

Government of Karnataka
Forest Department

Recruitment examination (main) for Range Forest Officer training 2007

06th November 2007 (2.30pm to 5.30 pm)

Optional paper: CHEMISTRY

Max. Marks: 100

Time : 3 hrs

All sections are compulsory

Part : A

1 mark each

Choose the correct answer.

- The first ionisation potential of Mg, Al, P and S follows the order
a) $Mg < Al < P < S$ b) $Al < Mg < P < S$
c) $Al < Mg < S < P$ d) $Mg < Al < S < P$
- The molecule that does not possess a permanent dipole moment is
a) NF_3 b) BF_3
c) CH_2Cl_2 d) NO_2
- The lattice energy of the alkali metal chlorides follows the order
a) $NaCl > KCl > RbCl > CsCl$
b) $KCl > NaCl > RbCl > CsCl$
c) $KCl > NaCl > CsCl > RbCl$
d) $CsCl > RbCl > KCl > NaCl$
- The correct nomenclature of the complex $[Co(NH_3)_6]Cl_3$ is :
a) Hexammine cobalt (II) chloride
b) Hexammine cobalt (III) chloride
c) Hexammine cobalt (II) tri chloride
d) Cobalt hexammine chloride
- The spin –only magnetic moment (μ_s) in BM for $[Mn(H_2O)_6]^{2+}$ ion is :
a) $\sqrt{8}$ b) $\sqrt{15}$ c) $\sqrt{24}$ d) $\sqrt{35}$
- The correct ground state electron configuration for copper atom is :
a) $[Ar] 3d^{10}4s^1$ b) $[Ar] 3d^94s^2$
c) $[Ar] 3d^74s^24p^2$ d) $[Ar] 3d^54s^24p^4$
- In which of the following molecules/ ions, the bond order is highest ?
a) O_2 b) O_2^- c) O_2^{2-} d) O_2^+
- The metal ion present in the oxygen uptake protein in our body is :
a) Mn (II) b) Fe (II) c) Fe (III) d) Zn (II)

9. Entropy, S is a measure of
- total energy
 - work
 - internal energy
 - randomness
10. The specific conductance of a 0.01M KCl solution is 0.0014 S m^{-1} at 25°C . Its molar conductance is :
- $140 \text{ S m}^2 \text{ mol}^{-1}$
 - $14.0 \text{ S m}^2 \text{ mol}^{-1}$
 - $1.4 \times 10^{-1} \text{ S m}^2 \text{ mol}^{-1}$
 - $1.4 \times 10^{-2} \text{ S m}^2 \text{ mol}^{-1}$
11. The Nernst equation for electrode potential, E for the redox reaction $\text{Ox} + ne^- \rightleftharpoons \text{Red}$, can be written as
- $E = E^\circ + \frac{R}{T} \ln \frac{[\text{Red}]}{[\text{Ox}]}$
 - $E = E^\circ + \frac{RT}{nF} \ln \frac{[\text{Ox}]}{[\text{Red}]}$
 - $E = E^\circ + \frac{RT}{F} \ln \frac{[\text{Ox}]}{[\text{Red}]}$
 - $E = E^\circ + \frac{R}{nF} \ln \frac{[\text{Red}]}{[\text{Ox}]}$
12. One of the reference electrodes used in e.m.f. measurements is :
- sat. calomel electrode
 - glass electrode
 - Pt - electrode
 - Ag - electrode
13. For a first – order reaction, the half – life is 50 sec. It means
- The reaction begins after 50 sec
 - The reaction is complete in 50 sec
 - The same quantity of reactant is consumed for every 50 sec
 - The reaction is half complete in 50 sec
14. Monosaccharides containing aldehyde group are called
- ketoses
 - aldoses
 - epimers
 - starch
15. Glucose on reduction with NaBH_4 gives
- saccharic acid
 - gluconic acid
 - sorbitol
 - glucaraic acid
16. Which is the correct order of priority for the following groups in the R, S – notation ?
- $\text{NO}_2 > \text{NH}_2 > \text{NHCOCH}_3 > \text{COOH}$
 - $\text{NO}_2 > \text{NHCOCH}_3 > \text{NH}_2 > \text{COOH}$
 - $\text{NH}_2 > \text{NO}_2 > \text{NHCOCH}_3 > \text{COOH}$
 - $\text{COOH} > \text{NH}_2 > \text{NO}_2 > \text{NHCOCH}_3$

