JUPITER ACADEMY

Chemistry JEE Solutions 2022

Chemistry

1. The spin only magnetic moment of the compound $[MnCl_6]^{-4}$ is

(1) 4.89   (2) 5.91

(3) 2.83   (4) 1.73

Sol. Answer (2)

$[MnCl_6]^{-4}$

$\Rightarrow e^-$ configuration of $Mn^{+2} = [Ar]3d^5$

Cl^- is a WFL

Hence, $t_{2g}^3 \quad e_g^2$

$\Rightarrow$ 5 unpaired e^- are present

$\therefore$ spin only magnetic moment $= \sqrt{n(n+2)}$

$$= \sqrt{35}$$
$$= 5.91 \text{ BM}$$

2. Which of the following species have carbonate ion

(1) Washing Soda   (2) Caustic Soda

(3) Baking Soda   (4) All of these

Sol. Answer (1)

(i) Washing Soda : $Na_2CO_3.10H_2O$

(ii) Caustic Soda : $NaOH$

(iii) Baking Soda : $NaHCO_3$

3. Consider the following calculation $\dfrac{0.002858 \times 0.112}{0.5702} = X$ .The value of X is

(1) 0.00056   (2) 0.000561

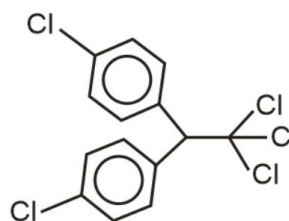(3) 0.000563   (4) 0.0005

Sol. Answer (2)

$$\frac{0.002858 \times 0.112}{0.5702} = 0.00056137$$

In multiplication and division answer is reported with least number of significant figure. That's why answer is 0.000561

4. Dichlorodiphenyl trichloroethane act as

(1) Antiseptic   (2) Disinfectant

(3) Pesticide   (4) Water softener
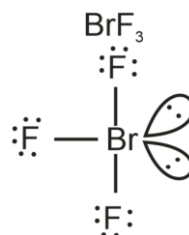
Sol. Answer (3)

DDT

It was used as a pesticides but now banned in India.

5. The shape and number of lone pair present in one molecule of BrF_3 are respectively.

(1) Tetrahedral ; Five

(2) T-shape ; two

(3) Trigonal planar, zero

(4) T-shape ; Eleven
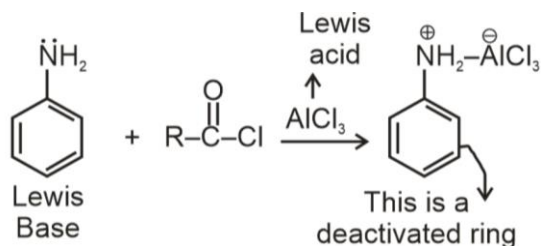
Sol. Answer (4)

No. of lone pair = 11

Shape = T-shaped

6. Which of the following is correct when aniline undergoes Friedel Craft reaction.

(1) Product is amine

(2) Product is substituted amine

(3) Product is amide

(4) Friedel craft reaction does not occur
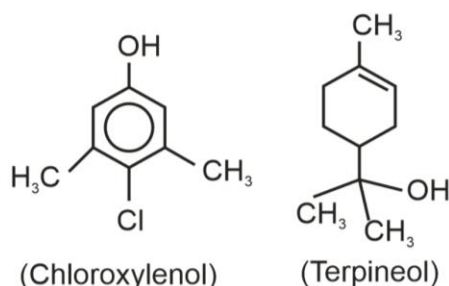
Sol. Answer (4)

Deactivated rings do not undergo Friedel Craft Reaction

7. Chloroxylenol and Terpineol are constituents of

(1) Bithionol

(2) Dettol

(3) Furacine

(4) Salvarsan

Sol. Answer (2)

Commonly used antiseptic, dettol is a mixture of chloroxylenol and terpineol



(Chloroxylenol)   (Terpineol)

