



## H.C.U.-2017 : CHEMISTRY

### PART – A

- Tommy has to cross two rivers to meet Janny. The first river has 10 bridges and the second one has 20 bridges. How many possible paths can Tommy follow to meet Janny?  
(a) 200 (b) 2 (c) 201 (d) 199
- If the carbon-carbon bond length in benzene ( $C_6H_6$ ) is  $1.40 \text{ \AA}$ , the distance between the carbons at 1 and 3 position is :  
(a)  $2.000 \text{ \AA}$  (b)  $2.135 \text{ \AA}$  (c)  $2.425 \text{ \AA}$  (d)  $2.800 \text{ \AA}$
- If the ratio of the area of a square to that of a circle is equal to  $\pi$ , the ratio of perimeter of the square to the circumference of the circle is equal to :  
(a) 1 (b) 2 (c) 3 (d) 4
- The absolute configurations of the following compounds are :  

$\begin{array}{c} \text{COOH} \\   \\ \text{H}_3\text{C}-\text{C}-\text{H} \\   \\ \text{CH}_2\text{OH} \\ \text{P} \end{array}$	$\begin{array}{c} \text{H} \\   \\ \text{H}_3\text{C}-\text{C}-\text{CH}_2\text{SH} \\   \\ \text{COOH} \\ \text{Q} \end{array}$
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(a) 'R' in P and 'S' in Q (b) 'R' in both P and Q  
(c) 'S' in P and 'R' in Q (d) 'S' in both P and Q
- The most electrophilic molecule among the following is :  
(a)  $H_2O$  (b)  $H_2C=CH_2$  (c)  $BF_3$  (d)  $NH_3$
- The gas which effuses 2.3 times faster than  $N_2O_4$  at the same temperature is :  
(a)  $NH_3$  (b)  $CN_2$  (c)  $O_3$  (d)  $N_2O$
- 100 g of  $C_6H_6$  is mixed with 100 g of  $C_6H_5CH_3$  at  $20^\circ C$  and 1 atm. Assuming ideal behavior, the entropy of mixing (in  $\text{cal K}^{-1}$ ) is :  
(a) 3.24 (b) 5.24 (c) 7.24 (d) 4.24
- The quantum numbers  $n$ ,  $l$ , and  $m$  of the highest occupied atomic orbital of Be are :  
(a) (1, 0, 0) (b) (2, 0, 0) (c) (2, 1, 0) (d) (2, 1, 1)
- The osmotic pressure of a 3.42% (W/V) solution of sucrose (Molecular weight = 342) and a solution of 1.73 g of a molecule, A, in 100 mL of water are same at the same temperature. The molecular weight of A is:  
(a) 123 (b) 273 (c) 676 (d) 173
- The IUPAC name of the following compound is :  

$$\text{HO}-\text{CH}_2-\text{C}\equiv\text{C}-\overset{\text{CH}_3}{\underset{|}{\text{CH}}}-\overset{\text{H}}{\text{C}}=\text{CH}_2$$

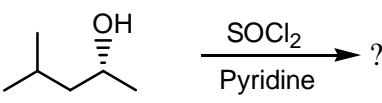
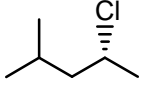
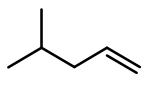
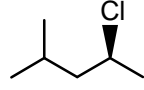
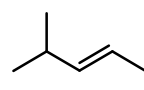
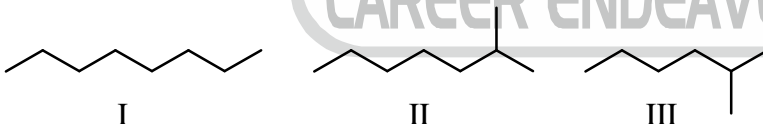
(a) 4-Methylhex-5-en-2-yn-1-ol (b) 3-Methylhex-4-yn-6-ol  
(c) 1-Hydroxy-4-methylhex-5-en-2-yne (d) 6-Hydroxy-3-methylhex-4-yn-1-ene



