Q1.

What is the percentage atom economy for the formation of sodium nitrate in the reaction between sodium carbonate and nitric acid?

$$Na_2CO_3 + 2\ HNO_3 \rightarrow 2\ NaNO_3 + H_2O + CO_2$$

A 36.6% ⬭

B 50.3% ⬭

C 57.8% ⬭

D 73.3% ⬭

(Total 1 mark)

Q2.

The table shows some results from a titration.

Titration	**Rough**	**Titre 1**	**Titre 2**	**Titre 3**
Initial reading / cm^3	0.00	11.30	0.00	8.55
Final reading / cm^3	26.85	37.20	26.20	34.55
Titre volume / cm^3	26.85	25.90	26.20	26.00

What is the correct mean titre?

A 25.95 cm^3 ⬭

B 26.03 cm^3 ⬭

C 26.10 cm^3 ⬭

D 26.24 cm^3 ⬭

(Total 1 mark)

Q3.

What is the empirical formula of an oxide of chlorine that contains 42.5% by mass of chlorine?

A ClO_2 ⬭

B ClO_3 ⬭

C Cl_2O_3 ⬭

D Cl_2O_5 ⬭

(Total 1 mark)

Q4.

Which of these practical steps will improve the accuracy of a titration?

A Using a 10.0 cm^3 pipette instead of a 25.0 cm^3 pipette. ⬭

B Rinsing the sides of the conical flask with water. ⬭

C Rinsing the burette with water before filling. ⬭

D Using 6 drops of indicator instead of 3 drops of indicator. ⬭

(Total 1 mark)

Q5.

The equation shows how **P** reacts with **Q** to make **R** and **S**.

$$\mathbf{P} + 2\,\mathbf{Q} \rightarrow \mathbf{R} + \mathbf{S}$$

When a mixture of 0.25 mol of **P** and 0.40 mol of **Q** react, 0.15 mol of **R** is obtained.

What is the percentage yield of **R** in this reaction?

A $\frac{0.15}{0.20} \times 100$ ⬭

B $\frac{0.15}{0.25} \times 100$ ⬭

C $\frac{0.15}{0.40} \times 100$ ⬭

D $\frac{0.15}{0.65} \times 100$ ⬭

(Total 1 marks)

Q6.

What is the M_r of this compound?

A 94.0 ○

B 96.0 ○

C 98.0 ○

D 100.0 ○

(Total 1 marks)

Q7.

This is the equation for the conversion of 1,2-dibromoethane to butanedinitrile.

$$CH_2BrCH_2Br + 2\ KCN \rightarrow NCCH_2CH_2CN + 2\ KBr$$

What is the percentage atom economy for the production of butanedinitrile in this reaction?

Relative formula masses, M_r

$CH_2BrCH_2Br = 187.8$

$KCN = 65.1$

$NCCH_2CH_2CN = 80.0$

$KBr = 119.0$

A 100% ○

B 40.2% ○

C 31.6% ○

D 25.2% ○

(Total 1 marks)

Q8.

A sample of cyclohexane contains 3.011×10^{24} atoms of carbon.

What is the mass of this sample?

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

A 70.0 g ○

B 71.7 g ○

C 420 g ○

D 430 g ○

(Total 1 marks)

Q9.

Compound **P** is converted into compound **R** by a two-stage synthesis via compound **Q**.

The yields for the individual steps are:

P → **Q**	50%
Q → **R**	30%

What is the overall yield of **R** in this synthesis?

A 15% ○

B 30% ○

C 40% ○

D 80% ○

(Total 1 mark)

Q10.

A student completes a titration to determine the concentration of ethanoic acid in vinegar.

25.0 cm^3 of vinegar are transferred to a conical flask using a pipette.
A few drops of phenolphthalein are added to the conical flask.
Sodium hydroxide solution is added from a burette to the conical flask.
The titration is repeated until concordant results are obtained.

Which suggestion improves the accuracy of the titres?

A Rinsing the conical flask with vinegar between each titration. ⬭

B Rinsing the conical flask with sodium hydroxide solution between each titration. ⬭

C Rinsing the conical flask with water between each titration. ⬭

D Not rinsing the conical flask between each titration. ⬭

(Total 1 mark)

Q11.

A student completes a titration to determine the concentration of ethanoic acid in vinegar.

25.0 cm^3 of vinegar are transferred to a conical flask using a pipette.
A few drops of phenolphthalein are added to the conical flask.
Sodium hydroxide solution is added from a burette to the conical flask.
The titration is repeated until concordant results are obtained.

Which suggestion decreases the percentage uncertainty in the mean titre?

A Use a more dilute solution of sodium hydroxide in the burette. ⬭

B Use a more dilute solution of vinegar. ⬭

C Rinse the inside of the conical flask with distilled water during each titration. ⬭

D Rinse the tip of the burette with distilled water near the end point in each titration. ⬭

(Total 1 mark)

Q12.

Which reaction has the highest percentage atom economy for the production of hydrogen?

A $LiH + H_2O \rightarrow LiOH + H_2$ ○

B $CO + H_2O \rightarrow CO_2 + H_2$ ○

C $2\ Al + 3\ H_2O \rightarrow Al_2O_3 + 3\ H_2$ ○

D $CH_4 + H_2O \rightarrow CO + 3\ H_2$ ○

(Total 1 mark)

Q13.

What is the minimum volume, in dm^3, of air needed for the complete combustion of 1 dm^3 of methane?

Assume that air contains 20% of oxygen by volume.

Assume that all volumes are measured at the same temperature and pressure.

A 1 ○

B 2 ○

C 5 ○

D 10 ○

(Total 1 mark)

Q14.

What is the atom economy for the formation of ethylamine in this reaction?

$$CH_3CH_2Br + 2\ NH_3 \rightarrow CH_3CH_2NH_2 + NH_4Br$$

A 31.5% ○

B 35.7% ○

C 36.1% ○

D 41.3% ○

(Total 1 mark)

Q15.

What is the relative molecular mass (M_r) of benzene-1,4-dicarboxylic acid?

A 164.0 ○

B 166.0 ○

C 168.0 ○

D 170.0 ○

(Total 1 mark)

Q16.

5.0 g of an oxide contains 4.0 g of molybdenum.

What is the empirical formula of this oxide?

A MoO_2 ○

B MoO_5 ○

C Mo_2O_3 ○

D Mo_3O_2 ○

(Total 1 mark)

Q17.

Which compound has the same empirical formula and molecular formula?

A butane ○

B but-1-ene ○

C propane ○

D propene ○

(Total 1 mark)