RAMAKRISHNA MISSION VIDYAMANDIRA

Belur Math, Howrah – 711 202

ADMISSION TEST – 2018

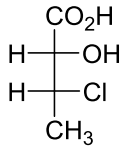
CHEMISTRY (Honours)

Date : 19-06-2018 **Full Marks : 50** Time: 11·00 a.m – 12·00 noon

Instructions for the candidate

Answer all the questions given below. Each question carries 2 marks. Tick (✓) the most appropriate option on the **OMR SHEET**. The tick must be very clear — if it is smudgy or not clear, no marks will be awarded. **Any rough work must be done in the supplied rough sheet(s)**.

1. The absolute configuration for the following molecule is:

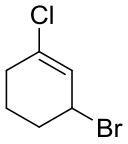


a) (2S,3R) b) (2S,3S) c) (2R,3R) d) (2R,3S)

2. Which of the following compounds will release CH_4 gas during addition of CH_3MgI:

a) $H_3C-\equiv CH$ b) $H_3C-\equiv-CH_3$ c) $C_2H_3-O-C_2H_3$ d) 

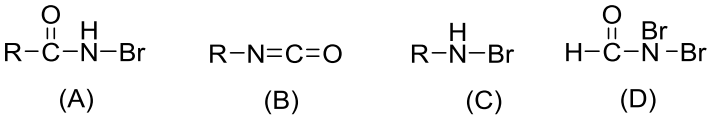
3. The IUPAC name of the compound shown below is:



a) 3-bromo-1-chlorocyclohex-1-ene b) 2-bromo-6-chlorocyclohex-1-ene

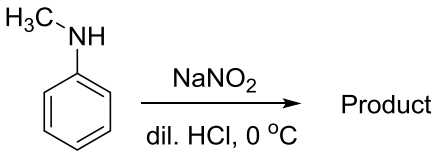
c) 6-bromo-2-chlorocyclohex-1-ene d) 1-bromo-3-chlorocyclohex-2-ene

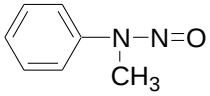
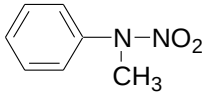
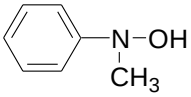
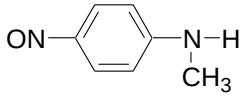
4. The reaction of $RCONH_2$ with a mixture of Br_2 and KOH gives RNH_2 as the main product. The intermediates involved in the reaction are:



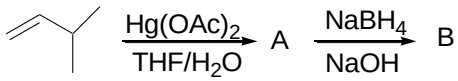
a) A and B b) B and C c) B and D d) A and C

5. Predict the product in the following reaction:

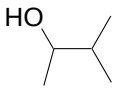


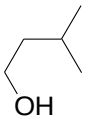
a)  b)  c)  d) 

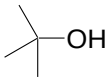
6. Predict the major product B in the following sequence of the reactions:



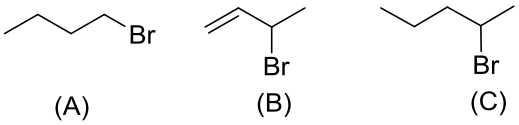
a) 

b) 

c) 

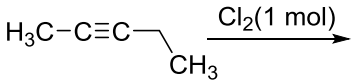
d) 

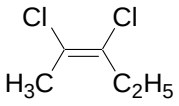
7. The correct order of S_N^1 reactivity for the following bromides is:

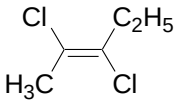


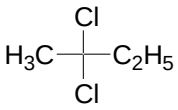
a) A > B > C b) B > C > A c) B > A > C d) C > B > A

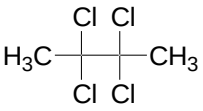
8. What is the major product of the following reaction?



a) 

b) 

c) 

d) 

9. Oxidimetric and acidimetric equivalent weight of $KH(IO_3)_2$ are respectively:
[M.Wt of $KH(IO_3)_2$ is 389.91 gm]

a) 32.492 and 389.91 b) 64.98 and 389.91 c) 389.91 and 64.98 d) 194.95 and 389.91

10. SbF_5 dissolves readily in anhydrous HF producing solution 'A' and heat. The solution 'A' dissolves copper forming a clear solution which contain 'B' and 'C'. Here A, B and C are respectively-

a) $HSbF_6$, $Cu(SbF_6)_2$ and H_2 b) $HSbF_6$, $Cu(SbF_6)_2$ and F_2

c) SbF_3, CuF and F_2 d) H_3SbF_8, $Cu(SbF_6)$ and F_2 .