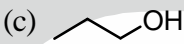
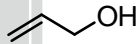
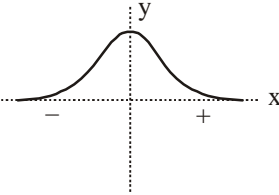
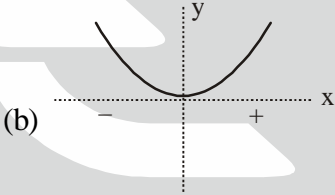
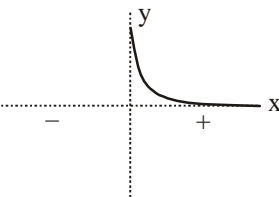
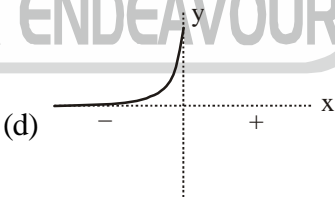
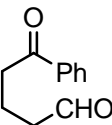
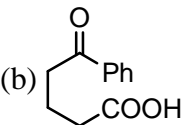
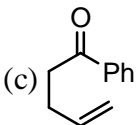
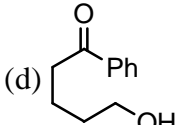


25.  $\text{Mg}_2\text{SiO}_4$  belongs to the class of  
 (a) pyrosilicates. (b) chain silicates. (c) sheet silicates. (d) orthosilicates.

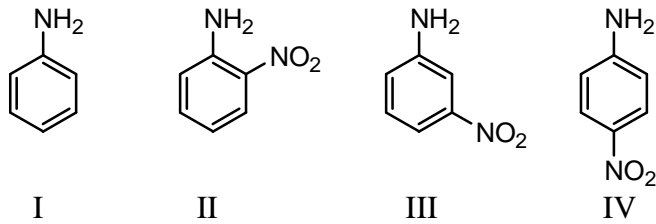
**PART – B**

26. Both  $[\text{Ni}(\text{CN})_4]^{2-}$  and  $[\text{Zn}(\text{CN})_4]^{2-}$  are diamagnetic. The hybridization of valence orbitals of  $\text{Ni}^{2+}$  and  $\text{Zn}^{2+}$  in these complexes will be  
 (a)  $sp^3$  for both. (b)  $sp^3$  and  $dsp^2$ , respectively.  
 (c)  $dsp^2$  for both. (d)  $dsp^2$  and  $sp^3$ , respectively.
27. The activation energy of a certain reaction is  $87 \text{ kJ mol}^{-1}$ . The ratio of the rate constants of this reaction at  $37^\circ\text{C}$  to the reaction at  $15^\circ\text{C}$  is:  
 (a)  $\frac{5}{1}$  (b)  $\frac{8.3}{1}$  (c)  $\frac{13}{1}$  (d)  $\frac{24}{1}$
28. Addition of concentrated  $\text{H}_2\text{SO}_4$  to a solution of  $\text{KMnO}_4$  leads to the formation of an explosive oil with formula:  
 (a)  $\text{Mn}_2\text{O}_7$  (b)  $\text{Mn}_3\text{O}_4$  (c)  $\text{MnO}_2$  (d)  $\text{K}_2\text{MnO}_4$
29. The borane  $[\text{B}_8\text{H}_8]^{8-}$  can be classified as:  
 (a) Arachno borane (b) Closo borane (c) Hypho borane (d) Nido borane
30. When dilute  $\text{HCl}$  is added to a white salt, effervescence is observed along with a colorless and odourless gas. Then a white precipitate is also formed which dissolves on heating. The salt is:  
 (a)  $\text{Na}_2\text{SO}_4$  (b)  $\text{ZnCO}_3$  (c)  $\text{PbCO}_3$  (d)  $\text{HgNO}_3$
31. How many geometric isomers are possible for the complex  $[\text{Co}(\text{dien})\text{ABC}]$ , where  $\text{dien} = \text{NH}_2\text{CH}_2\text{CH}_2\text{NHCH}_2\text{CH}_2\text{NH}_2$ , a tridentate ligand and A, B and C are monodentate ligands?  
 (a) 6 (b) 4 (c) 5 (d) 2
32. Which of the following is a correct description of the gas phase structure of  $\text{XeF}_6$ ?  
 (a) Perfect octahedral (b) Distorted octahedral  
 (c) Trigonal prismatic (d) Polymeric with Xe octahedral
33. A constant current of  $0.800 \text{ A}$  is used to deposit copper at the cathode. The number of grams of copper deposited in  $15.2 \text{ min}$ , considering the half-reaction;  $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}(s)$ , is (Atomic weight of  $\text{Cu} = 63.5 \text{ g mol}^{-1}$ ):  
 (a)  $0.772 \text{ g}$  (b)  $0.240 \text{ g}$  (c)  $0.480 \text{ g}$  (d)  $12.16 \text{ g}$
34. The total number of valence electrons in each metal atom in the dichloro bridged complex  $(\text{CO})_2\text{Rh}(\mu-\text{Cl}_2)\text{Rh}(\text{CO})_2$  is:  
 (a) 14 (b) 16 (c) 17 (d) 18
35. The amount of  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  (Molecular weight =  $244.3 \text{ g mol}^{-1}$ ) required to prepare  $500 \text{ mL}$  of  $0.0740 \text{ M}$  chloride ion ( $\text{Cl}^-$ ) solution in water is:  
 (a)  $4.52 \text{ g}$  (b)  $9.04 \text{ g}$  (c)  $7.71 \text{ g}$  (d)  $8.35 \text{ g}$
36. If  $i, j$  and  $k$  are unit vectors along the Cartesian axes  $x, y$  and  $z$  directions respectively, length of the projection of the vector  $3i - 4j + 2k$  on the  $xy$  plane is :  
 (a) 1 (b) 3 (c) 5 (d) 7

