JEE MAIN

QUESTION PAPER WITH SOLUTION

38000+

SELECTIONS SINCE 2007

CHEMISTRY

25th June 2022| Shift - 1

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STUDENT QUALIFIED IN NEET

2021	3296 / 3411 = 93.12%
2020	2663 / 2843 = 93.66%
2019	2041 / 2212 = 92.27%

STUDENT QUALIFIED IN JEE ADVANCED

2021	1256 / 2994 = 41.95%
2020	994 / 2538 = 39.16%
2019	769 / 2105 = 36.53%

STUDENT QUALIFIED IN JEE MAIN

2021	2994 / 4089 = 73.25%
2020	2538 / 3554 = 71.44%
2019	2288 / 3316 = 68.99%

SECTION - A

1. Bonding in which of the following diatomic molecule(s) become(s) stronger, on the basis of MO Theory, by removal of an electron?

(A) NO (B) N_2 (C) O_2 (D) C_2 (E) B_2

Choose the most appropriate answer from the options given below:

(A)(A), (B), (C) only (B) (B), (C), (E) only (C)(A), (C) only (D)(D) only

Sol. **(C)**

	NO $\rightarrow$	NO^+
Bond strength$\propto$ B. O.	BO = 2.5	BO = 3
	$O_2\rightarrow$	O_2^+
	BO = 2	BO = 2.5

2. Incorrect statement for Tyndall effect is:

(A) The refractive indices of the dispersed phase and the dispersion medium differ greatly in magnitude.

(B) The diameter of the dispersed particles is much smaller than the wavelength of the light used.

(C)During projection of movies in the cinemas hall, Tyndall effect is noticed.

(D) It is used to distinguish a true solution from a colloidal solution.

Sol. **(B)**

The diameter of the dispersed particles is not much smaller than the wavelength of the light used. The intensity of scattered light depends on the difference between the refractive indice of the D.P. and D.M., In lyophobic colloids.

3. The pair, in which ions are isoelectronic with Al^{3+} is:

(A) Br^- and Be^{2+} (B) Cl^- and Li^+ (C)S^{2-} and K^+ (D)O^{2-} and Mg^{2+}

Sol. **(D)**

O^{2-}, Mg^{2+} and Al^{3+} have 10 electrons so they are isoelectronic

4. Leaching of gold with dilute aqueous solution of NaCN in presence of oxygen gives complex [A], which on reaction with zinc forms the elemental gold and another complex [B]. [A] and [B], respectively are:

(A) $[Au(CN)_4]^-$ and $[Zn(CN)_2(OH)_2]^{2-}$ (B) $[Au(CN)_2]^-$ and $[Zn(OH)_4]^{2-}$

(C) $[Au(CN)_2]^-$ and $[Zn(CN)_4]^{2-}$ (D)$[Au(CN)_4]^-$ and $[Zn(CN)_6]^{4-}$

Sol. **(C)**

$$Au + 2NaCN + O_2 \rightarrow \underset{(A)}{Na[Au(CN)_2]}$$

$$Zn + 2Na\,[Au(CN)_2] \rightarrow \underset{(B)}{Na_2[Zn(CN)_4]}$$

5. Number of electron deficient molecules among the following

PH_3, B_2H_6, CCl_4, NH_3, LiH and BCl_3 is

(A)0 (B) 1 (C) 2 (D) 3

Sol. **(D)**

B_2H_6, LiH and BCl_3 are electron deficient

6. Which one of the following alkaline earth metal ions has the highest ionic mobility in its aqueous solution?

(A)Be^{2+} (B)Mg^{2+} (C)Ca^{2+} (D)Sr^{2+}

Sol. **(D)**

Ionic mobility$\propto \frac{1}{\text{size}}$

$$Be^{+2}_{(aq)} \quad Mg^{+2}_{(aq)} \quad Ca^{+2}_{(aq)} \quad Sr^{+2}_{(aq)} \longrightarrow$$

