TEST PAPER OF JEE(MAIN) EXAMINATION – 2019

(Held On Wednesday 09th JANUARY, 2019) TIME : 2 : 30 PM To 05 : 30 PM

CHEMISTRY

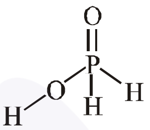
1. lood reducing nature of H_3PO_2 ttributed to the presence of:

(1) One P-OH bond (2) One P-H bond

(3) Two P-H bonds (4) Two P-OH bonds

Ans. (3)

Sol. H_3PO_2 is good reducing agent due to presence of two P–H bonds.



2. The complex thai has highest cry splitting energy (Δ), is :

(1) $K_3[Co(CN)_6]$

(2) $[Co(NH_3)_5(H_2O)]Cl_3$

(3) $K_2[CoCl_4]$

(4) $[Co(NH_3)_5Cl]Cl_2$

Ans. (1)

Sol. As complex $K_3[Co(CN)_6]$ have CN^- ligand which is strongfield ligand amongst the given ligands in other complexes.

3. The metal that forms nitride by reacting directly with N_2 of air, is :

(1) K (2) Cs (3) Li (4) Rb

Ans. (3)

Sol. Only Li react directly with N_2 out of alkali metals

$6Li + N_2 \rightarrow 2Li_3N$

4. In which of the following processes, the bond order has increased and paramagnetic character has changed to diamagnetic ?

(1) $N_2 \rightarrow N_2^+$ (2) $NO \rightarrow NO^+$

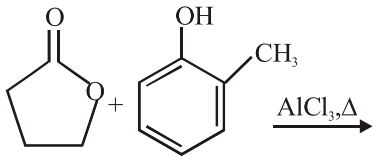
(3) $O_2 \rightarrow O_2^{2-}$ (4) $O_2 \rightarrow O_2^+$

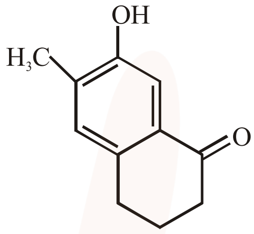
Ans. (2)

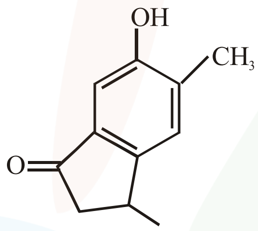
Sol.

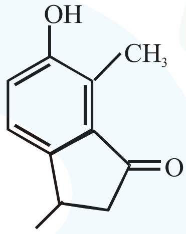
Process	Change in magnetic nature	Bond Order Change
$N_2 \rightarrow N_2^+$	Dia $\rightarrow$ para	$3 \rightarrow 2.5$
$NO \rightarrow NO^+$	Para $\rightarrow$ Dia	$2.5 \rightarrow 3$
$O_2 \rightarrow O_2^{-2}$	Para $\rightarrow$ Dia	$2 \rightarrow 1$
$O_2 \rightarrow O_2^+$	Para $\rightarrow$ Para	$2 \rightarrow 2.5$

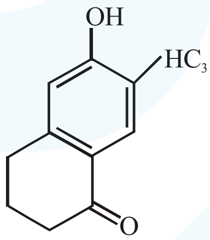
5. The major product of the following reaction is:



(1) 

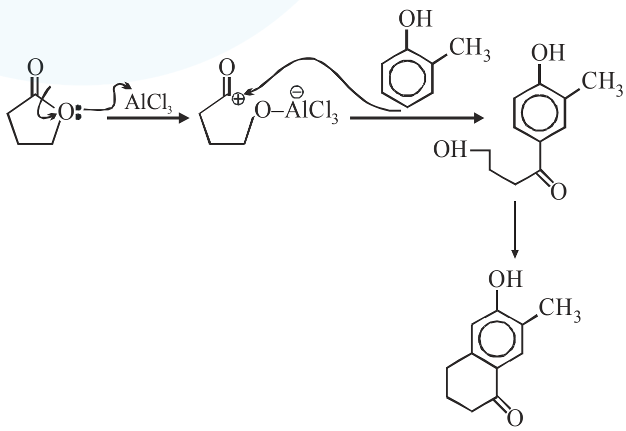
(2) 

(3) 

(4) 

Ans. (4)

Sol.



