

**Chemistry**

61. Which one of the following statements about water is FALSE?

- (1) Ice formed by heavy water sinks in normal water  
 (2) Water is oxidized to oxygen during photosynthesis  
 (3) Water can act both as an acid and as a base  
 (4) There is extensive intramolecular hydrogen bonding in the condensed phase

Ans. [4] There is extensive intramolecular hydrogen bonding in the condensed phase

62. The concentration of fluoride, lead, nitrate and iron in a water sample from an underground lake was found to be 1000 ppb, 40 ppb, 100 ppm and 0.2 ppm, respectively. This water is unsuitable for drinking due to high concentration of

- (1) Iron (2) Fluoride  
 (3) Lead (4) Nitrate

Ans. [4] max. limit of nitrate in drinking water is 50 ppm

63. Galvanization is applying a coating of

- (1) Zn (2) Pb  
 (3) Cr (4) Cu

Ans. [1] Zn

64. Which one of the following complex shows optical isomerism?

- (1)  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$  (2)  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$   
 (3)  $\text{cis}[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$  (4)  $\text{trans}[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$   
 (en = ethylenediamine)

Ans. [3] Due to the absence of plane of symmetry

65. Two closed bulbs of equal volume (V) containing an ideal gas initially at pressure  $p_i$  and temperature  $T_1$  are connected through a narrow tube of negligible volume as shown in the figure below. The temperature of one of the bulbs is then raised to  $T_2$ . The final pressure  $p_f$  is

- (1)  $2p_i \left( \frac{T_1 T_2}{T_1 + T_2} \right)$  (2)  $p_i \left( \frac{T_1 T_2}{T_1 + T_2} \right)$   
 (3)  $2p_i \left( \frac{T_1}{T_1 + T_2} \right)$  (4)  $2p_i \left( \frac{T_2}{T_1 + T_2} \right)$

Ans. [4]  $\frac{p_i V}{RT_1} + \frac{p_i V}{RT_1} = \frac{p_f V}{RT_1} + \frac{p_f V}{RT_2}$

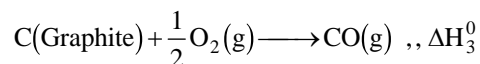
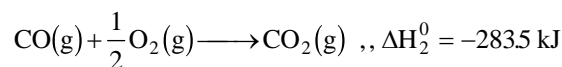
$$\Rightarrow \frac{2p_i}{T_1} = p_f \left( \frac{1}{T_1} + \frac{1}{T_2} \right)$$

$$\Rightarrow p_f = 2p_i \left( \frac{T_2}{T_1 + T_2} \right)$$

66. The heats of combustion of carbon and carbon monoxide are  $-393.5$  and  $-283.5$   $\text{kJ mol}^{-1}$ , respectively. The heat of formation (in kJ) of carbon monoxide per mole is

- (1)  $-110.5$  (2)  $110.5$   
 (3)  $676.5$  (4)  $-676.5$

Ans. [1]  $\text{C}(\text{Graphite}) + \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g}), \Delta H_1^0 = -393.5 \text{ kJ}$



$$\Delta H_3^0 = \Delta H_1^0 - \Delta H_2^0, \Delta H_3^0 = -110 \text{ kJ}$$

67. At 300 K and 1 atm, 15 mL of a gaseous hydrocarbon requires 375 mL air containing 20%  $\text{O}_2$  by volume for complete combustion. After combustion the gases occupy 330 mL. Assuming that the water formed is in liquid form and the volumes were measured at the same temperature and pressure, the formula of the hydrocarbon is

- (1)  $\text{C}_4\text{H}_{10}$  (2)  $\text{C}_3\text{H}_6$   
 (3)  $\text{C}_3\text{H}_8$  (4)  $\text{C}_4\text{H}_8$

Ans. [Bonus]

68. Decomposition of  $\text{H}_2\text{O}_2$  follows a first order reaction. In fifty minutes the concentration of  $\text{H}_2\text{O}_2$  decreases from 0.5 to 0.125 M in one such decomposition. When the concentration of  $\text{H}_2\text{O}_2$  reaches 0.05 M, the rate of formation of  $\text{O}_2$  will be

- (1)  $1.34 \times 10^{-2} \text{ mol min}^{-1}$  (2)  $6.93 \times 10^{-2} \text{ mol min}^{-1}$   
 (3)  $6.93 \times 10^{-4} \text{ mol min}^{-1}$  (4)  $2.66 \text{ L min}^{-1}$  at STP

