

TEST PAPER OF JEE(MAIN) EXAMINATION – 2019

(Held On Thursday 10th JANUARY, 2019) TIME : 02 : 30 PM To 05 : 30 PM

CHEMISTRY

1. An ideal gas undergoes isothermal compression from 5 m³ against a constant external pressure of 4 Nm⁻². Heat released in this process is used to increase the temperature of 1 mole of Al. If molar heat capacity of Al is 24 J mol⁻¹ K⁻¹, the temperature of Al increases by :

- (1) $\frac{3}{2}$ K (2) $\frac{2}{3}$ K (3) 1 K (4) 2 K

Ans. (2)

Sol. Work done on isothermal irreversible for ideal gas

$$\begin{aligned} &= -P_{\text{ext}}(V_2 - V_1) \\ &= -4 \text{ N/m}^2 (1\text{m}^3 - 5\text{m}^3) \\ &= 16 \text{ Nm} \end{aligned}$$

Isothermal process for ideal gas

$$\Delta U = 0$$

$$q = -w$$

$$= -16 \text{ Nm}$$

$$= -16 \text{ J}$$

Heat used to increase temperature of Al

$$q = n C_m \Delta T$$

$$16 \text{ J} = 1 \times 24 \frac{\text{J}}{\text{mol.K}} \times \Delta T$$

$$\Delta T = \frac{2}{3} \text{ K}$$

2. The 71st electron of an element X with an atomic number of 71 enters into the orbital :

- (1) 4f (2) 6p (3) 6s (4) 5d

Ans. (1)

3. The number of 2-centre-2-electron and 3-centre-2-electron bonds in B₂H₆, respectively, are :

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

Ans. (4)

4. The amount of sugar (C₁₂H₂₂O₁₁) required to prepare 2 L of its 0.1 M aqueous solution is :

- (1) 68.4 g (2) 17.1 g (3) 34.2 g (4) 136.8 g

Ans. (1)

Sol. Molarity = $\frac{(n)_{\text{solute}}}{V_{\text{solution}} \text{ (in lit)}}$

$$0.1 = \frac{\text{wt./342}}{2}$$

$$\text{wt (C}_{12}\text{H}_{22}\text{O}_{11}) = 68.4 \text{ gram}$$

5. Among the following reactions of hydrogen with halogens, the one that requires a catalyst is :

- (1) H₂ + I₂ → 2HI (2) H₂ + F₂ → 2HF
(3) H₂ + Cl₂ → 2HCl (4) H₂ + Br₂ → 2HBr

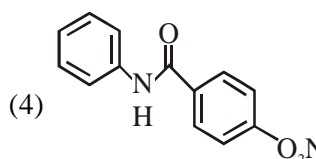
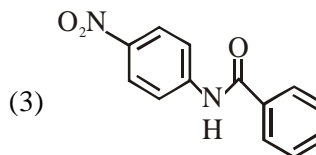
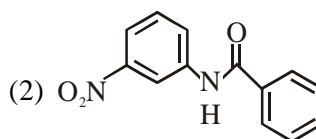
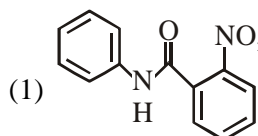
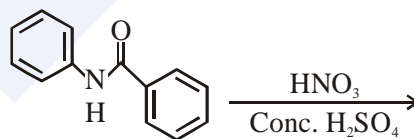
Ans. (1)

6. Sodium metal on dissolution in liquid ammonia gives a deep blue solution due to the formation of:

- (1) sodium ion-ammonia complex
(2) sodamide
(3) sodium-ammonia complex
(4) ammoniated electrons

Ans. (4)

7. What will be the major product in the following mononitration reaction ?



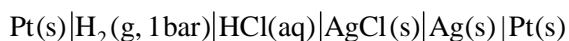
Ans. (3)