6. The transition element that has lowest enthalpy of atomisation, is :

(1) Zn

(2) Cu

(3) V

(4) Fe

Ans. **(2)**

Sol. Since Zn is not a transition element so transition element having lowest atomisation energy out of Cu, V, Fe is Cu.

7. Which of the following combination of statements is true regarding the interpretation of the atomic orbitals ?

(a) An electron in an orbital of high angular momentum stays away from the nucleus than an electron in the orbital of lower angular momentum.

(b) For a given value of the principal quantum number, the size of the orbit is inversely proportional to the azimuthal quantum number.

(c) According to wave mechanics, the ground state angular momentum is h equal to $\frac{h}{2\pi}$.

(d) The plot of ψ Vs r for various azimuthal quantum numbers, shows peak shifting towards higher r value.

(1) (b), (c) (2) (a), (d) (3) (a), (b) (4) (a), (c)

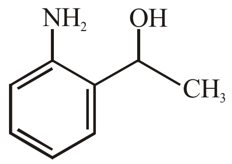
Ans. **(4)**

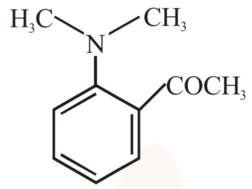
Sol. Refer Theory

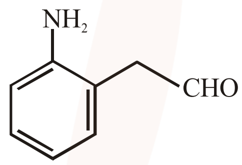
8. The tests performed on compound X and their inferences are:

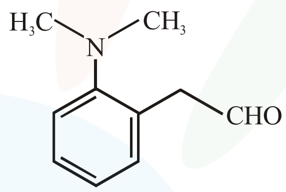
Test	Inference
(a) 2,4 - DNP test	Coloured precipitate
(b) Iodoform test	Yellow precipitate
(c) Azo-dye test	No dye formation

Compound 'X' is:

(1) 

(2) 

(3) 

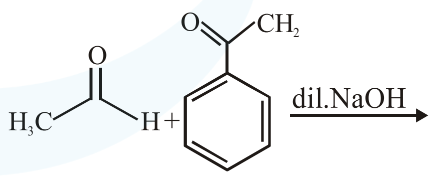
(4) 

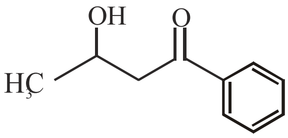
Ans. **(2)**

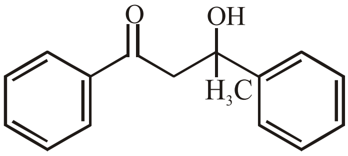
Sol. → 2,4 – DNP test is given by aldehyde on ketone

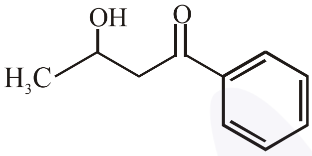
→ Iodoform test is given by compound having $CH_3-\underset{\underset{O}{\|}}{C}-$ group.

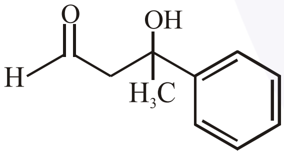
9. The major product formed in the following reaction is:



(1) 

(2) 

(3) 

(4) 

Ans. **(1)**

Sol. Aldehyde reacts at a faster rate than keton during aldol and stericall less hindered anion will be a better nucleophile so sefl aldol at $CH_3-\overset{O}{\overset{\|}{C}}-H$ will be the major product.

10. For the reaction, 2A + B $\rightarrow$ products, when the concentrations of A and B both wrere doubled, the rate of the reaction increased from 0.3 mol $L^{-1}s^{-1}$ to 2.4 mol L^{-1} s^{-1}. When the concentration of A alone is doubled, the rate increased from 0.3 mol $L^{-1}s^{-1}$ to0.6 mol $L^{-1}s^{-1}$

Which one of the following statements is correct ?

