



Physical Chemistry

Thermodynamics and Thermochemistry

Vikasana - CET 2012



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**



2. Given that $\text{Zn} + \frac{1}{2} \text{O}_2 \rightarrow \text{ZnO} + 35.28\text{kJ}$

**$\text{HgO} \rightarrow \text{Hg} + \frac{1}{2}\text{O}_2 - 9.11\text{kJ}$ so that
heat of the reaction**

$\text{Zn} + \text{HgO} \rightarrow \text{ZnO} + \text{Hg}$ is

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



**3. Given $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}; \Delta H = -395 \text{ kJ}$
 $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}; \Delta H = -295 \text{ kJ}$
 $CS_{2(l)} + 3O_{2(g)} \rightarrow CO_{2(g)} + 2SO_{2(g)};$
 $\Delta H = -295 \text{ kJ}$ so heat of formation of
carbon bisulphide is**

- 1) 85 kJ**
- 2) 125 kJ**
- 3) 165 kJ**
- 4) 205 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 ΔH is the enthalpy change and ΔE 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

Vikasana - CET 2012

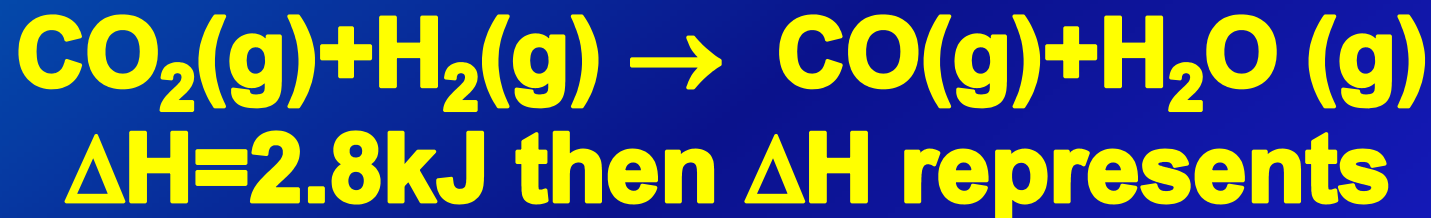


**5. Given $C(\text{graphite}) \rightarrow C(g) \Delta H=716.7\text{kJ}$,
 $C(\text{diamond}) \rightarrow C_{(g)}$, $\Delta H=714.8\text{kJ}$. The
 ΔH for the reaction
 $C(\text{graphite}) \rightarrow C(\text{diamond})$ is**

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



6. In the reaction



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



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**



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**



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**

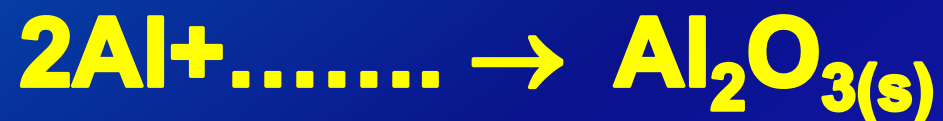


10. The heat of formation of $\text{Fe}_2\text{O}_{3(s)}$ is -820kJ . The heat of combustion of iron is

- 1) -410 kJ**
- 2) -820 kJ**
- 3) 820 kJ**
- 4) -1620kJ**



11. The thermochemical equation for the formation of Al_2O_3 is



- 1) $3\text{CO}_{2(g)}$
- 2) $3/2\text{O}_{2(g)}$
- 3) $3/4\text{O}_{2(g)}$
- 4) $2/3\text{O}_{2(g)}$



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

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



13. In an exothermic reaction heat is

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



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**



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 aqueous solution.**



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**



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**



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

- 1) $\text{N}_{2(g)} + 3\text{H}_{2(g)} \leftrightarrow 2\text{NH}_{3(g)}$
- 2) $2\text{SO}_{2(g)} + \text{O}_{2(g)} \leftrightarrow 2\text{SO}_{3(g)}$
- 3) $\text{PCl}_{5(g)} \leftrightarrow \text{PCl}_{3(g)} + \text{Cl}_{2(g)}$
- 4) $\text{N}_{2(g)} + \text{O}_{2(g)} \leftrightarrow 2\text{NO}_{(g)}$



Physical Chemistry

Chemical Equilibrium

Vikasana - CET 2012



1. $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$ the forward reaction is favoured by

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



2. The equilibrium $\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$ 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**



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**



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

Vikasana - CET 2012



5. In a reaction $A+B \rightleftharpoons C+D$ 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**



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**



7. A quantity of PCl_5 was heated in 10 dm^3 vessel at 250° C . At equilibrium, the vessel contains 0.1 mole 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**



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**



9. 15 moles of H_2 and 5.2 moles of I_2 are mixed and allowed to attain equilibrium at $500^\circ C$. 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**



10. $2\text{HI} \leftrightarrow \text{H}_2 + \text{I}_2$ 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) $K_p \neq K_c$



11. $\text{N}_2 + 3\text{H}_2 \leftrightarrow 2\text{NH}_3 + \text{Heat}$. 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**



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

- 1) $\text{PCl}_3 + \text{Cl}_2 \leftrightarrow \text{PCl}_5$
- 2) $\text{N}_2 + \text{O}_2 \leftrightarrow 2\text{NO}$
- 3) $\text{N}_2 + 3\text{H}_2 \leftrightarrow 2\text{NH}_3$
- 4) $2\text{SO}_2 + \text{O}_2 \leftrightarrow 2\text{SO}_3$



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.**



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 $40 \times 10^{-3} \text{ mol l}^{-1}\text{s}^{-1}$. If there are no side reactions the rate of the concentration as expressed in terms of hydrogen is



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



15. At a given temperature, the equilibrium constant for the reaction, $\text{PCl}_{5(g)} \leftrightarrow \text{PCl}_{3(g)} + \text{Cl}_{2(g)}$ is 2.4×10^{-3} . At the same temperature, the equilibrium constant for the reaction $\text{PCl}_{3(g)} + \text{Cl}_{2(g)} \leftrightarrow \text{PCl}_{5(g)}$ is

- 1) 2.4×10^{-3}
- 2) -2.4×10^{-3}
- 3) 4.2×10^2
- 4) 4.8×10^{-2}

KEA



Physical Chemistry

Surface Chemistry

Catalyst & Adsorption

Vikasana - CET 2012



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**



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**



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.**



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**



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**



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**



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



8. Rate of physisorption increases with

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



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**



10. The decomposition of H_2O_2 increases in the presence of

- 1) Acetanilide**
- 2) dil. H_2SO_4**
- 3) Alcohol**
- 4) MnO_2**



11. An inhibitor is

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



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**



13. In the case of auto catalysis

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



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**

Vikasana - CET 2012



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) $\log k$
- 3) n
- 4) $1/n$



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**



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**



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

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

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

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



Thank You

Vikasana - CET 2012