8. In the cell $\text{Pt(s)}|\text{H}_2(\text{g}, 1\text{bar})|\text{HCl}(\text{aq})|\text{Ag}(\text{s})|\text{Pt}(\text{s})$ the cell potential is 0.92 when a 10^{-6} molal HCl solution is used. The standard electrode potential of $(\text{AgCl}/\text{Ag}, \text{Cl}^-)$ electrode is :

$$\left\{ \text{given, } \frac{2.303RT}{F} = 0.06\text{V at } 298\text{K} \right\}$$

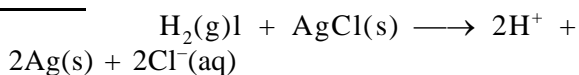
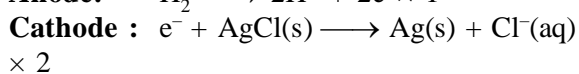
- (1) 0.20 V (2) 0.76 V (3) 0.40 V (4) 0.94 V

Ans. (1)



Sol.

$$10^{-6} \text{ m}$$



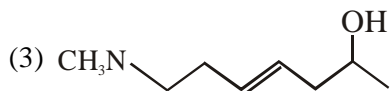
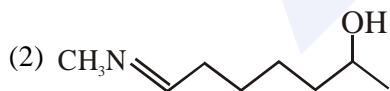
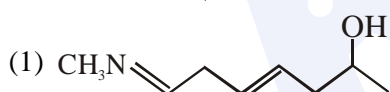
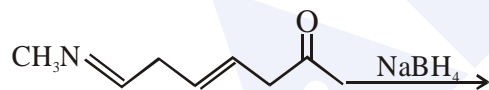
$$E_{\text{cell}} = E_{\text{cell}}^0 - \frac{0.06}{2} \log_{10} ((\text{H}^+)^2 \cdot (\text{Cl}^-)^2)$$

$$.925 = \left(E_{\text{H}_2/\text{H}^+}^0 + E_{\text{AgCl}/\text{Ag}, \text{Cl}^-}^0 \right) - \frac{0.06}{2} \log_{10} ((10^{-6})^2 (10^{-6})^2)$$

$$.92 = 0 + E_{\text{AgCl}/\text{Ag}, \text{Cl}^-}^0 - 0.03 \log_{10} (10^{-6})^4$$

$$E_{\text{AgCl}/\text{Ag}, \text{Cl}^-}^0 = .92 + .03 \times -24 = 0.2 \text{ V}$$

9. The major product of the following reaction is:



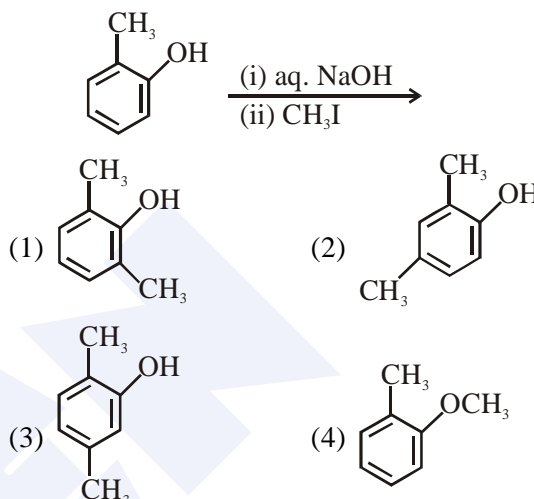
Ans. (3)

10. The pair that contains two P-H bonds in each of the oxoacids is :

- (1) H_3PO_2 and $\text{H}_4\text{P}_2\text{O}_5$
(2) $\text{H}_4\text{P}_2\text{O}_5$ and $\text{H}_4\text{P}_2\text{O}_6$
(3) H_3PO_3 and H_3PO_2
(4) $\text{H}_4\text{P}_2\text{O}_5$ and H_3PO_3

Ans. (1)

11. The major product of the following reaction is:



Ans. (4)