(1) Order of the reaction with respect to Bis2

(2) Order of the reaction with respect to Ais2

(3) Total order of the reaction is 4

(4) Order of the reaction with respect to B is 1

Ans. **(1)**

Sol. $r = K[A]^x[B]^y$

$\Rightarrow 8 = 2^3 = 2^{x+y}$

$\Rightarrow x + y = 3$ ...(1)

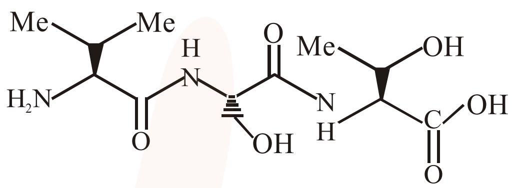
$\Rightarrow 2 = 2^x$

$\Rightarrow x = 1, y = 2$

Order w.r.t. A = 1

Order w.r.t. B = 2

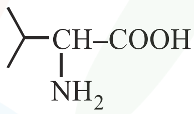
11. The correct sequence of amino acids present in the tripeptide given below is :



(1) Leu - Ser - Thr (2) Thr - Ser- Leu

(3) Thr - Ser - Val (4) Val - Ser - Thr

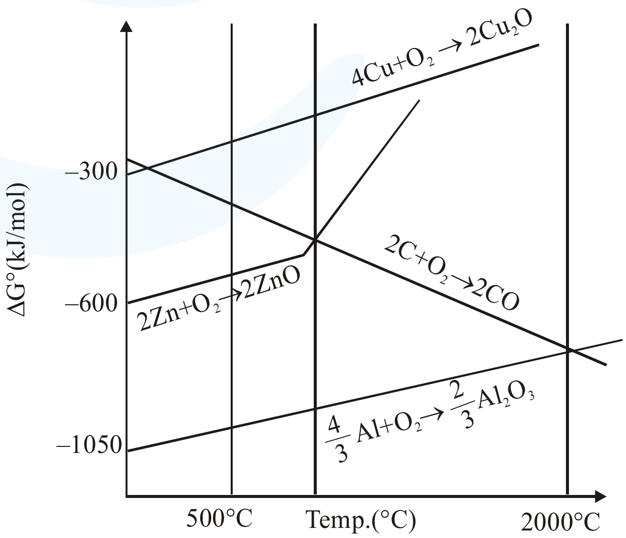
Ans. **(4)**

Sol. **Leusine** 

Serine $NO-CH_2-\underset{NH_2}{\underset{|}{CH}}-COOH$

Thrconine $H_3C-\underset{OH}{\underset{|}{CH}}-\underset{NH_2}{\underset{|}{CH}}-COOH$

12. The correct statement regarding the given Ellingham diagram is:



(1) At 800°C, Cu can be used for the extraction of Zn from ZnO

(2) At 500 C, coke can be used for the extraction of Zn from ZnO

(3) Coke cannot be used for the extraction of Cu from Ca_2O.

(4) At 1400°C, Al can be used for the extraction of Zn from ZnO

Ans. **(4)**

Sol. According to the given diagram Al can reduce ZnO.

$3ZnO + 2Al \rightarrow 3Zn + Al_2O_3$

13. For the following reaction, the mass of water produced from 445 g of $C_{57}H_{110}O_6$ is :

$2C_{57}H_{110}O_6(s) + 163O_2(g) \rightarrow 114CO_2(g) + 110\ H_2OP(1)$

(1) 495 g (2) 490 g (3) 890 g (4) 445 g

Ans. **(1)**

Sol. moles of $C_{57}H_{110}O_6(s) = \frac{445}{890} = 0.5$ moles

$2C_{57}H_{110}O_6(s) + 163\ O_2(g) \rightarrow 114\ CO_2(g) + 110\ H_2O(l)$

$$n_{H_2O} = \frac{110}{4} = \frac{55}{2}$$

$$m_{H_2O} = \frac{55}{2} \times 18$$

$$= 495\text{gm}$$

14. The correct match between Item I and Item II is :

Item I	**Item II**
(A) Benzaldehyde	(P) Mobile phase
(B) Alumina	(Q) Adsorbent
(C) Acetonitrile	(R) Adsorbate

(1) (A) → (Q);(B) → (R);(C) → (P)

(2) (A) → (P); (B) → (R); (C) → (Q)

(3) (A) → (Q); (B) → (P); (C) → (R)

(4) (A) → (R); (B) → (Q); (C) → (P)

Ans. **(4)**

Sol.

