Acid Unit: Le Chatelier's principle

1. The following reaction takes place in a closed container.

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

Four stresses are applied to the reaction.

1	Volume of reacting vessel is decreased
2	Oxygen is removed from the reaction vessel
3	$O_2(g)$ is added to the container
4	$SO_3(g)$ is vented from the container

The stresses that would cause the equilibrium to **shift to the products** is/are ____

a	1,2,4
b	1,3,4
c	2, 4
d	3

2. For the reaction $2H_2(g) + O_2(g) \leftrightarrow 2H_2O(g)$, the reaction vessel is doubled in size.

Which of the statements below is TRUE?

a	The pressure is decreased and the K_{eq} is increased.
b	The pressure is decreased and the K_{eq} is decreased.
c	The pressure is decreased and the K_{eq} is unchanged
d	The pressure is increased and the K_{eq} is unchanged

3. Consider the reaction given below.
$5R(g) + 3M(g) \leftrightarrow 2Q(g) + 4D(g) + 14.7\ kJ$

Choose the stress that will shift the reaction to **the products** and keep the **K_{eq} unchanged.**

a	Addition of a catalyst.
b	Increase the volume of the reacting vessel
c	Vent Q(g) from the reacting vessel.
d	Remove heat from the reacting vessel.

4. Consider the reaction given below.
$5R(g) + 3M(g) \leftrightarrow 2Q(g) + 4D(g) + 14.7\ kJ$

Choose the stress that will shift the reaction to the reactants and allow the K_{eq} to change.

a	Add heat to the system.
b	Increase the size of the reaction vessel.
c	Add D(g) to the system
d	Remove R(g) from the system.

5. Consider the reaction below:

$2NO_2(g) \leftrightarrow N_2O_4(g) + 55.3\ kJ$

Which of the following stresses would increase the production of $N_2O_4(g)$?

a	add a catalyst
b	increase the volume of the container
c	decrease the volume of the container
d	Remove $NO_2(g)$

6. Catalysts are substances that are used industrially or within our bodies to _____

a	alter the equilibrium constant
b	shift the position of the equilibrium system
c	provide an alternate pathway for chemical changes
d	lower the number of effective collisions between molecules

7. Consider the following reaction

$H_2O(l) + HBb(aq) \leftrightarrow H_3O^+(aq) + Bb^-(aq)$

Choose the correct statement below.

a	When KOH(aq) is added, the [HBb(aq)] increases and the solution turns yellow
b	When HCl(aq) is added, the $[H_3O^+(aq)]$ increases and the solution turns yellow
c	When HCl(aq) is added, the equilibrium is shifted toward the reactants and the solution will turn blue
d	When KOH(aq) is added, the equilibrium is shifted toward the reactants and the solution turns yellow.

8. Boric acid is used to maintain a pH level in the nickel plating bath:

$H_3BO_3(aq) + SO_4^{2-}(aq) \leftrightarrow H_2BO_3^-(aq) + HSO_4^-(aq)$

The addition of more $NiSO_4(aq)$ would _____

a	Increase $[H_3BO_3(aq)]$ and $[SO_4^{2-}(aq)]$
b	Decrease $[H_2BO_3^-(aq)]$ and increase $[HSO_4^-(aq)]$
c	Increase $[HSO_4^-(aq)]$ and $[H_2BO_3^-(aq)]$
d	Decrease $[H_2BO_3^-(aq)]$ and increase $[H_3BO_3(aq)]$

9. **Numerical response question**

Left justify your answer in the boxes provided.

Consider the following equilibrium equation.
$N_2O_{4(g)}$ + heat $\leftrightarrow$ $2NO_{2(g)}$

From the list below, choose 4 options that would <u>increase</u> the concentration of the product.

1. Increase volume of reaction vessel
2. Decrease volume of reaction vessel
3. Add $NO_{2(g)}$
4. Remove $NO_{2(g)}$
5. Add $N_2O_{4(g)}$
6. Remove $N_2O_{4(g)}$

Put the answers in ascending order.

Solutions:

1. B
2. C
3. C
4. A
5. C
6. C
7. B
8. C
9. 145