



## D.U. M.Sc. CHEMISTRY ENTRANCE - 2016 (Set - A)

Time : 2 Hours

M. Marks: 270

### Instructions:

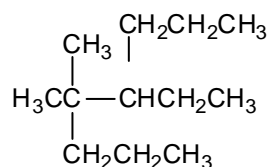
- (i) This test booklet contains **90** Multiple Choice Questions.  
(ii) Each correct answer will be given **3 marks**, and for each incorrect answer **1 mark** will be deducted.

- Which of the following is the correct order of increasing acidity sequence?  
(a)  $\text{HI} < \text{HBr} < \text{HCl} < \text{HF}$  (b)  $\text{HI} < \text{HCl} < \text{HBr} < \text{HF}$   
(c)  $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$  (d)  $\text{HF} \approx \text{HBr} < \text{HCl} < \text{HI}$
- Which of the following statement is correct?  
(a) only one bond length is observed in both  $\text{PF}_5$  and  $\text{SF}_6$   
(b) two different bond lengths are observed in both  $\text{PF}_5$  and  $\text{SF}_6$   
(c) only the equatorial bond lengths are uniform in  $\text{PF}_5$  and the axial bond lengths in  $\text{SF}_6$   
(d) two different bond lengths are observed in  $\text{PF}_5$  and only one bond length in  $\text{SF}_6$
- When  ${}^{23}_{11}\text{Na}$  nuclide is bombarded with alpha particles the resultant products will be  
(a)  ${}^{24}_{12}\text{Mg}$  and  ${}^2_1\text{H}$  (b)  ${}^{26}_{12}\text{Mg}$  and  ${}^1_1\text{H}$  (c)  ${}^{26}_{11}\text{Mg}$  and  ${}^1_0\text{n}$  (d)  ${}^{25}_{12}\text{Na}$  and  ${}^1_1\text{He}$
- The magnetic moments of the lanthanoid compounds arise from  
(a) spin-only angular momentum  
(b) only from orbital angular momentum  
(c) both from spin and orbital angular momentum  
(d) all of the above
- Which is the best way of identifying a given colourless liquid to be water or not?  
(a) by tasting  
(b) by adding methyl orange  
(c) by smelling  
(d) by adding a pinch of copper sulphate
- The addition of KI and  $\text{CuSO}_4$  gives  
(a)  $\text{CuI}_2$  and  $\text{K}_2\text{SO}_4$  (b)  $\text{Cu}_2\text{I}_2$  and  $\text{K}_2\text{SO}_4$   
(c)  $\text{K}_2\text{SO}_4$ ,  $\text{CuI}_2$  and  $\text{I}_2$  (d)  $\text{K}_2\text{SO}_4$ ,  $\text{Cu}_2\text{I}_2$  and  $\text{I}_2$
- In diborane,  
(a) there exists a direct bond between boron and boron  
(b) all the atoms are in one plane  
(c) the number of electrons in B-H-B is formed by two electrons  
(d) the number of electrons in B-H-B is formed by three electrons



