AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.8.1.2

Formulations

Past-paper questions

Tier	**Higher**
Question groups	**4**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

5.8.1.2 Formulations

Question 01

June 2018 | 8464/C/2H | Original Q4

0 4 Fertilisers are formulations.

0 4 . 1 What is a formulation?

[1 mark]

0 4 . 2 A bag of fertiliser contains 14.52 kg of ammonium nitrate (NH_4NO_3).

Relative formula mass (M_r): NH_4NO_3 = 80

Calculate the number of moles of ammonium nitrate in the bag of fertiliser.

Give your answer in standard form to 2 significant figures.

[4 marks]

Moles of ammonium nitrate = _____ mol

Question 4 continues on the next page

5.8.1.2 Formulations

Question 01 · continued

0 4 . 3 The fertiliser also contains potassium chloride.

Explain why potassium chloride has a high melting point.

[4 marks]

9

5.8.1.2 Formulations

Question 02

June 2019 | 8464/C/2H | Original Q3

0 3 This question is about chromatography of food colouring.

0 3 . 1 Food colouring is a formulation.

What is a formulation?

[1 mark]

0 3 . 2 Explain how paper chromatography separates the dyes in a food colouring.

Do **not** give details of how to do the experiment.

[2 marks]

0 3 . 3 Explain how the student could tell from the chromatogram that the food colouring contained more than one dye.

[2 marks]

Question 3 continues on the next page

5.8.1.2 Formulations

Question 02 · continued

0 3 . 4 Explain how the student could use chromatography to identify unknown dyes in the food colouring.

[3 marks]

8

5.8.1.2 Formulations

Question 03

June 2023 | 8464/C/2H | Original Q3

0 3 Crude oil is a mixture of many different compounds.

0 3 . 1 Give **two** reasons why crude oil is **not** a formulation.

[2 marks]

1 _____

_____

2 _____

_____

0 3 . 2 Describe how crude oil is separated into fractions.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

0 3 . 3 The fractions from crude oil contain alkanes.

Explain why alkanes are cracked.

[2 marks]

_____

_____

_____

_____

5.8.1.2 Formulations

Question 03 · continued

Cracking produces a mixture of products.

0 3 . 4 An equation for cracking decane ($C_{10}H_{22}$) is:

$$C_{10}H_{22}(l) \rightarrow C_{10}H_{20}(l) + H_2(g)$$

Describe a test to identify the gas produced in the reaction.

[2 marks]

Test _____

_____

Result _____

_____

0 3 . 5 Alkenes are produced in cracking.

The general formula for the homologous series of alkenes is C_nH_{2n}

Which formula represents an alkene?

[1 mark]

Tick (✓) **one** box.

C_2H_2 ☐

C_2H_4 ☐

C_2H_6 ☐

C_3H_8 ☐

11

5.8.1.2 Formulations

Question 04

0 4 This question is about methanol.

0 4 . 1 Methanol is used in screenwash.

Screenwash is used to keep car windscreens clean.

Screenwash is a formulation.

Define the term 'formulation'.

[1 mark]

Question 4 continues on the next page

5.8.1.2 Formulations

Carbon monoxide and hydrogen are used to produce methanol.

The conditions used in the production of methanol are:

- high temperature
- high pressure
- a catalyst.

The equation for the reaction is:

$$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$$

91 kJ/mol of energy is transferred during the exothermic forward reaction.

0 4 . 2 How much energy is transferred when methanol is decomposed into carbon monoxide and hydrogen?

[1 mark]

Tick (✓) **one** box.

< 91 kJ/mol ☐

91 kJ/mol ☐

> 91 kJ/mol ☐

0 4 . 3 A scientist developed a principle to predict the effect of changing conditions on a system at equilibrium.

What was the name of the scientist?

[1 mark]

_____

5.8.1.2 Formulations

Question 04 · continued

0 4 . 4 What is the effect of increasing the temperature on the proportion of methanol in the equilibrium mixture?

[1 mark]

Tick (✓) **one** box.

The proportion of methanol decreases. ☐

The proportion of methanol stays the same. ☐

The proportion of methanol increases. ☐

0 4 . 5 What is the effect of using a catalyst on the proportion of methanol in the equilibrium mixture?

[1 mark]

Tick (✓) **one** box.

The proportion of methanol decreases. ☐

The proportion of methanol stays the same. ☐

The proportion of methanol increases. ☐

0 4 . 6 Explain the effect of increasing the pressure on the proportion of methanol in the equilibrium mixture.

[3 marks]

5.8.1.2 Formulations

Question 04 · continued

0 4 . 7 Explain the effect of using a catalyst on the **rate** of production of methanol.

[3 marks]

0 4 . 8 The catalyst allows the reaction to take place at a lower temperature.

Explain **one** advantage of using a lower temperature in the production of methanol.

Do **not** refer to the position of equilibrium in your answer.

[2 marks]

0 4 . 9 Methanol (CH_3OH) can also be produced by reacting carbon dioxide with hydrogen.

Water is the other product of the reaction.

Write a balanced equation for the reaction.

[2 marks]

_____ + _____ → _____ + _____

15