12. The difference in the number of unpaired electrons of a metal ion in its high-spin and low-spin octahedral complexes is two. The metal ion is :

- (1) Fe^{2+} (2) Co^{2+} (3) Mn^{2+} (4) Ni^{2+}

Ans. (2)

13. A compound of formula A_2B_3 has the hcp lattice. Which atom forms the hcp lattice and what fraction of tetrahedral voids is occupied by the other atoms :

- (1) hcp lattice-A, $\frac{2}{3}$ Tetrahedral voids-B
(2) hcp lattice-B, $\frac{1}{3}$ Tetrahedral voids-A
(3) hcp lattice-B, $\frac{2}{3}$ Tetrahedral voids-A
(4) hcp lattice-A, $\frac{1}{3}$ Tetrahedral voids-B

Ans. (2)

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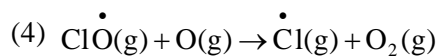
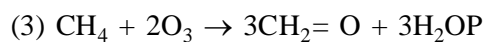
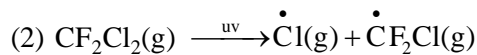
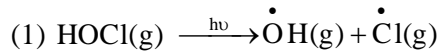
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Sol. A_2B_3 has HCP lattice

If A form HCP, then $\frac{3}{4}$ of THV must occupied by B to form A_2B_3

If B form HCP, then $\frac{1}{3}$ of THV must occupied by A to form A_2B_3

14. The reaction that is NOT involved in the ozone layer depletion mechanism is the stratosphere is:



Ans. (3)

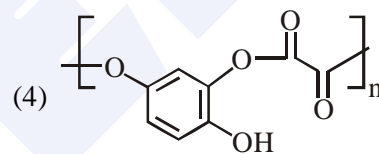
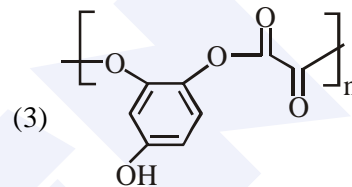
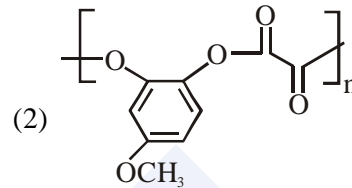
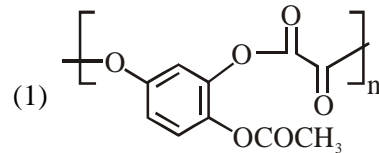
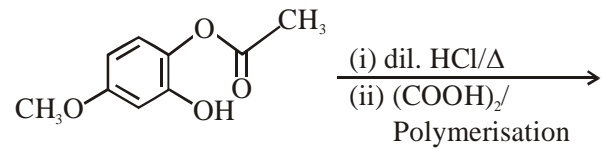
15. The process with negative entropy change is :

- (1) Dissolution of iodine in water
- (2) Synthesis of ammonia from N_2 and H_2
- (3) Dissolution of $CaSO_4(s)$ to $CaO(s)$ and $SO_3(g)$
- (4) Sublimation of dry ice

Ans. (2)

Sol. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) ; \Delta n_g < 0$

16. The major product of the following reaction is:



Ans. (3)

17. A reaction of cobalt(III) chloride and ethylenediamine in a 1 : 2 mole ratio generates two isomeric products A (violet coloured) B (green coloured). A can show optical activity, B is optically inactive. What type of isomers does A and B represent ?