15. The increasing basicity order of the following compounds is :

(A) $CH_3CH_2NH_2$

(B) CH_3CH_2NH with CH_2CH_3 on N

(C) $H_3C{-}N{-}CH_3$ with CH_3 on N

(D) $Ph{-}N{-}H$ with CH_3 on N

(1) (D)<(C)<(A)<(B) (2) (A)<(B)<(D)<(C)

(3) (A)<(B)<(C)< (D) (4) (D)<(C)<(B)<(A)

Ans. **(1)**

Sol.

$Ph-N(CH_3)-H < CH_3-N(CH_3)-CH_3 < CH_3-CH_2-NH(CH_2-CH_3) < CH_3-CH_2-NH_2$

lone pair delocalized

more steric hinderence

less solutions energy

16. For coagulation of arscnious sulphide sol, which one of the following salt solution will be most effective ?

(1) $AlCl_3$ (2) NaCl

(3) $BaCl_2$ (4) Na_3PO_4

Ans. **(1)**

Sol. Sulphide is –ve charged colloid so cation with maximum charge will be most effective for coagulation.

$Al^{3+} > Ba^{2+} > Na^+$ coagulating power.

17. At 100°C, copper (Cu) has FCC unit cell structure with cell edge length of x Å. What is the approximate density of Cu (in g cm^{-3}) at this temperature ?

[Atomic Mass of Cu = 63.55u]

(1) $\frac{105}{x^3}$ (2) $\frac{211}{x^3}$ (3) $\frac{205}{x^3}$ (4) $\frac{422}{x^3}$

Ans. **(4)**

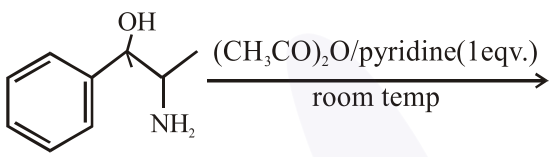
Sol. FCC unit cell Z = 4

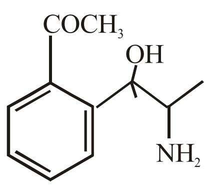
$$d = \frac{63.5\times 4}{6\times 10^{23}\times x^3\times 10^{-24}}\ \text{g/cm}^3$$

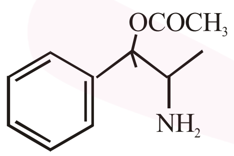
$$d = \frac{63.5\times 4\times 10}{6}\ \text{g/cm}^3$$

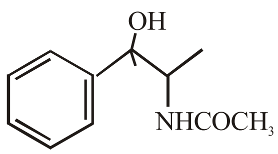
$$d = \frac{423.33}{x^3} \simeq \left(\frac{422}{x^3}\right)$$

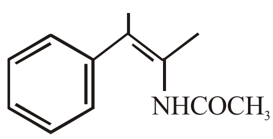
18. The major product obtained in the following reaction is :



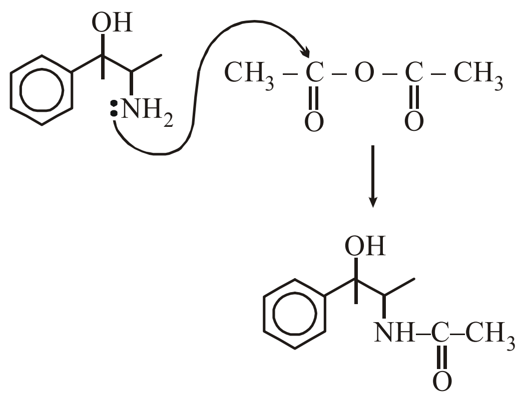
(1) 

(2) 

(3) 

(4) 

Ans. **(3)**

Sol. 

19. Which of the following conditions in drinking water causes methemoglobinemia ?

(1) > 50ppm of load

(2) > 100 ppm of sulphate

(3) > 50 ppm of chloride

(4) > 50 ppm of nitrate

Ans. **(4)**

Sol. Concentration of nitrate >50 ppm in drinking water causes methemoglobinemia

20. Homoleptic octahedral complexes of a metal ion 'M^{3+}' with three monodentate ligands and L_1, L_2, L_3 absorb wavelengths in the region of green, blue and red respectively. The increasing order of the ligand strength is :

