JEE MAIN 2024

Paper with Solution

Chemistry | 29th January 2024 _ Shift-1

MOTION

PRE-ENGINEERING | **PRE-MEDICAL** | **FOUNDATION (Class 6th to 10th)**
JEE (Main+Advanced) | NEET | Olympiads/Boards

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MOTION LEARNING APP

Scan Code for Demo Class

SECTION – A

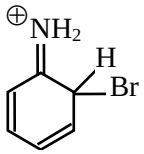
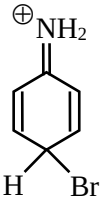
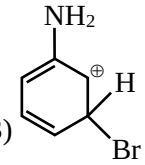
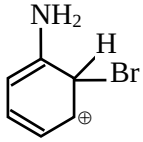
1. Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R :**
Assertion A : The first ionisation enthalpy decreases across a period.
Reason R : The increasing nuclear charge outweighs the shielding across the period.
In the light of the above statements, choose the **most appropriate** from the options given below :
(1) A is false but R is true
(2) A is ture but R is false
(3) Both A and R are true and R is the correct explanation of A
(4) Both A and R are true but R is NOT the correct explanation of A

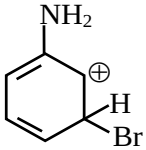
Ans. **(1)**
Along the period shielding increases in less amount than nuclear charge

2. The difference in energy between the actual structure and the lowest energy resonance structure for the given compound is :
(1) electromeric energy
(2) ionization energy
(3) hyperconjugation energy
(4) resonance energy

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

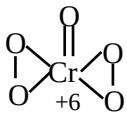
3. The arenium ion which is not involved in the bromination of Aniline is _____.

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

Ans. **3**
In  , positive charge is not stabilized by +M effect of $-\ddot{N}H_2$ so this arenium ion is not formed during bromination of aniline.

4. In chromyl chloride test for confirmation of Cl^-ion, a yellow solution is obtained. Acidification of the solution and addition of amyl alcohol and 10% H_2O_2 turns organic layer blue indicating formation of chromium pentoxide. The oxidation state of chromium in that is :
(1) +5
(2) +3
(3) +10
(4) +6

Ans. **(4)**
CrO_5 has two peroxide linkage



5. Match List I with List II

List I (Substances)		**List II (Element Present)**	
A.	Ziegler catalyst	I.	Rhodium
B.	Blood Pigment	II.	Cobalt
C.	Wilkinson catalyst	III.	Iron
D.	Vitamin B_{12}	IV.	Titanium

Choose the correct answer from the options given below :

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

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

Ans. **(2)**

Fact

(1) Wilkinson catalyst = $[Rh(PPh_3)_3Cl]$

(2) Zigler catalyst = $TiCl_4–AlR_3$

6. Type of amino acids obtained by hydrolysis of proteins :

(1) γ (2) δ (3) β (4) α

Ans. **4**

$\rightarrow$ Natural proteins are polymers of α–amino acids.

7. The interaction between π bond and lone pair of electrons present on an adjacent atom is responsible for :

(1) Resonance effect (2) Electromeric effect (3) Inductive effect (4) Hyperconjugation

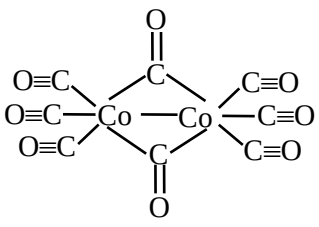
Ans. **1**

$\rightarrow$ The interaction between π bond and lone pair of electron present on adjacent atom is responsible for resonance effect.

8. In which one of the following metal carbonyls, CO forms a bridge between metal atoms?

(1) $[Os_3(CO)_{12}]$ (2) $[Ru_3(CO)_{12}]$ (3) $[Co_2(CO)_8]$ (4) $[Mn_2(CO)_{10}]$

Ans. **(3)**



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

Assertion A : Aryl halides connot 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 :

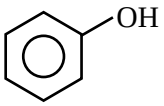
(1) **A** is false but **R** is true

(2) Both A and R are true and R is the correct explanation of A

(3) A is true but R is false

(4) Both A and R are true but R is NOT the correct explanation of A

Ans. **3**

→  does not give substitution rx^n due to double bond character in C–O bond.

