# Physical Chemistry

## Thermodynamics and Thermochemistry

# 1. If in a chemical reaction the products have less energy than the reactants that reaction is

1) A reversible reaction
2) An endothermic reaction
3) An isothermal reaction
4) An exothermic reaction

# Answer:

## 4) An exothermic reaction

# Explanation:

Because $\Delta E = E_P - E_R$

Here, $E_P < E_R$

$\therefore \Delta E = - ve$

Hence the reaction is exothermic

# 2. Given that $Zn + 1/2\ O_2 \rightarrow ZnO + 35.28kJ$

$HgO \rightarrow Hg + 1/2 O_2 - 9.11kJ$ so that heat of the reaction

$Zn + HgO \rightarrow ZnO + Hg$ is

1) 26.17kJ
2) 44.39kJ
3) - 44.39kJ
4) 2.617kJ

**Answer:**

1) 26.17kJ

**Explanation:**

Required equation=equation-1+ equation-2

$$\therefore Zn + HgO \rightarrow ZnO + Hg + 26.17$$

3. Given $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$; $\Delta H = -395kJ$

$S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$; $\Delta H = -295kJ$

$CS_{2(l)} + 3O_{2(g)} \rightarrow CO_{2(g)} + 2SO_{2(g)}$; $\Delta H = -295kJ$ so heat of formation of carbon bisulphide is

1) 85 kJ
2) 125kJ
3) 165kJ
4) 205kJ

# Answer:

2) 125kJ

# Explanation:

$$\Delta H = H_P - H_R$$

$$\Delta H = \Delta H_{fCO2} + 2\Delta H_{fSO2} - \Delta H_{fCS2} - 3\Delta H_{fO2}$$

$$-1110 = -395 - 2\times295 - \Delta H_{fCS2} - 3\times0$$

$$-1110 = -395 - 590 - \Delta H_{fCS2} - 0$$

$$\Delta H_{fCS2} = -985 + 1110$$

$$\Delta H_{fCS2} = 125 \text{ kJ}$$

**4. A mixture of two moles of carbon monoxide and one mole of oxygen in a closed vessel, is ignited to convert the carbon monoxide to carbon dioxide. If $\Delta H$ is the enthalpy change and $\Delta E$ is the change in internal energy**

1) $\Delta H > \Delta E$        2) $\Delta H < \Delta E$        3) $\Delta H = \Delta E$

4) The relationship depends on the capacity of the vessel

# Answer:

## 2) $\Delta H < \Delta E$

# Explanation:

$$2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$$

$$\Delta n_g = n_p - n_r$$

$$\Delta n_g = 2 - 3$$

$$\Delta n_g = -1$$

W.K.T. $\Delta H = \Delta E + RT \times \Delta n_g$

$$\therefore \Delta H = \Delta E - RT$$

Hence $\Delta H < \Delta E$

**5. Given C(graphite) → C(g) ΔH=716.7kJ, C(diamond) → C$_{(g)}$, ΔH=714.8kJ. The ΔH for the reaction C(graphite) → C(diamond) is**

1) 1.9kJ
2) -1.9kJ
3) Zero
4) 714.8kJ

**Answer:**

1) 1.9kJ

# Explanation:

Required equation: equation1 – equation2
$$= 716.7kJ – 714.8kJ$$
$$= 1.9kJ$$

# 6. In the reaction

$$CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(g)$$
$$\Delta H = 2.8kJ \text{ then } \Delta H \text{ represents}$$

1) Heat of reaction
2) Heat of combustion
3) Heat of formation
4) Heat of solution

**Answer:**

1) Heat of reaction

# Explanation:

**Enthalpy of reaction ($\Delta H_r$): Enthalpy of reaction is the enthalpy change when the number of moles of reactants react completely to give the products as indicated by the balanced chemical equation.**

**7. The enthalpies of elements in their standard states are taken as zero. Hence the enthalpy of formation of a compound**

1) Should always be negative
2) Should always be positive
3) Will be equal to twice the energy of combustion
4) May be positive or negative

**Answer:**

4) May be positive or negative

## Explanation:

**Enthalpy of formation ($\Delta H_f$):** It is the enthalpy change (heat evolved or absorbed) when one mole of compound formed from its elements under given condition.

8. The enthalpy of formation of two compounds A and B are -84kJ and -156kJ respectively. Which one of the following statements is correct?

1) Both A and B are unstable
2) A is less stable than B
3) A is more stable than B
4) A and B are endothermic compounds

# Answer:

2) A is less stable than B

# Explanation:

Stability of compounds depend on the amount of heat evolved during their formation, larger the heat evolved, more stable is the compound. i.e. more negative $\Delta H_f$, more stable is the compound.