8. Which of the following sulphides is not black?  
 (a) ZnS (b) NiS (c) CoS (d) CuS
9. For a transition metal with seven electrons the effective magnetic moment will be  
 (a) 3.16 BM (b) 3.87 BM (c) 15 BM (d) 5.92 BM
10. Schottky defects form in a crystal  
 (a) when unequal number of cations and anions are missing from the lattice  
 (b) when equal number of cations and anions are missing from the lattice  
 (c) when cations leave its normal positions in the lattice and move in to interstitial sites  
 (d) when the density of the crystal is increased
11. Decreasing order of the dipole moments is  
 (a)  $\text{AsH}_3 > \text{BiH}_3 > \text{SbH}_3 > \text{NH}_3 > \text{PH}_3$  (b)  $\text{BiH}_3 > \text{SbH}_3 > \text{AsH}_3 > \text{NH}_3 > \text{PH}_3$   
 (c)  $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$  (d)  $\text{PH}_3 > \text{NH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$
12. The metal ions responsible for  $\text{N}_2$  fixation by the enzyme nitrogenase are  
 (a) Co and Fe (b) Cu and Fe  
 (c) W and Cu (d) Fe and Mo
13. The speed of the electron is  $1.2 \times 10^6 \text{ ms}^{-1}$  and the mass of the electron is  $9.1 \times 10^{-31} \text{ Kg}$ . Its de Broglie wavelength is  
 (a)  $1.46 \times 10^{-10} \text{ m}$  (b)  $6.07 \times 10^{-15} \text{ m}$   
 (c)  $6.907 \times 10^{-10} \text{ m}$  (d)  $6.071 \times 10^{-10} \text{ m}$
14. A radioactive element lost 50% activity in 3 days and 20 hrs. The decay constant of the element is  
 (a)  $7.53 \times 10^{-3} \text{ hr}^{-1}$  (b)  $5.73 \times 10^{-3} \text{ hr}^{-1}$   
 (c)  $7.35 \times 10^{-2} \text{ hr}^{-1}$  (d)  $9.73 \times 10^{-3} \text{ hr}^{-1}$
15. Which of the following has a higher crystal field splitting energy ( $\Delta_0$ )  
 (a)  $[\text{Co}(\text{CN})_6]^{3-}$  (b)  $[\text{Co}(\text{NH}_3)_6]^{3+}$   
 (c)  $[\text{CoF}_6]^{3-}$  (d)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
16. The pH and pOH of 0.1 M  $\text{H}_2\text{SO}_4$  are  
 (a) 0.1, 13.9 (b) 0.3, 13.7 (c) 0.7, 13.3 (d) 1.0, 13.0
17. The symmetry possessed by a cubic crystal system, all axes being equal and all angles at  $90^\circ$  is due to the  
 (a) nine planes of symmetry (b) six two-fold axes ( $C_2$ ) of symmetry  
 (c) three four-fold axes ( $C_4$ ) of symmetry (d) four three-fold axes ( $C_3$ ) of symmetry
18. The Ziegler-Natta catalysts used for the polymerization of olefins is  
 (a)  $\text{TiO}_2$  and  $\text{Al}_2\text{O}_3$  (b)  $\text{TiCl}_3$  and  $\text{Al}(\text{C}_2\text{H}_5)_3$   
 (c)  $\text{TiCl}_4$  and  $\text{ZnO}$  (d)  $\text{PdCl}_4$
19. A delta ( $\delta$ ) bond formation is known in  
 (a)  $\text{Na}[\text{Re}(\text{CO})_5]$  (b)  $\text{ReO}_3$   
 (c)  $[\text{Re}_2\text{Cl}_8]^{2-}$  (d)  $\text{ReOCl}_4$
20. The tetragonal elongation resulting in the increase of the two trans M-L bond distances occur in octahedral complexes of transition metal ions with a configuration of  
 (a)  $d^{10}$  (b)  $d^7$  (c)  $d^2$  (d)  $d^9$

