

7.1 Equilibrium

Question Paper

Course	DPIB Chemistry
Section	7. Equilibrium
Topic	7.1 Equilibrium
Difficulty	Hard

Time allowed: 20
Score: /10
Percentage: /100

Question 1

Study the following equilibrium reaction and determine which of the statements must be true.

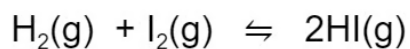


- A $[X] \gg [Y]$
- B $[X] > [Y]$
- C $[X] = [Y]$
- D $[X] < [Y]$

[1 mark]

Question 2

Hydrogen reacts with iodine according to the following equation



The value of K_c for this reaction has been measured at different temperatures

$$K_c = 60 \text{ at } 355 \text{ }^\circ\text{C}$$

$$K_c = 47 \text{ at } 450 \text{ }^\circ\text{C}$$

From the information given which of the following must be true?

- A** The reaction is exothermic
- B** The reaction is endothermic
- C** The reaction barely proceeds at 355 °C
- D** The reaction almost goes to completion at 450 °C

[1 mark]

Question 3

The following K_c values were obtained for a reaction carried out at different temperatures, T_1 to T_4 .

Temperature	K_c value
T_1	1×10^{-2}
T_2	1×10^1
T_3	1
T_4	1×10^2

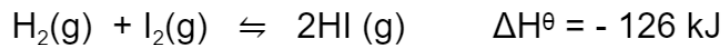
Which of the following gives the correct amount of products in the mixtures from least to most?

- A** $T_1 < T_2 < T_3 < T_4$
- B** $T_4 < T_3 < T_2 < T_1$
- C** $T_4 < T_2 < T_3 < T_1$
- D** $T_1 < T_3 < T_2 < T_4$

[1 mark]

Question 4

Which of the following conditions and reasons will increase the amount of hydrogen iodide produced?

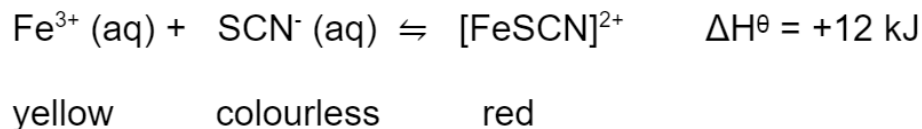


	Condition	Reason	Condition	Reason
A	increase T	exothermic reaction	increase P	two gaseous reactants but only one gaseous product
B	increase T	endothermic reaction	no change in P	equal numbers of moles of gases
C	decrease T	exothermic reaction	decrease P	two moles of gaseous product but only one mole of each gaseous reactant
D	decrease T	exothermic reaction	no change in P	equal numbers of moles of gases

[1 mark]

Question 5

The blood-red complex iron(III)thiocyanate, $[\text{FeSCN}]^{2+}$ is formed when iron(III) ions react with thiocyanate ions in the following equilibrium reaction:



Which of the following changes would make the solution go darker?

- I. raising the temperature of the solution
- II. adding iron(III)chloride solution
- III. adding a catalyst

- A** I and II only
- B** I and III only
- C** II and III only
- D** I, II and III

[1 mark]

Question 6

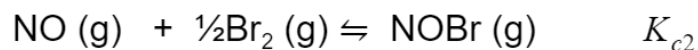
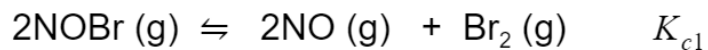
Which of the following features is not a characteristic of a state of equilibrium?

- A Equilibrium is dynamic
- B Equilibrium is achieved in a closed system
- C Concentrations of reactants and products are equal
- D Equilibrium can be reached from either direction

[1 mark]

Question 7

What is the relationship between K_{c1} and K_{c2} in the following reactions?

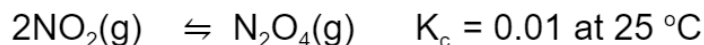


- A $2K_{c2} = K_{c1}$
- B $(K_{c2})^2 = K_{c1}$
- C $K_{c2} = \frac{1}{\sqrt{K_{c1}}}$
- D $K_{c2} = \frac{1}{2K_{c1}}$

[1 mark]

Question 8

Nitrogen dioxide can react with itself to produce a dimer molecule called dinitrogen tetroxide in the following equilibrium reaction



In an experiment, 100 cm^3 of nitrogen dioxide is placed in a gas syringe and the barrel is pushed in, meaning the volume is reduced to 50 cm^3 at constant temperature.

Which of the following are true?

- I. The value of K_c increases
- II. More N_2O_4 is formed
- III. The ratio of $\frac{[\text{NO}_2]}{[\text{N}_2\text{O}_4]}$ decreases

- A** I and II only
- B** I and III only
- C** II and III only
- D** I, II and III

[1 mark]

Question 9

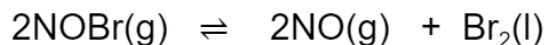
One of the characteristics of a state of equilibrium, is that equilibria are said to be *dynamic*. What is the meaning of *dynamic* in this context?

- A The position of equilibrium is constantly changing
- B The rates of forward and backward reactions change
- C The reactants and products are continually reacting
- D The concentrations of the reactants and products continue to change

[1 mark]

Question 10

The reaction shown below has a value of $K_c = 1.0 \times 10^{-4}$ at 25 °C



Which of the following relationships is correct about this equilibrium at 25 °C?

- A $[\text{NO}] \gg [\text{NOBr}]$
- B $[\text{NOBr}] \gg [\text{Br}_2]$
- C $2 \times [\text{NOBr}] = [\text{Br}_2]$
- D $[\text{NO}] = [\text{NOBr}]$

[1 mark]