

**JEE-MAIN EXAM JANUARY, 2024**

Date: - 29-01-2024 (SHIFT-1)

**CHEMISTRY****SECTION-A**

1. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R:

**Assertion A:** The first ionisation enthalpy decreases across a period.

**Reason R:** The increasing nuclear charge outweighs the shielding across the period.

In the light of the above statements, choose the most appropriate from the options given below:

- (1) Both A and R are true and R is the correct explanation of A  
 (2) A is true but R is false  
 (3) A is false but R is true  
 (4) Both A and R are true but R is NOT the correct explanation of A

2. Match List I with List II

**List-I****(Substances)**

- A. Ziegler catalyst  
 B. Blood Pigment  
 C. Wilkinson catalyst  
 D. Vitamin B<sub>12</sub>

**List-II****(Element present)**

- I. Rhodium  
 II. Cobalt  
 III. Iron  
 IV. Titanium

Choose the correct answer from the options given below:

- (1) A-II, B-IV, C-I, D-III  
 (2) A-II, B-III, C-IV, D-I  
 (3) A-III, B-II, C-IV, D-I  
 (4) A-IV, B-III, C-I, D-II

3. In chromyl chloride test for confirmation of Cl<sup>-</sup> ion, a yellow solution is obtained. Acidification of the solution and addition of amyl alcohol and 10% H<sub>2</sub>O<sub>2</sub> turns organic layer blue indicating formation of chromium pentoxide. The oxidation state of chromium in that is

- (1) +6                      (2) +5                      (3) +10                      (4) +3

4. The difference in energy between the actual structure and the lowest energy resonance structure for the given compound is

- (1) electromeric energy                      (2) resonance energy  
 (3) ionization energy                      (4) hyperconjugation energy

5. Given below are two statements :

**Statement I :** The electronegativity of group 14 elements from Si to Pb gradually decreases.

**Statement II :** Group 14 contains non-metallic, metallic, as well as metalloid elements.

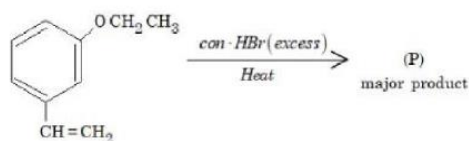
In the light of the above statements, choose the most appropriate from the options given below :

- (1) Statement I is false but Statement II is true    (2) Statement I is true but Statement II is false  
 (3) Both Statement I and Statement II are true    (4) Both Statement I and Statement II are false

6. The correct set of four quantum numbers for the valence electron of rubidium atom ( $Z = 37$ ) is:

- (1)  $5, 0, 0, +\frac{1}{2}$       (2)  $5, 0, 1, +\frac{1}{2}$       (3)  $5, 1, 0, +\frac{1}{2}$       (4)  $5, 1, 1, +\frac{1}{2}$

7. The major product (P) in the following reaction is



- (1) (2) (3) (4)

8. The arenium ion which is not involved in the bromination of Aniline is \_\_\_\_\_.

- (1) (2) (3) (4)

9. Appearance of blood red colour, on treatment of the sodium fusion extract of an organic compound with  $\text{FeSO}_4$  in presence of concentrated  $\text{H}_2\text{SO}_4$  indicates the presence of element/s

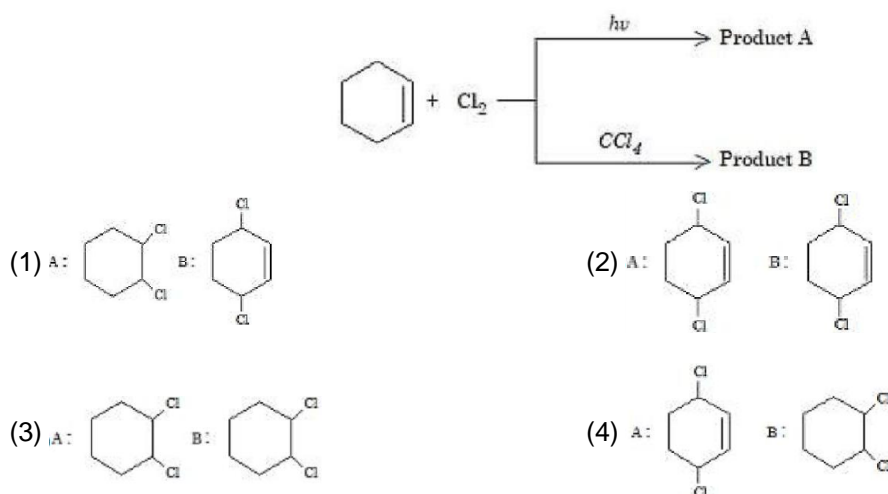
- (1) Br      (2) N      (3) N and S      (4) S

10. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :  
Assertion A : Aryl halides cannot be prepared by replacement of hydroxyl group of phenol by halogen atom.

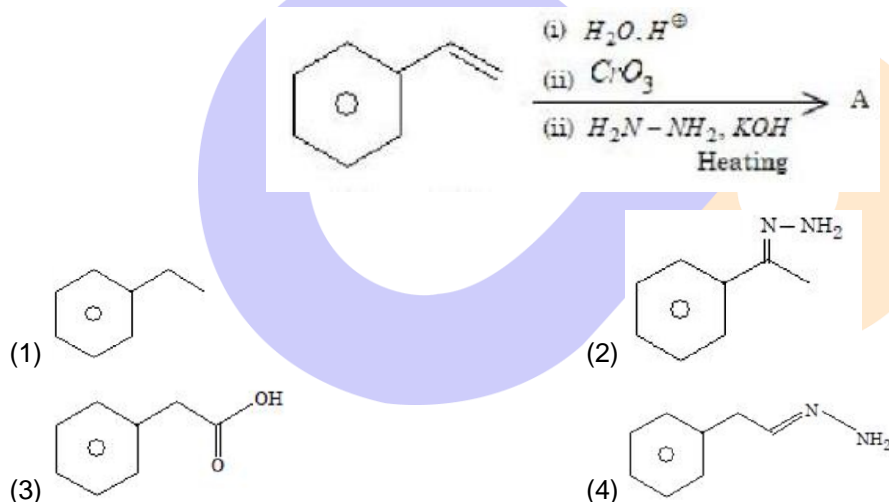
Reason R : Phenols react with halogen acids violently. In the light of the above statements, choose the most appropriate from the options given below:

- (1) Both A and R are true but R is NOT the correct explanation of A  
(2) A is false but R is true  
(3) A is true but R is false  
(4) Both A and R are true and R is the correct explanation of A

11. Identify product A and product B :



12. Identify the incorrect pair from the following:
- Fluorspar-  $\text{BF}_3$
  - Cryolite-  $\text{Na}_3\text{AlF}_6$
  - Fluorapatite-  $3\text{Ca}_3(\text{PO}_4)_2 \cdot \text{CaF}_2$
  - Carnallite-  $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$
13. The interaction between  $\pi$  bond and lone pair of electrons present on an adjacent atom is responsible for
- Hyperconjugation
  - Inductive effect
  - Electromeric effect
  - Resonance effect
14.  $\text{KMnO}_4$  decomposes on heating at 513 K to form  $\text{O}_2$  along with
- $\text{MnO}_2$  &  $\text{K}_2\text{O}_2$
  - $\text{K}_2\text{MnO}_4$  &  $\text{Mn}$
  - $\text{Mn}$  &  $\text{KO}_2$
  - $\text{K}_2\text{MnO}_4$  &  $\text{MnO}_2$
15. In which one of the following metal carbonyls, CO forms a bridge between metal atoms?
- $[\text{Co}_2(\text{CO})_8]$
  - $[\text{Mn}_2(\text{CO})_{10}]$
  - $[\text{Os}_3(\text{CO})_{12}]$
  - $[\text{Ru}_3(\text{CO})_{12}]$
16. Type of amino acids obtained by hydrolysis of proteins is :
- $\beta$
  - $\alpha$
  - $\delta$
  - $\gamma$
17. The final product A formed in the following multistep reaction sequence is