48. One mole of a compound with molecular formula  $C_9H_{16}$  upon ozonolysis gives one mole each of acetone, formaldehyde and levulinaldehyde (a ketoaldehyde). The compound is:  
 (a) 2,6-dimethylhepta-2,5-diene (b) 2,6-dimethylhepta-1,6-diene  
 (c) 2,6-dimethylhepta-1,5-diene (d) (*E*)-2,6-dimethylhepta-2,4-diene
49. The major product formed in the following reaction is:
- 
- (a)  (b)  (c)  (d) 
50. Choose the planar species from the following:  
 (i)  $XeF_4$ , (ii)  $ClO_4^-$ , (iii)  $PdCl_4^{2-}$ , (iv)  $MnO_4^-$   
 (a) (i) and (ii) (b) (i) and (iv) (c) (iii) only (d) (i) and (iii)
51. The two curves  $X^2 + Y^2 = 4$  and  $X^2 - Y^2 = 2$  intersect each other at  
 (a) no point. (b) one point. (c) two points. (d) four points.
52. If  $\alpha$  and  $\beta$  are the remaining two angles of a right angle triangle,  $\sin(2\beta)$  is equal to:  
 (a)  $\cos(2\alpha)$  (b)  $\sin(2\alpha)$  (c)  $1 + \tan^2 \alpha$  (d)  $\sec^2 \alpha$
53. Given the series 1, 1, 2, 3, 5, 8, 13, 21, X, ..., the value of X is:  
 (a) 34 (b) 29 (c) 27 (d) 25
54.  $\frac{d}{dx} [\ln(x^2 + 2x + 1)]$  at  $x = 0$  is:  
 (a) 0 (b) 1 (c) 2 (d) 3
55. The complex number  $(-2 - i 2\sqrt{3})$  in polar form is given by:  
 (a)  $4e^{i\pi/3}$  (b)  $4e^{i2\pi/3}$  (c)  $4e^{i4\pi/3}$  (d)  $4e^{i5\pi/3}$
56. The increasing order of heat of combustion of the following compounds is:
- 
- (a) I < II < III (b) II < III < I (c) II < I < III (d) III < II < I
57. Nickel (Atomic weight =  $58.71 \text{ g mol}^{-1}$ ) crystallizes in FCC lattice with a unit cell length of  $3.52 \text{ \AA}$ . The density (in  $\text{g cm}^{-3}$ ) of nickel is:  
 (a) 3.24 (b) 5.64 (c) 8.94 (d) 18.2
58.  $\int_0^l \sin\left(\frac{\pi x}{l}\right) \cos\left(\frac{\pi x}{l}\right) dx =$   
 (a) 0.00 (b)  $l$  (c) 1.00 (d)  $\infty$
59.  $\lim_{x \rightarrow 0} \frac{\partial^2}{\partial x^2} \left( \sqrt{(4-x^2)} \right) =$   
 (a) 0.50 (b) 0.25 (c) 0.00 (d) 2.00

