Le-Chaterlier principle and It's application

1 Le-Chatelier's Principle

Le-Chatelier's Principle states that **if a system at equilibrium is disturbed** by changing **temperature, pressure, or concentration**, the equilibrium will **shift in a direction that tends to counteract (neutralize)** the change and restore a new equilibrium.

2. (a) $N_2 + O_2 \rightleftharpoons 2NO; Q\ cal$

The above reaction is endothermic so for higher production of *NO*, and the temperature should be high.

3 (c) Only the speed of that reaction increases which nullifies the factor causing increase of speed

Explanation:

According to **Le–Chatelier's Principle**, when a change (like temperature, pressure, or concentration) is applied to a system at equilibrium, the reaction shifts in a direction that **opposes the change**.

So, the **rate of the reaction** that helps **counteract the disturbance** increases temporarily until a new equilibrium is established.

4. (c) At low pressure, reaction proceeds where volume is increasing. This is the favourable condition for the reaction. $PCl_5 \rightleftharpoons PCl_3 + Cl_2$.

5 (a) Both for physical and chemical equilibrium

Explanation:

Le–Chatelier's Principle applies to **all types of equilibria** — both **physical** (like evaporation, dissolution) and **chemical** (like reversible chemical reactions).

It predicts how a system at equilibrium responds when **temperature, pressure, or concentration** is changed.

6. (c) Reaction is exothermic and volume is decreasing from left to right so for higher production of SO_3 there should be low temperature and high pressure.

7. (a) $\underset{\text{more volume}}{\text{Ice}} \rightleftharpoons \underset{\text{lessvolume}}{\text{Water}}$

On increasing pressure, equilibrium shifts forward.

8. (c) Exothermic reaction is favoured by low temperature to proceed in forward direction.

9. (a) Effect of catalyst is that it attains equilibrium quickly by providing a new reaction path of low activation energy. It does not alter the state of equilibrium.

10 (c) The ratio of mixture at equilibrium is not changed by catalyst

Explanation:
A **catalyst** increases the **rate of both forward and backward reactions equally**, helping the system reach equilibrium faster.
However, it **does not change the equilibrium constant (K)** or the **ratio of reactants and products** at equilibrium — only the time to reach equilibrium is affected.

11. (a) On increasing temperature equilibrium will shift in forward direction due to decrease in intermolecular forces of solid.

12. (c) Both Δn and ΔH are negative. Hence, high pressure and low temperature will forward reaction.

13. (b) Exothermic reaction, favoured by low temperature.

14. (c) $\Delta n = 0$, No effect of pressure.

15. (b) The reaction is endothermic in reverse direction and hence increase in temperature will favour reverse reaction.

16. (c) A reaction is in equilibrium it will shift in reverse or backward direction when we increase the concentration of one or more product (from Le chatelier's principle).

17. (a) According to Le chatelier's principle.

18. (c) The reaction takes place with a reduction in number of moles (volume) and is exothermic. So high pressure and low temperature with favour the reaction in forward direction

19. (b) At equilibrium, the addition of $(CN)^-$ would decrease the (H^+) ion concentration to produce more and more *HCN* to nullified the increase of $CN^-{}_{aq}$.

20. (b) $H_2X_2 + \text{heat} \rightleftharpoons 2HX$.

Reaction is endothermic and volume increasing in forward direction so according to Le chatelier's principle for formation of *HX*, Temperature of the reaction should be high and pressure should be low.