JEE MAIN SEP 2020 (MEMORY BASED) | 5th Sep. SHIFT-1

Note: The answers are based on memory based questions which may be incomplete and incorrect.

1. Which orbitals are filled in 6^{th} period.

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

Ans. (1)

Sol. In 6^{th} period 6s, 4f, 5d and 6p orbitals are gradually filled.

2. What is the correct electronic configuration and magnetic moment (spin only) for $^{64}Gd^{3+}$ ion.

(1) [Xe] $4f^7$, 7.93 BM (2) [Xe] $4f^6 6s^1$, 6.93 BM

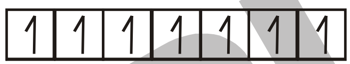
(3) [Xe] $4f^5 6s^2$, 3.87 BM (4) [Xe] $5f^7$, 4.89 BM

Ans. (1)

Sol. Electronic configuration of $^{64}Gd = [Xe]\ 4F^7\ 5d^1\ 6s^2$

Electronic configuration of $^{64}Gd^{3+} = [Xe]\ 4F^7 \Rightarrow$

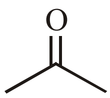
$4f^7$

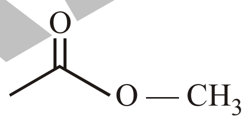


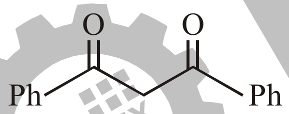
No. of unpaired electron (n) = 7

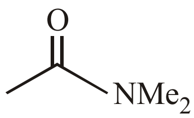
$\mu = \sqrt{n(n+2)}BM = \sqrt{63} = 7.93BM$

3. What is the correct order of acidic strength of α-hydrogens for the following compounds :

(a) 

(b) 

(c) 

(d) 

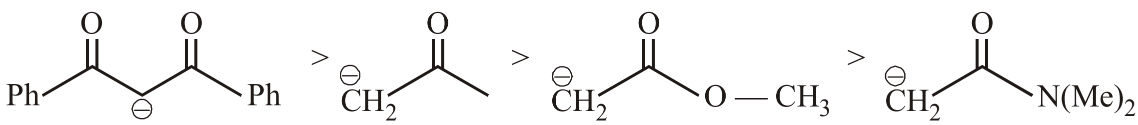
(1) (c) > (a) > (b) > (d) (2) (c) > (a) > (d) > (b)

(3) (a) > (b) > (c) > (d) (4) (b) > (a) > (d) > (c)

Ans. (1)

Sol. Acidic strength of α–Hydrogen ∝ stability of conjugate base.

Order of stability of conjugate base.



(c) (a) (b) (d)

Then order of acidic strength of α–Hydrogen.

(c) > (a) > (b) > (d)

4. Which of the following is suggested to supress the effect of <u>Noradrenaline</u> :

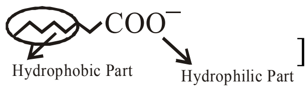
(1) Analgesic (2) Anti depressant drugs

(3) Anti histamine (4) Anti inflammatory

Ans. (2)

Sol. If the level of noradrenaline is low for some reason, then the signal-sending activity becomes low, and the person suffers from depression. In such situations, antidepressant drugs are required.

5. Which one will be a correct diagram for micelle formation at CMC.

[Give : 

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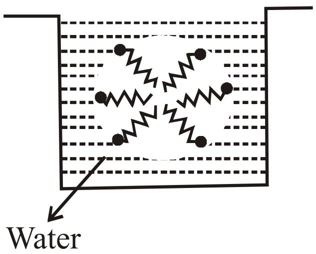
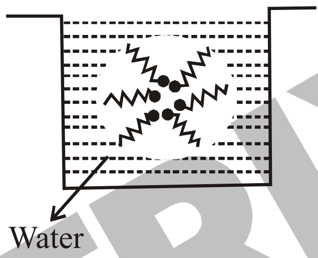
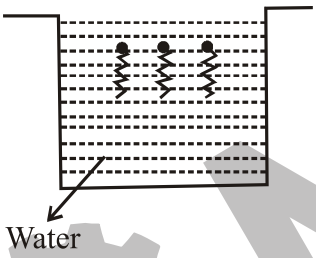
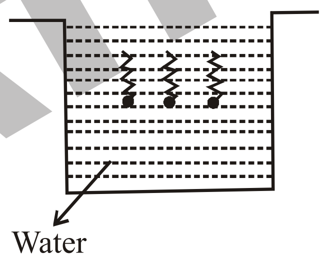
(1) 