**9.** **The enthalpy of neutralization of acetic acid and sodium hydroxide is -55.4kJ. What is the enthalpy of ionization of acetic acid**

1) -1.9 kJ
2) +1.9 kJ
3) +5.54 kJ
4) -5.54 kJ

**Answer:**

2) +1.9 kJ

## Explanation:

**Enthalpy of ionization = Heat of neutralization of strong acid by a weak base or weak acid by a strong base + 57.3.**

$$= - 55.4kJ + 57.3kJ$$
$$= 1.9kJ$$

**10. The heat of formation of $Fe_2O_{3(s)}$ is -820kJ. The heat of combustion of iron is**

1) – 410 kJ
2) – 820 kJ
3) 820 kJ
4) – 1620kJ

**Answer:**

1)  − 410 kJ

**Explanation:**

$2Fe + O_2 \rightarrow Fe_2O_3 \quad \Delta H = -820kJ$

$2 \times 56g$ of Fe liberates 820kJ of Heat.

$\therefore$ 56g of Fe liberates ........ kJ of Heat.
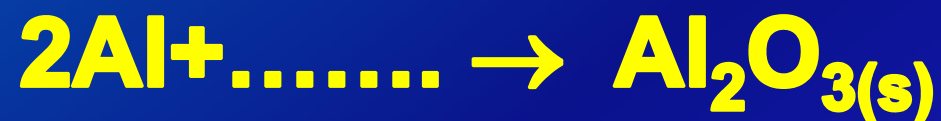
$$= 820 \times 56 \div 2 \times 56$$

$$= 410 \text{ kJ}$$

Enthalpy of combustion ($\Delta H_c$): It is the enthalpy change when one mole of the substance completely burnt in excess of air or oxygen. $\Delta H_c$ is always negative.

# 11. The thermochemical equation for the formation of $Al_2O_3$ is
$$2Al + \ldots\ldots \rightarrow Al_2O_{3(s)}$$

1) $3CO_{2(g)}$
2) $3/2 O_{2(g)}$
3) $3/4 O_{2(g)}$
4) $2/3 O_{2(g)}$

**Answer:**

2) $3/2\,O_{2(g)}$

**Explanation:**

**Enthalpy of formation ($\Delta H_f$): It is the enthalpy change when one mole of compound formed from its elements under given condition.**

# 12. If 4g of methane are to be completely burnt, the amount of oxygen required is

1) 4g
2) 8g
3) 16g
4) 32g

**Answer:**

3) 16g

## Explanation:

$$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$$

16g of methane requires 64g of $O_2$

$\therefore$ 4g of methane requires ……..g of $O_2$

$$= 4 \times 64 \div 16$$

$$= 16$$

## 13. In an exothermic reaction heat is

1) Evolved
2) Absorbed
3) Either evolved or absorbed
4) Neither evolved nor absorbed

**Answer:**

1) Evolved

## Explanation:

All exothermic reactions takes place with the liberation of heat.

**14. Heat of transition is the heat evolved or absorbed when a substance is converted from**

1) Solid to liquid
2) Solid to vapour
3) Liquid to vapour
4) One allotropic form to another allotropic form

**Answer:**

4) One allotropic form to another
allotropic form

# Explanation:

It is the enthalpy change when one mole of an element undergoes a transition from one allotropic form to another.

# 15. Heat of neutralisation of a strong acid by a strong base is a constant because

1) Salt formed does not hydrolyse
2) Only $H^+$ and $OH^-$ ions react in every case
3) The strong base and strong acid react completely
4) The strong base and strong acid react in aqeous solution.

# Answer:

## 2) Only H$^+$ and OH$^-$ ions react in every case

# Explanation:

Heat of neutralisation of strong acid by a strong base is nothing but reaction of $H^+$ ion of strong acid with $OH^-$ ion of strong base to form water only.

i.e. $H^+ + OH^- \rightarrow H_2O$    $\Delta H = -57.3$ kJ.

**16.** The heat of formation of carbon dioxide is -393.5kJ. The heat of decomposition of carbon dioxide into the elements is

1) 393.5kJ
2) 161.7kJ
3) 196.7kJ
4) 203kJ

**Answer:**

1) 393.5kJ

# Explanation:

According to Lavoisier and Laplace law 'The quantity of heat that required to decompose a compound in to its elements is equal to the quantity of heat liberated when the same amount of compound is formed from its elements.

**17. When a gm. atom of carbon is converted into a gm. molecule of carbon dioxide, the heat liberated is the same**

1) Irrespective of whether the volume is kept constant.
2) Irrespective of the temperature at which the reaction was carried out.

3) Whether the carbon taken was graphite or diamond.

4) Whether the reaction was carried out in one step or whether the carbon was first converted to carbon monoxide and then to carbon dioxide

## Answer:

**4) Whether the reaction was carried out in one step or whether the carbon was first converted to carbon monoxide and then to carbon dioxide**

# Explanation:

According to Hess's law of constant heat summation "The enthalpy change in a given reaction is the same whether the reaction takes place in one step or several steps.

