Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Chemical Equilibria, Le Chatelier's Principle And Kc

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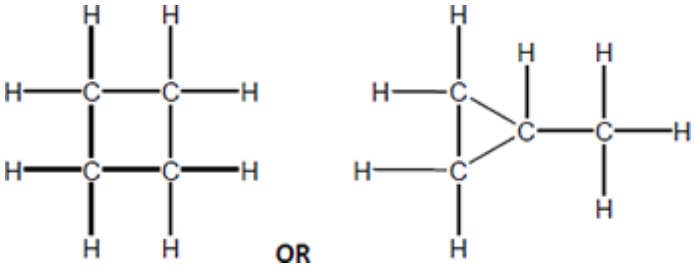
Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

(a) Alkenes

1



Correctly drawn molecule of cyclobutane or methyl cyclopropane, need not be displayed formula

1

(b) C_6H_{14} (or correct alkane structure with 6 carbons)

Allow hexane or any other correctly named alkane with 6 carbons

1

(c) Poly(but-2-ene)

1

(d) High pressure

Allow pressure □ MPa

Mention of catalyst loses the mark

1

(e) This question is marked using levels of response. Refer to the Mark Scheme Instructions for Examiners for guidance on how to mark this question.

Level 3

All stages are covered and the explanation of each stage is generally correct and virtually complete.

Answer communicates the whole process coherently and shows a logical progression from stage 1 and stage 2 (in either order) to stage 3.

5–6 marks

Level 2

All stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies OR two stages are covered and the explanations are generally correct and virtually complete.

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Answer is mainly coherent and shows progression. Some steps in each stage may be out of order and incomplete.

3–4 marks

Level 1

Two stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies, OR only one stage is covered but the explanation is generally correct and virtually complete.

Answer includes isolated statements but these are not presented in a logical order or show confused reasoning.

1–2 marks

Level 0

Insufficient correct chemistry to gain a mark.

0 marks

Indicative chemistry content

Stage 1*: consider effect of higher temperature on yield*

(Or vice versa for lower temperature)

- *Le Chatelier's principle predicts that equilibrium shifts to oppose any increase in temperature*
- *Exothermic reaction, so equilibrium shifts in endothermic direction / to the left*
- *So a Higher T will reduce yield*

Stage 2*: consider effect of higher temperature on rate*

(Or vice versa for lower temperature)

- *At higher temperature, more high energy molecules*
- *more collisions have E>Ea*
- *So rate of reaction increases / time to reach equilibrium decreases*

Stage 3*: conclusion*

Industrial conditions chosen to achieve (cost-effective) balance of suitable yield at reasonable rate

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Q2.

(a) Stage 1: Moles of acid at equilibrium

Moles of sodium hydroxide in each titration
= $(3.20 \times 2.00 \times 10^{-1}) / 1000 = 6.40 \times 10^{-4}$

Extended response

1

Sample = 10 cm^3 so moles of acid in 250 cm^3 of equilibrium mixture
= $25 \times 6.40 \times 10^{-4} = 1.60 \times 10^{-2}$

M2 can only be scored if = answer to M1 × 25

1

Stage 2: Moles of ester and water formed

Moles of acid reacted = $8.00 \times 10^{-2} - 1.60 \times 10^{-2} = 6.40 \times 10^{-2}$

= moles ester and water formed

M3 is 8.00×10^{-2} – M2

1

Stage 3: Moles of ethanol at equilibrium

Moles of ethanol remaining = $1.20 \times 10^{-1} - 6.40 \times 10^{-2} = 5.60 \times 10^{-2}$

M4 is 1.20×10^{-1} – M3

1

Stage 4: Calculation of equilibrium constant

$K_c = [CH_3COOCH_2CH_3]\,[H_2O] / [CH_3COOH]\,[CH_3CH_2OH]$

1

$= (6.40 \times 10^{-2})^2 / (1.60 \times 10^{-2})(5.60 \times 10^{-2})$

$= 4.5714 = 4.57$

M6 is $M3^2$ / M2 × M4

Answer must be given to 3 significant figures

1

(b)

	Rough	**1**	**2**	**3**
Final burette reading / cm^3	4.60	8.65	12.85	16.80
Initial burette reading / cm^3	0.10	4.65	8.65	12.85
Titre / cm^3	4.50	4.00	4.20	3.95

1

(c) Mean = 4.00 + 3.95 / 2 = 3.98 (cm^3)

Allow 3.975 (cm^3)

1

Titres 1 and 3 are concordant

Allow titre 2 is not concordant

1

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(d) Thymol blue

1

(e) Percentage uncertainty: 0.15 / 3.98 × 100 = 3.77%

Allow consequential marking on mean titre from 2.3

1

(f) Use a lower concentration of NaOH

1

So that a larger titre is required (reduces percentage uncertainty in titre)

1

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