

Balanced Equations + Associated Calcs

Question Paper 16

Level	A Level
Subject	Chemistry
Exam Board	AQA
Module	3.1 Physical Chemistry
Topic	3.1.2 Atomic Substance
Sub-Topic	3.1.2.5 Balanced Equations + Associated Calcs
Booklet	Question Paper 16

Time Allowed: 23 minutes

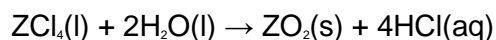
Score: /23

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	70%	60%	55%	50%	<50%

Q1. The chloride of an element **Z** reacts with water according to the following equation.



A 1.304 g sample of ZCl_4 was added to water. The solid ZO_2 was removed by filtration and the resulting solution was made up to 250 cm^3 in a volumetric flask. A 25.0 cm^3 portion of this solution was titrated against a $0.112 \text{ mol dm}^{-3}$ solution of sodium hydroxide, of which 21.7 cm^3 were required to reach the end point.

Use this information to calculate the number of moles of HCl produced and hence the number of moles of ZCl_4 present in the sample. Calculate the relative molecular mass, M_r , of ZCl_4 .

From your answer deduce the relative atomic mass, A_r , of element **Z** and hence its identity.

(Total 9 marks)

Q2. On heating, magnesium reacts vigorously with element **X** to produce compound **Y**. An aqueous solution of **Y**, when treated with aqueous silver nitrate, gives a white precipitate that is readily soluble in dilute aqueous ammonia. What is the minimum mass of **X** that is needed to react completely with 4.05 g of magnesium?

- A** 11.83 g
- B** 5.92 g
- C** 5.33 g
- D** 2.67 g

(Total 1 mark)

Q3.1, 3-dinitrobenzene can be prepared by heating nitrobenzene with a mixture of fuming nitric acid and concentrated sulphuric acid. The reaction can be represented by the following equation.



If the yield of the reaction is 55%, the mass of 1,3-dinitrobenzene produced from 12.30 g of nitrobenzene is

- A 16.90 g
- B 16.80 g
- C 9.30 g
- D 9.24 g

(Total 1 mark)

Q4. 0.00125 mol of a compound was heated with an excess of a solution of potassium hydroxide and the ammonia evolved required 17.0 cm³ of 0.220 M hydrochloric acid for neutralisation. Which one of the following could be the formula of this compound?

- A BF₃NH₃
- B VCl₃(NH₃)₃
- C CrCl₂(NH₃)₂
- D [Be(NH₃)₄]Cl₂

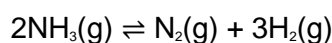
(Total 1 mark)

Q5. Which one of the following compounds contains the smallest percentage, by mass, of oxygen?

- A CH₃OCH₂CH₃
- B CH₃OCH₂NH₂
- C COS
- D C₄H₉Al(OH)₂

(Total 1 mark)

Q6. When one mole of ammonia is heated to a high temperature, 50% dissociates according to the following equilibrium.

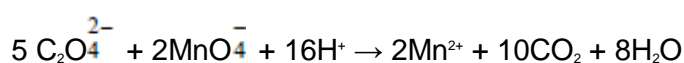


What is the total number of moles of gas present in the equilibrium mixture?

- A 1.5
- B 2.0
- C 2.5
- D 3.0

(Total 1 mark)

Q7. Aqueous $\text{C}_2\text{O}_4^{2-}$ ions react with MnO_4^- ions in acidic solution according to the equation



Under the same conditions Fe^{2+} ions also react with MnO_4^- ions. How many moles of MnO_4^- ions are required to react exactly with one mole of $\text{Fe}(\text{C}_2\text{O}_4)_2 \cdot 2\text{H}_2\text{O}$?

- A 0.4
- B 0.6
- C 2.5
- D 7.5

(Total 1 mark)

Q8. On complete combustion, 0.0150 mol of an organic acid produced 735 cm³ of carbon dioxide (measured at 101 kPa and 298 K). The same amount of acid required 15.0 cm³ of 2.00 M sodium hydroxide solution for neutralisation. Which one of the following could be the formula of the acid?

- A HCOOH
- B CH₃COOH
- C HOCCOH
- D HOOCCH₂CH₂COOH

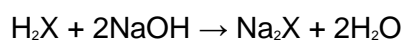
(Total 1 mark)

Q9. An excess of methanol was mixed with 12 g of ethanoic acid and an acid catalyst. At equilibrium the mixture contained 8 g of methyl ethanoate. The percentage yield of ester present was

- A 11
- B 20
- C 54
- D 67

(Total 1 mark)

Q10. In a titration, 0.52 g of a diprotic acid, H_2X , reacts exactly with 100 cm³ of 0.10 M sodium hydroxide.

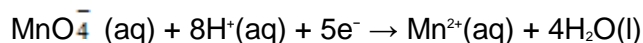
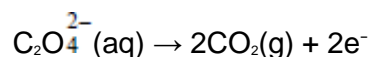


The acid could be

- A ethanedioic
- B propanedioic
- C butanedioic
- D pentanedioic

(Total 1 mark)

Q11. The oxidation of ethanedioate (*oxalate*) ions by manganate(VII) ions can be represented by the half equations:



What volume (in cm³) of 0.02 M $KMnO_4$ is required to oxidise completely a solution containing 0.02 mol of ethanedioate ions?

- A 25
- B 40
- C 250
- D 400

(Total 1 mark)

Q12.Hydrolysis of the ester, $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_3$, produces ethanoic acid. In an experiment, 2.04 g of the ester was used and 0.90 g of ethanoic acid was produced. The percentage yield of ethanoic acid was:

- A 44
- B 59
- C 75
- D 90

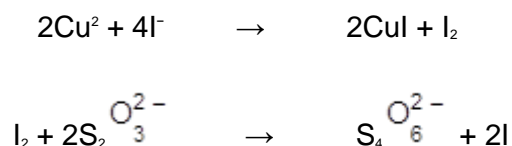
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Q13.When vanadium reacts with chlorine at 400°C , a brown compound is obtained. When an aqueous solution containing 0.193 g of this compound was treated with aqueous silver nitrate all the chlorine in the compound was precipitated as silver chloride. The mass of silver chloride (AgCl) produced was 0.574 g. Which one of the following could be the formula of the brown compound?

- A VCl
- B VCl_2
- C VCl_3
- D VCl_4

(Total 1 mark)

Q14.Copper(II) ions can be estimated volumetrically by the addition of an excess of potassium iodide followed by titration of the liberated iodine with sodium thiosulphate solution. The following equations apply:



What volume (in cm^3) of 0.1 M $\text{Na}_2\text{S}_2\text{O}_3$ would be required to react with the iodine produced from 1.249 g of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (M_r 249.7)?

- A 10
- B 25
- C 50
- D 100

(Total 1 mark)

Q15.A “drink-driving” offence is committed if the blood alcohol level of a driver is over 80 mg of ethanol per 100 cm³ of blood.

What is the concentration (in mol dm³) of ethanol if there are 80 mg of ethanol per 100 cm³ of blood?

- A** 0.0017
- B** 0.017
- C** 0.080
- D** 0.80

(Total 1 mark)