(2) 

(3) 

(4) 

Ans. (1)

Sol. At CMC the anions are pulled into the bulk of the solution and aggregate to form a spherical shape with their hydrocarbon chains pointing towards the centre of the sphere with COO^- part remaining outward on the surface of the sphere.

6. The value of CFSE for complex having $3d^6$ configuration in high spin is :

(1) $-0.4\Delta_0, -0.6\Delta_t$ (2) $-0.8\Delta_0, -0.6\Delta_t$

(3) $-0.4\Delta_0, -1.2\Delta_t$ (4) $-0.4\Delta_0, -0.27\Delta_t$

Ans. (1)

Sol. For $3d^6$ configuration, (high spin complex)

(a) For octahedral complex

$3d^6 = t_{2g}^{2,1,1}, e_g^{1,1}$

Value of CFSE $= [-0.4nt_{2g} + 0.6ne_g]\ \Delta_0 + n(P)$

$= [-0.4 \times 4 + 0.6 \times 2]\ \Delta_0 + 0$

$= -0.4\ \Delta_0$

(b) For tetrahedral complex

$3d^6 = e_g^{2,1,}, t_{2g}^{1,1,1}$

Value of CFSE $= [-0.6ne_g + 0.4nt_{2g}]\Delta_t + n(P)$

$= [-0.6 \times 3 + 0.4 \times 3]\Delta_t + 0$

$= -0.6\Delta_t$

7. The following reaction is at equilibrium

$2NO_2(g) \rightleftharpoons N_2O_2(g) \quad \Delta H = -58.kJ/mole$

Following change are made then reaction will shift in which direction :

Increase in temperature	**Increase pressure**
(1) towards product side	towards product side
(2) towards reactant side	towards product side
(3) towards reactant side	towards reactant side
(4) towards product side	towards reactant side

Ans. (2)

Sol. (a) As ΔH is negative so reaction is exothermic.

On increasing in temperature equilibrium will shift in backward direction (reactant side).

(b) $\Delta n_g < 0$

On increasing in pressure equilibrium will shift in forward direction (product side).

8. Correct structure of PCl_5 (s) is :

(1) Square pyramidal

(2) Trigonal bipyramidal

(3) It exist as $[PCl_4]^+$ (square planar) & $[PCl_6]^-$ (octahedral)

(4) It exist as $[PCl_4]^+$ (tetrahedral) & $[PCl_6]^-$ (octahedral)

Ans. (4)

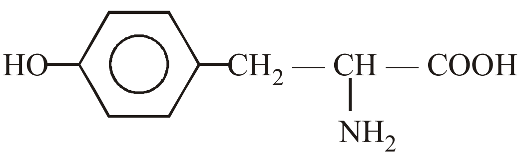
Sol. $2PCl_5(s) \rightarrow [PCl_4]^+ \ [PCl_6]^-$

	Hybridisation	Structure
$[PCl_4]^+$	sp^3	tetrahedral
$[PCl_6]^-$	sp^3d^2	octahedral

9. Which of the following is not an essential amino acid :

(1) Valine (2) Tyrosine (3) Leucine (4) Lysine

Ans. (2)

Sol. Tyrosine 

is a non-essential amino acid.

10. When atmosphere become polluted

(1) When CO_2 value is 0.03% in atmosphere

(2) When B.O.D. value is 5 ppm

(3) Due to presence of Eutrophication

(4) If concentration of dissolved oxygen of water is greater than 6 ppm

Ans. (3)

Sol. (1) In general in atmosphere CO_2 is 0.03% by volume.