## 18. $\Delta H = \Delta E$ for the reaction

1) $N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)}$
2) $2SO_{2(g)} + O_{2(g)} \leftrightarrow 2SO_{3(g)}$
3) $PCl_{5(g)} \leftrightarrow PCl_{3(g)} + Cl_{2(g)}$
4) $N_{2(g)} + O_{2(g)} \leftrightarrow 2NO_{(g)}$

# Answer:

4) $N_{2(g)} + O_{2(g)} \leftrightarrow 2NO_{(g)}$

# Explanation:

W.K.T., $\Delta H = \Delta E + \Delta nRT$,

Where $\Delta n$ = difference in number of moles of gaseous products and reactants.

$$N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)} \qquad \Delta n = 2-2 = 0$$

$$\therefore \Delta H = \Delta E$$

# Physical Chemistry

## Chemical Equilibrium

# 1. $2SO_2 + O_2 \Leftrightarrow 2SO_3$ the forward reaction is favoured by

1) High temperature
2) Low pressure
3) Removal of sulphur dioxide
4) High pressure

**Answer:**

4) High pressure

# Explanation:

In a reaction, If $\Delta n_g = n_p - n_r$ = -ve, high pressure is favoured for the reaction

$$2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$$

In this reaction $\Delta n_g = 2 - 3 = -1$

If $\Delta n < 0$ high pressure favours forward reaction.

$\Delta n > 0$ high pressure favours backward reaction.

$\Delta n = 0$ pressure has no effect on the reaction at equilibrium.

**2.** The equilibrium $N_2 + O_2 \Leftrightarrow 2NO$ is established in a reaction vessel of 2.5 litres capacity. The amounts of nitrogen and oxygen taken at the start were respectively 2 moles and 4 moles. Half a mole of nitrogen has been used up at equilibrium. The molar concentration of nitric oxide is

1) 0.2     2) 0.4     3) 0.6     4) 0.1

**Answer:**

2) 0.4

## Explanation:

No. of moles at t=0 in 2.5 litres

$$N_2 + O_2 \Leftrightarrow 2NO$$
$$2 \quad 4 \quad\quad 0$$

No. of moles at equilibrium

$$(2 - 0.5) \quad (4 - 0.5) \quad (2 \times 0.5)$$

$\therefore$ [NO] = No. moles / volume = 1 / 2.5 = 0.4

**3. One mole of hydrogen iodide is heated in a closed container of capacity 2 litres. At equilibrium half a mole of hydrogen iodide has dissociated. The equilibrium constant is**

1) 1.00
2) 0.50
3) 0.25
4) 0.75

**Answer:**

3) 0.25

**Explanation:**

$$2HI \Leftrightarrow H_2 + I_2$$

No. of moles at t=0

in 2 litres          1        0     0

No. of moles at

equilibrium                  (1 – 0.5)    (0.25) (0.25)

$\therefore$ [H$_2$]=No. moles at eq./volume=0.25 / 2=0.125

[I$_2$]=No. moles at eq./volume=0.25 / 2=0.125

[HI]=No. moles at eq./volume=0.5 / 2= 0.25

$$K = \frac{[H_2][I_2]}{[HI]^2} = \frac{0.125 \times 0.25}{(0.25)^2} = 0.25$$

4. A and B are gaseous substances which react reversibly to give two gaseous substances C and D, accompanied by liberation of heat. When the reaction reached equilibrium it is found that $K_c = K_p$. The equilibrium cannot be disturbed by

1) Adding A                               2) Adding D
3) Raising the temperature
4) Increasing the pressure

# Answer:

4) Increasing the pressure

# Explanation:

$A_{(g)} + B_{(g)} \Leftrightarrow C_{(g)} + D_{(g)} + \text{Heat}$

Here, $\Delta n = n_p - n_r = 2 - 2 = 0$

$K_p = K_c (RT)^{\Delta n}$

If $\Delta n = 0$,  $K_p = K_c$

In such cases pressure has no effect on the equilibrium

**5. In a reaction A+B ⇔ C+D the initial concentration of A and B were 0.9 mol dm$^{-3}$ each. At equilibrium the concentration of D was found to be 0.6 mol dm$^{-3}$. What is the value of equilibrium constant for the reaction?**