Ans. [3]  $\text{H}_2\text{O}_2 \longrightarrow \text{H}_2\text{O} + \frac{1}{2} \text{O}_2$

$$\frac{d[\text{O}_2]}{dt} = -\frac{1}{2} \frac{d[\text{H}_2\text{O}_2]}{dt}$$

$$t_{1/2} = 25 \text{ min}$$

$$-\frac{d[\text{H}_2\text{O}_2]}{dt} = k[\text{H}_2\text{O}_2]$$

$$= \left( \frac{\ln 2}{t_{1/2}} \right) [\text{H}_2\text{O}_2]$$



$$\Rightarrow \frac{d[\text{O}_2]}{dt} = \frac{1}{2} \times \frac{0.693}{25} \times 0.05 \text{ M min}^{-1}$$

$$\frac{d[\text{O}_2]}{dt} = 6.93 \times 10^{-4} \text{ M min}^{-1}$$

69. The pair having the same magnetic moment is [At. No. : Cr = 24, Mn = 25, Fe = 26, Co = 27]

- (1)  $[\text{CoCl}_4]^{2-}$  and  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$   
 (2)  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{CoCl}_4]^{2-}$   
 (3)  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$   
 (4)  $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$

Ans. [3] Both species have 4 unpaired electron

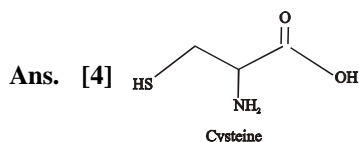
70. The species in which the N atom is in a state of sp hybridization is

- (1)  $\text{NO}_2$  (2)  $\text{NO}_2^+$   
 (3)  $\text{NO}_2^-$  (4)  $\text{NO}_3^-$

Ans. [2]  $\text{NO}_2^+$

71. Thiol group is present in

- (1) Methionine (2) Cytosine  
 (3) Cystine (4) Cysteine



72. The pair in which phosphorous atoms have a formal oxidation state of +3 is

- (1) Pyrophosphorous and pyrophosphoric acids  
 (2) Orthophosphorous and pyrophosphorous acids  
 (3) Pyrophosphorous and hypophosphoric acids  
 (4) Orthophosphorous and hypophosphoric acids

Ans. [2]  $\text{H}_3\text{PO}_3$  Orthophosphorous acid  
 $\text{H}_2\text{P}_2\text{O}_5$  Pyrophosphorous acid

73. The distillation technique most suited for separating glycerol from spent-lye in the soap industry is

- (1) Distillation under reduced pressure  
 (2) Simple distillation  
 (3) Fractional distillation  
 (4) Steam distillation

Ans. [1] Distillation under reduced pressure

74. Which one of the following ores is best concentrated by froth floatation method?

- (1) Malachite (2) Magnetite  
 (3) Siderite (4) Galena

Ans. [4] Galena

75. Which of the following atoms has the highest first ionization energy?

- (1) Sc (2) Rb  
 (3) Na (4) K

Ans. [1] Sc

76. In the Hofmann bromamide degradation reaction, the number of moles of NaOH and  $\text{Br}_2$  used per mole of amine produced are

- (1) Four moles of NaOH and one mole of  $\text{Br}_2$   
 (2) One mole of NaOH and one mole of  $\text{Br}_2$   
 (3) Four moles of NaOH and two moles of  $\text{Br}_2$   
 (4) Two moles of NaOH and two moles of  $\text{Br}_2$

Ans. [1] Four moles of NaOH and one mole of  $\text{Br}_2$

77. Which of the following compounds is metallic and ferromagnetic?

- (1)  $\text{MnO}_2$  (2)  $\text{TiO}_2$   
 (3)  $\text{CrO}_2$  (4)  $\text{VO}_2$

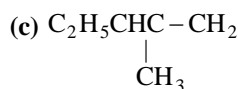
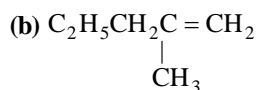
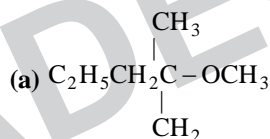
Ans. [3]  $\text{CrO}_2$

78. Which of the following statements about low density polythene is FALSE?

- (1) It is used in the manufacture of buckets, dust-bins etc  
 (2) Its synthesis requires high pressure  
 (3) It is a poor conductor of electricity  
 (4) Its synthesis requires dioxygen or a peroxide initiator as a catalyst

Ans. [1] It is used in the manufacture of buckets, dust-bins etc

79. 2-chloro-2-methylpentane or reaction with sodium methoxide in methanol yields



- (1) (a) and (b) (2) All of these  
 (3) (a) and (c) (4) (c) only

Ans. [4]

80. A stream of electrons from a heated filament was passed between two formed plates kept at a potential difference  $V$  esu. If  $e$  and  $m$  charge and mass of an electron, respectively, then the value of  $h/\lambda$  (where  $\lambda$  is wavelength associated with electron wave) is given by

- (1)  $\sqrt{2meV}$                       (2)  $meV$   
 (3)  $2meV$                         (4)  $\sqrt{2meV}$

Ans. [1]  $p = \frac{h}{\lambda} \Rightarrow p = \sqrt{2mK}$   
 $p = \sqrt{2meV}$