(2) Clean water would have B.O.D. value of less than 5 ppm whereas highly polluted water coluld have a B.O.D value of 17 ppm or more.

(3) The process in which nutrient enriched water bodies support a dense plant population which kill animal life by depriving it of oxygen results in subsequent loss of biodiversity is known as Eutrophication.

(4) If the concentration of dissolved oxygen of water is below 6 ppm, the growth of fish get inhibited.

11. Difference in radius of 3^{rd} and 4^{th} orbit in in He^+ ion is R_1 and in Li^{2+} ion is R_2, then calculate ratio of $\frac{R_1}{R_2}$

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

Ans. (3)

Sol. Radius of n^{th} orbit $= r_n = 0.529 \times \frac{n^2}{Z}$ Å

(a) For He^+ ion (Z = 2)

$$r_4 - r_3 = \frac{0.529}{2}[16 - 9] = R_1$$

(b) For Li^{2+} ion (Z = 3)

$$r_4 - r_3 = \frac{0.529}{3}[16 - 9] = R_2$$

Then value of $\frac{R_1}{R_2} = \frac{3}{2}$

12. For complete combustion of 1 mole of each propane and butane, find sum of minimum number of required moles of O_2.

Ans. 11.50

Sol. (1) Combustion reaction of C_3H_8.

$$C_3H_8 + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(\ell)$$

For 1 mole of C_3H_8, minimum 5 moles of O_2 are required.

(2) Combustion reaction of C_4H_{10}

$$C_4H_{10} + \frac{13}{2}O_2(g) \rightarrow 4CO_2(g) + 5H_2O(\ell)$$

For 1 mole of C_4H_{10}, minimum 6.5 moles of O_2 are required.

So total minimum moles of O_2 required = 5 + 6.5 = 11.5

13. How many isomers are possible for the complex $[Pt(en)_2(NO_2)_2]$

Ans. 09.00

Sol.

For cis complex	number of isomers
Cis-NO_2|NO_2	2
Cis-NO_2|ONO	2
Cis-ONO|ONO	2
For trans complex	**number of isomers**
Trans-NO_2|NO_2	1
Trans-NO_2|ONO	1
Trans-ONO|ONO	1

So total possible number of isomers are 9.

14. $A \longrightarrow$ product (1^{st} order)

$B \longrightarrow$ product (1^{st} order)

Half life of 1^{st} reaction is 180 sec and for 2^{nd} reaction it is 300 sec. Initially [A] = [B], then after how much time (in min) concentration of B become 4 time of concentration of A.

Ans. (15)

Sol. For 1^{st} order

$$C_t = C_0 e^{-kt} \qquad k = \frac{\ln 2}{t_{1/2}}$$

$$(C_0)_A = (C_0)_B$$

$$(C_t)_A = (C_0)_A e^{-k_A t} \text{ .... (1)}, \qquad k_A = \frac{\ln 2}{180}$$

$$(C_t)_B = (C_0)_B e^{-k_B t} \text{ .... (2)}, \qquad k_B = \frac{\ln 2}{300}$$

Divide Equation (1)/(2).

$$\frac{(C_t)_B}{(C_t)_A} = \frac{(C_0)_B}{(C_0)_A} \times e^{(k_A - k_B)t} \qquad [(C_t)_B = 4(C_t)_A] \text{ at time t.}$$

$$4 = e^{(k_A - k_B)t}$$

$$2 \ln 2 = \left[\frac{\ln 2}{180} - \frac{\ln 2}{300}\right] t$$

$$2 = \left(\frac{120}{180 \times 300}\right) t$$

$$t = \frac{2 \times 180 \times 300}{120} = 900 \text{ sec} = 15 \text{ min}$$

15. For galvanic cell

$M^{2+}(aq) + Zn(s) \rightarrow M(s) + Zn^{2+}(aq)$; $\Delta G^0 = -386$ kJ/mole

The value of E^0_{cell} (in V) is -

Ans. (2)