Hydration $\downarrow$, size of Aq. ion $\downarrow$, mobility$\uparrow$

7. White precipitate of AgCl dissolves in aqueous ammonia solution due to formation of:

(A) $[Ag(NH_3)_4]Cl_2$ (B) $[Ag(Cl)_2(NH_3)_2]$ (C) $[Ag(NH_3)_2]Cl$ (D) $[Ag(NH_3)Cl]Cl$

Sol. **(C)**

$AgCl + NH_4OH \rightarrow [Ag(NH_3)_2Cl]$

White ppt excess soluble complex

8. Cerium (IV) has a noble gas configuration. Which of the following is correct statement about it?

(A) It will not prefer to undergo redox reactions.

(B) It will prefer to gain electron and act as an oxidizing agent.

(C) It will prefer to give away an electron and behave as reducing agent.

(D) It acts as both, oxidizing and reducing agent.

Sol. **(B)**

More stable and common oxidation state of lanthanoids is +3

$\underset{\text{(O.A.)}}{Ce\,(IV)} + e^- \rightarrow Ce\,(III)$

9. Among the following, which is the strongest oxidizing agent?

(A) Mn^{3+} (B) Fe^{3+} (C) Ti^{3+} (D) Cr^{3+}

Sol. **(A)**

$E^o_{m^{3+}/m^{2+}}$ of mn^{3+} is highest in given ions.

10. The eutrophication of water body results in:

(A) loss of Biodiversity (B) Breakdown of organic matter

(C) Increase in biodiversity (D) Decrease in BOD

Sol. **(A)**

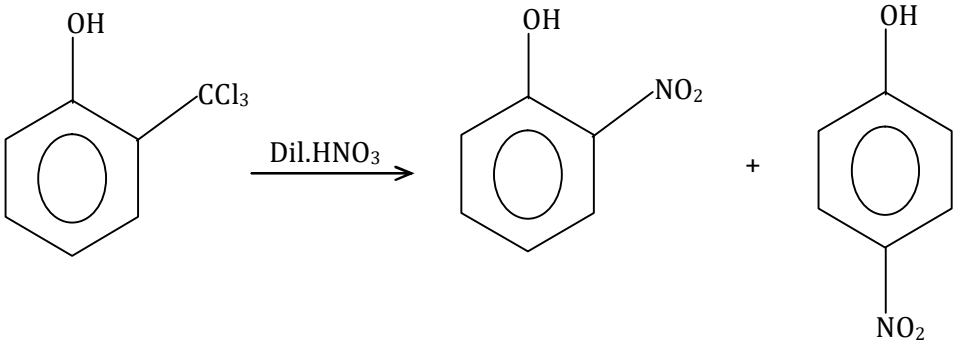
Fact

11. Phenol on reaction with dilute nitric acid, gives two products. Which method will be most efficient for large scale separation?

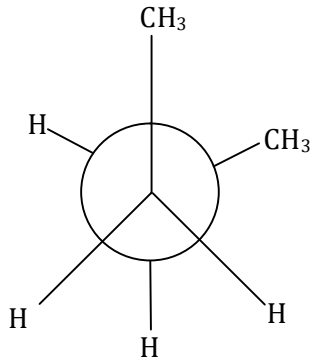
(A) Chromatographic separation (B) Fractional Crystallisation

