JEE–MAIN EXAMINATION – JUNE, 2022

29 June S - 01 Paper Solution

SECTION-A

1. Production of iron in blast furnace follows the following equation

$Fe_3O_4(s) + 4CO(g) \rightarrow 3Fe(l) + 4CO_2(g)$

when 4.640 kg of Fe_3O_4 and 2.520 kg of CO are allowed to react then the amount of iron (in g) produced is :

[Given : Molar Atomic mass (g mol^{-1}): Fe = 56

Molar Atomic mass (g mol^{-1}) : 0 = 16

Molar Atomic mass (g mol^{-1}): = C = 12

(A) 1400 (B) 2200

(C) 3360 (D) 4200

Ans. (C)

Sol. Moles of $Fe_3O_4 = \frac{4.640 \times 10^3}{232} = 20$

Moles of $CO = \frac{2.52 \times 10^3}{28} = 90$

So limiting Reagent = Fe_3O_4

So moles of Fe formed = 60

Weight of Fe = 60 × 56 = 3360 gms

2. Which of the following statements are **correct** ?

(A) The electronic configuration of Cr is [Ar] $3d^5$ $4s^1$.

(B) The magnetic quantum number may have a negative value.

(C) In the ground state of an atom, the orbitals are filled in order of their increasing energies.

(D) The total number of nodes are given by n – 2 .

Choose the **most appropriate** answer from the options given below :

(A) (A), (C) and (D) only

(B) (A) and (B) only

(C) (A) and (C) only

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

Ans. (D)

Sol. (A) Cr = [Ar]$3d^5$ $4s^1$

(B) m = – ℓ to +ℓ

(C) According to Aufbau principle, orbitals are filled in order of their increasing energies.

(D) Total nodes = n – 1

3. Arrange the following in the decreasing order of their covalent character :

(A) LiCl

(B) NaCl

(C) KCl

(D) CsCl

Question: Choose the **most appropriate** answer from the options given below :

(A) (A)> (C) > (B)> (D)

(B) (B) > (A) > (C) > (D)

(C) (A) > (B) > (C) > (D)

(D) (A) > (B) > (D) > (C)

Ans. (C)

Sol. LiCl > NaCl > KCl > CsCl (Covalent character)

4. The solubility of AgCl will be maximum in which of the following ?

(A) 0.01 M KCl

(B) 0.01 M HC1

(C) 0.01 M $AgNO_3$

(D) Deionised water

Ans. (D)

Sol. In deionized water no common ion effect will take place so maximum solubility

5. Which of the following is a **correct** statement ?

(A) Brownian motion destabilises sols.

(B) Any amount of dispersed phase can be added to emulsion without destabilising it.

(C) Mixing two oppositely charged sols in equal amount neutralises charges and stabilises colloids.

(D) Presence of equal and similar charges on colloidal particles provides stability to the colloidal solution.

Ans. (D)

Sol. As equal & similar charge particle will repel each other, hence will never precipitate.

6. The electronic configuration of Pt (atomic number 78) is:

(A) [Xe] $4f^{14}\,5d^{9}\,6s^{1}$

(B) [Kr] $4f^{14}\,5d^{10}$

(C) [Xe] $4f^{14}\,5d^{10}$

(D) [Xe] $4f^{14}\,5d^{8}\,6s^{2}$

Ans. (A)

Sol. $_{78}Pt$ = [Xe] $4f^{14}\ 5d^{9}\ 6s^{1}$ (Exceptional electronic configuration)

7. In isolation of which one of the following metals from their ores, the use of cyanide salt is not commonly involved ?

(A) Zinc

(B) Gold

(C) Silver

(D) Copper

Ans. (D)

Sol. For ZnS, KCN is used as depressant.

For Gold and silver $\Rightarrow$ leaching [Cyanide process]

8. Which one of the following reactions indicates the reducing ability of hydrogen peroxide in basic medium ?

(A) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$

(B) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

(C) $2MnO_4^- + 3H_2O_2 \rightarrow 2MnO_2 + 3O_2 + 2H_2O + 2OH^-$

(D) $Mn^{2+} + H_2O_2 \rightarrow Mn^{4+} + 2OH^-$

Ans. (C)

Sol. In option (A) and (C) reducing action of hydrogen peroxide is shown.

In option (A) it is in acidic medium, in option (B) it is in basic medium.

or

For reducing ability H_2O_2 changes to O_2 , i.e. oxidize , so in option 'A' & 'C' O_2 is formed but 'A' is in acidic medium so option - C correct.

