Exam Papers Practice

15.2 Entropy & Spontaneity

Question Paper

Course	DP IB Chemistry
Section	15. Energetics/Thermochemistry (HL only)
Topic	15.2 Entropy & Spontaneity
Difficulty	Medium

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To be used by all students preparing for DP IB Chemistry HL
Students of other boards may also find this useful

Question 1

Which of the following conditions will mean a reaction is never feasible?

	ΔH	ΔS	Temperature
A	Negative	Positive	High
B	Positive	Negative	High
C	Negative	Negative	Low
D	Positive	Positive	High

[1 mark]

Question 2

Ethene is produced according to the following gas-phase synthesis:

$$2C(s) + 2H_2(g) \rightarrow C_2H_4(g)$$

Thermodynamic data for the components of this equilibrium are

Change	Value
$\Delta H^{\ominus}_r$ / kJ mol^{-1}	p
$\Delta S^{\ominus}$ / J K^{-1} mol^{-1}	q

The free energy change for this reaction at 298 K is:

A. $\Delta G^{\ominus} = p - 298 \times q$

B. $\Delta G^{\ominus} = \dfrac{p}{298 \times \frac{q}{1000}}$

C. $\Delta G^{\ominus} = p - 298 \times \dfrac{q}{1000}$

D. $\Delta G^{\ominus} = \dfrac{p \times 298}{q}$

[1 mark]

Question 3

Which statements are correct for the following reaction?

$$CO(NH_2)_2(aq) + H_2O(l) \rightarrow CO_2(g) + 2NH_3(g)$$

$\Delta H^{\Theta}_r = +119\ kJ\ mol^{-1}$

$\Delta S^{\Theta} = +354.8\ J\ K^{-1}\ mol^{-1}$

I. The reaction will be feasible at high temperatures
II. The reaction will never be feasible
III. The reaction becomes more disordered

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

[1 mark]

Question 4

Which of the following equations is used when calculating the temperature, in Kelvin, at which a reaction becomes feasible if $\Delta H^{\Theta} = x$ and $\Delta S^{\Theta} = y$.

A. $T = \frac{x}{y}$

B. $T = xy$

C. $T = x + y$

D. $T = \frac{y}{x}$

[1 mark]

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Question 5

The $\Delta G^{\ominus}_f$ values for the following substances are shown.

Substance	$\Delta G^{\ominus}_f$ (kJ mol^{-1})
NH_3 (g)	-16.4
O_2 (g)	0
H_2O (g)	-228.6
NO (g)	87.6

Which of the following is the correct calculation to determine $\Delta G^{\ominus}$?

$$4NH_3\,(g) + 5O_2\,(g) \rightleftharpoons 6H_2O\,(g) + 4NO\,(g)$$

A. (-228.6 + 87.6) + (-16.4)

B. (-16.4 x 4) - [(-228.6 x 6) + (87.6 x 4)]

C. [-228.6 + (87.6 x 4)] - (-16.4 x 4)

D. [(-228.6 x 6) + (87.6 x 4)] - (-16.4 x 4)

[1 mark]

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