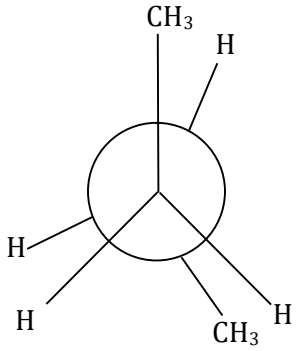
(C) Steam distillation (D) Sublimation

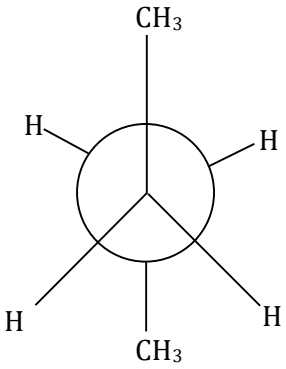
Sol. **(C)**

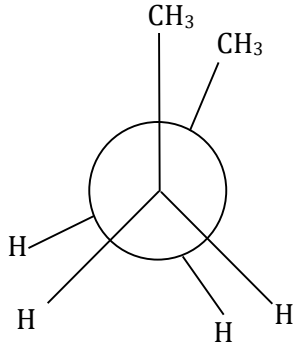


12. In the following structures, which one is having staggered conformation with maximum dihedral angle?

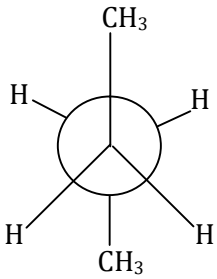
(A) 

(B) 

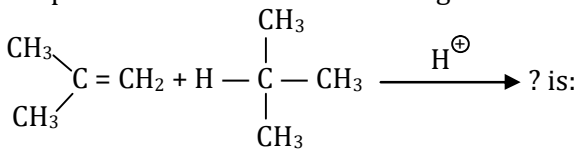
(C) 

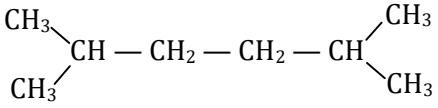
(D) 

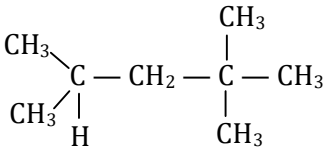
Sol. **(C)**

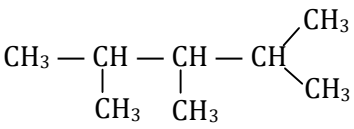


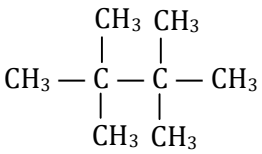
13. The product formed in the following reaction.



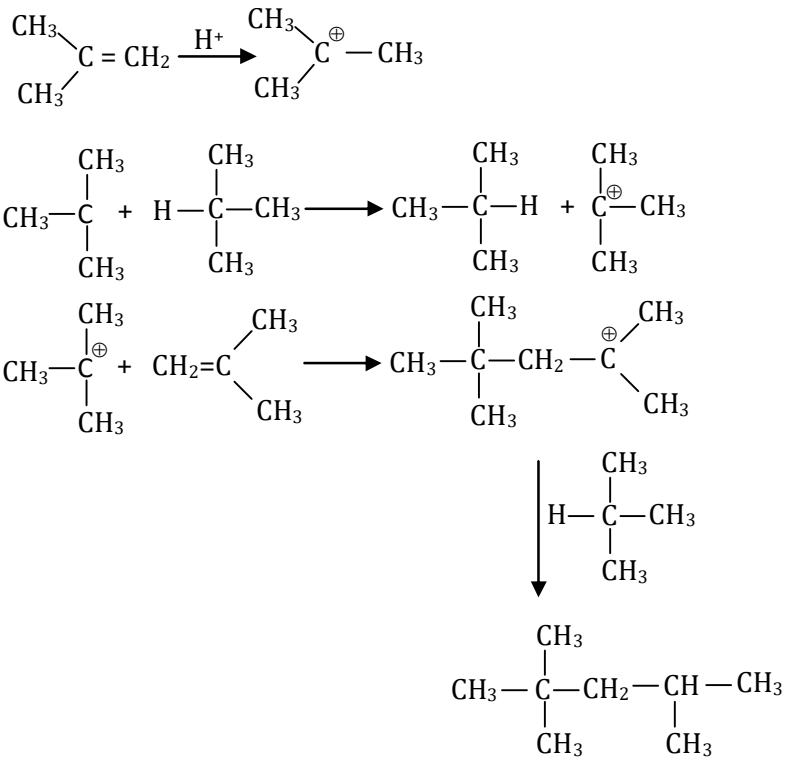
(A) 

