17.1 The Equilibrium Law

Question Paper

Course	DP IB Chemistry
Section	17. Equilibrium (HL only)
Topic	17.1 The Equilibrium Law
Difficulty	Hard

Time allowed: 10

Score: /5

Percentage: /100

Question 1

The Haber process is a key step in the manufacture of fertilisers:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \quad \Delta H = \text{-ve}$$

Which is correct about the effect of increasing temperature for this reaction?

	Effect on equilibrium position	Effect on K_c
A.	Shifts left	No change
B.	Shifts right	No change
C.	Shifts right	Increase
D.	Shifts left	Decrease

[1 mark]

Question 2

Which equation represents a reaction where the number of moles alone can not be used to calculate the value of K_c?

A. $CH_3CH_2OH(aq) + CH_3COOH(aq) \rightleftharpoons CH_3CH_2OCOCH_3(aq) + H_2O(l)$

B. $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

C. $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

D. $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

[1 mark]

Question 3

When 0.20 mol NO, 0.08 mol H_2 and 0.10 mol of H_2O are placed in a 1.0 dm^3 flask, the following equilibrium is established:

$$2NO(g) + 2H_2(g) \rightleftharpoons N_2(g) + 2H_2O(g)$$

At equilibrium, the concentration of $H_2(g)$ was found to be 0.02 mol dm^{-3}.

What is the correct calculation to work out K_c?

A. $K_c = \frac{[0.14]^2[0.02]^2}{[0.03][0.16]^2}$

B. $K_c = \frac{[0.03][0.16]^2}{[0.14]^2[0.02]^2}$

C. $K_c = \frac{[0.03][0.06]^2}{[0.06]^2[0.06]^2}$

D. $K_c = \frac{[0.06][0.16]^2}{[0.14]^2[0.04]^2}$

[1 mark]

Question 4

Nitrogen dioxide can form a dimer that can also break back down again as part of a reversible reaction:

$$N_2O_4(g) \rightleftharpoons NO_2(g) \quad \Delta H = +ve$$

The reaction reaches an equilibrium at temperature T, where $K_c = 1$

What is true for a higher temperature, T_2?

	K_c value	ΔG^θ value
A.	Increases	Increases
B.	Decreases	Increases
C.	Decreases	Decreases
D.	Increases	Decreases

[1 mark]

Question 5

Which would be the correct way to plot a graph and then calculate ΔG^θ from experimental data of K_c and temperature values?

$$\Delta G^\theta = -RT \ln K$$

	y-axis	x-axis	ΔG^θ =
A.	$1/T$	$\ln K$	-R x gradient
B.	$\ln K$	$1/T$	-R x gradient
C.	$\ln K$	$1/T$	R / gradient
D.	$1/T$	$\ln K$	R / gradient

[1 mark]