→ Phenol does not react with HX violently.

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

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

Ans. **(4)**

1st group element.

valence e$^-$ configuration = 5 s^1

n=5, ℓ=0, m=0, s=+1/2

11. Identify the incorrect pair from the following :

(1) Carnallite – $KCl.MgCl_2.6H_2O$ (2) Cryolite – Na_3AlF_6

(3) Fluroapatite – 3 $Ca_3(PO_4)_2.CaF_2$ (4) Fluorspar – BF_3

Ans. **(4)**

Fact

12. Appearance of blood red colour, on treatment of the sodium fusion extract of an organic compound with $FeSO_4$ in presence of concentrated H_2SO_4 indicates the presence of element/s :

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

Ans. **1**

If organic compound contain N and S then sodium fusion extract has NaCNS which give blood red colour with Fe^{3+} ion

$NaCNS+FeCl_3 \rightarrow Fe(SCN)_3$

blood Red

13. In alkaline medium, MnO_4^- oxidises I^- to :

(1) IO^- (2) IO_4^- (3) I_2 (4) IO_3^-

Ans. **(4)**

$$I^- + 2MnO_4^- + H_2O \rightarrow IO_3^- + 2MnO_2 + 2OH^-$$

14. Which of the following is not correct?

(1) ΔG is zero for a reversible reaction.

(2) ΔG is negative for a spontaneous reaction

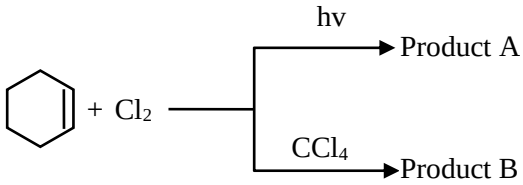
(3) ΔG is positive for a spontaneous reaction

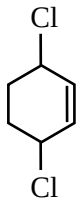
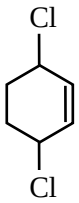
(4) ΔG is positive for a non-spontaneous reaction

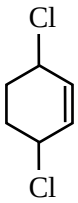
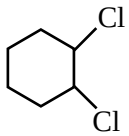
Ans. **(3)**

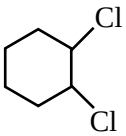
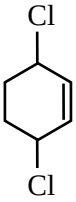
Fact based

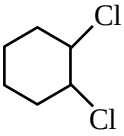
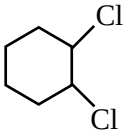
15. Identify product A and product B :



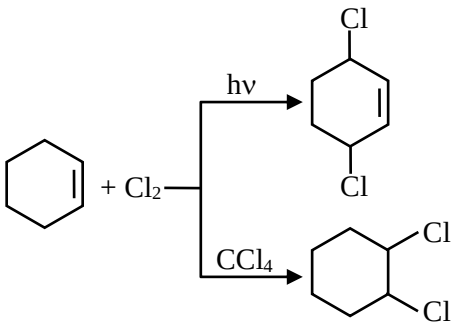
(1) A :  B : 

(2) A :  B : 

(3) A :  B : 

(4) A :  B : 

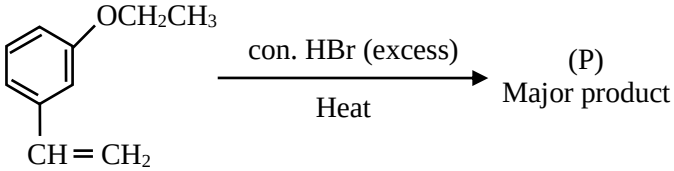
Ans. **2**

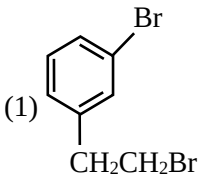


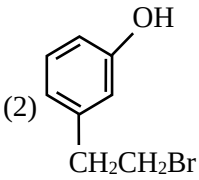
(Allylic substitution Rx^n)

