How Far (MCQ)

1. The reversible reaction of nitrogen and hydrogen to form ammonia is shown below.

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$

In the equilibrium mixture, the partial pressure of N_2 is 18.75 MPa and the partial pressure of H_2 is 2.50 MPa.
The total pressure is 25 MPa.

What is the value of K_p, in MPa^{-2}?

A 1.2×10^{-4}
B 0.048
C 0.075
D 21

Your answer ☐ **[1]**

2. Which statement(s) is/are correct when a catalyst is added to a system in dynamic equilibrium?

1 The rates of the forward and reverse reactions increase by the same amount.
2 The concentrations of the reactants and products do not change.
3 The value of K_c increases

A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer ☐ **[1]**

3. The reversible reaction of sulfur dioxide and oxygen to form sulfur trioxide is shown below.

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

An equilibrium mixture contains 2.4 mol SO_2, 1.2 mol O_2 and 0.4 mol SO_3.
The total pressure is 250 atm.

What is the partial pressure of SO_3?

A 15 atm
B 25 atm
C 100 atm
D 200 atm

Your answer ☐ **[1]**

4. A mixture of N_2 and O_2 gases has a total pressure of 1.42 atm.
The mole fraction of N_2 is 0.700.

What is the partial pressure, in atm, of O_2 in the mixture?

A 0.211
B 0.426
C 0.493
D 0.994

Your answer ☐ **[1]**

5. Ammonia, NH_3, is formed in the reversible reaction below.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

A mixture at equilibrium contains 0.320 mol N_2, 0.960 mol H_2 and 0.120 mol NH_3.

What is the mole fraction of H_2 in the equilibrium mixture?

A 0.279
B 0.686
C 0.837
D 2.06

Your answer ☐

[1]

6. The equilibrium system below is set up.

$$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g) \qquad \Delta H = +14 \text{ kJ mol}^{-1}$$

The equilibrium system is compressed at constant temperature.

What is the effect on the value of K_c and the amount, in moles, of CH_3OH?

	K_c	Amount in moles of CH_3OH
A	increases	increases
B	decreases	decreases
C	no change	no change
D	no change	increases

Your answer ☐

[1]

7. Two students set up the equilibrium system below.

$$CH_3COOC_2H_5(l) + H_2O(l) \rightleftharpoons C_2H_5OH(l) + CH_3COOH(l)$$

The students titrated samples of the equilibrium mixture with sodium hydroxide, NaOH(aq), to determine the concentration of CH_3COOH.

The students used their results to calculate a value for K_c.

The students' values for K_c were different.

Which of the reason(s) below could explain why the calculated values for K_c were different?

1: Each student carried out their experiment at a different temperature.

2: Each student used a different concentration of NaOH(aq) in their titration.

3: Each student titrated a different volume of the equilibrium mixture.

A. 1, 2 and 3
B. Only 1 and 2
C. Only 2 and 3
D. Only 1

Your answer ☐

[1]

8. $NO(g)$, $H_2(g)$, $N_2(g)$ and $H_2O(g)$ exist in equilibrium:

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

At room temperature and pressure, the equilibrium lies well to the right-hand side.

Which of the following could be the equilibrium constant for this equilibrium?

A. 1.54×10^{-3} mol dm^{-3}
B. 6.50×10^{2} mol dm^{-3}
C. 1.54×10^{-3} dm^3 mol^{-1}
D. 6.50×10^{2} dm^3 mol^{-1}

Your answer ☐

[1]

END OF QUESTION PAPER

Mark scheme – How Far (MCQ)

Question			Answer/Indicative content	Marks	Guidance
1			**B**	1 (AO 2.6)	
			Total	**1**	
2			**B**	1 (AO 1.1)	
			Total	**1**	
3			**B**	**1 (AO 1.3)**	**Examiner's Comments** This was a very successful multiple choice question for nearly all candidates.
			Total	**1**	
4			**B**	1	**ALLOW** 0.426 in the box
			Total	**1**	
5			**B**	1	
			Total	**1**	
6			D	1	
			Total	**1**	
7			D	1	
			Total	**1**	
8			D	1	
			Total	**1**	