9. Match the **List-I** with **List- II.**

List-I (Metal)	**List-II (Emitted light wavelength (nm))**
(A) Li	(I) 670.8
(B) Na	(II) 589.2
(C) Rb	(III) 780.0
(D) Cs	(IV) 455.5

Choose the **most appropriate** answer from the options given below:

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

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

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

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

Ans. (A)

Sol. NCERT Table 10.1.5

Metal	**Li**	**Na**	**K**	**Rb**	**Cs**
Colour	Crimson red	Yellow	Violet	Red Violet	Blue
λ/nm	670.8	589.2	766.5	780.0	455.5

10. Match the **List-I** with **List- II.**

List-I (Metal)	List-II Application
(A) Cs	(I) High temperature thermometer
(B) Ga	(II) Water repellent sprays
(C) B	(III) Photoelectric cells
(D) Si	(IV) Bullet proof vest

Choose the most appropriate answer from the option given below:

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

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

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

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

Ans. (A)

Sol. Caesium is used in devising photoelectric cells.

Boron fibres are used in making bullet–proof vest.

Silicones being surrounded by non–polar alkyl groups are water repelling in nature.

Gallium is less toxic and has a very high boiling point, so it is used in high temperature thermometers.

11. The oxoacid of phosphorus that is easily obtained from a reaction of alkali and white phosphorus and has two P-H bonds, is :

(A) Phosphonic acid
(B) Phosphinic acid
(C) Pyrophosphorus acid
(D) Hypophosphoric acid

Ans. (B)

Sol. $P_4 + 3NaOH + 3H_2O \rightarrow PH_3 + 3NaH_2PO_2$

oxoacid = H_3PO_2 (hypo phosphorus acid) or (phosphinic acid)

12. The acid that is believed to be mainly responsible for the damage of Taj Mahal is

(A) Sulfuric acid (B) Hydrofluoric acid
(C) Phosphoric acid (D) Hydrochloric acid

Ans. (A)

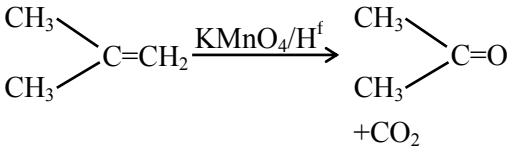
Sol. $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

13. Two isomers 'A' and 'B' with molecular formula C_4H_8 give different products on oxidation with $KMnO_4$ in acidic medium. Isomer 'A' on reaction with $KMnO_4/H^+$ results in effervescence of a gas and gives ketone. The compound 'A' is

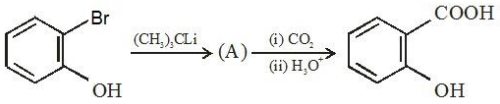
(A) But-1-ene (B) cis-But-2-ene
(C) trans-But-2ene (D) 2-methyl propene

Ans. (D)

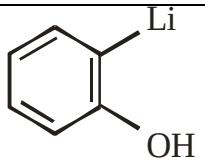
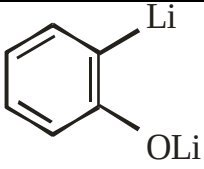
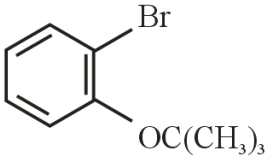
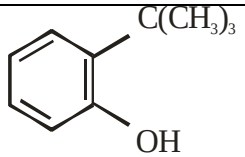
Sol.



14.

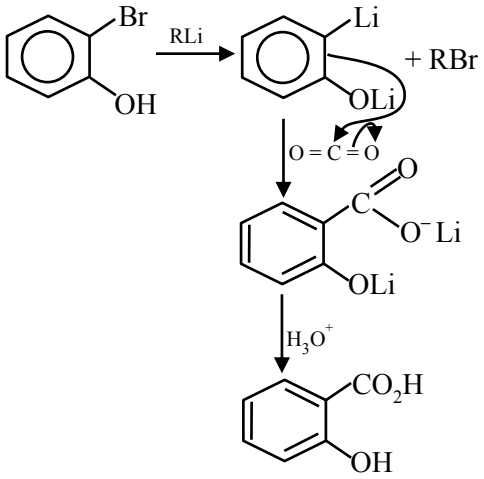


In the given conversion the compound A is:

(A)	
(B)	
(C)	
(D)	

Ans. (B)

Sol.



