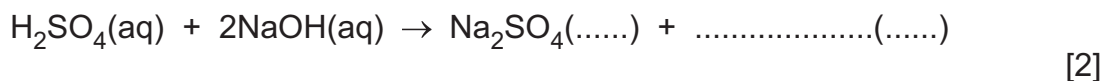
A 1.00×10^{22} **B** 1.20×10^{23} **C** 6.02×10^{22} **D** 6.02×10^{23}

- 3** A student makes crystals of the salt sodium sulfate, Na_2SO_4 . The student reacts 0.200 mol/dm^3 dilute sulfuric acid, $\text{H}_2\text{SO}_4(\text{aq})$, with aqueous sodium hydroxide, $\text{NaOH}(\text{aq})$.

The student uses the following steps.

- step 1** The student places 40.0 cm^3 of $\text{NaOH}(\text{aq})$ into a conical flask. This volume contains 0.0100 moles of NaOH .
- step 2** The student adds a few drops of methyl orange indicator to the $\text{NaOH}(\text{aq})$ in the conical flask.
- step 3** The student adds 0.200 mol/dm^3 $\text{H}_2\text{SO}_4(\text{aq})$ to the flask until the end-point is reached.
- step 4** The student transfers the mixture from the conical flask to an evaporating basin and obtains dry crystals.

- (a)** Complete the symbol equation for the reaction. Include state symbols.



- (b)** State the type of exothermic reaction taking place.

..... [1]

- (c)** Calculate the concentration of $\text{NaOH}(\text{aq})$ used in **step 1**.

concentration of $\text{NaOH}(\text{aq}) = \text{..... mol/dm}^3$ [1]

- (d)** Name the item of apparatus the student uses to add $\text{H}_2\text{SO}_4(\text{aq})$ in **step 3**.

..... [1]

- (e)** Calculate the volume of $\text{H}_2\text{SO}_4(\text{aq})$, in cm^3 , added in **step 3**.

volume of $\text{H}_2\text{SO}_4(\text{aq}) = \text{..... cm}^3$ [2]

- (f)** State the colour change observed in **step 3**.

from to [2]

- (g) The dry crystals formed in **step 4** are coloured and **not** white. This is because the student should do an additional step between **step 3** and **step 4**.

Suggest what the student should do in this additional step to produce white crystals.

.....
..... [1]

- (h) In **step 4**, the student gently heats the solution in the evaporating basin until the solution is saturated. The student then stops heating and leaves the hot solution to cool. Crystals start to appear.

- (i) Explain the term saturated solution.

.....
.....
..... [2]

- (ii) Explain why crystals start to appear as the hot solution cools.

.....
..... [1]

- (iii) Suggest the effect, if any, on the mass of crystals collected in **step 4** if the solution in the evaporating basin is allowed to dry without gentle heating.

..... [1]

[Total: 14]

- 3** A student prepares a sample of the insoluble salt barium sulfate, BaSO_4 .
The student adds aqueous sodium sulfate, $\text{Na}_2\text{SO}_4(\text{aq})$, to aqueous barium chloride, $\text{BaCl}_2(\text{aq})$.

The student carries out the following steps.

- step 1** Dissolve 0.100 moles of solid BaCl_2 in 100cm^3 of distilled water in a beaker to form $\text{BaCl}_2(\text{aq})$.
- step 2** Add an aqueous solution which contains 0.100 moles of $\text{Na}_2\text{SO}_4(\text{aq})$ to the beaker containing the $\text{BaCl}_2(\text{aq})$ from **step 1**.
- step 3** Stir the mixture and then filter it.
- step 4** Dry the solid left in the filter paper.

- (a) Complete the symbol equation for the reaction. Include state symbols.



[2]

- (b) Calculate the mass of solid BaCl_2 dissolved in **step 1**.

mass = g [2]

- (c) The concentration of $\text{Na}_2\text{SO}_4(\text{aq})$ in **step 2** is 1.25mol/dm^3 .

Calculate the volume, in cm^3 , of 1.25mol/dm^3 $\text{Na}_2\text{SO}_4(\text{aq})$ added in **step 2** which contains 0.100 moles of Na_2SO_4 .

volume = cm^3 [1]

- (d) State the colour of the solid formed in **step 2**.

..... [1]

- (e) The mixture is filtered in **step 3**.

State the general term given to a solid left in the filter paper after filtration.

..... [1]

- (f) The actual mass of dry BaSO_4 collected in **step 4** is greater than the expected mass. This is because the student should do an additional step between **step 3** and **step 4**.

Suggest what the student should do in this additional step, and explain why the actual mass collected is greater than the expected mass.

.....
.....
.....
..... [2]

- (g) State the name of this method of salt preparation.

..... [1]

- (h) State the name of a different:

- barium salt that can be used in place of BaCl_2
- sulfate salt that can be used in place of Na_2SO_4
- barium salt that can be made by this method.

[3]

[Total: 13]

- 9** Calcium carbonate reacts with dilute hydrochloric acid.

The equation for the reaction is shown.



1.00 g of calcium carbonate is added to 50.0 cm^3 of 0.0500 mol/dm^3 hydrochloric acid.

Which volume of carbon dioxide is made in this reaction?

- A** 30 cm^3 **B** 60 cm^3 **C** 120 cm^3 **D** 240 cm^3

20 The formulae of two hydrated salts are shown.

- $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$
- $\text{CoCl}_2 \cdot y\text{H}_2\text{O}$

What are the values of x and y ?

	x	y
A	5	5
B	5	6
C	6	5
D	6	6

9 The concentration of a solution of aqueous sodium hydroxide is 0.50 mol/dm^3 .

Which mass of sodium hydroxide is used to make 500 cm^3 of this solution?

- A** 10 g **B** 20 g **C** 40 g **D** 160 g

12 The value of the Avogadro constant is 6.02×10^{23} .

What is the total number of atoms in 2.00 mol of ammonia gas?

- A** 1.20×10^{24} **B** 2.41×10^{24} **C** 4.82×10^{24} **D** 2.89×10^{25}