1) 8
2) 4
3) 9
4) 3

# Answer:

## 2) 4

# Explanation:

$$A + B \Leftrightarrow C + D$$

Initial Concentration
equilibrium at t=0

$$0.9 \quad 0.9 \quad 0 \quad 0$$

No. of moles at
equilibrium

$$(0.9{-}0.6) \quad (0.9{-}0.6) \quad 0.6 \quad 0.6$$

$$K=[C][D] \div [A][B] = (0.6)(0.6) \div (0.3)(0.3) = 2 \times 2 = 4$$

6. 5 moles of $SO_2$ and 5 moles of $O_2$ are allowed to react to form $SO_3$ in the closed vessel. At equilibrium state, 60% of $SO_2$ is used. The total number of moles of $SO_2$, $O_2$ and $SO_3$ in the vessel now is
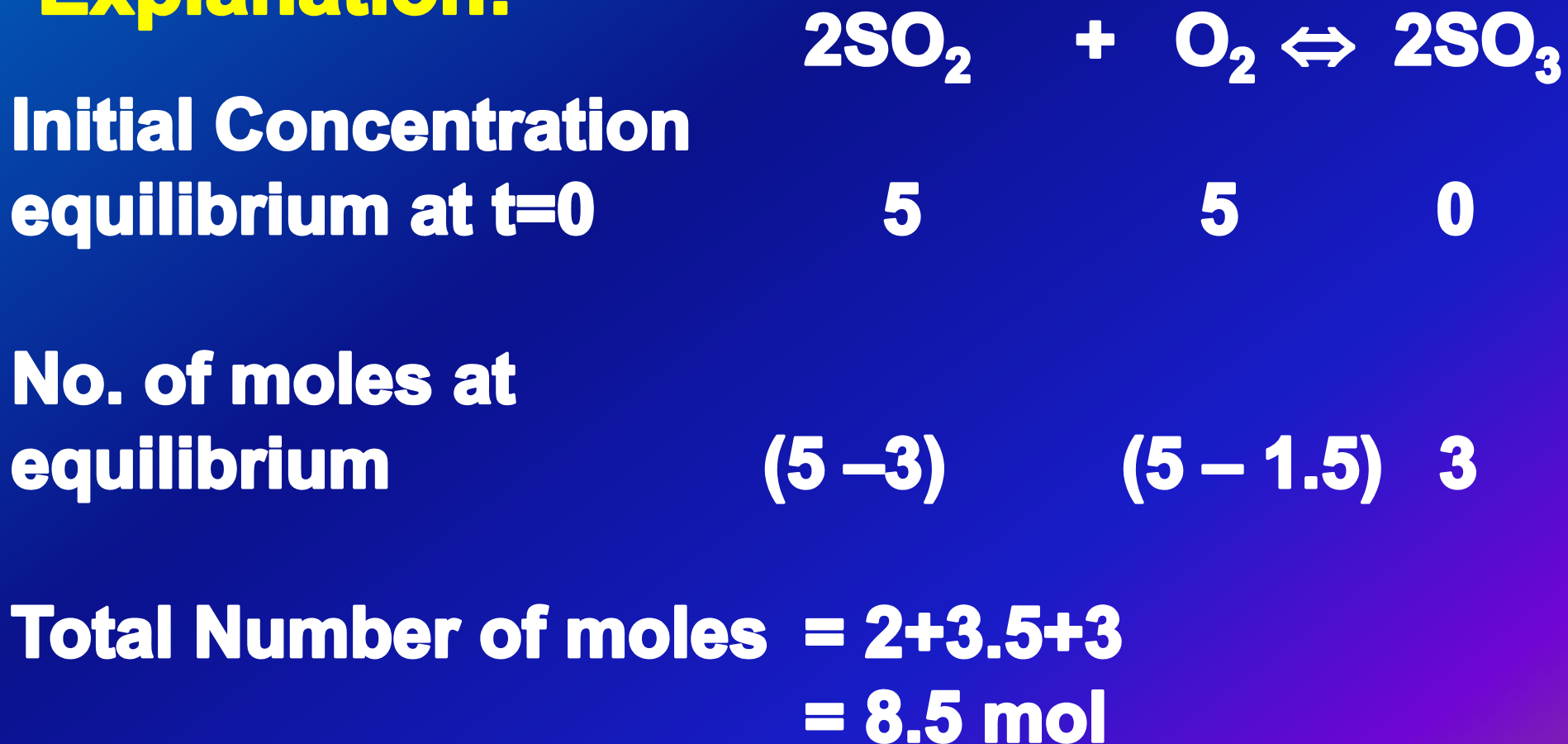
1) 10·0
2) 8·5
3) 10·5
4) 3·9

**Answer:**

2) 8·5

## Explanation:

$$2SO_2 \quad + \quad O_2 \Leftrightarrow 2SO_3$$

**Initial Concentration equilibrium at t=0**

| | | |
|---|---|---|
| 5 | 5 | 0 |

**No. of moles at equilibrium**

$(5 - 3) \qquad (5 - 1.5) \qquad 3$

**Total Number of moles** = 2+3.5+3

= 8.5 mol

**7. A quantity of PCl$_5$ was heated in 10 dm$^3$ vessel at 250$^0$ C. At equilibrium, the vessel contains 0.1mole of PCl$_5$ and 0.2 mole of Cl$_2$. The equilibrium constant for the reaction is**

1) 0.05
2) 0.02
3) 0.025
4) 0.04

**Answer:**

4) 0.04

# Explanation:

$$PCl_5 \Leftrightarrow PCl_3 + Cl_2$$

No. of moles at equilibrium

| | | |
|---|---|---|
| 0.1 | 0.2 | 0.2 |

Concentration at Equilibrium

| | | |
|---|---|---|
| 0.1/10 | 0.2/10 | 0.2/10 |

$$K=[PCl_3][Cl_2] \div [PCl_5] = 0.02 \times 0.02 / 0.01$$
$$= 0.04$$

# 8. The rate of forward reaction is twice the rate of reverse reaction at a given temperature and identical concentration $K_{eq}$ is

1) 0.5
2) 1.5
3) 2.5
4) 2.0

**Answer:**

4) 2.0

# Explanation:

$$K = K_f / K_b$$
$$K = 2.0 / 1.0$$
$$K = 2$$

**9.** 15 moles of $H_2$ and 5.2 moles of $I_2$ are mixed and allowed to attain equilibrium at $500^0C$. At equilibrium the concentration of HI is found to be 10 moles. The equilibrium constant for the formation of HI is