11. Specify the coordination geometry around and hybridisation of 'N' and 'B' in 1:1 complex of BF_3 and NH_3 –

a) N: Tetrahedral, sp^3 & B: Tetrahedral, sp^3 b) N: Pyramidal, sp^3 & B: Pyramidal, sp^3

c) N: Pyramidal, sp^3 & B: planer, sp^2 d) N: Pyramidal, sp^3 & B: Tetrahedral, sp^3

12. Potential difference through which an electron must be accelerated in order to raise the energy of a Ne^{9+} ion from ground state to second excited state is

a) 1209 eV b) 1020 eV c) 12.09 eV d) -12.09 eV

13. The increasing order of ionic radii of the following ions, H^- , I^-, Cl^-, Br^-, F^- is –

a) $F^- < Cl^- < Br^- < I^- < H^-$ b) $F^- < Cl^- < Br^- < H^- < I^-$

c) $F^- < H^- < Cl^- < Br^- < I$ d) $H^- < F^- < Cl^- < Br^- < I^-$

14. There is no S-S bond in-

a) $S_2O_4^{2-}$ b) $S_2O_7^{2-}$ c) $S_2O_5^{2-}$ d) $S_2O_3^{2-}$

15. When nitrite ion and bisulphite ion is treated in cold aqueous acidic solution, produces 'A' and 'B', where 'A' shows both oxidising and reducing property. The 'A' and 'B' are respectively –

a) N_2H_4 and SO_4^{2-} b) $NHOH^+$ and SO_4^{2-} c) HNO_2 and H_2SO_4 d) $N_2H_5^+$ and $S_2O_3^{2-}$

16. A buffer solution contain 0.1M acetic acid and 0.2M sodium acetate ($K_a = 1.8x10^{-5}$). By addition of (i) 10 cm^3 of 1 (N) HCl and (ii) 10cm^3 NaOH solution separately to the 500cm^3 of the buffer solution, the pH of the buffer solution becomes(neglect volume change) –

a) 1.69 and 12.31 respectively b) 4.92 and 5.18 respectively

c) 4.98 and 5.01 respectively d) none of these

17. The standard electrode potential for couples involving Cu^+, Cu^{2+} and ammonium complexes are given as follows -

$$[Cu(NH_3)_2]^+ + e^- \rightleftharpoons Cu + 2\ NH_3 \qquad E_0 = -0.14\ V$$

$$[Cu(NH_3)_4]^{2+} + 2\ e^- \rightleftharpoons Cu + 4\ NH_3 \quad E_0 = -0.02\ V$$

The standard electrode potential for the following couple is _____.

$$[Cu(NH_3)_4]^{2+} + e^- \rightleftharpoons [Cu(NH_3)_2]^+ + 2\ NH_3$$

Does the disproportion of the $[Cu(NH_3)_2]^+$ take place?

a) – 0.12 V, yes b) 0.12 V, no c) – 0.24 V, yes d) 0.10 V, no

18. Consider an experiment - 10 ml of 0.01(N) HA (a strong acid) is mixed to 40 ml of water, kept in a beaker and the solution is connected to a conductivity-meter. From the burette, 2 ml of 0.1(N) solution of BOH (a strong base) is added drop wise to the solution in beaker, what will be the trend in values of conductance observed (in a conductance vs. amt. of BOH plot) with the addition of drop of BOH?