(1) $L_2 < L_1 < L_3$ (2) $L_3 < L_2 < L_1$

(3) $L_3 < L_1 < L_2$ (4) $L_1 < L_2 < L_3$

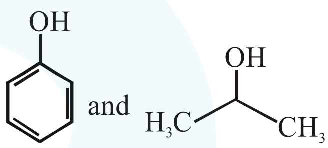
Ans. **(3)**

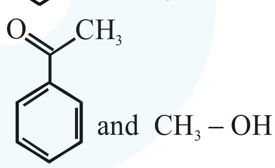
Sol. Order of λ_{abs} - $L_3 > L_1 > L_2$

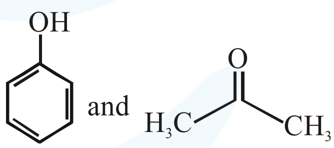
So Δ_O order will be $L_2 > L_1 > L_3$ (as $\Delta_O \propto \frac{1}{\lambda_{abs}}$)

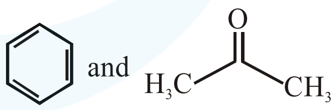
So order of ligand strength will be $L_2 > L_1 > L_3$

21. The product formed in the reaction of cumene with O_2 followed by treatment with dil. HCl are :

(1) 

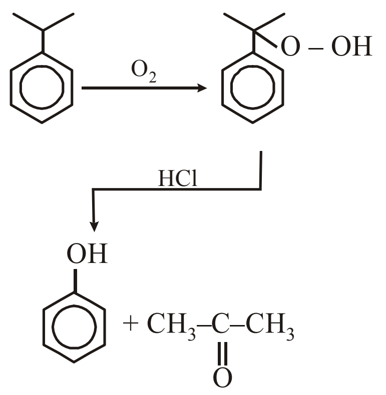
(2) 

(3) 

(4) 

Ans. **(3)**

Sol. Cummene hydroperoxide reaction



22. The temporary hardness of water is due to :-

(1) $Ca(HCO_3)_2$ (2) $NaCl$

(3) Na_2SO_4 (4) $CaCl_2$

Ans. (1)

Sol. $Ca(HCO_3)_2$ is reponsible for temporary hardness of water

23. The entropy change associated with the conversion of 1 kg of ice at 273 K to water vapours at 383 K is :

(Specific heat of water liquid and water vapour are 4.2 kJ K^{-1} kg^{-1} and 2.0 kJ K^{-1} kg^{-1} ; heat of liquid fusion and vapourisation of water are 344 kJ kg^{-1} and 2491 kJ kg^{-1}, respectively).

(log 273 = 2.436, log 373 = 2.572, log 383 = 2.583)

(1) 7.90 kJ kg^{-1} K^{-1} (2) 2.64 kJ kg^{-1} K^{-1}

(3) 8.49 kJ kg^{-1} K^{-1} (4) 4.26 kJ kg^{-1} K^{-1}

Ans. (4)

Sol.

$$\underset{273K}{H_2O(s)} \xrightarrow{\Delta S_1} \underset{273K}{H_2O(\ell)} \xrightarrow{\Delta S_2} \underset{373K}{H_2O(\ell)}$$

$$\xrightarrow{\Delta S_3} \underset{373K}{H_2O(g)} \xrightarrow{\Delta S_4} \underset{383K}{H_2O(g)}$$

$$\Delta S_1 = \frac{\Delta H_{fusion}}{273} = \frac{334}{273} = 1.22$$

$$\Delta S_2 = 4.2\ell N\left(\frac{363}{273}\right) = 1.31$$

$$\Delta S_3 = \frac{\Delta H_{vap}}{373} = \frac{2491}{373} = 6.67$$

$$\Delta S_4 = 2.0\ell n\left(\frac{383}{373}\right) = 0.05$$

$$\Delta S_{total} = 9.26 \text{ kJ kg}^{-1} \text{ K}^{-1}$$

24. The pH of rain water, is approximately :

(1) 6.5 (2) 7.5 (3) 5.6 (4) 7.0

Ans. (3)

Sol. pH of rain water is approximate 5.6

25. If the standard electrode potential for a cell is 2 V at 300 K, the equilibrium constant (K) for the reaction

$$Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}(aq) + Cu(s)$$

at 300 K is approximately.

