

Formulas and Balanced Equations

Q1. (2018) – 8a (ii)

- (ii) Ammonia, NH_3 , is made by reacting nitrogen with hydrogen.

Write the balanced equation for this reaction.

(2)

Q2. (2019) – 4d

- 4 Calcium carbonate decomposes on heating to form calcium oxide and carbon dioxide.



- (d) (i) Calculate the relative formula mass of calcium carbonate, CaCO_3 .
(relative atomic masses: C = 12, O = 16, Ca = 40)

(2)

Q3. (2019)

- 5 (a) One way to extract metals from land contaminated with metal compounds is phytoextraction.
When plants grow they absorb metal ions through their roots.
The plants are harvested, dried and burned forming an ash.
The ash contains metal compounds.

Plants were grown in a piece of ground contaminated with nickel compounds.

- (i) 1 kg of the ash from these plants contained 142.0 g of nickel compounds.

Calculate the percentage by mass of nickel compounds in the ash.

(3)

Q4. (2019) – 5b

- (b) Some nickel ores contain nickel sulfide.

- (i) In the first stage of extracting nickel from nickel sulfide, the nickel sulfide, NiS , is heated in air to form nickel oxide, NiO , and sulfur dioxide.

Write the balanced equation for this reaction.

(2)

Q5. (2020) – 1b

- (b) Figure 2 shows the relationship between the purity of gold in carats and the percentage of gold in the alloy.

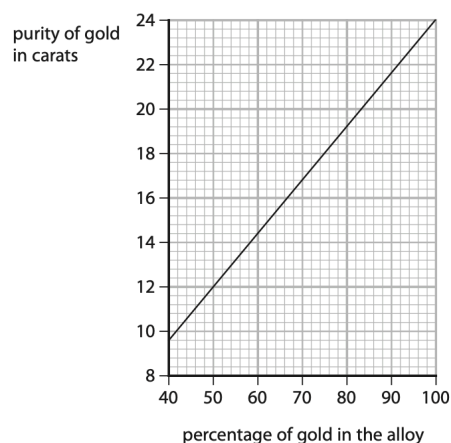


Figure 2

A necklace with a mass of 5.0 g was found to contain 2.9 g of gold.

Determine the purity of the gold necklace in carats.
Show your working.

(3)

Q6. (2020) – 2c

- 2 Figure 3 shows the apparatus that can be used to electrolyse sodium sulfate solution using inert electrodes.

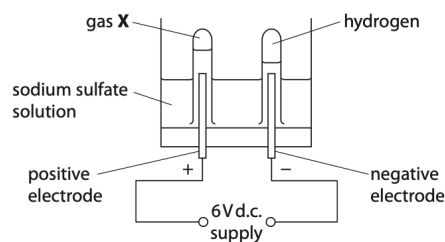


Figure 3

- (c) The ions present in sodium sulfate are

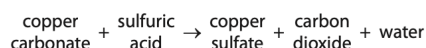
sodium	Na^+
sulfate	SO_4^{2-}

Write the formula of sodium sulfate using this information.

(1)

Q7. (2020)

- 3 The word equation for the reaction between copper carbonate and dilute sulfuric acid is



A)

- (a) (i) Complete the balanced equation for this reaction.

(2)



B)

- (ii) Calculate the relative formula mass of copper carbonate, CuCO_3 .
(relative atomic masses: C = 12.0, O = 16.0, Cu = 63.5)

(2)

Q8. (2020) – 10b (ii)

- (b) Ammonium sulfate and ammonium nitrate are used as fertilisers as they both contain nitrogen, which will increase the yield of crops.
(ii) Ammonium nitrate can be made by the reaction of ammonia with nitric acid.

Write the balanced equation for this reaction.

(2)

Q9. (2021) – 2b, 2c (i)

- 2 The scientist John Dalton lived over 200 years ago.

A)

- (b) Dalton also investigated different gases.

One of the gases that Dalton investigated was ethene.

The structure of one molecule of ethene is shown in Figure 2.

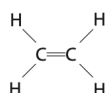


Figure 2

Give the molecular formula and the empirical formula of ethene.

(2)

molecular formula

empirical formula

B)

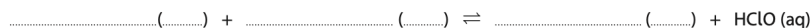
- (c) Another gas that Dalton investigated was chlorine.

Chlorine gas reacts with water.

The two products are a solution of hydrogen chloride and the substance HClO.

- (i) Complete the balanced equation for this reaction, including the three missing state symbols.