a) constant then decreases followed by increment

b) decreases then remains same followed by decrease

c) decreases then increases followed by constant value

d) decreases then increases followed by sharp increment

19. Which one from the followings is true?

a) A process in which the final temperature equals the initial temperature must be an isothermal process

b) All the molecules, in a pure gas, which is at a constant temperature, travel at the same speed

c) T remains unchanged for every adiabatic process in a closed system

d) Internal energy does not change in a cyclic process

20. Platinum(IV) oxide is not found in the nature, but it can be prepared in a laboratory. Solid platinum(IV) oxide is in equilibrium with platinum metal and oxygen gas at 1 atm (= 1.01325×10^5 Pa) and 650 °C. This suggests that the conditions on the Earth, when the minerals we know were formed, were: (most probable one)

a) $p(O_2) = 1$ atm, $t = 650$ °C b) $p(O_2) < 1$ atm, $t < 650$ °C

c) $p(O_2) > 1$ atm, $t < 650$ °C d) $p(O_2) < 1$ atm, $t > 650$ °C

21. The energy of stable states of the hydrogen atom is given by: $E_n = -2.18\times10^{-18}/n^2$ J, where n denotes the principal quantum number. A single photon, emitted in the sixth line of the Lyman series, can ionize a copper atom in the Cu crystal. What do you mean by sixth line of Lyman series? What is the kinetic energy of the electrons emitted from a copper crystal?
[The electron work function of Cu is = 7.44×10^{-19} J; h = 6.6256×10^{-34} J s; c = 2.99792×10^{8} m s^{-1}]

a) 6→1, 2.135×10^{-18} J b) 7→1, 2.135×10^{-18} J c) 7→1, 13.91×10^{-19} J d) 6→1, 13.91×10^{-19} J

22. The following statements contain relations (P, V, T) about real gas molecules, following van der Waals gas equation. Which one is correct? [Terms contain own significance]

a) $\left(P+\frac{a}{V^2/n^2}\right)\left(\frac{V}{n}-b\right)=nRT$ b) $P=\frac{RT}{V-nb}-\frac{n^2a}{V^2}$

c) $\left(\frac{dP}{dV}\right)_T+\frac{RT}{(V-nb)^2}=\frac{2n^2a}{V^3}$ d) $\left(\frac{d^2p}{dV^2}\right)_T+\frac{2RT}{(V-b)^3}=\frac{6n^2a}{V^4}$

23. Nitrogen dioxide NO_2 is one of a number of oxides of nitrogen found in our atmosphere. It can dimerize to give N_2O_4 (g):

$$2\ NO_2(g) \rightleftharpoons N_2O_4(g)$$

The dissociation of $N_2O_4(g)$ to give $NO_2(g)$ is a 1st order reaction with the specific rate constant of 5.3×10^{4} s^{-1} at 298 K. Starting with an initial concentration of 0.10 M for $NO_2(g)$, an equilibrium between these two molecules is established at 298 K, with the equilibrium constant 1.8×10^{2}. Which statement from the followings is correct?

a) The equilibrium constant for the above reaction is unchanged at 2980 K.

b) The specific rate constants for forward and backward reactions are temperature independent.

c) The specific rate constant for $NO_2(g)$ to $N_2O_4(g)$ is 9.8×10^{6} $dm^3mol^{-1}s^{-1}$ at 298 K.

d) Half life for the dissociation of $N_2O_4(g)$ is 5.3×10^{-4} s at 298 K.

24. An galvanic cell with Cu(1) and Cu (2) was designed as Cu(1)|$CuSO_4$(aq)|Cu(2) and the electromotive force E of the above cell was expressed as $E = \Phi_R - \Phi_L$, where Φ_R and Φ_L being the right and left electrode potentials (i. e. half-cell potentials), respectively. What is the E value for the cell and why?

a) E < 0; positive free energy change b) E > 0; equilibrium state

c) E > 0; negative free energy change d) E > 0; constant P and T

25. In the following two tables (A and B), some experiments/theoretical concepts and the consequences are mentioned.

A	B
1. Uncertainty principle	1. Electrons in orbit
2. Photoelectric effect	2. Includes spin of electrons
3. X-ray diffraction	3. Delocalized electrons
4. Angular momentum quantization	4. Corpuscular nature of light
5. Exclusion principle	5. Crystal structure analysis

Which option from the following will be the most suitable match?

a) A1 – B3, A4 – B1, A5 – B5 b) A2 – B3, A3 – B5, A4 – B1

c) A2 – B4, A3 – B5, A5 – B2 d) A3 – B5, A4 – B4, A5 – B2

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