(R = 8 JK^{-1} mol^{-1} , F = 96000 C mol^{-1})

(1) e^{160} (2) e^{320}

(3) e^{-160} (4) e^{-80}

Ans. (1)

Sol. $\Delta G^\circ = -RT \ln k = -nFE^\circ_{cell}$

$$\ln k = \frac{n \times F \times E^\circ}{R \times T} = \frac{2 \times 96000 \times 2}{8 \times 300}$$

$\ln k = 160$

$k = e^{160}$

26. A solution containing 62 g ethylene glycol in 250 g water is cooled to –10°C. If K_f for water is 1.86 K kg mol^{-1}, the amount of water (in g) separated as ice is :

(1) 32 (2) 48 (3) 16 (4) 64

Ans. (4)

Sol. $\Delta T_f = K_f \cdot m$

$$10 = 1.86 \times \frac{62/62}{W_{kg}}$$

$W = 0.186$ kg

$\Delta W = (250 - 186) = 64$ gm

27. When the first electron gain enthalpy ($\Delta_{eg}H$) of oxygen is –141 kJ/mol, its second electron gain enthalpy is :

(1) almost the same as that of the first

(2) negative , but less negative than the first

(3) a positive value

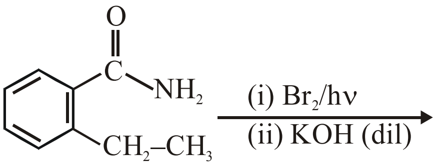
(4) a more negative value than the first

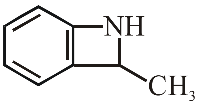
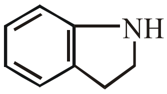
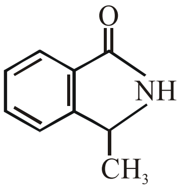
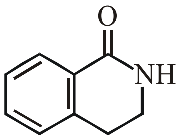
Ans. (3)

Sol. Second electron gain enthalpy is always positive for every element.

$O^-_{(g)} + e^- \rightarrow O^{-2}_{(g)}$; ΔH = positive

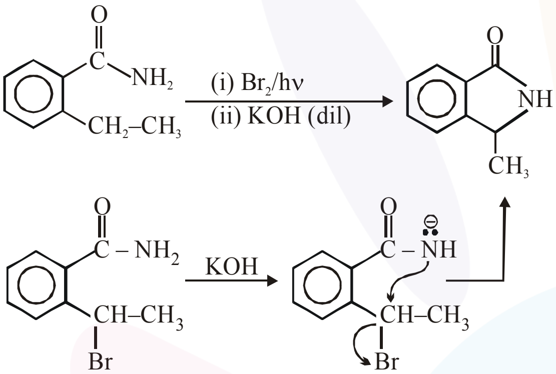
28. The major product of the following reaction is :



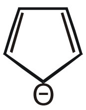
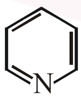
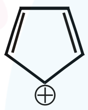
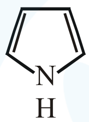
(1) 
(2) 
(3) 
(4) 

Ans. (3)

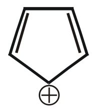
Sol.



29. Which of the following compounds is not aromatic ?

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

Ans. (3)

Sol. 

Do not have (4n + 2) π electron It has 4n π electrons

So it is Anti aromatic.

30. Consider the following reversible chemical reactions :

$$A_2(g) + Br_2(g) \overset{K_1}{\rightleftharpoons} 2AB(g) \quad .....(1)$$

$$6AB(g) \overset{K_2}{\rightleftharpoons} 3A_2(g) + 3B_2(g) \quad .....(2)$$

The relation between K_1 and K_2 is :

(1) $K_2 = K_1^3$ (2) $K_2 = K_1^{-3}$

(3) $K_1K_2 = 3$ (4) $K_1K_2 = \frac{1}{3}$

Ans. (2)

Sol. $A_2(g) + B_2(g) \overset{k_1}{\rightleftharpoons} 2AB \quad ...(1)$

$\Rightarrow$ eq. (1) $\times$ 3

$$6\ AB(g) \rightleftharpoons 3A_2(g) + 3B_2(g)$$

$$\Rightarrow \left(\frac{1}{k_1}\right)^3 = k_2 \Rightarrow k_2 = (k_1)^{-3}$$