17. The IR absorption (in cm^{-1}) for C-H stretching in acetylenic, ethylenic and paraffinic species occurs, respectively at
- a) 2800, 3080, 3300 b) 3300, 3080, 2800
 c) 3080, 2800, 3300 d) 3080, 3300, 2800
18. $\text{C}_6\text{H}_5\text{CHO} + \text{HCHO} \xrightarrow[\Delta]{\text{Base}} \text{C}_6\text{H}_5\text{CH}_2\text{OH} + \text{HCOOH}$. This is an example for :
- a) Cannizaro reaction b) Perkin reaction
 c) Crossed Cannizaro reaction d) Hofmann reaction
19. Maleic and fumaric acids are :
- a) geometrical isomers b) optical isomers
 c) position isomers d) function isomers
20. The order of stability of the following carbocations is
- C^+H_3 $\text{CH}_3\text{C}^+\text{H}_2$ $\text{C}_6\text{H}_5\text{C}^+\text{H}_2$ $(\text{C}_6\text{H}_5)_3\text{C}^+$
 (A) (B) (C) (D)
- a) $\text{A} > \text{B} > \text{C} > \text{D}$ b) $\text{B} > \text{A} > \text{C} > \text{D}$
 c) $\text{A} > \text{B} > \text{D} > \text{C}$ d) $\text{D} > \text{C} > \text{B} > \text{A}$

PART B

Section A : Answer any five questions (4 marks each)

21. What is lanthanide contraction and what are its consequences ?
22. Explain d- orbital splitting in an octahedral crystal field.
23. For a first – order reaction $\text{A} \longrightarrow \text{products}$, show that the rate constant k_t is given by
- $$k_t = \frac{1}{t} \ln \frac{a}{a - x}$$
24. Show that the work done, w in a reversible isothermal expansion of an ideal gas is :
- $$w = - nRT \ln (V_2/V_1)$$
25. Discuss the $\text{S}_{\text{N}}2$ reaction mechanism with a suitable example.
26. Give the evidences in support of open structure of glucose.
27. Explain the determination of pH of a solution using glass electrode.

28 . How does chemical adsorption (chemisorption) differ from physical adsorption (physisorption) ?

PART – II : Answer any 5 full questions (12 marks each)

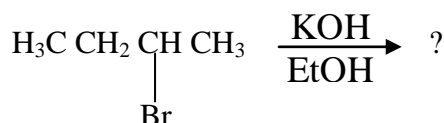
29. a) Why is the separation of lanthanides so difficult ? Explain the ion-exchange chromatographic method for their separation.
b) Explain the metal factors affecting stability of complexes. (8 + 4)

30. a) Based on Valence Bond Theory, explain the bonding in CH_4 and C_2H_6
b) Give the electronic configuration of dinitrogen (N_2) molecule. What is its bond order ? (8 + 4)

31. a) What is lattice energy of an ionic compound ? What are the factors affecting lattice energy ?
b) Explain Heisenberg's uncertainty principle.
c) What is electro negativity ? How does it vary along a period and down a group ? (4+4+4)

32. a) What is isoelectric point of an amino acid ? What is its importance ?
b) What are peptides ? Explain Merry Field's solid phase synthesis of peptides (4+8)

33. a) Predict the major product/s and give the mechanism for the reaction :



b) Name the product formed and explain the mechanism involved in the reaction :



34. a) Discuss the mechanism of nitration of benzene.
b) Explain orientation effect in electrophilic aromatic substitution taking nitration of toluene as an example. (6+6)

35. a) Discuss the Debye-Huckel theory of strong electrolytes.
b) Explain the general characteristics of catalytic reactions. (7+5)

36. a) Discuss the mechanism of chain reactions with a suitable example.
b) What is adiabatic process ? For a reversible adiabatic expansion of a gas show that $T_1 / T_2 = (V_2 / V_1)^{\gamma-1}$ where $\gamma = C_p / C_v$