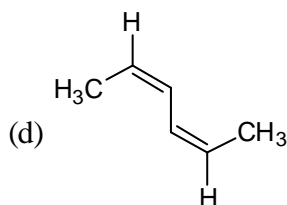
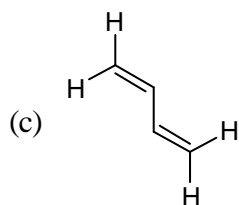
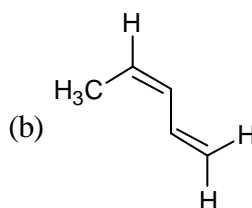
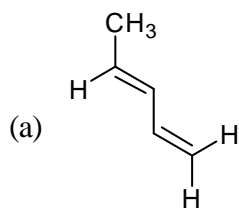
21. The increasing order of the observed Infra Red (IR)  $\nu_{\text{CO}}$  ( $\text{cm}^{-1}$ ) among the isoelectronic complexes will be  
 (a)  $[\text{V}(\text{CO})_6]^- < \text{Cr}(\text{CO})_6 < [\text{Mn}(\text{CO})_6]^+$  (b)  $[\text{V}(\text{CO})_6]^- < [\text{Mn}(\text{CO})_6]^+ < \text{Cr}(\text{CO})_6$   
 (c)  $\text{Cr}(\text{CO})_6 < [\text{V}(\text{CO})_6]^- < [\text{Mn}(\text{CO})_6]^+$  (d)  $[\text{Mn}(\text{CO})_6]^+ < \text{Cr}(\text{CO})_6 < [\text{V}(\text{CO})_6]^-$
22. In methane which of the following symmetry operations will result in a  $\text{C}_2$  symmetry operation?  
 (a) one  $\text{S}_3$  and one  $\text{S}_1$  operations (b) two  $\text{S}_4$  operations  
 (c) one  $\text{C}_3$  and one  $\text{C}_1$  operation (d) one  $\text{C}_3$  and E operations
23. The poisoning in the Minamata Bay in Japan was due to  
 (a) compounds of lead (b) methylmercury compounds  
 (c) arsenic (d) uranium
24. Resistance of solid  $\text{C}_{60}$  disappears when formed compounds with  
 (a) K, Rb, Cs (b) S, Se, Te (c) Zn, Cd, Hg (d) Ti, Y, Sc
25. Ground state for  $d^4$  electronic configuration is  
 (a)  $^5\text{F}$  (b)  $^5\text{D}$  (c)  $^2\text{D}$  (d)  $^3\text{F}$
26. Which of the following elements has a more stable oxidation state of III as compared to an oxidation state of I?  
 (a) Al (b) Ga (c) Tl (d) B
27. The structure of  $\text{ICl}_2$  is  
 (a) linear (b) tetrahedral  
 (c) trigonal bipyramid (d) octahedral
28. Which of the following materials show Meissner effect?  
 (a) metallic and paramagnetic (b) superconducting and diamagnetic  
 (c) semiconducting and diamagnetic (d) antiferromagnetic and insulating
29. The correct increasing order of Trans effects shown by the  $\sigma$  donor ligands is  
 (a)  $\text{OH}^- < \text{Br}^- < \text{SCN}^- < \text{PR}_3$  (b)  $\text{OH}^- < \text{Br}^- < \text{PR}_3 < \text{SCN}^-$   
 (c)  $\text{Br}^- < \text{PR}_3 < \text{OH}^- < \text{SCN}^-$  (d)  $\text{Br}^- < \text{OH}^- < \text{SCN}^- < \text{PR}_3$
30. Five experimental determinations of Fe in an iron ore by volumetric method gave the percentages 67.48, 67.37, 67.43, and 67.40. The standard, average and probable deviation of the mean are  
 (a) 0.047, 0.031, 0.036 (b) 0.031, 0.036, 0.047  
 (c) 0.047, 0.036, 0.031 (d) 0.036, 0.047, 0.031
31. The IUPAC name of the following compound is



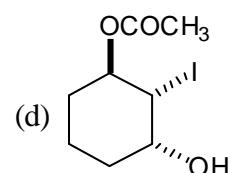
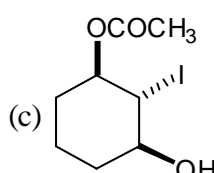
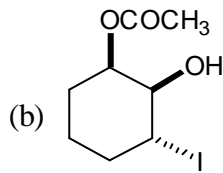
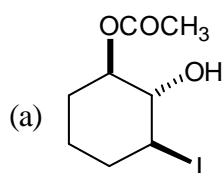
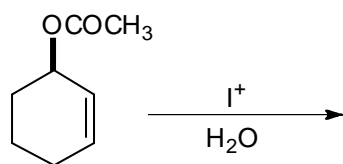
- (a) 4, 4-dimethyl-5-ethyloctane (b) 4-ethyl-5, 5-dimethyloctane  
 (c) 2-methyl-2, 3-dipropylpentane (d) 5-ethyl-4, 4-dimethyloctane



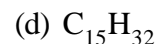
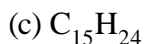
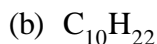
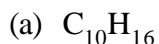
32. In Diels-Alder reaction which of the following will react most slowly with tetracyanoethene.



33. In the following reaction which will be the preferred product?



34. The general molecular formula of sesquiterpenoids is



35. Which of the following is not true?

(a) sun rays contain vitamin D

(b) sun's ultraviolet rays assist in the synthesis of vitamin D from a precursor present in our skin

(c) vitamin D deficiency could develop brittle bones

(d) vitamin D can be ingested through diet or supplements

36. Pick out the incorrect match?

(a) Sanger reagent

1-fluoro-2, 4-dinitrobenzene

(b) Edman reagent

phenyl isothiocyanate

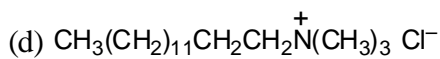
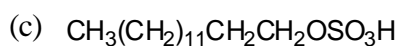
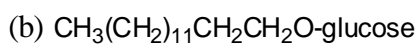
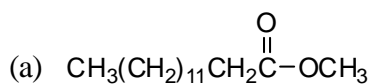
(c) Strecker amino acid synthesis

