

Q1.

A compound contains 40.0% carbon, 6.7% hydrogen and 53.3% oxygen by mass.

Which could be the molecular formula of this compound?

- A $C_2H_2O_2$
- B C_2H_2O
- C $C_2H_4O_2$
- D C_2HO_2

(Total 1 mark)

Q2.

When driving a car, a legal limit for ethanol ($M_r = 46.0$) is 80 mg per 100 cm³ of blood.

What is this concentration in mol dm⁻³?

- A 1.74×10^{-1}
- B 1.74×10^{-2}
- C 1.74×10^{-3}
- D 1.74×10^{-4}

(Total 1 mark)

Q3.

What is the percentage atom economy for the production of ethanol from glucose?



- A 25.6%
- B 27.1%
- C 51.1%
- D 54.2%

(Total 1 mark)

Q4.

What is the mole fraction of 1.0 g of a compound of relative molecular mass 100.0 dissolved in 30.0 g of a solvent of relative molecular mass 50.0?

A 6.0×10^{-3} B 1.6×10^{-2} C 1.7×10^{-2} D 3.0×10^{-2} **(Total 1 mark)****Q5.**

Which compound needs the greatest amount of oxygen for the complete combustion of 1 mol of the compound?

A ethanal

B ethanol

C ethane-1,2-diol

D methanol

(Total 1 mark)**Q6.**

Nitration of 1.70 g of methyl benzoate ($M_r = 136.0$) produces methyl 3-nitrobenzoate ($M_r = 181.0$). The percentage yield is 65.0%

What mass, in g, of methyl 3-nitrobenzoate is produced?

A 0.830

B 1.10

C 1.47

D 2.26

(Total 1 mark)

Q7.

What is the empirical formula of a hydrocarbon that contains 90% carbon by mass?

- A C_2H_3
- B C_3H_2
- C C_3H_4
- D C_4H_3

(Total 1 mark)**Q8.**

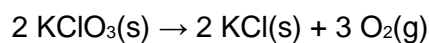
What is the minimum volume of $0.0500 \text{ mol dm}^{-3}$ aqueous bromine needed to react completely with 0.0200 g of buta-1,3-diene?

(M_r of buta-1,3-diene = 54.0)

- A 7.40 cm^3
- B 14.8 cm^3
- C 29.6 cm^3
- D 67.5 cm^3

(Total 1 mark)**Q9.**

When heated, a sample of potassium chlorate(V) ($KClO_3$) produced 67.2 cm^3 of oxygen, measured at 298 K and 110 kPa



What is the amount, in moles, of potassium chlorate(V) that has decomposed?

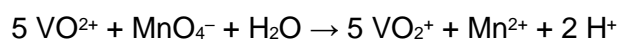
The gas constant, $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

- A 9.95×10^{-4}
- B 1.99×10^{-3}
- C 2.99×10^{-3}
- D 4.48×10^{-3}

(Total 1 mark)

Q10.

What is the minimum volume, in cm^3 , of 0.02 mol dm^{-3} KMnO_4 solution needed to oxidise 0.01 mol of VO^{2+} ?



- A 10
- B 50
- C 100
- D 200

(Total 1 mark)

Q11.

A student rinsed the apparatus before starting an acid-base titration. The results of the titration showed that the volume of acid added from the burette was larger than expected.

Which is a possible reason for this?

- A The conical flask was rinsed with water before the titration.
- B The walls of the conical flask were rinsed with water during the titration.
- C The pipette was rinsed only with water.
- D The burette was rinsed only with water.

(Total 1 mark)

Q12.

Which sample, measured at room temperature and pressure, contains the greatest number of the stated particles?

- A 1 g of hydrogen molecules
- B 1 g of helium atoms
- C 1 dm^3 of hydrogen molecules
- D 1 dm^3 of helium atoms

(Total 1 mark)

Q13.

5.0 g of an oxide of molybdenum contain 4.0 g of molybdenum.

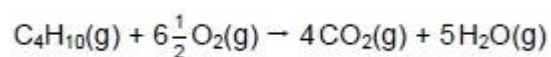
What is the empirical formula of this oxide?

- A MoO₂
- B Mo₄O₅
- C Mo₂O₃
- D Mo₃O₂

(Total 1 mark)

Q14.

The equation below represents the complete combustion of butane.



20 cm³ of butane are completely burned in 0.20 dm³ of oxygen.
Which statement is correct?

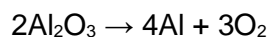
All volumes are measured at the same temperature and pressure.

- A 40 cm³ of carbon dioxide are formed
- B 0.065 dm³ of oxygen react
- C 70 cm³ of oxygen remain
- D 0.50 dm³ of steam are formed

(Total 1 mark)

Q15.

What is the percentage yield when 20 g of aluminium are produced from 50 g of aluminium oxide?



- A 76%
- B 40%
- C 33%
- D 19%

(Total 1 mark)

Q16.