1) 50
2) 15
3) 100
4) 25

**Answer:**

1) 50

**Explanation:**

$$H_2 + I_2 \Leftrightarrow 2HI$$

Initial Concentration    :    15    5.2

Concentration at
equilibrium    :    (15 - 5)  (5.2 - 5)    (2×5)

$K_c = [HI]^2 \div [H_2][I_2] = 10 \times 10 \div 10 \times 0.2 = 50$

# 10. $2HI \leftrightarrow H_2 + I_2$ Here the relation between $K_P$ and $K_C$ is

1) $K_P > K_C$
2) $K_P < K_C$
3) $K_P = K_C$
4) $K_P \neq K_C$

**Answer:**

3) $K_P = K_C$

## Explanation:

W.K.T., $K_p = K_c(RT)^{\Delta n}$

$2HI_{(g)} \leftrightarrow H_{2(g)} + I_{2(g)};$ $\qquad \Delta n = 2 - 2 = 0$

$\therefore \quad K_p = K_c$

**11. $N_2 + 3H_2 \leftrightarrow 2NH_3$ + Heat. What is the effect of increase of temperature on the equilibrium of the reaction?**

1) Equilibrium is shifted to the left
2) Equilibrium is shifted to the right
3) Equilibrium is unaltered
4) Reaction rate does not change

# Answer:

## 1) Equilibrium is shifted to the left

# Explanation:

According Le-chatelier's principle all exothermic reactions are favoured by low temperature. Since the forward reaction is exothermic. If we increase the temperature backward reaction takes place. Hence equilibrium shifted to left.

**12. The reaction in which the yield of the product cannot be increased by the application of high pressure is**

1)  $PCl_3 + Cl_2 \leftrightarrow PCl_5$
2)  $N_2 + O_2 \leftrightarrow 2NO$
3)  $N_2 + 3H_2 \leftrightarrow 2NH_3$
4)  $2SO_2 + O_2 \leftrightarrow 2SO_3$

**Answer:**

2) $N_2 + O_2 \leftrightarrow 2NO$

# Explanation:

If $\Delta n = 0$, then the pressure has no effect on the equilibrium.

In this reaction

$$N_{2(g)} + O_{2(g)} \leftrightarrow 2NO_{(g)}; \quad \Delta n = 2-2 = 0$$

**13. At any moment before a reversible reaction attains equilibrium it is found that**

1) The velocity of the forward reaction is increasing and that of the backward reaction is decreasing.

2) The velocity of the forward reaction is decreasing and that of the backward reaction is increasing.

3)   The velocities of both the forward reaction and backward reaction are increasing.

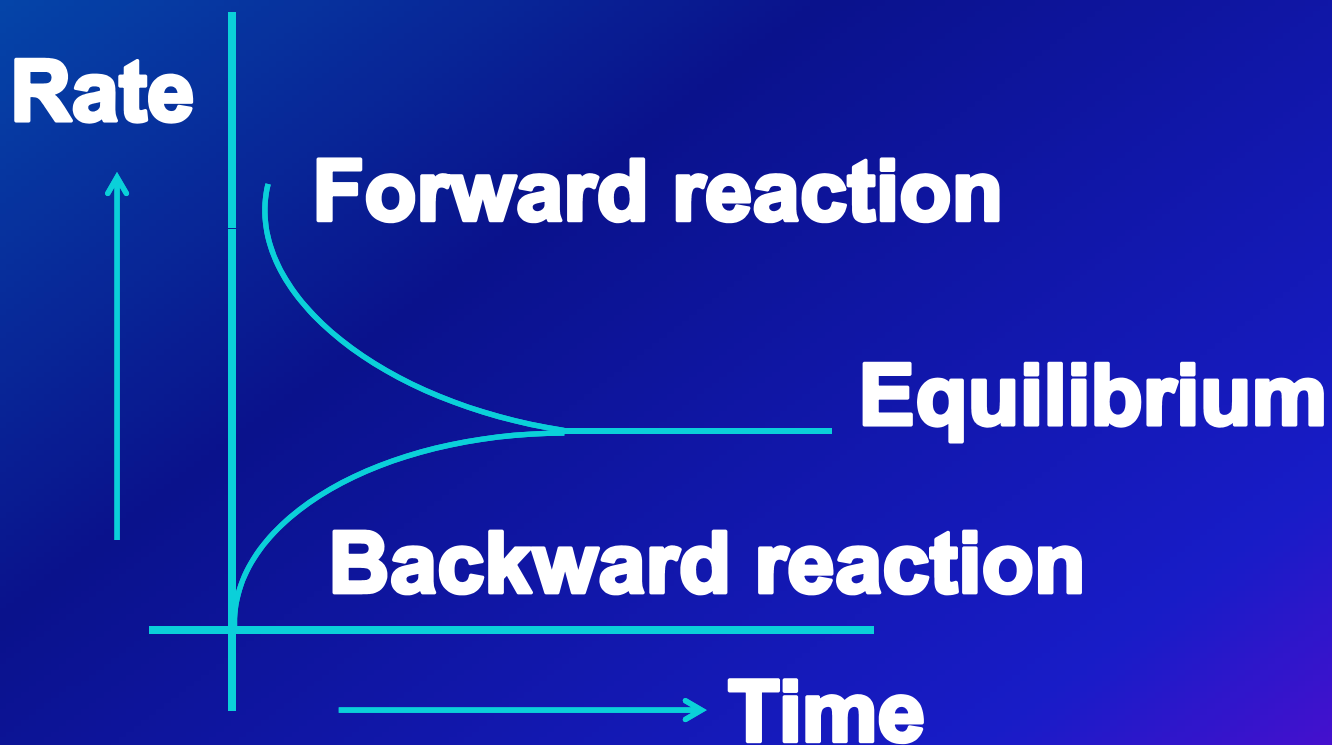4)   The velocities of both the forward reaction and backward reaction are decreasing.