8. Statement-1 : Dacron is a polyester polymer

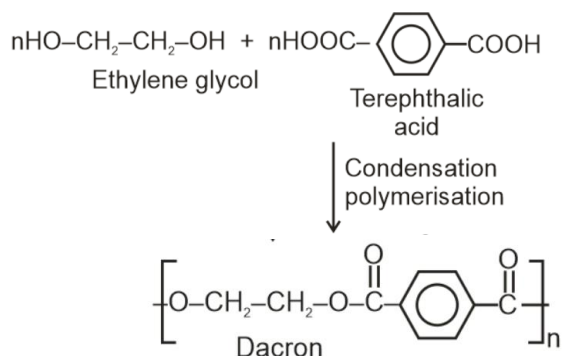Statement-2 : It is a condensation polymer of terephthalic acid and ethylene glycol

(1) Both Statements are correct and Statement 2 is correct explanation

(2) Both statement are correct and Statement 2 is not the correct explanation of Statement 1

(3) Statement 1 is true, Statement 2 is false

(4) Statement 1 is false, Statement 2 is true

Sol. Answer (1)
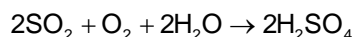
Statement 1 → Dacron is a polyester polymer

Dacron
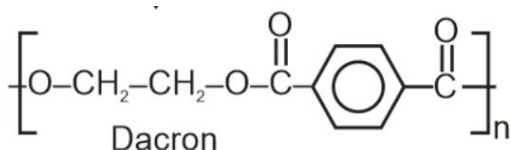
Statement 2

9. Which of the following reaction is most likely responsible for acid rain.

(1) $H_2S + O_2 \rightarrow S + H_2O$

(2) $S + NaOH \rightarrow Na_2S + Na_2S_2O_3 + H_2O$

(3) $I_2 + Na_2S_2O_3 \rightarrow Na_2S_4O_6 + NaI$

(4) $2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$

Sol. Answer (4)

$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$

Acid rain occur due to increased concentration of oxide of sulphur and nitrogen.

10. Consider work done by an ideal gas in reversible adiabatic expansion, reversible isothermal expansion and reversible isobaric expansion as $|w|_{adi}$, $|w|_{ist}$ and $|w|_{isb}$ respectively. Identify the correct order of work done by gas under these conditions

(1) $|w|_{adi} > |w|_{ist} > |w|_{isb}$ (2) $|w|_{isb} > |w|_{ist} > |w|_{adi}$

(3) $|w|_{ist} > |w|_{isb} > |w|_{adi}$ (4) $|w|_{adi} > |w|_{isb} > |w|_{ist}$

Sol. Answer (2)
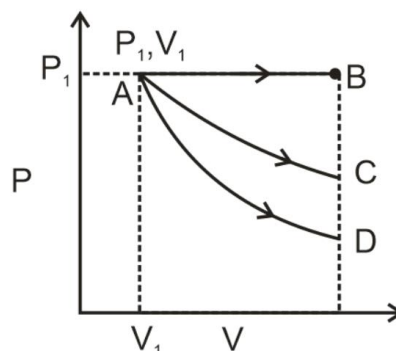
$A \rightarrow B \Rightarrow$ Reversible isobaric expansion

$A \rightarrow C \Rightarrow$ Reversible isothermal expansion

$A \rightarrow D \Rightarrow$ Reversible adiabatic expansion

∵ Area under P–V cure gives work done

∴ $|w|_{isb} > |w|_{ist} > |w|_{adi}$

11. The isoelectronic and isostructural pair is

(1) $NH_3 : H_2O$ (2) $CH_4 : \overset{+}{N}H_4$

(3) $BF_3 : C_2H_4$ (4) None of these

Sol. Answer (2)

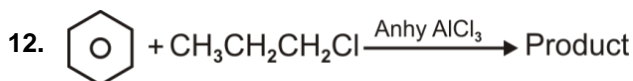|	CH_4	$\overset{+}{N}H_4$
No. of electrons	6+4=10	7–1+4=10

Hence both species are isoelectronic

For CH_4,   SN = 4 (sp³)

Structure = tetrahedral

For $\overset{+}{N}H_4$,   SN = 4 (sp³)