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 dm⁻³, of ethanol if there are 80 mg of ethanol ($M_r = 46.0$) per 100 cm³ of blood?

- A 0.00017
- B 0.0017
- C 0.017
- D 1.7

(Total 1 mark)

Q17.

The heat released when 1.00 g of ethanol ($M_r = 46.0$) undergoes complete combustion is 29.8 kJ

What is the heat released by each molecule, in joules, when ethanol undergoes complete combustion?

(the Avogadro constant $L = 6.022 \times 10^{23} \text{ mol}^{-1}$)

- A $2.28 \times 10^{-18} \text{ J}$
- B $4.95 \times 10^{-20} \text{ J}$
- C $2.28 \times 10^{-21} \text{ J}$
- D $4.95 \times 10^{-23} \text{ J}$

(Total 1 mark)

Q18.

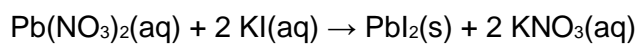
Which amount of sodium hydroxide would react exactly with 7.5 g of a diprotic acid, H₂A ($M_r = 150$)?

- A 50 cm³ of 0.05 mol dm⁻³ NaOH(aq)
- B 100 cm³ of 0.50 mol dm⁻³ NaOH(aq)
- C 100 cm³ of 1.0 mol dm⁻³ NaOH(aq)
- D 100 cm³ of 2.0 mol dm⁻³ NaOH(aq)

(Total 1 mark)

Q19.

Lead(II) nitrate and potassium iodide react according to the equation



In an experiment, 25.0 cm³ of a 0.100 mol dm⁻³ solution of each compound are mixed together.

Which amount, in mol, of lead(II) iodide is formed?

A 1.25×10^{-3}

B 2.50×10^{-3}

C 1.25×10^{-2}

D 2.50×10^{-2}

(Total 1 mark)

Q20.

How many protons are there in 6.0 g of nitrogen gas?

Avogadro constant, $L = 6.022 \times 10^{23} \text{ mol}^{-1}$

A 1.3×10^{23}

B 9.0×10^{23}

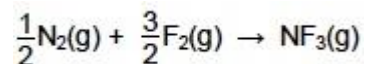
C 1.8×10^{24}

D 3.6×10^{24}

(Total 1 mark)

Q21.

A 30 cm³ sample of nitrogen was reacted with a 60 cm³ sample of fluorine according to the equation



What is the volume of the gas mixture after the reaction, at constant temperature and pressure?

A 20 cm³

B 30 cm³

C 40 cm³

D 50 cm³

(Total 1 mark)

Q22.

A solution of volume 500 cm³ contains 150 g of ammonia.

What is the concentration, in mol dm⁻³, of ammonia in this solution?

A 0.51

B 8.82

C 16.7

D 17.6

(Total 1 mark)

Q23.

A student devised an experiment to find the concentration of sulfuric acid in a sample of battery acid.

- A measuring cylinder was used to transfer 10 cm³ of battery acid to a volumetric flask.
- Distilled water was added to the volumetric flask until the volume reached 250 cm³
- A 25.0 cm³ sample of diluted acid was transferred from the volumetric flask to a conical flask using a pipette.
- A few drops of methyl orange indicator were added to the acid in the conical flask before titrating the acid with sodium hydroxide.
- The titration was repeated five times but concordant results were **not** obtained. (Note: Methyl orange is red in acid and yellow in alkali.)

Which suggestion would reduce the overall measurement uncertainty in the titration?

- A** Use less concentrated alkali in the burette.
- B** Use phenolphthalein indicator instead of methyl orange.
- C** Use smaller samples of the diluted acid in each titration.
- D** Begin each titration with the burette filled to the 0.00 cm³ mark.

(Total 1 mark)

Q24.

Ethanol can be made from glucose by fermentation.



In an experiment, 268 g of ethanol ($M_r = 46.0$) were made from 1.44 kg of glucose ($M_r = 180.0$).

What is the percentage yield?

- A** 18.6%
- B** 36.4%
- C** 51.1%
- D** 72.8%

(Total 1 mark)

Q25.

A gas cylinder contains 5.0 kg of propane.

How many propane molecules are in the cylinder?

The Avogadro constant, $L = 6.022 \times 10^{23} \text{ mol}^{-1}$

- A 6.8×10^{22}
- B 7.2×10^{22}
- C 6.8×10^{25}
- D 7.2×10^{25}

(Total 1 mark)

Q26.

Which sample of liquid has the greatest volume?

- A 500 mg of pentane (density = 0.63 g cm^{-3})
- B 650 mg of propan-1-ol (density = 0.80 g cm^{-3})
- C 1.20 g of dichloromethane (density = 1.33 g cm^{-3})
- D 1.30 g of trichloromethane (density = 1.48 g cm^{-3})

(Total 1 mark)

Q27.

