RAMAKRISHNA MISSION VIDYAMANDIRA

Belur Math, Howrah – 711 202

ADMISSION TEST – 2022

CHEMISTRY (Honours)

Date : 29-06-2022 **Full Marks : 50** Time: 3·00 p.m – 4·00 p.m.

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. Neglecting reduced mass effects, what optical transition in the He^+ spectrum have the same wave length as the first Lyman transition of hydrogen (n = 2 to n = 1)?
   a) n = 2 to n = 1 b) n = 3 to n = 2 c) n = 4 to n = 3 d) n = 4 to n = 2

2. The standard reduction potentials (volts) at 298 K for the following half-reactions are given against each in below:
   i) $Zn^{2+}_{(aq)} + 2e \leftrightarrow Zn_{(s)}$; −0.762 ii) $Cr^{3+}_{(aq)} + 3e \leftrightarrow Cr_{(s)}$; −0.740
   iii) $2H^+ + 2e \leftrightarrow H_{2(g)}$; 0.000 iv) $Fe^{3+}_{(aq)} + e \leftrightarrow Fe^{2+}_{(aq)}$; +0.760
   Which couples are representative of strongest and weakest reducing agents?
   a) (i), (iii) b) (ii), (iii) c) (i), (iv) d) (ii), (iv)

3. When these substances are arranged in order of increasing boiling point (lowest boiling point first), (i) NH_3 (ii) PH_3 (iii) AsH_3 ; what is the correct order?
   a) i < ii < iii, b) iii < ii < i , c) ii < iii < i d)iii < i < ii

4. Given the abundances of isotopes ^{54}Fe, ^{56}Fe and ^{57}Fe are 5.0 %, 90.0 % and 5.0 % respectively, the atomic mass of Fe is
   a) 55.85 b) 55.95 c) 55.75 d) 56.05.

5. Among the following, identify the correct statement.
   a) Chloride ion is oxidized by $O_{2(g)}$ b) Fe^{2+} is oxidized by iodine solution
   c) Iodide ion is oxidized by chlorine gas d) Mn^{2+} is oxidized by chlorine gas

6. Amongst the following, the compounds whose aqueous solutions turn red litmus paper blue are: KCN, K_2CO_3 , K_2SO_4, $(NH_4)_2C_2O_4$, NaCl, $Zn(NO_3)_2$, $FeCl_3$, NH_4NO_3, LiCN
   a) KCN, K_2CO_3, LiCN b) K_2CO_3, $(NH_4)_2C_2O_4$, $FeCl_3$
   c) KCN, K_2CO_3, $Zn(NO_3)_2$ d) K_2SO_4, $FeCl_3$, NH_4NO_3

7. The number of F-Br-F angles equals to 90° in BrF_5 as per VSEPR model is
   a) 3, b) 4, c) 5, d) zero.

8. Green chemistry is a production process that would bring about
   a) with the use of naturally occurring material
   b) with the use of natural gas
   c) minimum pollution or deterioration to the environment
   d) minimum waste generation with the use of existing practice.

9. Consider the following reaction :
   $MnO_4^{-1} + (COOH)_2 + H^+ \rightarrow Mn^{+2} + CO_2 + H_2O$
   Given that the molecular weight of $KMnO_4$ is 158 g/mol. The equivalent weight (in the unit of mol^{-1}) of $KMnO_4$ is
   a) 31.6 b)158 c) 79 d) 22.57

10. 10 ml of an 0.1 (N) oxalic acid solution for complete neutralization with 0.1 (N) NaOH solution requires
    a) 20 ml NaOH soln since both are of same concentration but oxalic acid is dibasic
    b) 10 ml NaOH soln as both are of same normality
    c) less than 10 ml NaOH since both are of same normality but second dissociation of oxalic acid is weak
    d) less than 20 ml NaOH since oxalic acid is dibasic with a weak a second dissociation

11. Tick the correct answer(s)
    a) Both the energy of the universe and its entropy are constant
    b) Energy of the universe is constant but entropy decreases with time
    c) Energy of the universe decreases with time but entropy remains constant
    d) Energy of the universe is constant but entropy increases with time

12. Consider the following data

Set	Initial con of A (moles/litre)	Initial con of B (moles/litre)	Rate (some units)
1	1×10^{-1}	1×10^{-1}	100
2	2×10^{-1}	1×10^{-1}	400
3	1×10^{-1}	2×10^{-1}	200

    The order of the reaction is
    a) 1 w.r.t A and 2 w.r.t B
    b) 2 w.r.t A and 1 w.r.t B
    c) 1 w.r.t A and 1 w.r.t B
    d) 2 w.r.t A and 2 w.r.t B

13. A 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) $E < 0$; negative free energy change
    b) $E = 0$; equilibrium state
    c) $E > 0$; negative free energy change
    d) $E > 0$; constant P and T