**Answer:**

2) The velocity of the forward reaction is decreasing and that of the backward reaction is increasing.

# Explanation:



Rate

Forward reaction

Equilibrium

Backward reaction

Time

**14. In a catalytic conversion of $N_2$ to $NH_3$ by Haber process the rate of a reaction was expressed as change in the concentration of ammonia per time is $40 \times 10^{-3}$ mol $l^{-1}s^{-1}$. If there are no side reactions the rate of the concentration as expressed in terms of hydrogen is**

1) $60 \times 10^{-3}$ mol l$^{-1}$ s$^{-1}$
2) $20 \times 10^{-3}$ mol l$^{-1}$ s$^{-1}$
3) $1200$ mol l$^{-1}$ s$^{-1}$
4) $10.3 \times$ mol l$^{-1}$ s$^{-1}$

**Answer:**

1) $60 \times 10^{-3}$ mol l$^{-1}$ s$^{-1}$

## Explanation:

$N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)}$

$-d[N_2]/dt = -1/3\,d[H_2]/dt = 1/2\,d[NH_3]/dt$

Given, $d[NH_3]/dt = 10 \times 10^{-3}$ mol $l^{-1}$ $s^{-1}$

$d[H_2]/dt = ?$

W.K.T.,

$1/3\,d[H_2]/dt = 1/2\,d[NH_3]/dt$

$d[H_2]/dt = 3/2\,d[NH_3]/dt$

$d[H_2]/dt = 3/2 \times 40 \times 10^{-3}$

$d[H_2]/dt = 60 \times 10^{-3}$ mol $l^{-1}$ $s^{-1}$

**15.** At a given temperature, the equilibrium constant for the reaction, $PCl_{5(g)} \leftrightarrow PCl_{3(g)} + Cl_{2(g)}$ is $2.4 \times 10^{-3}$. At the same temperature, the equilibrium constant for the reaction $PCl_{3(g)} + Cl_{2(g)} \leftrightarrow PCl_{5(g)}$ is

1) $2.4 \times 10^{-3}$
2) $-2.4 \times 10^{-3}$
3) $4.2 \times 10^{2}$
4) $4.8 \times 10^{-2}$

**Answer:**

3) $4.2 \times 10^2$

# Explanation:

Given, $K_f = 2.4 \times 10^{-3}$

$K_b = ?$

W.K.T.,

$K_b = 1/K_f$

$K_b = 1/2.4 \times 10^{-3}$

$K_b = 0.416 \times 10^3$

$K_b = 4.2 \times 10^2$

# Physical Chemistry

## Surface Chemistry

## Catalyst & Adsorption

# 1. Which of the following types of metals form the most efficient catalysts?

1) Alkali metals
2) Alkaline earth metals
3) Transition metals
4) All of these

# Answer:

### 3) Transition metals

# Explanation:

This is because they can provide larger surface for the adsoprtion of reactants and they exhibit multiple oxidation state.

**2. Which of the following statements is not true?**

1) A catalyst alters the rate of a reaction
2) A catalyst is specific in nature
3) A catalyst initiates a reaction
4) A catalyst does not affect an equilibrium

# Answer:

### 3) A catalyst initiates a reaction

# Explanation:

Catalyst does not initiate a reaction just it accelerates the reaction which is already in progress.

# 3. Mark the correct statement, in a reversible reaction.

1) The catalyst catalyses the forward reaction
2) The catalyst catalyses the backward reaction
3) The catalyst influences the direct and the reverse reaction to the same extent
4) The catalyst increases the rate of forward reaction and decreases the rate of backward reaction.

# Answer:

3) The catalyst influences the direct and the reverse reaction to the same extent.

# Explanation:

The catalyst helps to attain the equilibrium quickly by accelerating both forward and backward reaction equally.

**4. Which of the statement is wrong among the following?**

1) Haber's process of $NH_3$ requires iron as catalyst

2) Friedel-Craft's reaction uses iron as catalyst.

3) Hydrogenation of oils uses iron as catalyst

4) Oxidation of $SO_2$ to $SO_3$ requires $V_2O_5$

**Answer:**

**3) Hydrogenation of oils uses iron as catalyst**

**Explanation:**

In the hydrogenation of oil nickel is used as catalyst.