- (1) Geometrical isomers
- (2) Ionisation isomers]
- (3) Coordination isomers
- (4) Linkage isomers

Ans. (1)

MAJOR COMPUTER BASED TEST (CBT) SERIES

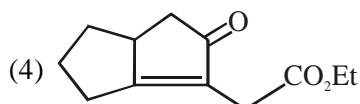
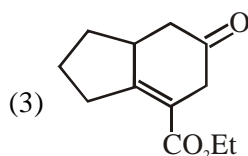
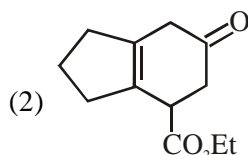
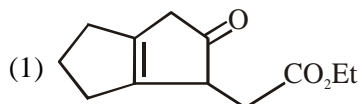
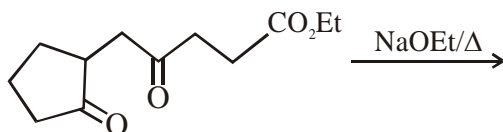
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18. The major product obtained in the following reaction is :



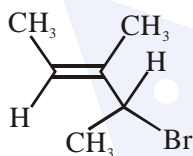
Ans. (4)

19. Which of the following tests cannot be used for identifying amino acids ?

- (1) Biuret test (2) Xanthoproteic test
(3) Barfoed test (4) Ninhydrin test

Ans. (3)

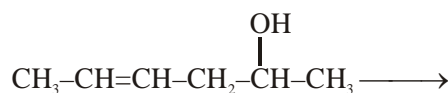
20. What is the IUPAC name of the following compound ?



- (1) 3-Bromo-1, 2-dimethylbut-1-ene]
(2) 4-Bromo-3-methylpent-2-ene
(3) 2-Bromo-3-methylpent-3-ene
(4) 3-Bromo-3-methyl-1, 2-dimethylprop-1-ene

Ans. (2)

21. Which is the most suitable reagent for the following transformation ?



- CH₃-CH=CH-CH₂CO₂H
(1) alkaline KMnO₄ (2) I₂/NaOH
(3) Tollen's reagent (4) CrO₂/CS₂

Ans. (2)

22. The correct match between item 'I' and item 'II' is :

Item 'I' (compound)	Item 'II' (reagent)
(A) Lysine	(P) 1-naphthol
(B) Furfural	(Q) ninhydrin
(C) Benzyl alcohol	(R) KMnO ₄
(D) Styrene	(S) Ceric ammonium nitrate

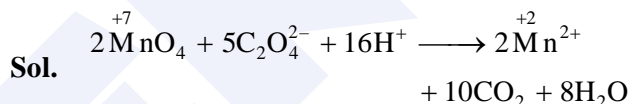
- (1) (A)→(Q), (B)→(P), (C)→(S), (D)→(R)
(2) (A)→(Q), (B)→(R), (C)→(S), (D)→(P)
(3) (A)→(Q), (B)→(P), (C)→(R), (D)→(S)
(4) (A)→(R), (B)→(P), (C)→(Q), (D)→(S)

Ans. (1)

23. In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO₂ is :

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

Ans. (3)

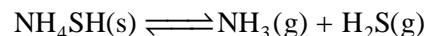


10 e⁻ trans for 10 molecules of CO₂ so per molecule of CO₂ transfer of e⁻ is '1'

24. 5.1g NH₄SH is introduced in 3.0 L evacuated flask at 327°C. 30% of the solid NH₄SH decomposed to NH₃ and H₂S as gases. The K_p of the reaction at 327°C is (R = 0.082 L atm mol⁻¹K⁻¹, Molar mass of S = 32 g mol⁻¹, molar mass of N = 14g mol⁻¹)

- (1) 1 × 10⁻⁴ atm² (2) 4.9 × 10⁻³ atm²
(3) 0.242 atm² (4) 0.242 × 10⁻⁴ atm²

Ans. (3)



