Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Physical 1_Thermodynamics

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Name of the Student:_____
Max. Marks : 28 Marks **Time : 28 Minutes**

Mark Schemes

Q1.

(a) *M1* $K_p = ({}_PY)^3.({}_PZ)^2/({}_PW)^2.({}_PX)$ *NB [ ] wrong* **1**

M2 temperature **1**

M3 increase **1**

M4 particles have more energy or greater velocity/speed **1**

M5 more collisions with $E > E_a$ or more successful collisions **1**

M6 Reaction exothermic or converse **1**

M7 Equilibrium moves in the left **1**

Marks for other answers

Increase in pressure or concentration	*allow M1, M5, M6*	*Max 3*
Addition of a catalyst;	*allow M1, M5, M6*	*Max 3*
Decrease in temperature;	*allow M1, M2, M6*	*Max 3*
Two or more changes made;	*allow M1, M6*	*Max 2*

(b) (i) Advantage; reaction goes to completion, not reversible or faster **1**

Disadvantage; reaction vigorous/dangerous
(exothermic must be qualified)

or HCl(g) evolved/toxic
or CH_3COCl expensive

NB Allow converse answers
Do not allow reactions with other reagents e.g. water or ease of separation **1**

(ii) $\Delta S = \Sigma S$ products $- \Sigma S$ reactants **1**

$\Delta S = (259 + 187) - (201 + 161)$ **1**

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$\Delta S = 84$ (JK^{-1} mol^{-1}) *(Ignore units)*

*Allow – 84 to score **(1)** mark*

1

$\Delta G = \Delta H - T\Delta S$

1

$= -21.6 - 298 \times 84/1000$

$= -46.6$ kJ mol^{-1} or $-46\,600$ J mol^{-1}

1

*Allow **(2)** for – 46.6 without units*

(Mark ΔG consequentially to incorrect ⊿S)

(e.g. ⊿S = –84 gives ⊿G = +3.4 kJ mol^{-1})

1

[15]

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Q2.

(a) *Standard enthalpy change, $\Delta H^{\ominus}$*: $\Delta H_R = \Sigma \Delta H_{f\text{products}} - \Sigma \Delta H_{f\text{reactants}}$ **(1)**
or cycle

$\Delta H_R = (0 + [2 \times -242]) - (4 \times -92)$ **(1)**
$= -484 + 368$
$= -116$ (kJ mol^{-1})
Allow max 1 for +116

Standard entropy change, $\Delta S^{\ominus}$: $\Delta S = \Sigma \Delta H_{f\text{ products}} - \Sigma \Delta H_{f\text{ reactants}}$

$\Delta S = ([2 \times 223] + [2 \times 189]) - (205 + [4 \times 187])$ **(1)**

$= 824 - 953$

$= -129$ (J K^{-1} mol^{-1})
allow max one for +129

6

(b) (i) *Effect*: Equilibrium displaced to right / to products **(1)**
Explanation: Reaction is endothermic **(1)**
Constraint reduced **(1)**
mark separately

(ii) Feasible when $\Delta G \leq 0$ **(1)**

$\Delta G = \Delta H - T\Delta S$ **(1)**

$T = \Delta H / \Delta S = 208 \times 1000$ **(1)** / 253

$= 822$ K **(1)**

7

[13]

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