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

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Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Mark Schemes

Q1.

(a) Because it is a gas compared with solid carbon
Mark independently
1

Nitrogen is more disordered/random/chaotic/free to move
1

(b) 0 K/–273 C/absolute zero
1

(c) $\Delta G = \Delta H - T\Delta S$
Allow $\Delta H = \Delta G - T\Delta S$
$T\Delta S = \Delta H - \Delta G$
$\Delta S = (\Delta H - \Delta G)/T$
Ignore ⊖ in $\Delta G^{\ominus}$
1

(d) ΔG is less than or equal to zero ($\Delta G \leq 0$)
Allow ΔG is less than zero ($\Delta G < 0$)
Allow ΔG is equal to zero ($\Delta G = 0$)
Allow ΔG is negative
1

(e) When $\Delta G = 0$ $T = \Delta H/\Delta S$
1

$\Delta H = +90.4$
Allow $\Delta H = +90$
1

$\Delta S = \Sigma S(\text{products}) - \Sigma S(\text{reactants})$
1

$\Delta S = 211.1 - 205.3/2 - 192.2/2 = 12.35$
1

$T = (90.4 \times 1000)/12.35 = 7320$ K/7319.8 K
Allow 7230 to 7350 K (Note 7.32 K scores 4 marks)
Units of temperature essential to score the mark
1

(f) Activation energy is high
Allow chemical explanation of activation energy

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Allow needs route with lower activation energy
Allow catalyst lowers activation energy

1

(g) $\Delta H = 1.9$ (kJ mol^{-1})

1

$\Delta S = 2.4 - 5.7 = -3.3$ (J K^{-1} mol^{-1})

for M1 and M2 allow no units, penalise wrong units

1

ΔG is always positive

This mark can only be scored if ΔH is +ve and ΔS is –ve

1

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Q2.

(a) Enthalpy change for the formation of 1 mol of gaseous atoms

allow heat energy change for enthalpy change

1

From the element (in its standard state)

ignore reference to conditions

1

Enthalpy change to separate 1 mol of an ionic lattice/solid/compound

enthalpy change not required but penalise energy

1

Into (its component) gaseous ions

mark all points independently

1

(b) $\Delta H_L = {}^{-}\Delta H_f + \Delta H_a$ + I.E. + 1/2E(Cl-Cl) + EA

Or correct Born-Haber cycle drawn out

1

= +411 + 109 + 494 + 121 – 364

1

= +771 (kJ mol^{-1})

–771 scores 2/3

+892 scores 1/3

–51 scores 1/3

–892 scores zero

+51 scores zero *ignore units*

1

(c) (i) Ions are perfect spheres (or point charges)

1

Only electrostatic attraction/no covalent interaction

mention of molecules/intermolecular forces/covalent bonds CE = 0

allow ionic bonding only

If mention of atoms CE = 0 for M2

1

(ii) Ionic

Allow no covalent character/bonding

1

(iii) Ionic with additional covalent bonding

Or has covalent character/partially covalent

Allow mention of polarisation of ions or description of polarisation

1

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