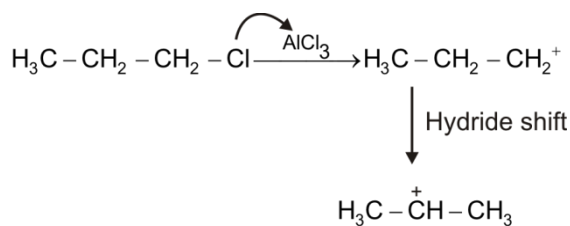Structure tetrahedral

12. $+ CH_3CH_2CH_2Cl \xrightarrow{\text{Anhy AlCl}_3}$ Product

The stable intermediate formed during the reaction is
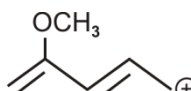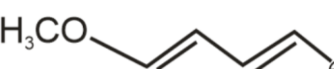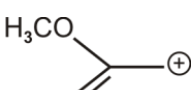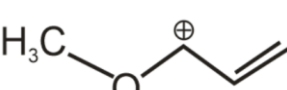
(1) $CH_3CH_2CH_2{}^+$ (2) $CH_3CH^+CH_3$

(3) $CH_3CH_2CH_2{}^-$ (4) $CH_3CH^-CH_3$

Sol. Answer (2)

$H_3C-CH_2-CH_2-Cl \xrightarrow{AlCl_3} H_3C-CH_2-CH_2{}^+$
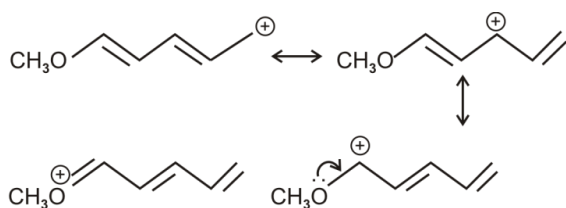
Hydride shift

$H_3C-\overset{+}{C}H-CH_3$

Option 2 is correct answer

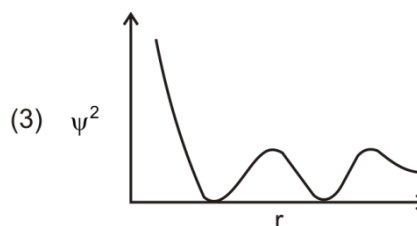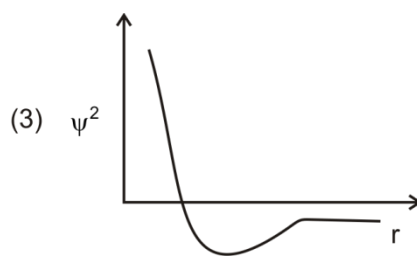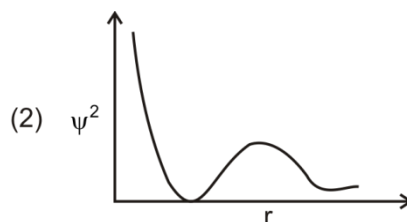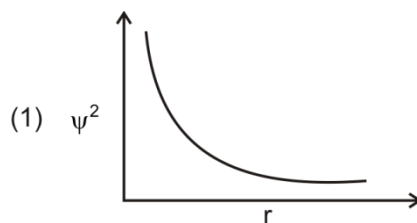**13.** Most stable carbocation is

(1)

(2)

(3)

(4)

Sol. Answer (2)

This carbocation is most stable among all because it has extended conjugation as well as it is stablized by + M effect of oxygen.

14. $\psi^2(r)$ Vs r plot for 2s orbital of single electron species is

(1) ψ^2

(2) ψ^2

(3) ψ^2

(3) ψ^2

Sol. Answer (2)

$\psi^2(r)$ Vs r plot of s-orbital starts from a non-zero value and the no. of times it intersects the x-axis will to equal to no. of radial nodes. Also $\psi^2(r)$ cannot take negative value.

