

REScore MARK TOTAL ONLY/BOTH SIDES

- 1 T F BB TF
DD5 A B C ● E
- 2 A B C ● E DD
BB7 A ● C D E
- 3 A B C ● E DD
BB8 A ● C D E
- 4 A B ● D E CC
BB9 A ● C D E
- 5 A B C ● E DD
CC30 A B ● D E
- 6 A B C ● E DD
BB31 A ● C D E
- 7 A ● C D E BB
BB32 A ● C D E
- 8 A ● C D E BB
DD33 A B C ● E
- 9 A B C ● E DD
BB34 A ● C D E
- 10 A ● C D E BB
CC35 A B ● D E
- 11 A ● C D E BB
BB36 A ● C D E
- 12 ● B C D E AA
CC37 A B ● D E
- 13 A ● C D E BB
AA38 ● B C D E
- 14 A B ● D E CC
AA39 ● B C D E
- 15 A ● C D E BB
AA40 ● B C D E
- 16 ● B C D E AA
CC41 A B ● D E
- 17 ● B C D E AA
CC42 A ● D E
- 18 ● B C D E AA
DD43 A B C ● E
- 19 ● B C D E AA
DD44 A B C ● E
- 20 A ● C D E BB
BB45 A ● C D E
- 21 A B C ● E DD
CC46 ● B C D E
- 22 ● B C D E AA
DD47 A B C ● E
- 23 A ● C D E BB
CC48 A B ● D E
- 24 A ● C D E BB
AA49 ● B C D E
- 25 ● B C D E AA
CC50 A B ● D E

KEY ITEM COUNT

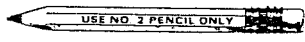
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3	3	
4	4	
●	5	
6	6	
7	7	
8	8	
9	9	



STUDENT ID (UPON REQUEST)

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9	9	9	9	9	9	9	9	9	9

MARKING INSTRUCTIONS



Use a No. 2 Pencil

A ● C D E

Fill circle completely

A B C D E

Erase cleanly

SCORE	50 100	# CORRECT
REScore	50 100	% CORRECT
ROSTER NUMBER	KEY	SCORE
		REScore

NAME Key

SUBJECT Equilibrium Review

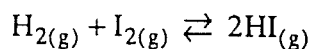
PERIOD _____ DATE _____

CHEMICAL EQUILIBRIUM REVIEW

1. State Le Chatelier's Principle. (2 marks)

An equilibrium system subjected to a stress
will re-establish equilibrium by partially alleviating
the stress.

2. 0.400 mol of H_2 and 0.200 mol of I_2 were placed in a 2.00 L flask and allowed to reach equilibrium according to the reaction:



At equilibrium the concentration of HI was 0.160 mol/L. Calculate the equilibrium constant value. (4 marks)

	H_2	I_2	$2HI$
I	.200	.100	0
C	-.080	-.080	+.160
E	.120	.020	.160

$$K_{eq} = \frac{[HI]^2}{[H_2][I_2]} = \frac{(.160)^2}{(.120)(.020)} = 11$$

3. Define the term 'closed system'. (1 mark)

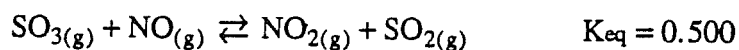
A confined space in which chemical reactions are occurring but no matter enters or leaves.

4. At equilibrium, the macroscopic properties of a system are constant. Give an example of a macroscopic property and explain why it is constant at equilibrium. (2 marks)

e.g. colour

The colour is constant because the coloured chemical(s) is being consumed & produced at the same rate.

5. Consider the following equilibrium:



Exactly 0.100 mol SO_3 and 0.100 mol NO were placed in a 1.00 L flask and allowed to react. Calculate the concentration of SO_2 at equilibrium. (4 marks)

	SO_3	NO	\rightleftharpoons	NO_2	SO_2
I	.100	.100		0	0
C	$-\infty$	$-\infty$		$+\infty$	$+\infty$
E	$.100 - \infty$	$.100 - \infty$		∞	∞

$$K_{\text{eq}} = \frac{[\text{NO}_2][\text{SO}_2]}{[\text{SO}_3][\text{NO}]} = \frac{\infty^2}{(.100 - \infty)^2} = .500$$

$$\frac{\infty}{.100 - \infty} = \sqrt{.500} = .707$$

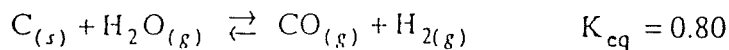
$$\infty = .7071(.100 - \infty)$$

$$\infty = .07071 - .7071\infty$$

$$1.7071\infty = .07071$$

$$\infty = \underline{\underline{[\text{SO}_2] = .0414 \text{ M}}}$$

6. Consider the following equilibrium system:



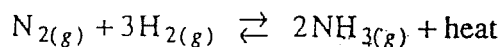
In an experiment, a student places 0.10 mol of C, 0.15 mol of H₂O, 0.25 mol of CO, and 0.20 mol of H₂ into a 1.0 L flask. The student predicts that the [CO] will decrease as equilibrium becomes established. (3 marks)

- a) Would you agree or ^{would you} disagree with the student? disagree
- b) Justify your answer, including appropriate calculations.

$$\text{Trial } K_{\text{eq}} = \frac{[\text{CO}][\text{H}_2]}{[\text{H}_2\text{O}]} = \frac{(0.25)(0.20)}{0.15} = 0.33 < 0.80$$

∴ reaction must proceed towards products (to the right) to achieve equilibrium

7. The production of ammonia by the Haber process involves the following equilibrium:



The table below indicates the percentage of ammonia in equilibrium mixtures at various temperatures.

Temperature °C	Percentage of Ammonia in Equilibrium
200	98
350	80
500	51

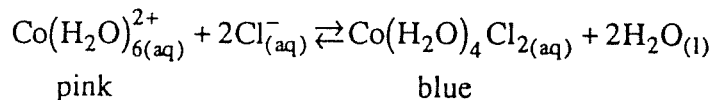
- a) Explain why the lower temperature results in a higher percentage of ammonia in the equilibrium mixture. (1 mark)

Lower temperatures shift the equilibrium to the right to replace some of the lost kinetic energy (Le Chatelier's)

- b) Explain why a temperature of 500°C is used in the Haber process rather than a lower temperature. (1 mark)

Equilibrium is achieved faster

8. Consider the equilibrium below:

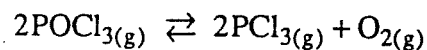


The colour of this equilibrium mixture is pink at 5°C, and blue at 60°C. Is the forward reaction endothermic or exothermic? Explain. (2 marks)

Endothermic

Increased temperature shifts an equilibrium in the endothermic direction to remove some of the added K.E. which in this case is to the right.

9. Consider the following equilibrium:



2.0 mol POCl_3 are placed in a 2.00 L container and allowed to establish equilibrium. At equilibrium, $[\text{O}_2] = 0.16 \text{ M}$. Calculate the value of K_{eq} . (3 marks)

	2POCl_3	\rightleftharpoons	$2 \text{PCl}_3 + \text{O}_2$
I	1.0		0
C	- .32		+ .16
E	.68		.16

$$K_{\text{eq}} = \frac{[\text{O}_2][\text{PCl}_3]^2}{[\text{POCl}_3]^2}$$

$$= \frac{(.16)(.32)^2}{(.68)^2} = 0.04$$

(only entitled to 1 sigfig in answer because of subtraction in first column)