i. aldehyde + HCN; ii. hydrolysis

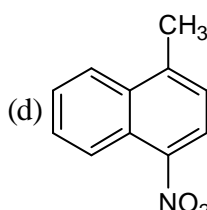
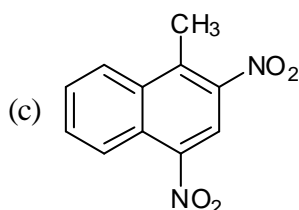
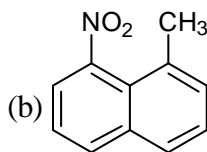
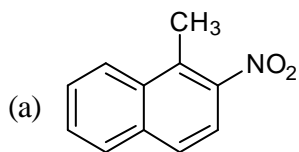
(d) Merrifield peptide synthesis

polystyrene resin

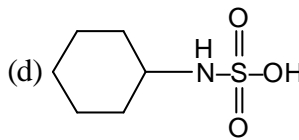
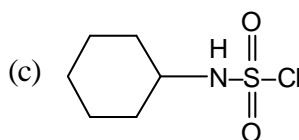
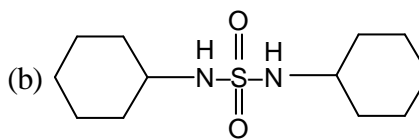
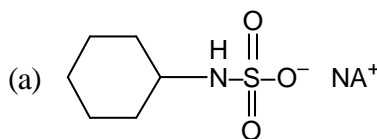
37. Which of the following structures will not have detergent properties?



38. Aspirin is  
 (a) salicylic acid (b) 2-acetoxybenzoic acid  
 (c) methyl salicylate (d) 2-acetoxy benzaldehyde
39. The major organic product of aromatic nitration of 1-methyl naphthalene is

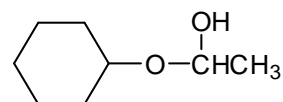


40. Which of the following aldehydes can undergo self condensation?  
 (a) PhCHO (b) HCHO  
 (c)  $(\text{CH}_3)_3\text{CCHO}$  (d)  $(\text{CH}_3\text{CH}_2)_2\text{CHCHO}$
41. Cyclamate, an artificial sweetener can be prepared by the reaction of cyclohexylamine and chlorosulfonic acid, followed by the treatment with sodium hydroxide. Which is the structure of this cyclamate?

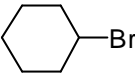
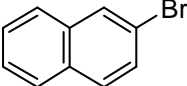


42. Which one of the following is un-reactive to  $\text{NaBH}_4$  reduction?  
 (a)  $\text{CH}_3\text{-CHO}$  (b)   
 (c) (d)

43. The functional group in the following compound is



- (a) hemiacetal (b) hemiketal (c) acetal (d) ketal
44. The octane rating of gasoline refers to its  
 (a) percentage  $\text{C}_8\text{H}_{18}$  in gasoline (b) radiation dose  
 (c) percentage of unsaturated hydrocarbons (d) ability to resist engine knocking

45. The compound  $\text{CFCl}_3$  is used as a/an  
 (a) enzyme (b) anesthetic  
 (c) gaseous fuel (d) refrigerant
46. An increase in the amount of particulate matter (dust and smoke) in the atmosphere may result in cooler world temperature because  
 (a) more sunlight is absorbed by Earth  
 (b) more IR is emitted into space  
 (c) the dust reflects solar radiation  
 (d) dust reacts with ozone in an exothermic reaction
47. Polacrylonitrile, characterized by the repeating units made from which of the following monomers?  
 (a)  $\text{CH}_3\text{CH}_2\text{CN}$  (b)  $\text{HOCH}_2\text{CH}_2\text{CH}_3$   
 (c)  $\text{CH}_3\text{CH}=\text{CHCN}$  (d)  $\text{CH}_2=\text{CHCN}$
48. Which of the following compounds could not be used to prepare a Grignard reagent?  
 (a)  (b)   
 (c)  $\text{HOCH}_2\text{CH}_2\text{CH}_2\text{Br}$  (d)  $\text{CH}_3\text{C}\equiv\text{CCH}_2\text{CH}_2\text{I}$
49. Identify the correct order for placing the following compounds in increasing oxidation state.  
 $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{CO}_2$ ,  $\text{CH}_2=\text{CH}_2$   
 (a)  $\text{CH}_2=\text{CH}_2 < \text{CH}_3\text{CH}_2\text{OH} < \text{CH}_3\text{COOH} < \text{CO}_2$   
 (b)  $\text{CH}_2=\text{CH}_2 = \text{CH}_3\text{CH}_2\text{OH} < \text{CH}_3\text{COOH} < \text{CO}_2$   
 (c)  $\text{CH}_3\text{CH}_2\text{OH} < \text{CH}_2=\text{CH}_2 < \text{CH}_3\text{COOH} < \text{CO}_2$   
 (d)  $\text{CH}_2=\text{CH}_2 < \text{CH}_3\text{CH}_2\text{OH} < \text{CO}_2 < \text{CH}_3\text{COOH}$
50. Which of the following alkenes will react most readily with HBr?  
 $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$        $\text{CH}_2=\text{CH}_2$        $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$   
 (a)  $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$  (b)  $\text{CH}_2=\text{CH}_2$   
 (c)  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$  (d) no difference in reactivity
51. In Williamson synthesis, ethers are produced by reacting an  
 (a) alcohol with a metal (b) an alkyl halide with alkoxide  
 (c) alkoxide with a metal (d) an aldehyde with alkyl halide
52. Which reaction produces ethyl alcohol as one of the principal products?  
 (a) an esterification reaction (b) a neutralization reaction  
 (c) a dehydration reaction (d) a fermentation reaction
53. The maximum number of hydrogen bonds that a molecule of water can have is  
 (a) 1 (b) 2 (c) 3 (d) 4
54. The major product of dehydration of neopentyl alcohol is  
 (a)  $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$  (b)  $(\text{CH}_3)_3\text{C}-\text{CHO}$   
 (c)  $\text{H}_2\text{C}=\text{CHCH}(\text{CH}_3)_2$  (d) None of the above



