Questions

Q1.

What is the number of ions in 9.53 g of magnesium chloride, $MgCl_2$?

[Avogadro constant = 6.02×10^{23} mol^{-1}]

(1)

- ☐ **A** 6.02×10^{22}
- ☐ **B** 1.20×10^{23}
- ☐ **C** 1.81×10^{23}
- ☐ **D** 6.02×10^{23}

(Total for question = 1 mark)

Q2.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

The equation for the complete combustion of butane is

$$2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$$

What is the minimum volume of oxygen, at room temperature and pressure (r.t.p.), needed for the complete combustion of 0.200 mol of butane?

[Molar volume of a gas at r.t.p. = 24.0 dm^3 mol^{-1}]

(1)

- ☐ **A** 4.8 dm^3
- ☐ **B** 9.6 dm^3
- ☐ **C** 31.2 dm^3
- ☐ **D** 62.4 dm^3

(Total for question = 1 mark)

Q3.

The reaction of sulfuric acid with potassium hydroxide is a neutralisation. The equation for this reaction is

$$H_2SO_4(aq) + 2KOH(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$$

A titration was carried out using the following method.

- Potassium hydroxide solution of unknown concentration was placed in a burette and the initial reading was recorded.
- 25.0 cm^3 of sulfuric acid solution, concentration 0.0800 mol dm^{-3}, was transferred to a conical flask.
- Three drops of phenolphthalein indicator were added to the sulfuric acid.
- Potassium hydroxide was added from the burette until the solution just changed colour and then the burette reading was recorded.
- Repeat titrations were carried out until concordant titres were obtained.

What is the colour of the solution when neutralisation has just occurred?

(1)

- ☒ **A** colourless
- ☒ **B** orange
- ☒ **C** pale pink
- ☒ **D** red

(Total for question = 1 mark)

Q4.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

The nitrates of lithium, rubidium and strontium are all white solids. The compounds are held together by ionic bonds.

What is the percentage by mass of strontium in strontium nitrate?

(1)

- ☒ **A** 38.0 %
- ☒ **B** 41.4 %
- ☒ **C** 58.6 %
- ☒ **D** 74.5 %

(Total for question = 1 mark)

Q5.

This is a question about catalytic converters in car exhaust systems.

In the UK, the exhaust emissions of a petrol-fuelled vehicle must be less than 1.00 g of carbon monoxide per kilometre.

What is the maximum number of carbon monoxide molecules that can be emitted per kilometre for a vehicle to meet this regulation?

(1)

- ☒ **A** 1.37×10^{22}
- ☒ **B** 2.15×10^{22}
- ☒ **C** 6.02×10^{23}
- ☒ **D** 1.69×10^{25}

(Total for question = 1 mark)

Q6.

Hydrochloric acid is prepared by dissolving hydrogen chloride gas in water. It is difficult to dissolve a known amount of hydrogen chloride, so the exact concentration of such solutions is uncertain. A solution of hydrochloric acid of concentration between 0.095 mol dm^{-3} and 0.105 mol dm^{-3} was prepared.

Before a class attempted a practical using this solution, a technician standardised the hydrochloric acid with sodium carbonate solution. The technician dissolved 1.30 g of anhydrous sodium carbonate in water and made up the solution to 100 cm^3.

The equation for the reaction which occurs is shown.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

A 10.0 cm^3 portion of the sodium carbonate solution was transferred to a conical flask. Three drops of methyl orange indicator were added and the solution titrated with hydrochloric acid. The results for the experiment are shown.

Titration	1	2	3	4	5
Final burette reading / cm^3	26.00	34.00	36.10	24.15	48.20
Initial burette reading / cm^3	0.00	10.00	11.00	0.05	24.15
Titre / cm^3					
Concordant results (✓)					

The colour change at the end-point when methyl orange is used as an indicator for this titration is from

(1)

☒ **A** orange to yellow

☒ **B** red to orange

☒ **C** yellow to orange

☒ **D** yellow to red

(Total for question = 1 mark)

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

How many **ions** are present in 306 g of aluminium oxide, Al_2O_3 ?

[Avogadro constant = 6.02×10^{23} mol^{-1} Molar mass of Al_2O_3 = 102 g mol^{-1}]

- ☐ **A** 6.02×10^{23}
- ☐ **B** 1.81×10^{24}
- ☐ **C** 3.01×10^{24}
- ☐ **D** 9.03×10^{24}

(Total for question = 1 mark)

Q8.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about compounds with the molecular formula C_4H_8O.

What is the percentage by mass of each element in C_4H_8O?

(1)

	Percentage carbon	Percentage hydrogen	Percentage oxygen
☐ **A**	66.67	11.11	22.22
☐ **B**	60.00	20.00	20.00
☐ **C**	41.38	3.45	55.17
☐ **D**	30.77	61.54	7.69

(Total for question = 1 mark)

Q9.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about iron(II) salts.

What is the percentage by mass of iron in anhydrous iron(II) sulfate, $FeSO_4$, to 3 significant figures?

(1)

- ☐ **A** 21.3%
- ☐ **B** 35.1%
- ☐ **C** 36.7%
- ☐ **D** 53.8%

(Total for question = 1 mark)

Q10.

The reaction of sulfuric acid with potassium hydroxide is a neutralisation. The equation for this reaction is

$$H_2SO_4(aq) + 2KOH(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$$

A titration was carried out using the following method.

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- Three drops of phenolphthalein indicator were added to the sulfuric acid.
- Potassium hydroxide was added from the burette until the solution just changed colour and then the burette reading was recorded.
- Repeat titrations were carried out until concordant titres were obtained.

Select the most appropriate piece of apparatus to measure the 25.0 cm^3 of sulfuric acid.

(1)

- ☐ **A** burette
- ☐ **B** measuring cylinder
- ☐ **C** pipette
- ☐ **D** volumetric flask

(Total for question = 1 mark)

Q11.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

This question is about iron(II) salts.

Mohr's salt is another compound containing iron(II) ions.

It has the formula $(NH_4)_2Fe(SO_4)_2 . 6H_2O$.

What is the molar mass, in g mol^{-1}, of Mohr's salt?

(1)

- ☐ **A** 392.0
- ☐ **B** 312.0
- ☐ **C** 302.0
- ☐ **D** 284.0

(Total for question = 1 mark)

Q12.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Malachite is a green mineral with the formula $Cu_2CO_3(OH)_2$. It has a molar mass of 221 g mol^{-1}.

What is the percentage by mass of copper in pure malachite?

(1)

- ☐ **A** 40.3%
- ☐ **B** 51.4%
- ☐ **C** 57.5%
- ☐ **D** 67.9%

(Total for question = 1 mark)

Q13.

Answer the question with a cross in the box you think is correct ☒ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒ .

What is the total number of **ions** in 26.4 g of ammonium sulfate, $(NH_4)_2SO_4$?

[Molar mass of $(NH_4)_2SO_4$ = 132 g mol^{-1} Avogadro constant = 6.0×10^{23} mol^{-1}]

☐ **A** 4.0×10^{22}

☐ **B** 1.2×10^{23}

☐ **C** 2.4×10^{23}

☐ **D** 3.6×10^{23}

(Total for question = 1 mark)