Some 1.0 mol dm^{-3} solutions were mixed using equal volumes of each solution.

Which pair of solutions would give the greatest mass of solid?

- A Ba(OH)_2 and MgCl_2
- B Ba(OH)_2 and MgSO_4
- C Ba(OH)_2 and NaCl
- D Ba(OH)_2 and Na_2SO_4

(Total 1 mark)

Q28.

A 4.85 g sample of anhydrous sodium sulfate is dissolved in water and the solution made up to 250 cm³ in a volumetric flask.

What is the concentration in mol dm⁻³ of sodium sulfate in the solution?

- A 0.0341
- B 0.137
- C 0.163
- D 0.273

(Total 1 mark)

Q29.

Which of these contains the greatest number of atoms?

- A 127 mg of iodine
- B 1.54×10^{-4} kg of phosphorus
- C 81.0 mg of carbon dioxide
- D 1.70×10^{-4} kg of ammonia

(Total 1 mark)

Q30.

25.0 cm³ samples of NaOH solution were taken by pipette from a beaker. These were then titrated with an aqueous solution of ethanoic acid. The concentration of ethanoic acid calculated from the experimental results was found to be lower than the actual value.

Which of these could explain the difference?

- A Rinsing the pipette with distilled water before filling with NaOH
- B Rinsing the burette with distilled water before filling with ethanoic acid
- C Rinsing the walls of the conical flask with distilled water during the titration
- D Rinsing the beaker with distilled water before filling with NaOH

(Total 1 mark)

Q31.

A 20.0 cm³ sample of a 0.400 mol dm⁻³ aqueous solution of a metal bromide (MBr_n) reacts exactly with 160 cm³ of 0.100 mol dm⁻³ aqueous silver nitrate.

What is the formula of the metal bromide?

- A MBr
- B MBr₂
- C MBr₃
- D MBr₄

(Total 1 mark)

Q32.

What is the empirical formula of an oxide of nitrogen that contains 26% nitrogen by mass?

- A NO₂
- B N₂O₃
- C N₂O₅
- D N₄O₅

(Total 1 mark)

Q33.

What is the burette reading for this transparent liquid?



- A 24.10 cm³
- B 24.30 cm³
- C 25.70 cm³
- D 25.90 cm³

(Total 1 mark)

Q34.

A volumetric flask was used to prepare 250 cm³ of a solution.

The solute was added from a plastic weighing container.

	Mass / g
Weighing container with solute	10.13
Weighing container after solute added to volumetric flask	4.48

Each reading from the balance has an uncertainty of ± 0.005 g

What is the percentage uncertainty in the mass of the solute used?

- A** 0.09%
- B** 0.11%
- C** 0.18%
- D** 0.22%

(Total 1 mark)

Q35.

Which sample contains the most molecules?

The Avogadro constant, $L = 6.022 \times 10^{23} \text{ mol}^{-1}$

- A** 2.10×10^{22} molecules of methane, CH₄
- B** 1.00 g of oxygen, O₂
- C** 65.0 mg of hydrogen, H₂
- D** 0.0300 mol of ethane, C₂H₆

(Total 1 mark)

Q36.

A sample of 2.0 mol dm^{-3} acid has a volume of 100 cm^3

What volume of water, in cm^3 , should be added to this acid to dilute the sample to a concentration of 1.5 mol dm^{-3} ?

- A 25
- B 33.3
- C 50
- D 66.7

(Total 1 mark)

Q37.

Two sealed flasks with the same volume are left side by side.

Flask **A** contains 4.0×10^{-3} mol of methane.

Flask **B** contains 340 mg of a different gas.

Both gases are at the same temperature and pressure.

Which gas could be in Flask **B**?

- A CH_2Cl_2
- B HBr
- C Kr
- D PF_3

(Total 1 mark)

Q38.

Analysis of a sample of a chemical with formula $C_{22}H_{30}N_6O_4S$, showed that it contained 0.0195 mol of carbon.

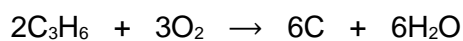
What mass of nitrogen was present in the sample?

- A 0.041 g
- B 0.057 g
- C 0.074 g
- D 0.420 g

(Total 1 mark)

Q39.

What is the mass, in mg, of carbon formed when 3.0×10^{-3} mol of propene undergoes incomplete combustion?

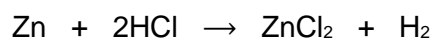


- A 9.0×10^{-3}
- B 3.6×10^{-2}
- C 1.08×10^2
- D 2.16×10^2

(Total 1 mark)

Q40.

The equation for the reaction between zinc and hydrochloric acid is



What is the minimum mass, in mg, of zinc ($A_r = 65.4$) needed to react with 50.0 cm^3 of 1.68 mol dm^{-3} hydrochloric acid?

- A** 2.75
- B** 5.49
- C** 2.75×10^3
- D** 5.49×10^3

(Total 1 mark)