67. The osmotic pressure of a 0.1M monobasic acid having a pH of 2 at 25°C is  
 (a)  $\sim 5.38$  atm                      (b)  $\sim 1.34$  atm                      (c)  $\sim 0.882$  atm                      (d)  $\sim 2.69$  atm
68. The mole fraction of a gas dissolved in a solvent is given by Henry's law. If the Henry's constant for a gas in water at 298K is  $5.55 \times 10^7$  torr and the partial pressure of the gas is 200 torr. What is the amount of gas dissolved in 1.0 kg of water.  
 (a)  $\sim 3.6 \times 10^{-7}$  mol                      (b)  $\sim 2.5 \times 10^{-5}$  mol  
 (c)  $\sim 2.0 \times 10^{-4}$  mol                      (d)  $\sim 1.2 \times 10^{-3}$  mol
69. The standard electrode potential of three metals X, Y and Z are  $-1.3V$ ,  $0.6V$  and  $-3.0V$  respectively. The reducing power of these metals follow the order  
 (a)  $X > Y > Z$                                       (b)  $Y > Z > X$   
 (c)  $Y > X > Z$                                       (d)  $Z > X > Y$
70. The emf of the given cell  $Pt|H_2(P_1)|H^+(aq)|H_2(P_2)|Pt$  is given by  
 (a)  $(RT/F)\ln(P_1/P_2)$                                       (b)  $(RT/2F)\ln(P_1/P_2)$   
 (c)  $(RT/F)\ln(P_2/P_1)$                                       (d) None of these
71. Acetaldehyde ( $CH_3CHO$ ) decomposes by second order kinetics with a rate constant of  $0.334 M^{-1} s^{-1}$  at 500°C. The time it would take for 80% of the acetaldehyde to decompose in a sample that has an initial concentration of 0.00750 M is  
 (a)  $\sim 1600$  sec                      (b)  $\sim 1850$  sec                      (c)  $\sim 1000$  sec                      (d)  $\sim 5100$  sec
72. For a van der Waals gas, the inversion temperature is given by  
 (a)  $T_i = 2aR/b$                       (b)  $T_i = a/2Rb$                       (c)  $T_i = ab/2R$                       (d)  $T_i = 2a/Rb$
73. Heat capacity of a diatomic gas in the low temperature range  
 (a) is independent of its temperature  
 (b) decreases with increase in temperature  
 (c) increases with increase in temperature  
 (d) increases followed by a decrease with increase in temperature
74. The ionic strength of a solution which is 0.1 m in KCl and 0.2 m in  $K_2SO_4$  is  
 (a) 0.96 m                      (b) 0.70 m                      (c) 0.011 m                      (d) 1.12 m
75. Which of the following facts regarding the viscosity of a gas is correct  
 (a) Viscosity of gas is due to intermolecular interaction  
 (b) Viscosity of gas is independent of pressure  
 (c) Viscosity of gas decreases with increase in temperature  
 (d) Viscosity of a gas is independent of molecular mass
76. Pure water has  $[H_3O^+] = 10^{-6}$  moles  $L^{-1}$  at 90°C, the value of  $K_w$  at this temperature will be  
 (a)  $10^{-8} M^2$                       (b)  $10^{-12} M^2$                       (c)  $10^{-14} M^2$                       (d)  $10^{-6} M^2$
77. If we titrate  $NH_4OH$  against HCl at 25°C, the pH of the solution at equivalence point will be  
 (a)  $\sim 5.5$                       (b)  $\sim 1.5$                       (c)  $\sim 8.5$                       (d)  $\sim 9.5$
78. Which of the following ions is the most effective in the coagulation of an Arsenic sulphide sol  
 (a)  $Ca^{2+}$                       (b)  $K^+$                       (c)  $Al^{3+}$                       (d)  $Cl^-$
79. For a diatomic gas at high temperature the value of the ratio of  $C_{p,m}$  and  $C_{v,m}$  is  
 (a) 7/5                      (b) 2/3                      (c) 9/7                      (d) 9/11
80. The rate of diffusion of methane at a given temperature is twice that of a gas 'P'. The molecular weight of P is  
 (a) 64                      (b) 36                      (c) 40                      (d) 16