(B) 

(C) 

(D) 

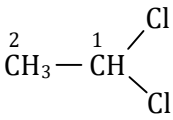
Sol. **(B)**



14. The IUPAC name of ethylidene chloride is:

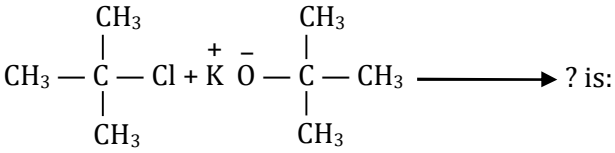
(A) 1-Chloroethene
(B) 1-Chloroethyne
(C) 1,2-Dichloroethane
(D) 1,1-Dichloroethane

Sol. **(D)**



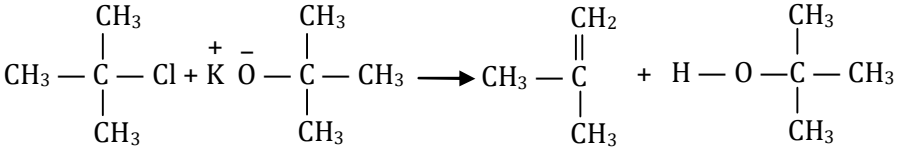
Ethylidene chloride
IUPAC Name : 1,1-dichloro ethane

15. The major product in the reaction

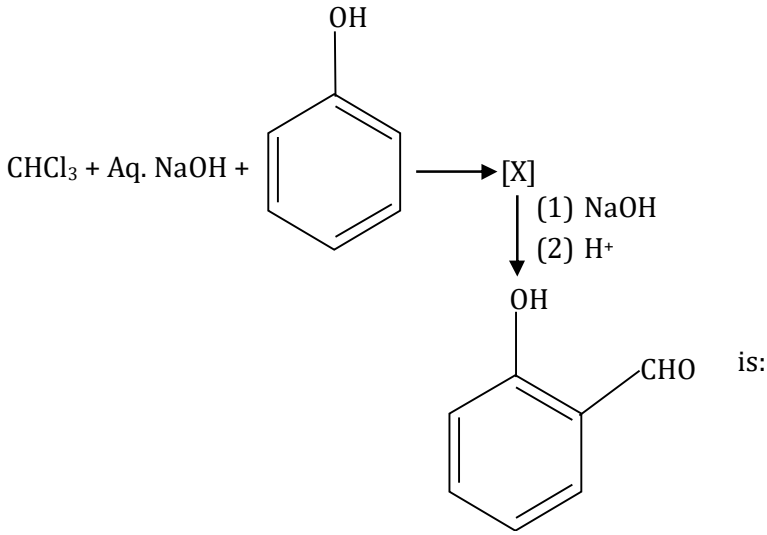


(A) t-Butyl ethyl ether
(B) 2,2-Dimethyl butane
(B) 2-Methyl pent-1-ene
(D) 2-Methyl prop-1-ene

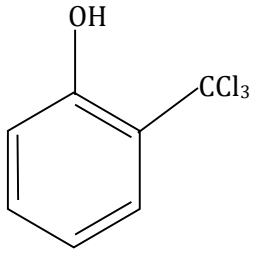
Sol. **(D)**

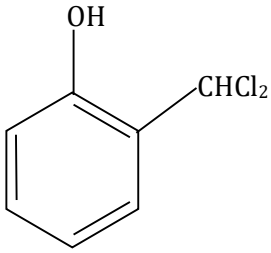


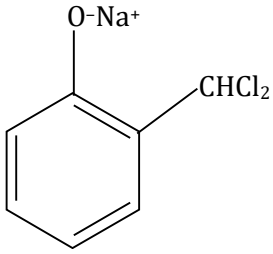
16. The intermediate X, in the reaction:

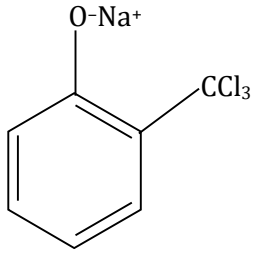


is:

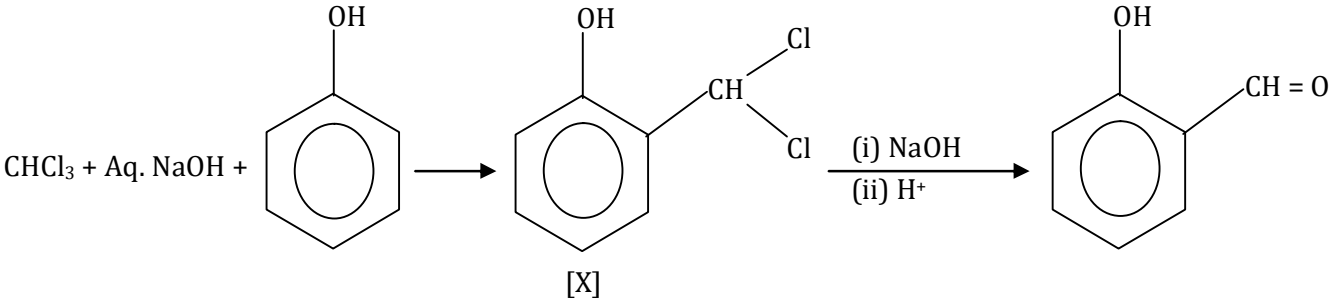
(A) 

(B) 

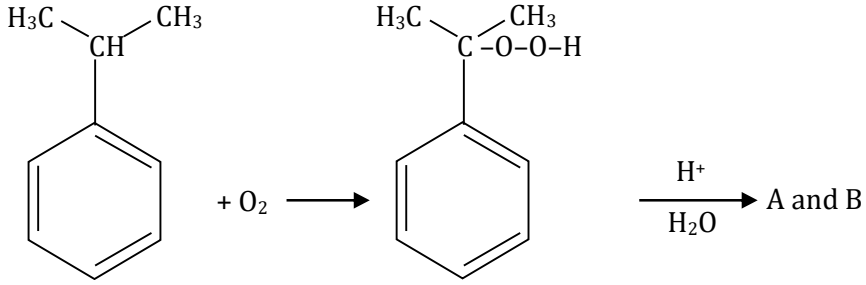
(C) 

(D) 

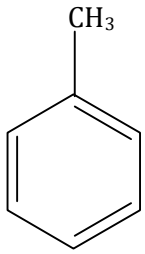
Sol. **(C)**

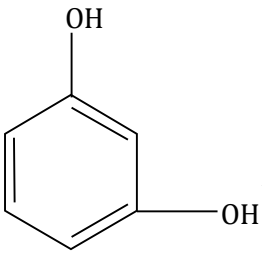


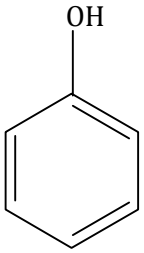
17. In the following reaction:

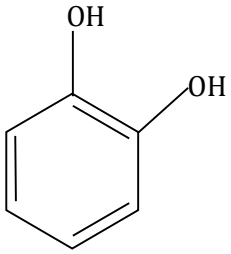


The compounds A and B respectively are:

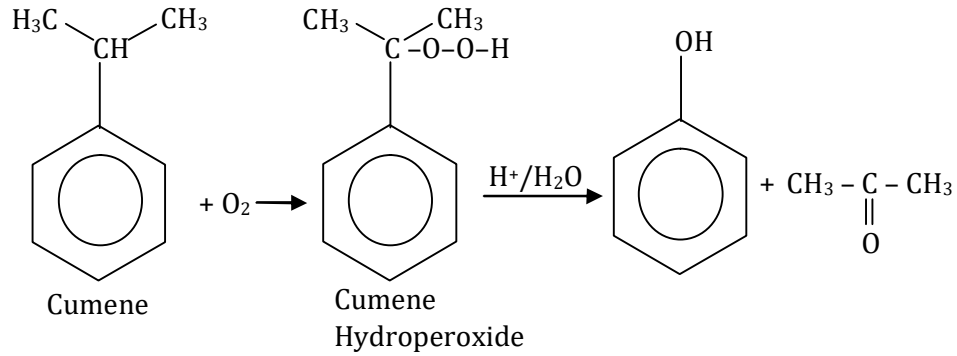
(A)  , CH_3COOH

(B)  , CH_3COCH_3

(C)  , CH_3COCH_3

(D)  , CH_3COCH_3

Sol. **(C)**



18. The reaction of $R-\underset{\underset{O}{\|}}{C}-NH_2$ with bromine and KOH gives RNH_2 as the end product. Which one of the following is the intermediate product formed in this reaction?

(A) $R-\underset{\underset{O}{\|}}{C}-NH-Br$

(B) $R-NH-Br$

(C) $R-N=C=O$

(D) $R-\underset{\underset{O}{\|}}{C}-NBr$

Sol. **(C)**

$$R-\underset{\underset{O}{\|}}{C}-NH-Br + KOH \longrightarrow R-N=C=O \xrightarrow{OH^-/H_2O} R-N=C=O$$

19. Using very little soap while washing clothes, does not serve the purpose of cleaning of clothes, because:
(A) soap particles remain floating in water as ions.
(B) the hydrophobic part of soap is not able to take away grease.
(C) the micelles are not formed due to concentration of soap, below its CMC value.
(D) colloidal structure of soap in water is completely disturbed.

Sol. **(C)**

Micelle formation occurs above a certain conc. Known as CMC.

20. Which one of the following is an example of artificial sweetner?
(A)Bithional (B) Alitame (C) Salvarsan (D) Lactose

Sol. **(B)**
Artificial sweetner : Aspartane, sucralose, saccharin, xylitol etc.

SECTION - B

21. The number of N atoms in 681 g of $C_7H_5N_3O_6$ is $x \times 10^{21}$. The value of x is _____. ($N_A = 6.02 \times 10^{23}$ mol^{-1}) (Nearest Integer)

Sol. **(5418)**
Molar massof$C_7H_5N_3O_6$ is 84 + 5 + 42 + 96 = 227

$n_{C_7H_5N_3O_6} = \frac{681}{227} = 3$ moles

$n_N = \frac{681}{227} \times 3 = 9$ moles of N

No. of N atoms = $9 \times 6.02 \times 10^{23}$

$= 5418 \times 10^{21}$

$= 5418$**Ans.**

22. The distance between Na^+ and Cl^- ions in solid NaCl of density 43.1 g cm^{-3} is _____ $\times 10^{-10}$ m. (Nearest Integer) (Given: $N_A = 6.02 \times 10^{23}$ mol^{-1})

Sol. **(1)**
For NaCl Z = 4 & M = 58.5 gram

$d = \frac{z \times M}{N_A \times volume}$

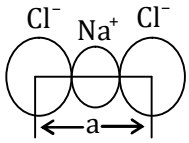
$43.1 = \frac{4 \times 58.5}{6 \times 10^{23} \times (a)^3}$

$a^3 = \frac{4 \times 58.5}{6 \times 43.1} \times 10^{-23}$

$= 0.9 \times 10^{-23} cm^3$

$= 0.9 \times 10^{-24} cm^3$

$A = 2.08 \times 10^{-8}$ cm



$d_{Na^+ + Cl^-} = \frac{a}{2} = \frac{2.08 \times 10^{-10}}{2}$ m

= 1 **Ans.**

23. The longest wavelength of light that can be used for the ionization of lithium atom (Li) in its ground state is $x \times 10^{-8}$ m. The value of x is _____. (Nearest Integer)
(Given: Energy of the electron in the first shell of the hydrogen atom is -2.2×10^{-18} J; h = 6.63×10^{-34}Js and c = 3×10^8ms^{-1})