15. Given below are two statements :

Statement I : The esterification of carboxylic acid with an alcohol is a nucleophilic acyl substitution.

Statement II : Electron withdrawing groups in the carboxylic acid will increase the rate of esterification reaction.

Choose the **most appropriate** option :

(A) Both **Statement I** and **Statement II** are correct.

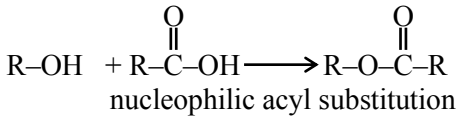
(B) Both **Statement I** and **Statement II** are incorrect.

(C) **Statement I** is correct but **Statement II** is incorrect.

(D) **Statement I** is incorrect but **Statement II** is correct.

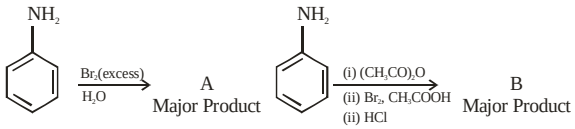
Ans. (A)

Sol.

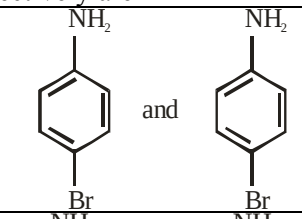
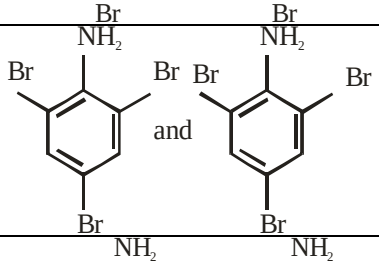
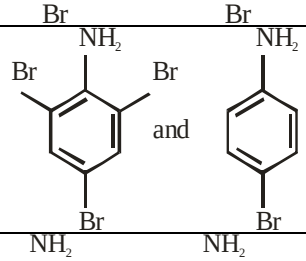
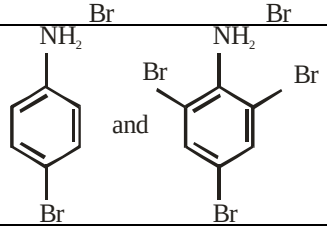


electron with drawing group on carboxylic acid will increase the rate of esterification

16.

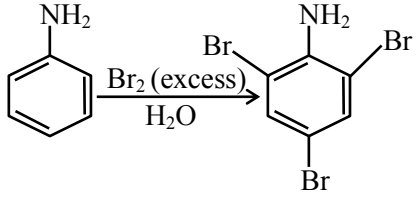


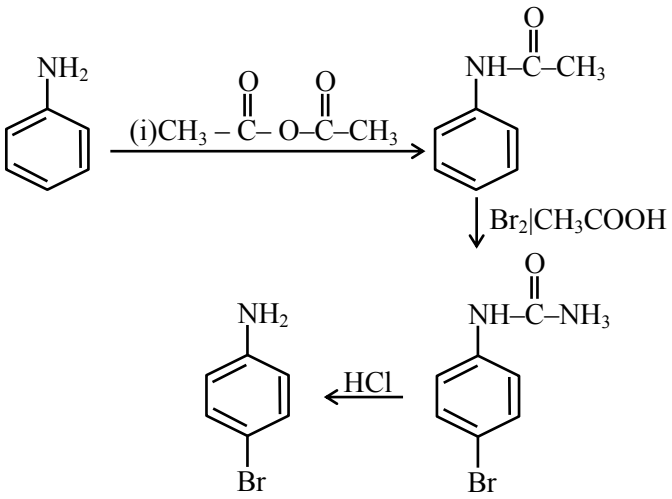
Consider the above reaction, the product A and product B respectively are

(A)	
(B)	
(C)	
(D)	

Ans. (C)

Sol.





17. The polymer, which can be stretched and retains its original status on releasing the force is

(A) Bakelite (B) Nylon 6,6

(C) Buna-N (D) Terylene

Ans. (C)

Buna – N is synthetic rubber which can be stretched and retains its original status on releasing the force.