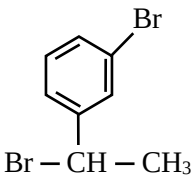
(Addition of halogen Electrophilic addition Rx^n)

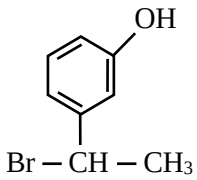
16. The major product(P) in the following reaction is :



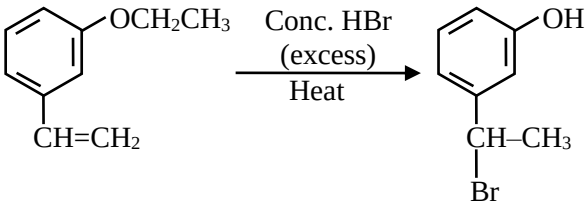
(1) 

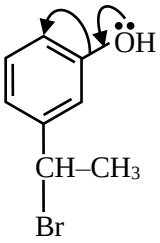
(2) 

(3) 

(4) 

Ans. **4**





further does not react with HBr due to double bond character between C–O bond.

17. Chlorine undergoes disproportionation in alkaline medium as shown below :

$a\ Cl_{2(g)} + b\ OH^-_{(aq)} \rightarrow c\ ClO^-_{(aq)} + d\ Cl^-_{(aq)} + e\ H_2O_{(l)}$

The value of a, b, c and d in a balanced redox reaction are respectively :

(1) 2, 2, 1 and 3 (2) 1, 2, 1 and 1 (3) 2, 4, 1 and 3 (4) 3, 4, 4 and 2

Ans. **2**

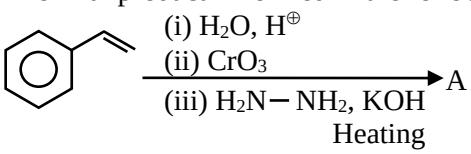
$Cl_2 \rightarrow 2Cl^- + 2e^-$ (Reduction half Reaction)

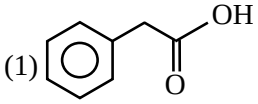
$2H_2O + Cl_2 \rightarrow 2\ ClO^- + 4H^+ + 2e^-$ (oxidation half)

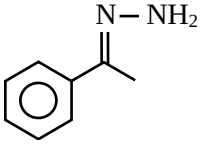
$2\ Cl_2 + 2\ H_2O \rightarrow 2\ Cl^- + 2\ ClO^- + 4\ H^+$

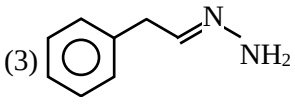
$Cl_2 + 2OH^- \rightarrow Cl^- + ClO^- + H_2O$

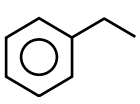
18. The final product A formed in the following multistep reaction sequence is :



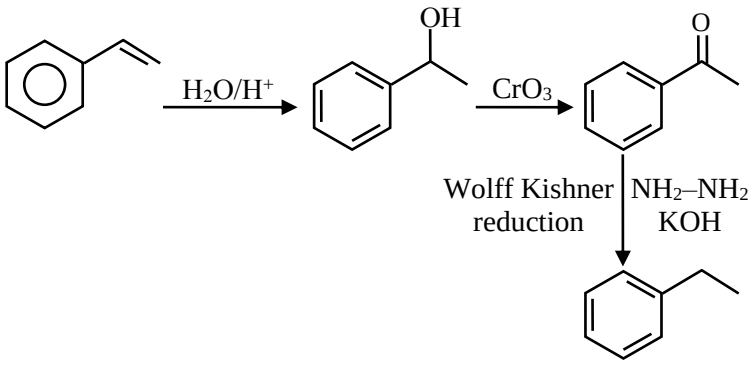
(1) 

(2) 

(3) 

(4) 

Ans. **4**



19. 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 true but Statement II is false.