18. Which of the following is not correct ?
- $\Delta G$  is negative for a spontaneous reaction
  - $\Delta G$  is positive for a spontaneous reaction
  - $\Delta G$  is zero for a reversible reaction
  - $\Delta G$  is positive for a non-spontaneous reaction
19. Chlorine undergoes disproportionation in alkaline medium as shown below :
- $$a \text{Cl}_2(\text{g}) + b \text{OH}^-(\text{aq}) \rightarrow c \text{ClO}^-(\text{aq}) + d \text{Cl}^-(\text{aq}) + e \text{H}_2\text{O}(\text{l})$$
- The values of  $a, b, c$  and  $d$  in a balanced redox reaction are respectively :
- 1, 2, 1 and 1
  - 2, 2, 1 and 3
  - 3, 4, 4 and 2
  - 2, 4, 1 and 3
20. In alkaline medium,  $\text{MnO}_4^-$  oxidises  $\text{I}^-$  to
- $\text{IO}_4^-$
  - $\text{IO}^-$
  - $\text{I}_2$
  - $\text{IO}_3^-$

## SECTION-B

21. Number of compounds with one lone pair of electrons on central atom amongst following is  $O_3, H_2O, SF_4, ClF_3, NH_3, BrF_5, XeF_4$
22. The mass of zinc produced by the electrolysis of zinc sulphate solution with a steady current of 0.015 A for 15 minutes is  $\times 10^{-4}$  g.  
(Atomic mass of zinc = 65.4amu )
23. For a reaction taking place in three steps at same temperature, overall rate constant  $K = \frac{K_1 K_2}{K_3}$ . If  $E_{a1}, E_{a2}$  and  $E_{a3}$  are 40, 50 and 60 kJ/mol respectively, the overall  $E_a$  is kJ/mol.
24. For the reaction  $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ ,  $K_p = 0.492$  atm at 300 K.  $K_c$  for the reaction at same temperature is  $\times 10^{-2}$ .  
(Given :  $R = 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}$  )
25. A solution of  $H_2SO_4$  is 31.4%  $H_2SO_4$  by mass and has a density of 1.25 g/mL. The molarity of the  $H_2SO_4$  solution is M (nearest integer)  
[Given molar mass of  $H_2SO_4 = 98 \text{ g mol}^{-1}$  ]
26. The osmotic pressure of a dilute solution is  $7 \times 10^5$  Pa at 273 K. Osmotic pressure of the same solution at 283 K is  $\times 10^4 \text{ Nm}^{-2}$ .
27. Number of compounds among the following which contain sulphur as heteroatom is  
Furan, Thiophene, Pyridine, Pyrrole, Cysteine, Tyrosine
28. The number of species from the following which are paramagnetic and with bond order equal to one is  
 $H_2, He_2^+, O_2^+, N_2^{2-}, O_2^{2-}, F_2, Ne_2^+, B_2$
29. From the compounds given below, number of compounds which give positive Fehling's test is  
Benzaldehyde, Acetaldehyde, Acetone,  
Acetophenone, Methanal, 4-nitrobenzaldehyde, cyclohexane carbaldehyde.
30. 
$$\begin{array}{c} \text{CH}_3 \quad \quad \text{H} \\ \quad \diagdown \quad \diagup \\ \quad \text{C}=\text{C} \\ \quad \diagup \quad \diagdown \\ \text{H} \quad \quad \text{CH}_3 \end{array} \xrightarrow[\text{(ii) Zn/H}_2\text{O}]{\text{(i) O}_3} \text{(P)}$$
  
Consider the given reaction. The total number of oxygen atoms present per molecule of the product (P) is

## NTA ANSWERS

- |                     |          |         |         |                     |         |         |
|---------------------|----------|---------|---------|---------------------|---------|---------|
| 1. (3)              | 2. (4)   | 3. (1)  | 4. (2)  | 5. (1)              | 6. (1)  | 7. (4)  |
| 8. (3)              | 9. (3)   | 10. (3) | 11. (4) | 12. (1)             | 13. (4) | 14. (4) |
| 15. (1)             | 16. (2)  | 17. (1) | 18. (2) | 19. (1)             | 20. (4) | 21. (4) |
| 22. (45.75) or (46) | 23. (30) | 24. (2) | 25. (4) | 26. (72.56) or (73) |         |         |
| 27. (2)             | 28. (1)  | 29. (3) | 30. (1) |                     |         |         |