Sol. $n = \frac{5.1}{51} = .1 \text{ mole}$ 0 0
.1(1-α) .1α .1α

α = 30% = .3

so number of moles at equilibrium

.1 (1 - .3) .1 × .3 .1 × .3
= .07 =.03 =.03

Now use PV = nRT at equilibrium

P_{total} × 3 lit = (.03 + .03) × .082 × 600

P_{total} = .984 atm

At equilibrium

$P_{NH_3} = P_{H_2S} = \frac{P_{total}}{2} = .492$

So $k_p = P_{NH_3} \cdot P_{H_2S} = (.492) (.492)$

$k_p = .242 \text{ atm}^2$

25. The electrolytes usually used in the electroplating of gold and silver, respectively, are :

- (1) $[\text{Au}(\text{OH})_4]^-$ and $[\text{Ag}(\text{OH})_2]^-$
- (2) $[\text{Au}(\text{CN})_2]^-$ and $[\text{Ag} \text{Cl}_2]^-$
- (3) $[\text{Au}(\text{NH}_3)_2]^+$ and $[\text{Ag}(\text{CN})_2]^-$
- (4) $[\text{Au}(\text{CN})_2]^-$ and $[\text{Ag}(\text{CN})_2]^-$

Ans. (4)

26. Elevation in the boiling point for 1 molal solution of glucose is 2 K. The depression in the freezing point of 2 molal solutions of glucose in the same solvent is 2 K. The relation between K_b and K_f is:

- (1) $K_b = 0.5 K_f$ (2) $K_b = 2 K_f$
- (3) $K_b = 1.5 K_f$ (4) $K_b = K_f$

Ans. (2)

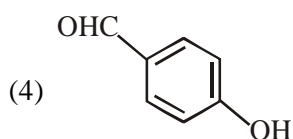
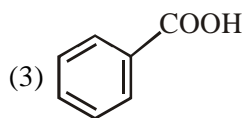
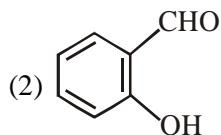
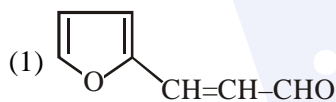
Sol. Ans.(2)

$$\frac{\Delta T_b}{\Delta T_f} = \frac{i \cdot m \times k_b}{i \times m \times k_f}$$

$$\frac{2}{2} = \frac{1 \times 1 \times k_b}{1 \times 2 \times k_f}$$

$$k_b = 2k_f$$

27. An aromatic compound 'A' having molecular formula $\text{C}_7\text{H}_6\text{O}_2$ on treating with aqueous ammonia and heating forms compound 'B'. The compound 'B' on reaction with molecular bromine and potassium hydroxide provides compound 'C' having molecular formula $\text{C}_6\text{H}_7\text{N}$. The structure of 'A' is :



Ans. (3)

28. The ground state energy of hydrogen atom is -13.6 eV . The energy of second excited state He^+ ion in eV is :

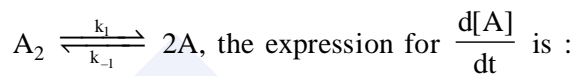
- (1) -6.04 (2) -27.2 (3) -54.4 (4) -3.4

Ans. (1)

Sol. $(E)_n^{\text{th}} = (E_{\text{GND}})_H \cdot \frac{Z^2}{n^2}$

$$E_{3^{\text{rd}}}(\text{He}^+) = (-13.6 \text{ eV}) \cdot \frac{2^2}{3^2} = -6.04 \text{ eV}$$

29. For an elementary chemical reaction,



- (1) $2k_1[\text{A}_2] - k_{-1}[\text{A}]^2$ (2) $k_1[\text{A}_2] - k_{-1}[\text{A}]^2$
- (3) $2k_1[\text{A}_2] - 2k_{-1}[\text{A}]^2$ (4) $k_1[\text{A}_2] + k_{-1}[\text{A}]^2$

Ans. (3)

Sol. Ans.(3)



$$\frac{d[\text{A}]}{dt} = 2k_1[\text{A}_2] - 2k_{-1}[\text{A}]^2$$

30. Haemoglobin and gold sol are examples of :

- (1) negatively charged sols
- (2) positively charged sols]
- (3) negatively and positively charged sols, respectively
- (4) positively and negatively charged sols, respectively

Ans. (4)

Sol. Ans.(4)

Haemoglobin \longrightarrow positive sol

Ag - sol \longrightarrow negative sol