18. Sugar moiety in DNA and RNA molecules respectively are

(A) β-D-2-deoxyribose, β -D-deoxyribose

(B) β-D-2-deoxyribose, β -D-ribose

(C) β-D-ribose, β -D-2-deoxyribose

(D) β-D-deoxyribose, β -D-2-deoxyribose

Ans. (B)

Sol. DNA contains $\Rightarrow$ β – D – 2 – deoxyribose

RNA contains $\Rightarrow$ β – D – ribose

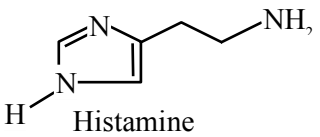
19. Which of the following compound **does not** contain sulphur atom ?

(A) Cimetidine (B) Ranitidine

(C) Histamine (D) Saccharin

Ans. (C)

Sol.



Histamine

Histamine is nitrogenous compound it does not contain sulpher.

20. Given below are two statements.

Statement I : Phenols are weakly acidic.

Statement II : Therefore they are freely soluble in NaOH solution and are weaker acids than alcohols and water.

Choose the **most appropriate** option:

(A) Both **Statement I** and **Statement II** are correct.

(B) Both **Statement I** and **Statement II** are incorrect.

(C) **Statement I** is correct but **Statement II** is incorrect.

(D) **Statement I** is incorrect but **Statement II** is correct.

Ans. (C)

Sol. Phenol are weakly acidic. Phenol is more acidic than alcohol & H_2O statement (I) is correct. (II) is incorrect.

SECTION-B

1. Geraniol, a volatile organic compound, is a component of rose oil. The density of the vapour is 0.46 gL^{-1} at 257°C and 100 mm Hg. The molar mass of geraniol is _____ (Nearest Integer)

[Given R = 0.082 L atm K^{-1} mol^{-1}]

Ans. (152)

Sol. Assuming ideal behaviour $P = \frac{dRT}{M}$

$P = \frac{100}{760}$ atm, T = 257 + 273 = 530 K

d = 0.46 gm/L

So $M = \frac{0.46 \times 0.082 \times 530}{100} \times 760$

$= 151.93 \approx 152$

2. 17.0 g of NH_3 completely vapourises at – 33.42°C and 1 bar pressure and the enthalpy change in the= process is 23.4 kJ mol^{-1}. The enthalpy change for= the vapourisation of 85 g of NH_3 under the same= conditions is _____ kJ.

Ans. (117)

Sol. Given data is for 1 moles and asked for 5 moles so value is $23.4 \times 5 = 117$ kJ

3. 1.2 mL of acetic acid is dissolved in water to make 2.0 L of solution. The depression in freezing point= observed for this strength of acid is 0.0198°C. The= percentage of dissociation of the acid is _____ . (Nearest integer)

[Given : Density of acetic acid is 1.02 g mL^{-1}= Molar mass of acetic acid is 60 g mol^{-1}

$K_f (H_2O)$ =1.85 K kg $mo1^{-1}$]

Ans. (5)

Sol. $M = d \times V = 1.02 \times 1.2 = 1.224$ gm

Moles of acetic acid = 0.0204 moles in 2L

So molality = 0.0102 mol/kg

Now $\Delta T_f = i \times K_f \times M$

$i = 1 + \alpha$ for acetic acid

$0.0198 = (1 + \alpha) \times 1.85 \times 0.0102$

$\alpha = 0.04928$

$\cong 5\%$

4. A dilute solution of sulphuric acid is electrolysed using a current of 0.10 A for 2 hours to produce=hydrogen and oxygen gas. The total volume of=gases produced at STP is _____ cm^3. (Nearest= integer) [Given : Faraday constant F = 96500 C =$mo1^{-1}$ at STP, molar volume of an ideal gas is =22.7 L $mo1^{-1}$]

Ans. (127)

Sol. At anode

$2H_2O \rightarrow O_2(g) + 4H^+ + 4e^-$

At cathode

$2H^+ + 2e^- \rightarrow H_2(g)$

Now number of gm eq. $= \dfrac{i \times t}{96500}$

$= \dfrac{0.1 \times 2 \times 60 \times 60}{96500}$

$= 0.00746$

$V_{O_2} = \dfrac{0.00746}{4} \times 22.7 = 0.0423$

$V_{H_2} = \dfrac{0.00746}{2} \times 22.7 = 0.0846$

$V_{Total} \approx$ 127 ml or cc

5. The activation energy of one of the reactions in a biochemical process is 532611 J $mo1^{-1}$. When the= temperature falls from 310 K to 300 K, the change= in rate constant observed is $k_{300} = x \times 10^{-3}\ k_{310}$. The= value of x is _____.