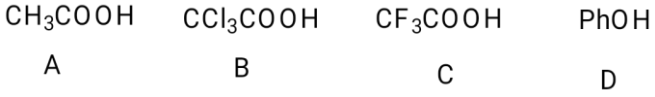
14. Which of the following function(s) pass through a single maxima
    a) $f(x) = x^2 \sin(x)$ b) $f(x) = e^{-x}/x$ c) $f(x) = x(1-x)$ d) $f(x) = x^2e^{-x}$

15. Which of the following(s) is/are true for the pH of a solution
    a) pH of acids does not change with temperature
    b) pH of acids increases with temperature
    c) pH of a weak acid decreases with temperature, that of a strong acid does not change
    d) pH of a weak acid increases with temperature, that of a strong acid does not change

16. Which of the following(s) is/are true for a catalyst.
    a) A catalyst does not take part in a reaction, still it can enhance the reaction rate
    b) A catalyst takes part in a reaction and enhances the reaction rate
    c) The amount of a catalyst does not change as the reaction goes to completion
    d) Catalyst increases the yield of a particular reaction

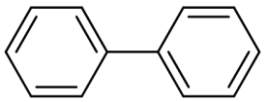
17. The correct order of boiling point of the solution is
    a) 0.1(M) of K_2SO_4 > 0.1 (M) NaCl > 0.1 (M) sucrose > pure water
    b) 0.1 (M) K_2SO_4 = 0.1(M) of NaCl = 0.1 (M) sucrose > pure water
    c) 0.1(M) of K_2SO_4 < 0.1 (M) NaCl < 0.1 (M) sucrose > pure water
    d) 0.1(M) of K_2SO_4 = 0.1 (M) NaCl < 0.1 (M) sucrose > pure water

18. Arrange the following molecule in increasing order of acidity:



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

19. Find out the symmetry element(s) present in the following molecule



a) Mirror plane (σ plane) b) Centre of symmetry (*i*)
c) both (σ plane) and (*i*) d) None

20. Which of the following molecules can't be used as alkylating agents in the Friedel-Craft reaction?

a) CH_2Cl_2

b) CH_2=CH-CH_2-Cl

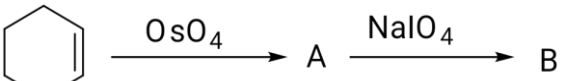
c) $(CH_3)_2CHCl$

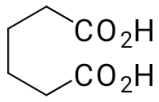
d) PhCl

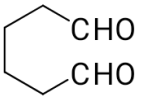
21. Consider the reaction: RCl + NaI → RI + NaCl. The reaction is known as:

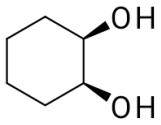
a) Wurtz reaction b) Fitting reaction c) Wurtz-Fitting reaction d)Finkelstein reaction

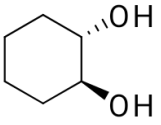
22. Predict the structure of B for the following reactions:



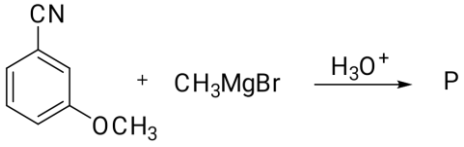
a) 

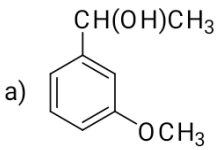
c) 

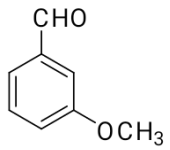
b) 

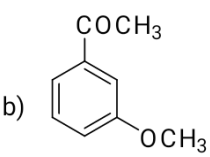
d) 

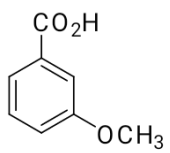
23. Predict the structure of P for the following reactions:



a) 

c) 

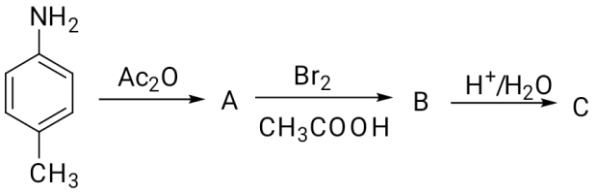
b) 

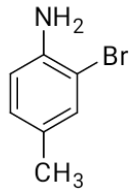
d) 

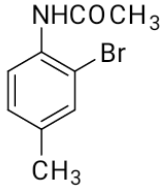
24. Urotropine $(CH_2)_6N_4$ can be prepared by reacting the following pair of reactants:

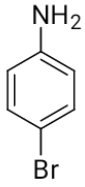
a) Formaldehyde and 2,4,-DNP
b) Formaldehyde and ammonia
c) Formaldehyde and Tollen's
d) Formaldehyde and NaOH

25. The final product "C" obtained in this following reaction is :



a) 

b) 

c) 

d)