

Name of the Student: _____

Max. Marks : 15 Marks

Time : 15 Minutes

Mark Schemes

Q1.

- (a) (i) (At 0 K) particles are stationary / not moving / not vibrating
 Allow have zero energy.
 Ignore atoms / ions. 1
- No disorder / perfect order / maximum order
 Mark independently. 1
- (ii) As T increases, particles start to move / vibrate
 Ignore atoms / ions.
 Allow have more energy.
 If change in state, $CE = 0$ 1
- Disorder / randomness increases / order decreases 1
- (iii) Mark on temperature axis vertically below second 'step'
 Must be marked as a line, an 'x', T_b or 'boiling point' on the temperature axis. 1
- (iv) L_2 corresponds to boiling / evaporating / condensing / $l \rightarrow g$ / $g \rightarrow l$
 And L_1 corresponds to melting / freezing / $s \rightarrow l$ / $l \rightarrow s$
 There must be a clear link between L_1 , L_2 and the change in state. 1
- Bigger change in disorder for L_2 / boiling compared with L_1 / melting
 M2 answer must be in terms of changes in state and not absolute states eg must refer to change from liquid to gas not just gas.
 Ignore reference to atoms even if incorrect. 1
- (b) (i) $\Delta G = \Delta H - T\Delta S$ 1
- $\Delta H = c$ and $(-)\Delta S = m$ / ΔH and ΔS are constants (approx)
 Allow ΔH is the intercept, and $(-)\Delta S$ is the slope / gradient.
 Can only score M2 if M1 is correct. 1

(ii) Because the entropy change / ΔS is positive / $T\Delta S$ gets bigger
Allow $-T\Delta S$ gets more negative

1

(iii) Not feasible / unfeasible / not spontaneous

1

(c) (i) $+ 44.5 \text{ J K}^{-1} \text{ mol}^{-1}$

*Allow answer without units but if units given they must be correct
(including mol^{-1})*

1

(c) (ii) At 5440 $\Delta H = T\Delta S$

$$= 5440 \times 44.5 = 242\,080$$

1

(**OR** using given value = $5440 \times 98 = 533\,120$)

Mark is for answer to (c)(i) $\times 5440$

1

$$\Delta H = 242 \text{ kJ mol}^{-1}$$

(**OR** using given value $\Delta H = 533 \text{ kJ mol}^{-1}$)

*Mark is for correct answer to M2 with correct units (J mol^{-1} or kJ mol^{-1})
linked to answer.*

*If answer consequentially correct based on (c)(i) except for incorrect
sign (eg -242), max 1 / 3 provided units are correct.*

1

[15]