

Name of the Student: _____

Max. Marks : 17 Marks

Time : 17 Minutes

Q1.

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

The yields for the individual steps are:

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

A 15%

☐

B 30%

☐

C 40%

☐

D 80%

☐

(Total 1 mark)

Q2.

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

A 164.0

☐

B 166.0

☐

C 168.0

☐

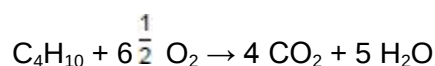
D 170.0

☐

(Total 1 mark)

Q3.

The equation for the complete combustion of butane is



What is the mole fraction of butane in a mixture of butane and oxygen with the minimum amount of oxygen needed for complete combustion?

A 0.133

☐

B 0.153

☐

C 0.167

☐

D 0.200

☐

(Total 1 mark)

Q4.

Complete combustion of 0.0100 mol of an organic acid produced 0.0200 mol of carbon dioxide.

The same amount of the acid required 20 cm³ of 1.00 mol dm⁻³ NaOH (aq) for neutralisation.

Which could be the formula of the acid?

A HCOOH

☐

B CH₃COOH

☐

C HOCCOOH

☐

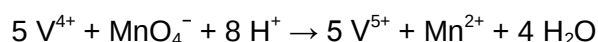
D HOOCCH₂COOH

☐

(Total 1 mark)

Q5.

The reaction between vanadium(IV) ions and manganate(VII) ions in acidic solution can be represented by the equation



What volume, in dm³, of 0.020 mol dm⁻³ KMnO₄ is needed to oxidise 0.10 mol of vanadium(IV) ions completely?

A 0.10

☐

B 0.50

☐

C 1.0

☐

D 5.0

☐

(Total 1 mark)

Q6.

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}

☐

Q7.

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)

Q8.

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)

Q9.

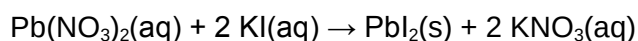
Which amount of sodium hydroxide would react exactly with 7.5 g of a diprotic acid, H_2A ($M_r = 150$)?

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

(Total 1 mark)

Q10.

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.

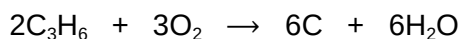
Which amount, in mol, of lead(II) iodide is formed?

- A 1.25×10^{-3} ☐
- B 2.50×10^{-3} ☐
- C 1.25×10^{-2} ☐
- D 2.50×10^{-2} ☐

(Total 1 mark)

Q11.

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)

Q12.

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

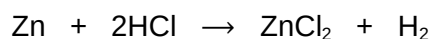
Which pair of solutions would give the greatest mass of solid?

- A $\text{Ba}(\text{OH})_2$ and MgCl_2 ☐
- B $\text{Ba}(\text{OH})_2$ and MgSO_4 ☐
- C $\text{Ba}(\text{OH})_2$ and NaCl ☐
- D $\text{Ba}(\text{OH})_2$ and Na_2SO_4 ☐

(Total 1 mark)

Q13.

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)

Q14.

A solution of lead(II) chloride ($M_r = 278.2$) contains 1.08 g of PbCl_2 in 100 cm^3 of solution. In this solution, the lead(II) chloride is fully dissociated into ions.

What is the concentration of chloride ions in this solution?

A $3.88 \times 10^{-3} \text{ mol dm}^{-3}$ ☐

B $7.76 \times 10^{-3} \text{ mol dm}^{-3}$ ☐

C $3.88 \times 10^{-2} \text{ mol dm}^{-3}$ ☐

D $7.76 \times 10^{-2} \text{ mol dm}^{-3}$ ☐

(Total 1 mark)

Q15.

A 385 cm^3 sample of carbon dioxide at 100 kPa and 25°C was mixed with $2.89 \times 10^{-2} \text{ mol}$ of argon. The gas constant, $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

What is the mole fraction of carbon dioxide in the mixture?

A 0.35 ☐

B 0.46 ☐

C 0.54 ☐

D 0.65 ☐

(Total 1 mark)

Q16.

A student is provided with 5.00 cm^3 of 1.00 mol dm^{-3} ammonia solution. The student was asked to prepare an ammonia solution with a concentration of $0.050 \text{ mol dm}^{-3}$

What volume of water should the student add?

A 45.0 cm^3 ☐

B 95.0 cm^3 ☐

C 100 cm^3 ☐

D 995 cm^3 ☐

(Total 1 mark)

Q17.

130 cm³ of oxygen and 40 cm³ of nitrogen, each at 298 K and 100 kPa, were placed into an evacuated flask of volume 0.50 dm³.

What is the pressure of the gas mixture in the flask at 298 K?

A 294 kPa ☐

B 68.0 kPa ☐

C 34.0 kPa ☐

D 13.7 kPa ☐

(Total 1 mark)