(2) Statement I is false but Statement II is true.

(3) Both Statement I and Statement II are false.

(4) Both Statement I and Statement II are true.

Ans. **2**

EN of gp. 14 $\rightarrow$ C>Si=Ge=Sn<Pb

C .Si Ge Sn Pb

non Metals — Metalloid — Metals

20. $KMnO_4$ decomposes on heating at 513K to form O_2 along with :

(1) Mn & KO_2 (2) K_2MnO_4 & MnO_2 (3) K_2MnO_4 & Mn (4) MnO_2 & K_2O_2

Ans. **2**

Fact

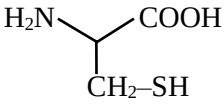
$2KMnO_4 \xrightarrow{513K} K_2MnO_4+MnO_2+O_2$

SECTION – B

21. Number of compounds among the following which contain sulphur as heteroatom is _____.
Furan, Thiophene, Pyridine, Pyrrole, Cysteine, Tyrosine

Ans. **2**

Trioptene



Cystein

22. The osmotic pressure of a dilute solution is 7×10^5 Pa at 273K. Osmotic pressure of the same solution at 283K is _____ $\times10^4 Nm^{-2}$.

Ans. **73**

$\pi=CRT$

$$\frac{\pi_1}{\pi_2}=\frac{T_1}{T_2}$$

$$\Rightarrow \pi_2=\frac{7\times10^5\times283}{273}$$

$= 72.5\times10^4 \approx 73\times10^4$

23. 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

Ans. **1**

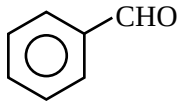
$B_2=\sigma1s^2\ \sigma^*1s^2\ \sigma2s^2\ \sigma^*2s^2\pi2p^1=\pi2p^1$

$$BO=\frac{6-4}{2}=1$$

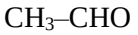
Paramagnetic due to presence of two unpaired electrons

24. From the compounds given below, number of compounds which give positive Fehling's test is _____.
Benzaldehyde, Acetaldehyde, Acetone, Acetophenone, Methanal, 4-nitrobenzaldehyde, cyclohexane carbaldehyde.

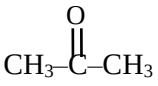
Ans. **3**



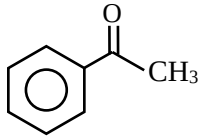
benzaldehyde



Acetaldehyde

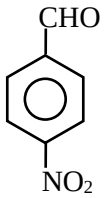


Acetone

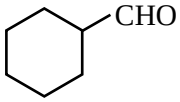


Acetophenone

Methanal



4-nitro benzaldehyde



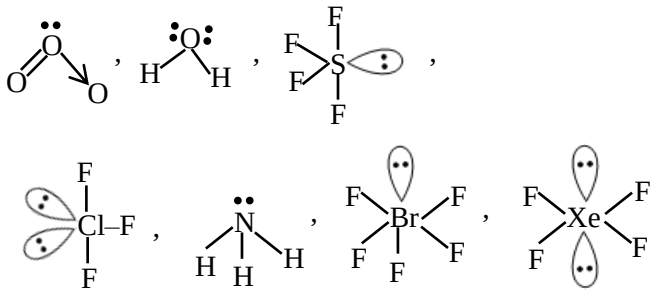
Cyclo hexane carbaldehyde

→ Aliphatic aldehydes give positive fehling test. So acetaldehyde, methanol & cyclohexane carbaldehyde give positive fehling test.

25. 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

Ans. **4**



O_3, SF_4, NH_3 and BrF_5 contain 1 lp only at central atom.