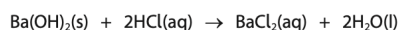
(3)



Q10. (2022)

- 2 Barium hydroxide reacts with dilute hydrochloric acid to form barium chloride and water.

- (a) The equation for the reaction is



Which row of the table shows the correct state of each of the substances in the equation for the reaction?

(1)

	barium hydroxide	hydrochloric acid	barium chloride	water
☐ A	solid	aqueous	aqueous	liquid
☐ B	solid	liquid	solid	aqueous
☐ C	aqueous	aqueous	solid	liquid
☐ D	aqueous	liquid	aqueous	aqueous

Q11. (2022) – 3c

- (c) Magnesium carbonate reacts with dilute hydrochloric acid. Water and carbon dioxide are two of the products of the reaction.

Complete the balanced equation for this reaction.

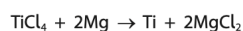
(1)



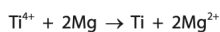
Q12. (2022) – 6b (ii)

- 6 The method used to extract a metal from its ore depends on the position of the metal in the reactivity series.

- (b) (i) One step in the extraction of titanium metal involves the displacement reaction between titanium chloride,
- TiCl_4
- , and magnesium.



This equation can be simplified as



Explain why this displacement reaction can be described as a redox reaction.

(3)

Question:

- (ii) The formula of the sulfate ion is
- SO_4^{2-}
- .

Which of the following is the formula of titanium sulfate containing the Ti^{4+} ion?

(1)

- ☐ A TiSO_4
- ☐ B Ti_2SO_4
- ☐ C $\text{Ti}(\text{SO}_4)_2$
- ☐ D $\text{Ti}_2\text{S}_2\text{O}_8$

Q13. (2022) – 7b

- 7 The volume of dilute sulfuric acid required to neutralise 25.0 cm^3 of ammonia solution can be found by titration.

In the titration, a few drops of methyl orange indicator were added to the ammonia solution in a conical flask before adding the dilute sulfuric acid.

- (b) When the ammonia solution was neutralised by the dilute sulfuric acid, a solution of ammonium sulfate was formed.

Complete the balanced equation for the reaction between ammonia solution and sulfuric acid.

(2)



Q14. (2023) – 2b, 2c

- 2 In an experiment, powdered calcium hydroxide was added to dilute hydrochloric acid and the pH was measured.

The method used was

step 1 measure 200 cm^3 dilute hydrochloric acid into a beaker

step 2 add 0.1 g of powdered calcium hydroxide to the beaker

step 3 find the pH of the mixture

step 4 repeat steps 2 and 3 until the pH stops changing.

A)

- (b) Complete the word equation for the reaction.

(2)



B)

- (c) Which row of the table shows the state symbols for powdered calcium hydroxide and dilute hydrochloric acid in the balanced chemical equation?

(1)

	calcium hydroxide	hydrochloric acid
☐ A	aq	l
☐ B	l	aq
☐ C	s	aq
☐ D	s	l

Q15. (2023)

- 5 (a) Ammonia is manufactured in the Haber process by the reversible reaction between nitrogen and hydrogen.

- (i) Write the balanced equation for the reversible reaction between nitrogen and hydrogen to make ammonia, NH_3 .

(3)

Q16. (2023)

- 9 (a) Figure 11 shows the structure of a molecule of compound **S**.

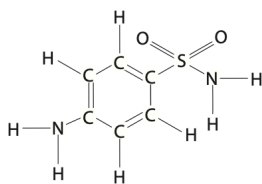


Figure 11

- (i) Use Figure 11 to deduce the empirical formula of compound **S**.

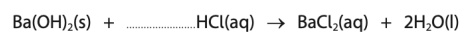
(1)

Q17. (2024)

- 2 Barium hydroxide reacts with dilute hydrochloric acid to form barium chloride solution and water.

- (a) (i) Complete the balanced equation for the reaction by adding a **number** in front of HCl(aq).

(1)



Q18. (2024) – 5b (ii)

- (ii) The formula of the cadmium ion is Cd^{2+} .
The formula of the phosphate ion is PO_4^{3-} .

Which is the formula of cadmium phosphate?

(1)

- ☐ **A** $\text{Cd}_2(\text{PO}_4)_3$
☐ **B** $\text{Cd}_3\text{PO}_{12}$
☐ **C** $\text{Cd}_3(\text{PO}_4)_2$
☐ **D** $\text{Cd}_3\text{P}_2\text{O}_8$