In 2s orbital

radial node = $n - \ell - 1$

$= 2 - 0 - 1 = 1$

15. Match the names of the ores in column I with their corresponding formula in column II

Column I		Column II	
(i)	Malachite	(P)	ZnS
(ii)	Calamine	(Q)	PbS
(iii)	Sphalerite	(R)	$ZnCO_3$
(iv)	Galena	(S)	$CuCO_3.Cu(OH)_2$

(1) (i) - (S)　　　　　(2) (i) - (P)

　　(ii) - (P)　　　　　　　(ii) - (Q)

　　(iii) - (Q)　　　　　　　(iii) - (R)

　　(iv) - (R)　　　　　　　(iv) - (S)

(3) (i) - (S)　　　　　(4) (i) - (S)

　　(ii) - (R)　　　　　　　(ii) - (R)

　　(iii) - (P)　　　　　　　(iii) - (Q)

　　(iv) - (Q)　　　　　　　(iv) - (P)

Sol. Answer (3)

(i) Malachite - $CuCO_3.Cu(OH)_2$

(ii) Calamine - $ZnCO_3$

(iii) Sphalerite - ZnS

(iv) Galena - PbS

Option (3) is correct answer

16. Statement-1: Ionization energy of oxygen is less than that of nitrogen

Statement-2: 2p subshell of nitrogen is half filled.

(1) Statement 1 and 2 both are correct and statement 2 is the correct explanation of statement 1

(2) Statement 1 and 2 both are correct but statement 2 is not correct explanation of statement 1

(3) Statement 1 is correct but statement 2 is incorrect

(4) Statement 1 is incorrect but statement 2 is correct

Sol. Answer (1)

In general, $IE \propto Z_{eff.} \propto \dfrac{1}{\text{Atomic size}}$

But

IE (Oxygen)　　　<　　IE (Nitrogen)

$1s^2 2s^2 2p^4$　　　　　　$1s^2 2s^2 2p^3$

Because in Nitrogen e^- is removed from stable half-filled configuration, So it's IE is high than that of oxygen.

17. The temperature dependence of rate constant of a reaction is given by $k = Ae^{-2600/T}$, the activation energy is

[Symbols have their usual meanings]

(1) 15.48 kJ mol^{-1}　　　(2) 21.62 kJ mol^{-1}

(3) 35. 28 kJ mol^{-1}　　　(4) 42.63 kJ mol^{-1}

Sol. Answer (2)

$$k = A\,e^{\frac{-E_a}{RT}}$$

On comparing

$$\dfrac{E_a}{R} = 2600 \Rightarrow E_a = \dfrac{8.314 \times 2600}{1000}\,\dfrac{kJ}{mole}$$

$$\Rightarrow E_a = 21.62\ kJ/mol$$

∴　Option (2) is correct answer

18. Which structure of protein doesn't get affected on heating

(1) Primary structure

(2) Secondary structure

(3) Tertiary structure

(4) Quaternary

Sol. Answer (1)

Structure 2°, 3° and 4° structure of protein are held by hydrogen bonding or Vander waal forces of attraction so on heating the hydrogen bond breaks but 1° structure are held by covalent bond so, the does not break the covalent bond.

19. How many chiral alcohols have molecular formula $C_4H_{10}O$ (including stereoisomers)

Sol. Answer (2)

Possible structure of $C_4H_{10}O$ having alcohol as a functional group is

$CH_3–CH_2–CH_2–CH_2–OH$ achiral
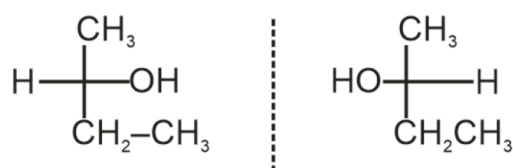

$CH_3\!-\!CH_2\!-\!\overset{*}{C}H\!-\!CH_3$　Chiral
　　　　　　|
　　　　　　OH

$CH_3\!-\!CH\!-\!CH_2\!-\!OH$　achiral
　　　　|
　　　　CH_3

　　　　CH_3
　　　　|
$CH_3\!-\!C\!-\!CH_3$　achiral
　　　　|
　　　　OH

Now chiral alcohols remains in two form

So there is two chiral alcohols are possible

20.

$$\xrightarrow[\text{2. Heat}]{\text{1. Dil. NaOH}} \text{P (Major product)}$$
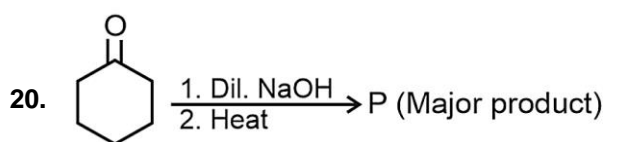
The number of π bonds in the product P is …?