81. The angular momentum of an electron in  $4f$  orbital is  
 (a)  $(24)^{3/2}(h/2\pi)$  (b)  $(12)^{1/2}(h/2\pi)$  (c)  $(6)^{1/2}(h/2\pi)$  (d)  $(2)^{1/2}(h/2\pi)$
82. In an atomic orbital the sign of lobes indicate  
 (a) sign of charge (b) sign of the probability distribution  
 (c) sign of the wave function (d) presence and absence of electrons
83. The energy of the electron in the first Bohr orbit for hydrogen is  $-13.6$  eV. Which one of the following is the possible energy of the excited state for electron in Bohr orbits of hydrogen atom?  
 (a)  $-3.4$  eV (b)  $-6.8$  eV (c)  $+1.9$  eV (d)  $13.6$  eV
84. A particle of mass  $2.0 \times 10^{-26}$  g is in a one dimensional box of length  $4.0$  nm. The wavelength of the photon emitted when this particles goes from  $n = 3$  to  $n = 2$  level is  
 (a)  $1.11 \times 10^{-5}$  m (b)  $3 \times 10^{-10}$  m  
 (c)  $8.96 \times 10^{-6}$  m (d)  $2.32 \times 10^{-4}$  m
85. An electrochemical cell can behave like an electrolyte cell when  
 (a)  $E_{\text{cell}} = 0$  (b)  $E_{\text{cell}} > E_{\text{ext}}$  (c)  $E_{\text{ext}} > E_{\text{cell}}$  (d)  $E_{\text{cell}} = E_{\text{ext}}$   
 ( $E_{\text{ext}}$ : external emf)
86. Which of the following expressions is not correct (the symbols have their usual meanings)  
 (a)  $A = \log(I_0 / I)$  (b)  $\mu = m_1 m_2 / (m_1 + m_2)$   
 (c)  $\bar{v} = (1 / 2\pi c)(\mu / K)^{1/2}$  (d)  $E_v = (v + \frac{1}{2})h\nu$
87. Which of the following expression about logarithm is incorrect  
 (a)  $\log(2)^{2n} = n \log 4$  (b)  $\log(m + n) = \log m + \log n$   
 (c)  $\log(m / n) = \log m - \log n$  (d)  $\log 1000 = 3$
88. Which of the following is not true for X-rays  
 (a) These radiation can ionize gases  
 (b) It causes ZnS to fluoresce  
 (c) These are deflected by electric and magnetic fields  
 (d) Have wavelength shorter than ultraviolet radiations
89. Which of the following statement is not correct for the order of a reaction  
 (a) The order of a reaction is the sum of coefficients of the reactants in the balanced chemical equation  
 (b) The order of a reaction is an experimentally determined quantity  
 (c) The order of a reaction can be fractional  
 (d) The order of a reaction can be zero
90. Which of the following represent the wave number of radiation lying in the visible region  
 (a)  $2 \times 10^4 \text{ cm}^{-1}$  (b)  $1 \times 10^7 \text{ cm}^{-1}$   
 (c)  $4 \times 10^9 \text{ cm}^{-1}$  (d)  $4 \times 10^{12} \text{ cm}^{-1}$