[Given: 1n10 = 2.3

R=8.3 J K^{-1} $mo1^{-1}$]

Ans. (1)

Sol. $\ell n\left(\dfrac{K_2}{K_1}\right) = \dfrac{E_a}{R}\left(\dfrac{1}{T_1} - \dfrac{1}{T_2}\right)$

$\ell n\left(\dfrac{K_2}{K_1}\right) = \dfrac{532611}{8.3} \times \left(\dfrac{10}{310 \times 300}\right)$

where K_2 is at 310 K & K_1 is at 300 K

$\ell n\left(\dfrac{K_2}{K_1}\right) = 6.9$

$= 3 \times \ell n10$

$\ell n\dfrac{K_2}{K_1} = \ell n10^3$

$K_2 = K_1 \times 10^3$

$K_1 = K_2 \times 10^3$

So K = 1

6. The number of terminal oxygen atoms present in the product B obtained from the following reaction is _____.

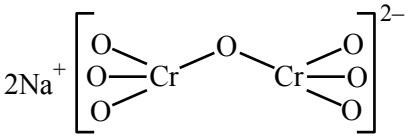
$FeCr_2O_4 + Na_2CO_3 + O_2 \rightarrow A + Fe_2O_3 + CO_2$

$A + H^+ \rightarrow B + H_2O + Na^+$

Ans. (6)

Sol. $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

$2Na_2CrO_4 + 2H^+ \rightarrow \underbrace{Na_2Cr_2O_7}_{B} + 2Na^+ + H_2O$



7. An acidified manganate solution undergoes disproportionation reaction. The spin-only magnetic moment value of the product having manganese in higher oxidation state is _____ B.M. (Nearest integer)

Ans. (0)

Sol. $3MnO_4^{2-} + 4H^+ \longrightarrow 2\overset{+7}{Mn}O_4^- + \overset{+4}{Mn}O_2 + 2H_2O$

$\overset{+7}{Mn}$ = no. of unpaired electrons is '0'

μ = 0 B.M.

8. Kjeldahl's method was used for the estimation of nitrogen in an organic compound. The ammonia evolved from 0.55 g of the compound neutralised 12.5 mL of 1 M H_2SO_4 solution. The percentage of nitrogen in the compound is _____. (Nearest integer)

Ans. (64)

Sol. Meq of H_2SO_4 used by NH_3 = $12.5 \times 1 \times 2 = 25$

$$\% \text{ of N in the compound} = \frac{25\times10^{-3}\times14\times100}{0.55} = 63.6$$

or

Meq. of H_2SO_4 = Meq. of NH_3

$12.5 \times 1 \times 2 = 25$ meq. of NH_3

= 25 millimoles of NH_3

So Millimoles of 'N' = 25

Moles of 'N' = 25×10^{-3}

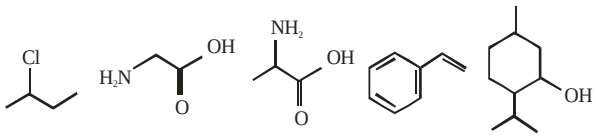
wt. of N = $14 \times 25\times10^{-3}$

$$\%N = \frac{14\times25\times10^{-3}}{0.55}\times100$$

= 63.66

$\approx$ 64%

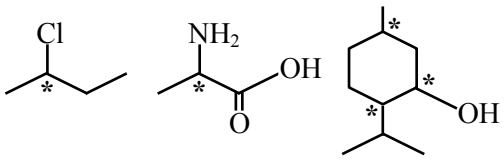
9. Observe structures of the following compounds



The total number of structures/compounds which possess asymmetric carbon atoms is _____.

Ans. (3)

Sol.



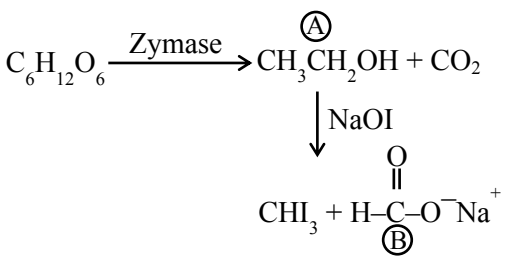
Number of compounds containing asymmetric carbons are three.

10. $C_6H_{12}O_6 \xrightarrow{\text{Zymase}} A \xrightarrow[\Delta]{\text{NaOI}} B + CHI_3$

The number of carbon atoms present in the product B is _____.

Ans. (1)

Sol.



no. of carbon atoms present in B is 1