Sol. For galvanic cell

$\Delta G^0 = -nF E^0_{cell}$

$\Delta G^0 = -386 \times 10^3$, n = 2, F = 96500 C

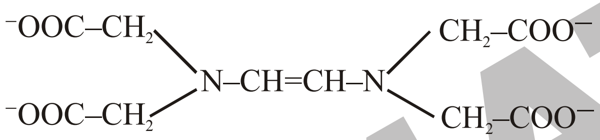
$-386 \times 10^3 = -2 \times 96500 \times E^0_{cell}$

$E^0_{cell} = 2V$

16. Calculate denticity of $[EDTA]^{4-}$.

Ans. (6)

Sol. Structure of $[EDTA]^{4-}$.



Number of donor sites = 6. So denticity will be 6.

17. A diatomic molecule crystallize in BCC structure with edge length of unit cell is 300 pm and density is 6.17 gm/cm^3 then calculate total number of molecules in 200 gram crystal.

(1) $4N_A$ (2) $8N_A$ (3) $40N_A$ (4) $400N_A$

Ans. (1)

Sol. For BCC [Z = 2]

$$d = \frac{Z \times M}{N_A \times \text{Volume}} = 6.17 \text{ gm/cm}^3$$

[Z = 2, Volume = a^3, a = 3×10^{-8} cm]

$$6.17 = \frac{2 \times M}{6.02 \times 10^{23} \times [3 \times 10^{-8}]^3}$$

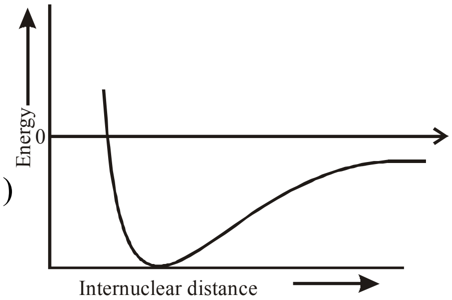
$$6.17 = \frac{2 \times M}{6.02 \times 2.7}$$

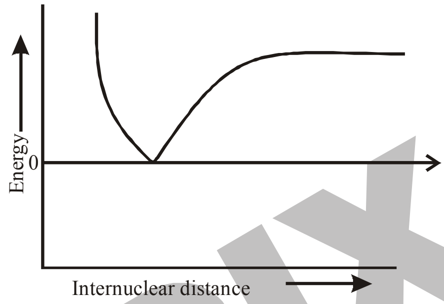
M = 50 gm = molecular mass

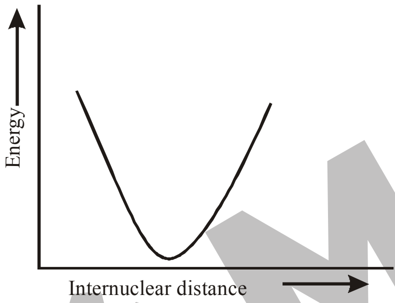
So number of total moles $= \dfrac{200}{50} = 4$

Then total number of molecules = $4\ N_A$

18. Identify the correct potential energy curve for the formation of H_2 molecule as a function of internuclear distance of the H atoms

(1)


(2)


(3)