26. For the reaction $N_2O_{4(g)} \rightleftarrows 2NO_{2(g)}$, K_p = 0.492 atm at 300 K. K_c for the reaction at same temperature is _____$\times 10^{-2}$.

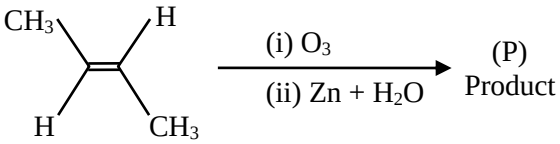
(Given : R = 0.082 L atm mol^{-1} K^{-1})

Ans. **2**

$K_P = K_C\,(RT)^{\Delta n_g}$

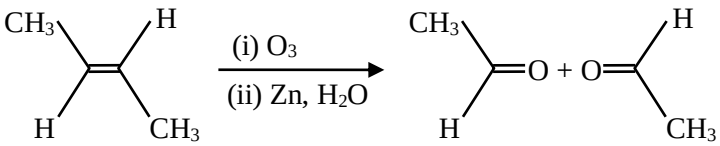
$0.492 = K_C\,(0.082\times 300)^1$

$K_C = 2\times 10^{-2}$

27. 

Consider the given reaction. The total number of oxygen atom/s present per molecule of the product (P) is _____.

Ans. **1**



28. A solution of H_2SO_4 is 31.4% H_2SO_4 by mass and has a density of 1.25g/mL. The molarity of the H_2SO_4 solution is_____ M (nearest integer).

[Given molar mass of H_2SO_4 = 98g mol^{-1}]

Ans. **4**

$M = \% \dfrac{w}{W} \times d \times \dfrac{10}{M_{solute}}$

$= 31.4\times 1.25 \times \dfrac{10}{98}$

= 4 M

29. 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 = 65.4 amu)

Ans. **46**

Mass of Zinc

deposited = ZIt

$= \frac{65.4/2}{96500} \times 0.015 \times 15 \times 60$

$= 4.57 \times 10^{-3}$

$= 45.7 \times 10^{-4}$

30. For a reaction taking place in three steps at same temperature, overall rate constant $K = \frac{K_1 K_2}{K_3}$. If Ea_1, Ea_2 and Ea_3 are 40, 50 and 60 kJ/mol respectively, the overall Ea is _____ kJ/mol.

Ans. **30**

$K = \frac{K_1 K_2}{K_3}$

$= \frac{A_1 e^{-Ea_1/RT} A_2 e^{-Ea_2/RT}}{A_3 e^{-Ea_3/RT}}$

$= \frac{A_1 A_2}{A_3} . e^{-1/RT(Ea_1 + Ea_2 - Ea_3)}$

overall Ea = $Ea_1 + Ea_2 - Ea_3$

= 40+50–60

= 30 KJ/mol

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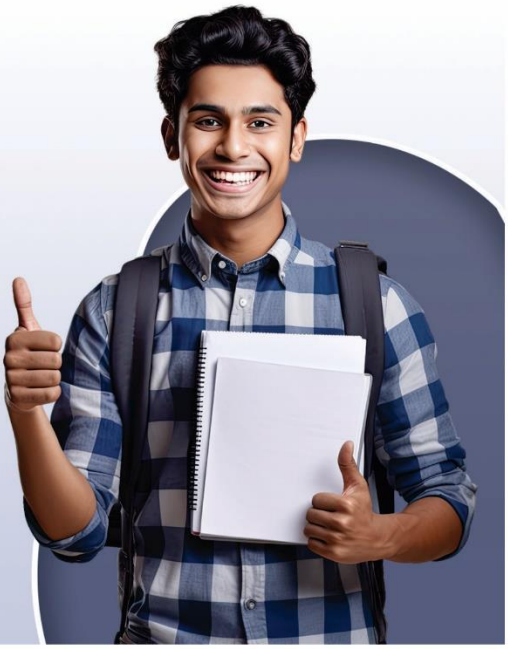

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