

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:



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

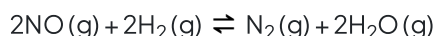
Which equation represents a reaction where the number of moles alone can not be used to calculate the value of K_c ?

- A. $\text{CH}_3\text{CH}_2\text{OH}(\text{aq}) + \text{CH}_3\text{COOH}(\text{aq}) \rightleftharpoons \text{CH}_3\text{CH}_2\text{OCOCH}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- B. $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$
- C. $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$
- D. $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$

[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:



At equilibrium, the concentration of $\text{H}_2(\text{g})$ was found to be 0.02 mol dm^{-3} .

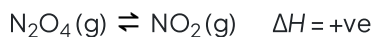
What is the correct calculation to work out K_c ?

- 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:



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	$\Delta G^\theta =$
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]