Sol. **(4)**
Ele. conf. of Li = $1s^2 2s^1$

$(E_{Li})_{n=2} = (E_H)\frac{Z^2}{n^2} = -2.2 \times 10^{-18} \times \frac{9}{4}$ J

$E = \left(\frac{hc}{\lambda}\right) = 2.2 \times 10^{-18} \times \frac{9}{4}$ J

$\frac{6.63 \times 10^{-34} \times 3 \times 10^8}{\lambda} = 2.2 \times 10^{-18} \times \frac{9}{4}$ J

$\lambda = 4 \times 10^{-8}$m

= 4 **Ans.**

24. The standard entropy change for the reaction
$4Fe(s) + 3O_2(g) \longrightarrow 2Fe_2O_3(s)$ is $-550\ J\ K^{-1}$ at 298 K.
[Given: The standard enthalpy change for the reaction is $-165\ kJ\ mol^{-1}$]. The temperature in K at which the reaction attains equilibrium is _____. (Nearest Integer)

Sol. **(300)**

$\Delta G^o = \Delta H^o - T\Delta S^o = 0$ at equilibrium

$\Rightarrow -165 \times 10^3 - T \times (-505) = 0$

$\Rightarrow T = 300\ K$

$= 300$ **Ans.**

25. 1L aqueous solution of H_2SO_4 contains 0.02 mmol H_2SO_4 . 50% of this solution is diluted with deionized water to give 1 L solution (A). In solution (A), 0.01 mmol of H_2SO_4 are added. Total mmoles of H_2SO_4 in the final solution is _____ $\times 10^3$ mols.

Sol. **(20)**

Initial moles of H_2SO_4 (in/Lit.) = 0.02

In 50% solution moles of H_2SO_4 = 0.01

Added moles of H_2SO_4 = 0.01

Total moles of H_2SO_4 in resulting solution = 0.02

$= 20 \times 10^{-3}$ moles

= 20 milimoles

= 20 **Ans.**

26. The standard free energy change ($\Delta G°$) for 50% dissociation of N_2O_4 into NO_2 at 27°C and 1 atm pressure is $-x\ J\ mol^{-1}$. The value of x is _____. (Nearest Integer)
[Given: $R = 8.31\ J\ K^{-1}\ mol^{-1}$, log 1.33 = 0.1239, In 10 = 2.3]

Sol. **(710)**

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

$1-\alpha \qquad 2\alpha$

$k_p = \frac{4\alpha^2 p}{1-\alpha} = \frac{4\times(0.5)^2\times 1}{1-(0.5)^2} = \frac{1}{0.75}$

$k_p = \frac{4}{3}$

$\Delta G^o = -2.3\ RT\log Kp$

$= -2.3 \times 8.31 \times 300 \times \log(1.33)$

$= -710.4\ J\ mol^{-1} \approx -710\ J\ mol^{-1}$

$= 710$ **Ans.**

27. In a cell, the following reactions take place

$Fe^{2+} \rightarrow Fe^{3+} + e^- \qquad E^\circ_{Fe^{3+}/Fe^{2+}} = 0.77\ V$

$2I^- \rightarrow I_2 + 2e^- \qquad E^\circ_{I_2/I^-} = 0.54\ V$

The standard electrode potential for the spontaneous reaction in the cell is $x \times 10^{-2}$ V at 298 K. The value of x is _____. (Nearest Integer)

Sol. **(23)**

$\underset{\text{Cathode}}{Fe^{+3}} + \underset{\text{anode}}{I^-} \rightarrow I_2 + Fe^{+2}$