# 5. Which one of the following is a homogeneous catalysis?

1) Hydrogenation of oils
2) Synthesis of ammonia by Haber's process
3) Manufacture of sulphuric acid by lead chamber process
4) Manufacture of sulphuric acid by contact process

**Answer:**

3) Manufacture of sulphuric acid by lead chamber process

# Explanation:

In Lead chamber process following reaction takes place, Here reactants and catalysts are in same phase.

$NO_{(g)}$

$$2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$$

**6. The adsorption of inert gases on the surface of activated charcoal increases with**

1) Decrease of both atomic mass and temperature
2) Increase of both atomic mass and temperature
3) Increase of atomic mass and decrease in temperature
4) Decrease of atomic mass and increase in temperature

# Answer:

3) Increase of atomic mass and decrease in temperature

# Explanation:

Increase in atomic mass and decrease in temperature are favourable for adsorption.

**7.** **A small amount of silica gel and that of anhydrous $CaCl_2$ are placed separately in two corners of room containing water vapour. What phenomena will occur in these two cases?**

1) Adsorption in both        2) Absorption in both

3) Adsorption on silica gel and absorption on $CaCl_2$

4) Absorption on silica gel and adsorption on $CaCl_2$

# Answer:

3) Adsorption on silica gel and absorption on $CaCl_2$

# Explanation:

Adsorption is a surface phenomena and absorption is a bodily phenomena hence water vapours are adsorbed by silica gel and absorbed by anhydrous calcium chloride.

# 8. Rate of physisorption increases with

1) Decrease in temperature
2) Increase in temperature
3) Decrease in pressure
4) Decrease in surface area

**Answer:**

1) Decrease in temperature

# Explanation:

Physisorption is exothermic hence it is favoured by low temperature.

# 9. In chemisorption, as the pressure increases the rate of adsorption

1) Decreases
2) Increases
3) Increases up to certain pressure and later remains constant
4) Remains the same

# Answer:

3) Increases up to certain pressure and later remains constant

# Explanation:

In chemisorption as pressure increases rate of adsorption also increases but pressure has no effect after the formation of unilayer.

**10.** The decomposition of $H_2O_2$ increases in the presence of

1) Acetanilide
2) dil.$H_2SO_4$
3) Alcohol
4) $MnO_2$

**Answer:**

4) $MnO_2$

**Explanation:**

MnO$_2$ acts as positive catalyst acetanilide, dil.H$_2$SO$_4$, Alcohol acts as negative catalyst.

## 11. An inhibitor is

1) A homogeneous catalysis
2) A heterogeneous catalyst
3) A negative catalyst
4) An auto catalyst

# Answer:

3) A negative catalyst

# Explanation:

Negative catalyst is a catalyst which decreases the rate of reaction.

Catalytic inhibitor decreases the efficiency of catalyst by blocking the active centres and hence rate of reaction decreases.

**12. Potassium metabisulphite used as a food preservative is**

1) A homogeneous catalyst
2) A heterogeneous catalyst
3) A positive catalyst
4) A negative catalyst

# Answer:

4) A negative catalyst

# Explanation:

Food preservative decreases the rate of spoiling of food hence it is taken as negative catalyst.

# 13. In the case of auto catalysis

1) Solvent catalyses
2) Product catalyses
3) Heat produced in the reaction catalyses
4) Reactant catalyses

# Answer:

**2) Product catalyses**

# Explanation:

Auto catalyst is a substance produced during a reaction and it self acts as catalyst.

During the titrations using acidified $KMnO_4$, $MnSO_4$ formed as product and acts as an auto catalyst.

**14.** A catalytic poison destroys the activity of a catalyst by

1) Forming a protective coating on the layer of the surface of the catalyst
2) Decreasing the activation energy of the reaction
3) Establishing weak Vander Waals forces at the active centres
4) Blocking active centres permanently

# Answer:

4) Blocking active centres permanently

# Explanation:

Catalytic inhibitor decreases the efficiency of catalyst by blocking the active centres permanently.

**15. For adsorption of a gas on a solid, the plot of log x/m Vs log P is linear with slope equal to (n being whole number)**