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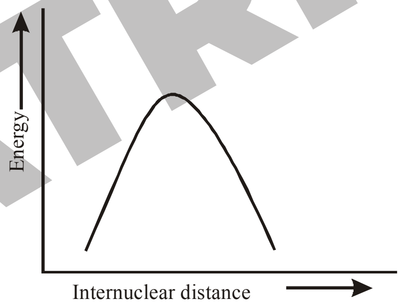
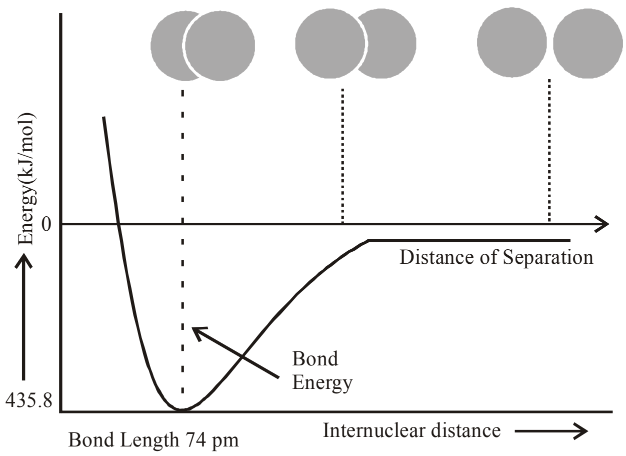


Ans. (1)

Sol. Following curve is for potential energy for the formation of H_2 molecule as a function of internuclear distance of the H atoms. The minimum in the curve corresponds to the most stable state of H_2 (from NCERT).



19. Select the correct statement about Ellingham diagram.

(a) Ellingham diagram is graph between ΔH_f^0 & T if any metal or element oxide.

(b) Any metal will reduce the oxide of other metals which lie above it in the Ellingham diagram.

(c) Any mental will reduce theoxide of other metals which lie lower it in the Ellingham diagram

(d) Slope of ΔG^0 Vs T plot of the reaction $C(s) + \frac{1}{2} O_2(g) \rightarrow CO(g)$ is negative

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

Sol. Ellingham diagram is graph of ΔG^0 vs T of any / element oxide. Since

$\Delta G^0 = \Delta H^0 - T\Delta S^0$

for most metal oxide formation

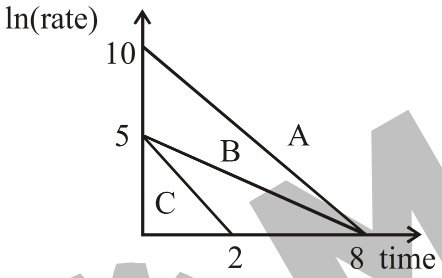
metal (s) + oxygen (g) $\rightarrow$ metal oxide (s)

$\Delta H^0 = -$ ve

$\Delta S^0 = -$ ve

so graph will be a straight line with – ve y – intracept & +ve slope.

20.



Observe the above given plot of ln(rate) v/s time in minutes for a first order reaction and select the correct option for $T_{1/2}$ for A, B, C.

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

Ans. (1)

Sol. For a 1[st] order reaction $C_t = C_0e^{-kt}$

rate = KC_0e^{-kt}

$\ln(\text{rate}) = -kt + \ln(KC_0)$

So graph between ln (rate) and time will be straight line with slope = –K.

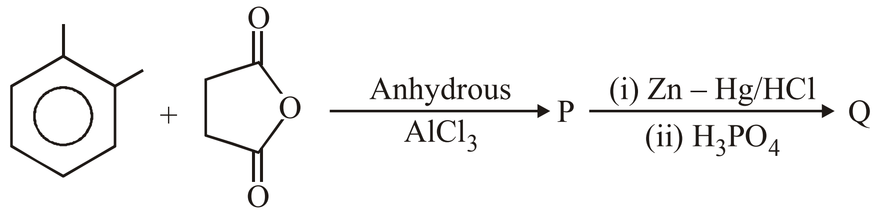
$$K_A = \frac{10}{8}, K_B \frac{5}{8} \text{ and } K_C = \frac{5}{2} = \frac{20}{8}$$

$$\text{Since } T_{\frac{1}{2}} = \frac{\text{In}2}{K},$$

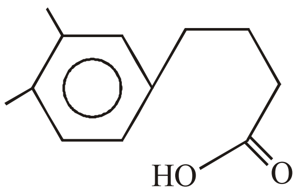
$$\text{So } T_A : T_B : T_C = \frac{1}{K_A} : \frac{1}{K_B} : \frac{1}{K_C}$$