Sol. Answer (2)

P
(major)

21.

$$\xrightarrow{K_2Cr_2O_7} A \xrightarrow{C_6H_5MgBr} B$$

$$\downarrow H_2O$$

$$D \xleftarrow[\Delta]{H_3O^+} C$$
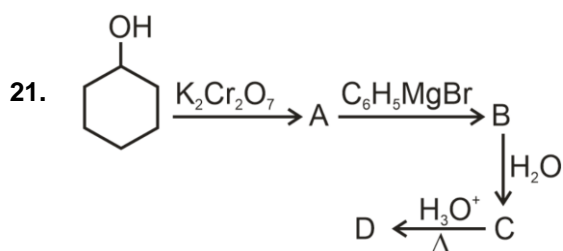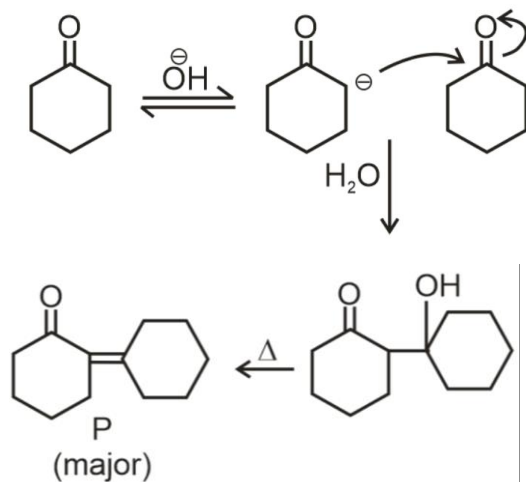
Number of sp^2 hybridised carbon atoms present in D are

Sol. Answer (8)
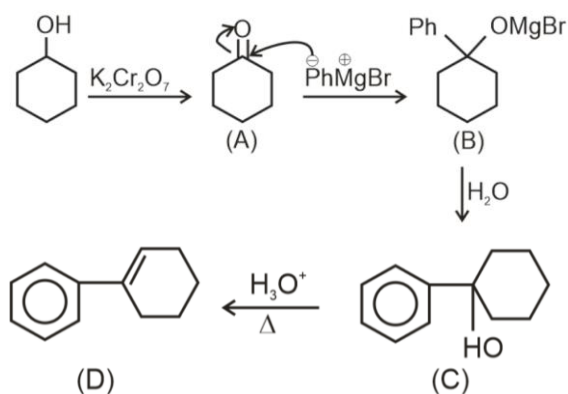
No. of sp^2 hybridised carbon in (D) = 8

22. A mixture contain 16 g He and 128 g O$_2$ at STP. The volume of mixture in litres is

Sol. Answer (179.2)

$$V = \frac{n_T RT}{P}$$

$$V = \left[\left(\frac{16}{4}\right) + \left(\frac{128}{32}\right)\right] \times 22.4 = 179.2L$$

23. Elevation in boiling point of 1.5 molal salt solution is 4K and depression in freezing point of 4.5 molal solution of same salt is 4K. Find the ratio of K$_b$/K$_f$ of the salt.

Sol. Answer (3)

Elevation in boiling point $\Delta T_b = i\, k_b m_1$

Depression in freezing point $\Delta T_f = i\, k_f m_2$

$$\Delta T_b = \Delta T_f = 4K$$

$$m_1 = 1.5, \quad m_2 = 4.5$$

$$1 = \frac{k_b}{k_f} \times \frac{1.5}{4.5}$$

$$\frac{k_b}{k_f} = 3$$

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