81. 18 g glucose ( $C_2H_{12}O_6$ ) is added to 178.2 g water. The vapor pressure of waetr (in torr) for this aqueous solution is

- (1) 759.0                              (2) 7.6  
 (3) 76.0                                (4) 752.4

Ans. [4]  $\chi_{\text{glucose}} = \frac{\Delta P}{P^0}$

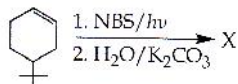
$$\frac{0.1}{9.9 + 0.1} = \frac{\Delta P}{760}$$

$$\Rightarrow \Delta P = 7.6 \text{ torr}$$

$$\Rightarrow P = 760 - 7.6$$

$$P = 752.4 \text{ torr}$$

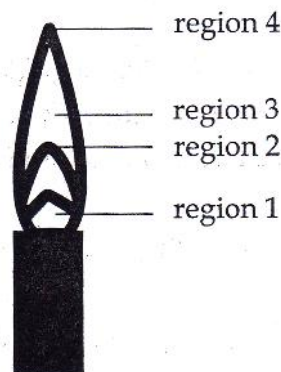
82. The product of reaction given below is



- (1) (2)   
 (3) (4)

Ans. [3]

83. The hottest region of Bunsen flame shown in the figure below is



- (1) region 4                              (2) region 1  
 (3) region 2                              (4) region 3

Ans. [3]

84. The reaction of zinc with dilute and concentrated nitric acid, respectively produces

- (1)  $\text{NO}_2$  and  $\text{N}_2\text{O}$                       (2)  $\text{N}_2\text{O}$  and  $\text{NO}_2$   
 (3)  $\text{NO}_2$  and  $\text{NO}$                       (4)  $\text{NO}$  and  $\text{N}_2\text{O}$

Ans. [2]  $\text{N}_2\text{O}$  and  $\text{NO}_2$

85. Which of the following is an anionic detergent?

- (1) Glyceryl oleate  
 (2) Sodium stearate  
 (3) Sodium lauryl sulphate  
 (4) Cetyltrimethyl ammonium bromide

Ans. [3]

86. The reaction of propene with  $\text{HOCl}$  ( $\text{Cl}_2 + \text{H}_2\text{O}$ ) proceeds through the intermediate

- (1)  $\text{CH}_3 - \text{CHCl} - \text{CH}_2^+$   
 (2)  $\text{CH}_3 - \text{CH}^+ - \text{CH}_2 - \text{Cl}$   
 (3)  $\text{CH}_3 - \text{CH}^+ - \text{CH}_2 - \text{Cl}$   
 (4)  $\text{CH}_3 - \text{CH}(\text{OH}) - \text{CH}_2^+$

Ans. [3]

87. For a linear plot of  $\log(x/m)$  versus  $\log p$  in a Freundlich adsorption isotherm, which of the following statements is correct? ( $k$  and  $n$  are constants)

- (1)  $\log(1/n)$  appears as the intercept  
 (2) Both  $k$  and  $1/n$  appear in the slope term  
 (3)  $1/n$  appears as the intercept  
 (4) Only  $1/n$  appears as the slope

Ans. [4]



88. The main oxides formed on combustion of Li, Na and K in excess of air are, respectively

- (1)  $\text{Li}_2\text{O}$ ,  $\text{Na}_2\text{O}_2$  and  $\text{KO}_2$  (2)  $\text{Li}_2\text{O}$ ,  $\text{Na}_2\text{O}$  and  $\text{KO}_2$   
(3)  $\text{LiO}_2$ ,  $\text{Na}_2\text{O}_2$  and  $\text{K}_2\text{O}$  (4)  $\text{Li}_2\text{O}_2$ ,  $\text{Na}_2\text{O}_2$  and  $\text{KO}_2$

Ans. [1]

89. The equilibrium constant at 298 K for a reaction  $\text{A} + \text{B} \rightleftharpoons \text{C} + \text{D}$  is 100. If the initial concentration of all the four species were 1 M each, then equilibrium concentration of D (in  $\text{mol L}^{-1}$ ) will be

- (1) 1.181 (2) 0.182  
(3) 0.818 (4) 1.818

Ans. [4]  $\text{A} + \text{B} \rightleftharpoons \text{C} + \text{D}$   
Eqm:  $1-x$      $1-x$      $1+x$      $1+x$

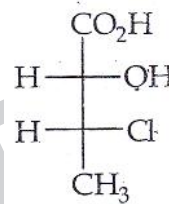
$$\Rightarrow \left( \frac{1+x}{1-x} \right)^2 = 100$$

$$\Rightarrow 1+x = 10(1-x)$$

$$\Rightarrow x = \frac{9}{11}$$

$$\Rightarrow [\text{D}] = 1.818 \text{ M}$$

90. The absolute configuration of



is

- (1) (2R, 3R) (2) (2R, 3S)  
(3) (2S, 3R) (4) (2S, 3S)

Ans. [3]