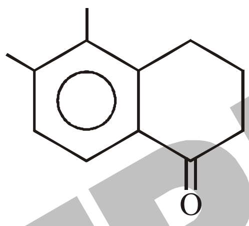
$= \frac{8}{10} : \frac{8}{5} : \frac{8}{20}$

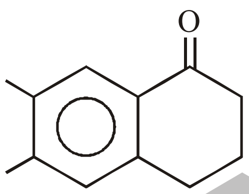
$= 2 : 4 : 1$

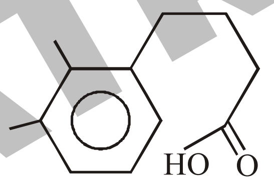
21. 

Structure of Q is :

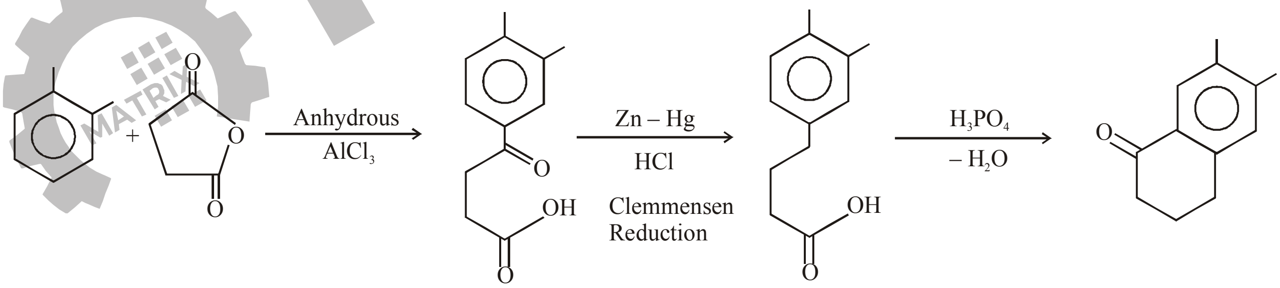
(1) 

(2) 

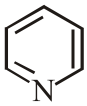
(3) 

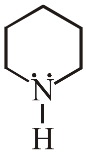
(4) 

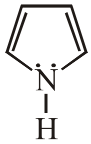
Ans. (3)

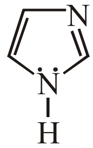
Sol. 

22. Arrange the following in increasing order of basicity :

(A) 

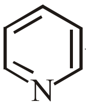
(B) 

(C) 

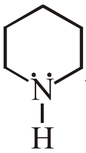
(D) 

(1) A < B < D < C (2) C < A < D < B (3) B < D < C < A (4) C < A < B < D

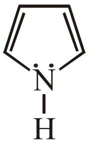
Ans. (2)

Sol. (A) 

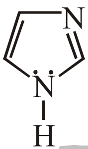
Nitrogen atom is sp^2 hybridised and lone pair does not participate in resonance.

(B) 

Nitrogen atom is sp^3 hybridised and +I of ring is present.

(C) 

Nitrogen atom is sp^2 hybridised and lone pair participate in resonance.

(D) 

Nitrogen atom is sp^2 hybridsed and lone pair is has partial negative charge due to resonance.

23. Which one of the following reaction is used for preparation of water gas on commercial scale.

(1) $C_{(s)} + H_2O_{(g)} \xrightarrow{473-1273K} Co_{(g)} + H_{2(g)}$

(2) $2C_{(s)} + O_{2(g)} + 4N_{2(g)} \xrightarrow{1273K} 2CO_{(g)} + 2N_{2(g)}$

(3) $CH_{4(g)} + H_2O_{(g)} \xrightarrow{473-1273K} CO_{(g)} + 3H_{2(g)}$

(4) $CO_{2(g)} + H_{2(g)} \longrightarrow CO_{(g)} + H_2O_{(g)}$

Ans. (1)

Sol. $C_{(s)} + H_2O_{(g)} \xrightarrow{473-1273K} CO_{(g)} + H_{2(g)}$ (water gas).