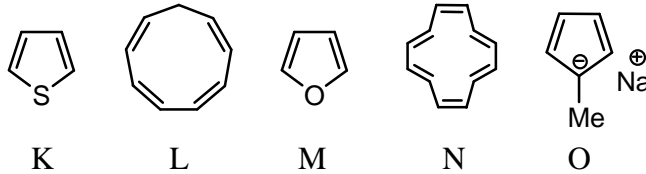
72. If the average speed of hydrogen molecule at a given temperature is  $c$ , then the average speed of oxygen molecule at the same temperature will be  
 (a)  $2c$  (b)  $4c$  (c)  $\frac{c}{2}$  (d)  $\frac{c}{4}$
73. Argon gas (assumed to be ideal) is expanded reversibly and adiabatically from a volume of 50 L to 200 L. If the initial temperature is 300 K then the final temperature would be :  
 (a) 75 K (b) 37.5 K (c) 119 K (d) 200 K
74. The standard potential of the cell,  $\text{Zn} | \text{Zn}^{2+} || \text{Fe}^{3+} | \text{Fe}^{2+}$  ( $E_{\text{Zn}^{2+}/\text{Zn}}^0 = -0.76 \text{ V}$  and  $E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^0 = 0.77 \text{ V}$ ) is:  
 (a) +0.77 V (b) -1.53 V (c) +2.30 V (d) +1.53 V
75. Which of the following processes results in the formation of neutrino?  
 (a)  $\alpha$ -ray emission (b)  $\beta$ -ray emission (c)  $\gamma$ -ray emission (d) X-ray emission
76. The organelle in the cell, other than the nucleus, that contains DNA is:  
 (a) Golgi apparatus (b) lysosomes (c) mitochondria (d) peroxisomes
77. Identify the reaction involving olefination of ketones from the following:  
 (a) Friedel-Crafts reaction (b) Wittig reaction  
 (c) Cannizzaro reaction (d) Schmidt reaction
78. The major product formed in the following reaction is:  
 $\text{Cyclopropane} \xrightarrow{\text{Conc. H}_2\text{SO}_4} ?$   
 (a)  (b)  (c)  (d) 
79. The graph of  $y = e^{-x^2}$  is  
 (a)  (b)   
 (c)  (d) 
80. The product formed in the following reaction is:  
 $\text{Cyclopentanone} \xrightarrow[\text{(iii) O}_3/\text{aq H}_2\text{O}_2]{\text{(i) C}_6\text{H}_5\text{MgBr in Et}_2\text{O, (ii) H}_3\text{PO}_4 \text{ heat}} ?$   
 (a)  (b)  (c)  (d) 
81. Which of the following hormones contains iodine?  
 (a) thyroxine (b) adrenalin (c) testosterone (d) insulin

90. The decreasing order of basicity of the following compounds is:



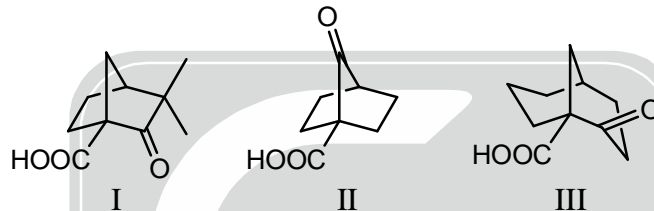
- (a) I > IV > III > II    (b) I > III > IV > II    (c) II > IV > III > I    (d) I > II > III > IV

91. The aromatic compounds among the following are :



- (a) K, L and M    (b) K, M and O    (c) K, M and N    (d) K, M, N and O

92. Identify the compound(s) that can easily undergo decarboxylation from the following:



- (a) II    (b) I and II    (c) I, II and III    (d) III

93. The key reagent in Woodward cis dihydroxylation is:

- (a)  $\text{OsO}_4$     (b)  $\text{KMnO}_4$   
 (c)  $\text{CH}_3\text{COOAg}/\text{I}_2/\text{H}_2\text{O}$     (d)  $\text{C}_6\text{H}_5\text{COOAg}/\text{I}_2/\text{benzene}$

94. A ball which is thrown vertically upwards, satisfies the height (m) vs time (s) equation,  $h = 3 + 14t - 5t^2$ . the maximum height it would reach is :

- (a) 12.8 m in 1.4 s    (b) 11.8 m in 1.4 s    (c) 12.8 m in 1.5 s    (d) 11.8 m in 1.5 s

95. The value of  $A = \begin{vmatrix} 1 & 0 & 0 \\ 2 & \cos x & \sin x \\ 3 & \sin x & \cos x \end{vmatrix}$  is:

- (a) 1    (b) 0    (c)  $\cos 2x$     (d)  $\sin 2x$

96. The compound that does NOT give a tertiary alcohol upon reaction with an excess of ethyl magnesium bromide is:

- (a) 3,3-dimethylhexan-2-one    (b) hexan-2-one  
 (c) ethyl benzoate    (d) ethyl formate

97. If the vectors  $X\mathbf{i} + j - 2\mathbf{k}$ ,  $2\mathbf{i} + \mathbf{k}$  and  $3\mathbf{i} - 2\mathbf{j} + \mathbf{k}$  are coplanar ( $\mathbf{i}$ ,  $\mathbf{j}$  and  $\mathbf{k}$  are the unit vectors), then  $X =$

- (a) -9    (b) 9    (c)  $-\frac{9}{2}$     (d)  $\frac{9}{2}$