$E^o_{cell} = E^o_{cathode} - E^o_{anode}$

$= 0.77 - 0.54$

$= 0.23$

$= 23 \times 10^{-2}\ V$

$= 23$ **Ans.**

28. For a given chemical reaction
$\gamma_1 A + \gamma_2 B \rightarrow \gamma_3 C + \gamma_4 D$
Concentration of C changes from 10 mmol dm^{-3} to 20 mmol dm^{-3} in 10 seconds. Rate of appearance of D is 1.5 times the rate of disappearance of B, which is twice the rate of disappearance of A. The rate of appearance of D has been experimentally determined to be 9 mmol dm^{-3} s^{-1}. Therefore the rate of reaction is _____ mmol dm^{-3} s^{-1}. (Nearest Integer)

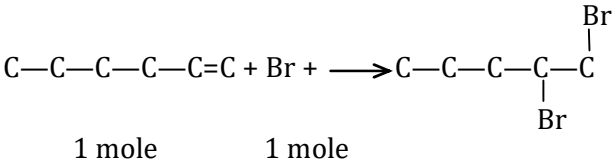
Sol. **(1)**
$\gamma_1 A + \gamma_2 B \rightarrow \gamma_3 C + \gamma_4 D$
Given : $+\frac{d[D]}{dt} = \frac{-3}{2}\frac{d[B]}{dt}$
$\Rightarrow \frac{-1}{2}\frac{d[B]}{dt} = \frac{+1}{3}\frac{d[D]}{dt}$
$-\frac{d[B]}{dt} = -2\frac{d[A]}{dt} \Rightarrow -\frac{1}{2}\frac{[B]}{dt} = \frac{-d(A)}{dt} + \frac{d[B]}{dt} = 9 \text{ mmol dm}^{-3}\text{s}^{-1}$
$\frac{+d[C]}{dt} = \frac{20-10}{10} = 1 \text{ mmol dm}^{-3}\text{s}^{-1}$
$\frac{+d[C]}{dt} = \frac{1}{9} \times \frac{+d[D]}{dt}$
$1A + 2B \rightarrow \frac{1}{3}C + 3D$
$\Rightarrow 3A + 6B \rightarrow C + 9D$
Rate of reaction $= \frac{+d[C]}{dt} = 1 \text{ mmol dm}^{-3}\text{s}^{-1}$
= 1 **Ans.**

29. If $[Cu(H_2O)_4]^{2+}$ absorbs a light of wavelength 600 nm for d-d transition, then the value of octahedral crystal field splitting energy for $[Cu(H_2O)_6]^{2+}$ will be _____ × 10^{-21} J. [Nearest Integer]
[Given: h = 6.63 × 10^{-34}Js and c = 3.08 × $10^8$$ms^{-1}$]

Sol. **(1021)**
$[Cu(CH_2O)_6]^{2+} \rightarrow Cu^{2+}(3d^9) \rightarrow t_{2g}^6 e_g^3$
$\text{CFSE} = (6 \times \frac{2}{5} - 3 \times \frac{3}{5})\Delta_0$
$= \frac{3}{5} \times \frac{hc}{\lambda}$
$= \frac{3}{5} \times \frac{6.63\times10^{-34}\times3.08\times10^8}{600\times10^{-9}}$
$= \frac{3\times6.63\times3.08}{6} \times 10^{-19}$
$= 10.21 \times 10^{-19}$
$= 10.21 \times 10^{-2} \times 10^2 \times 10^{-19}$
$= 1021 \times 10^{-21}$

30. Number of grams of bromine that will completely react with 5.0 g of pent-1-ene is _____ × 10^{-2} g. (Atomic mass of Br = 80 g/mol) [Nearest Integer]

Sol. **(1142)**



1 mole 1 mole
Molecular mass of pent-1-ene = 70
Mole of pent-1-ene = $\frac{5}{70} \times \frac{1}{14}$ mole
Required mole of bromine = $\frac{1}{14} \times 160 = 11.42$ or 1142×10^{-2}