1) k
2) logk
3) n
4) 1/n

**Answer:**

4) 1/n

# Explanation:

W.K.T., Freundlich adsorption isotherm is $x/m = kp^{1/n}$, where x/m is the mass of the gas adsorbed per unit mass of the adsorbent, P is the equilibrium pressure, k and n are constants.
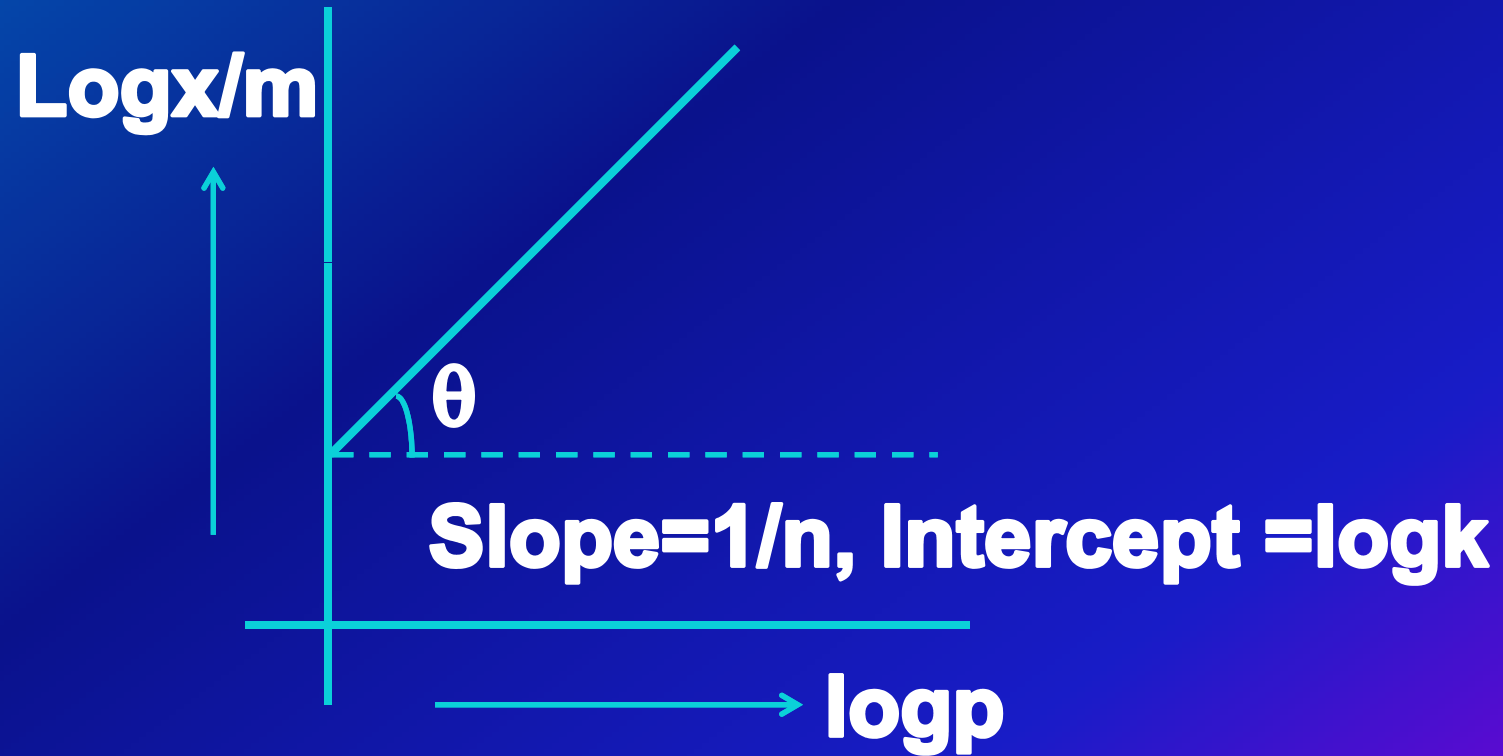
Taking log

$\log x/m = \log k + 1/n \log p$     is similar to equation of the straight line with slope m

$$y = c + m \ x$$

$\therefore$  m=1/n

Slope=1/n, Intercept =logk

# 16. Which of the following is not correct regarding the physical adsorption of a gas on the solid surface?

1) On increasing temperature, adsorption increases continuously

2) Enthalpy and entropy changes are negative

3) Adsorption is more for specific substance

4) It is a reversible reaction

**Answer:**

1) On increasing temperature, adsorption increases continuously

## Explanation:

Adsorption is exothermic hence it decreases with increasing temperature.

**17. In Langmuir's model of adsorption of a gas on a solid surface**

1) The rate of dissociation of adsorbed molecules from the surface does not depend on the surface covered

2) The adsorption at a single site on the surface may involve multiple molecules at the same time

3) The mass of gas striking a given area of surface is proportional to the pressure of the gas

4) The mass of gas striking a given area of surface is independent of the pressure of the gas

**Answer:**

3)   The mass of gas striking a given area of surface is proportional to the pressure of the gas

## Explanation:

The amount of gas striking a given surface area is directly proportional to the pressure of gas.

**18. Freundlich equation for a adsorption of gases (in amount of X g) on a solid (in amount of m g) at constant temperature can be expressed as**

1) $\log \dfrac{X}{m} = \log p + \dfrac{1}{n} \log k$

2) $\dfrac{X}{m} \propto p^n$

3) $\dfrac{x}{m} = \log p + \dfrac{1}{n} \log k$

4) $\log \dfrac{x}{m} = \log k + \dfrac{1}{n} \log p$

# Answer:

4) $$\log \frac{x}{m} = \log k + \frac{1}{n} \log p$$

## Explanation:

W.K.T., Freundlich adsorption isotherm is $x/m = kp^{1/n}$, where x/m is the mass of the gas adsorbed per unit mass of the adsorbent, P is the equilibrium pressure, k and n are constants.

Taking log

$$\log x/m = \log k + 1/n \log p$$

# Thank You