CHEMISTRY

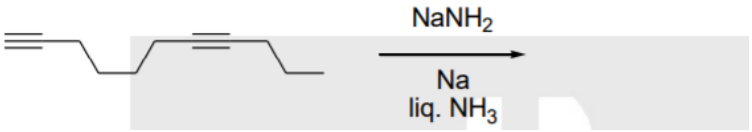
BOOKS - JEE ADVANCED PREVIOUS YEAR

JEE ADVANCED 2021

Question

1. Match the following columns

The major product formed in the following reaction is



A. (A) 

B. (B) 

C. (C) 

D. (D) 

Answer:

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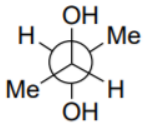
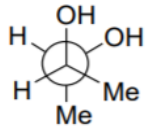
2. Among the following conformation that corresponds to the most stable conformation of meso-butane-2,3-diol is

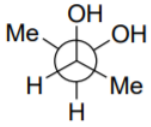
(A)

A. 

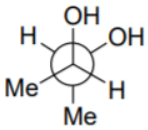
(B)

B. 

(C)

C. 

(D)

D. 

Answer:

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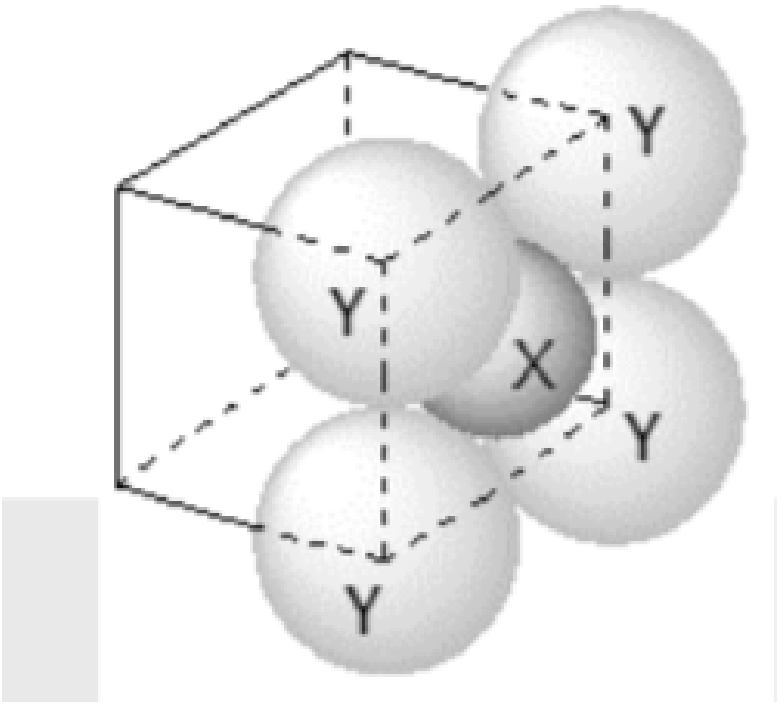
3. For the given closed packed structure of a salt made of cation X and anion Y shown below(ions of only one face are shown for

clarity), the packing fraction is



A. 0.74

B. 0.63

C. 0.52

D. 0.48

Answer:

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4. The calculated spin only magnetic moments of $\left[Cr(NH_3)_6\right]^{3+}$ and $\left[CuF_6\right]^{3-}$ in BM respectively are

A. 3.87 and 2.84

B. 4.90 and 1.73

C. 3.87 and 1.73

D. 4.90 and 2.84

Answer:

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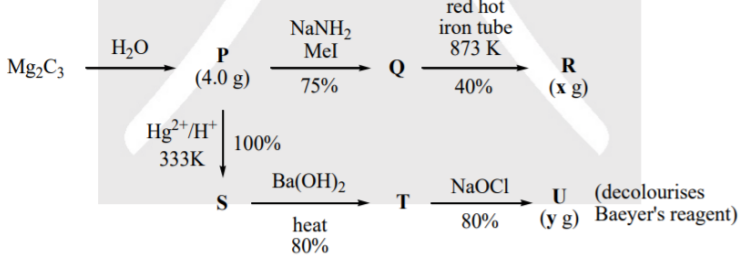
5. For the following reaction scheme, percentage yields are given along the arrows:



x g and **y** g are mass of **R** and **U**, respectively.
(Use: Molar mass (in g mol^{-1}) of H, C and O as 1, 12 and 16, respectively)

The value of "x" is

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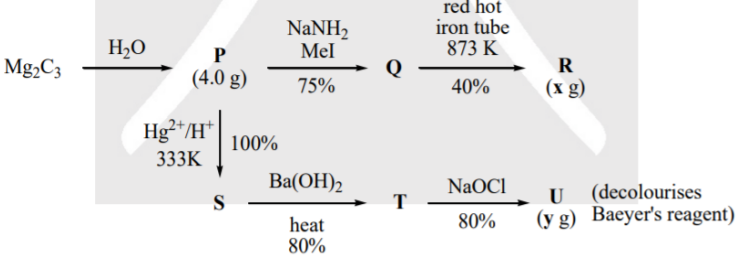
6. For the following reaction scheme, percentage yields are given along the arrows:



x g and **y** g are mass of **R** and **U**, respectively.
(Use: Molar mass (in g mol^{-1}) of H, C and O as 1, 12 and 16, respectively)

The value of "y" is

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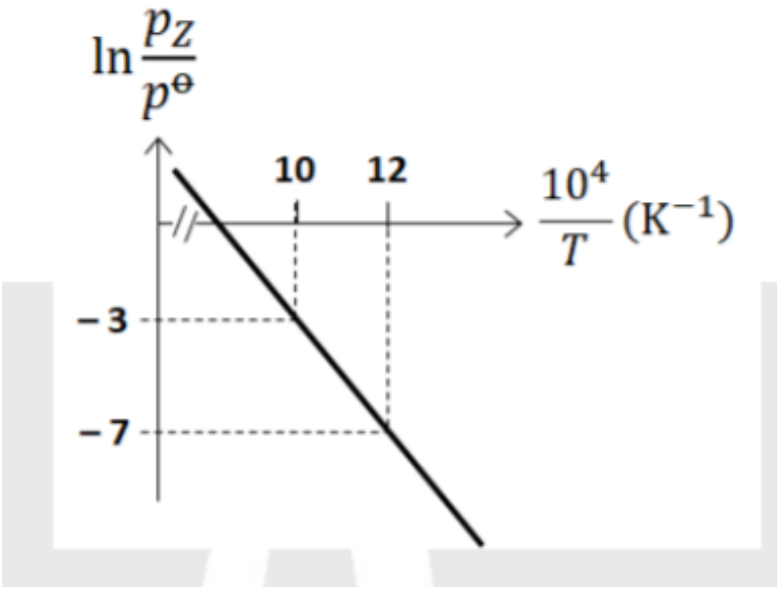
7. For the reaction , $X(s) \leftrightarrow Y(s) + Z(g)$, the plot of $\ln\frac{pz}{p^\theta}$ versus $\frac{10^4}{T}$ is given below (in solid line), where p_z is the pressure (in bar) of the gas at temperature T and p^θ= 1bar



(Given, $\frac{d(\ln K)}{d\left(\frac{1}{T}\right)} = -\frac{\Delta H^\theta}{R}$, where the equilibrium constant , $K = \frac{p_z}{p^\theta}$ and the gas constant, R=8.314$JK^{-1}mol^{-1}$

The value of standard enthalpy,ΔH^θ(in $kjmol^{-1}$) for the given reaction is ---------`

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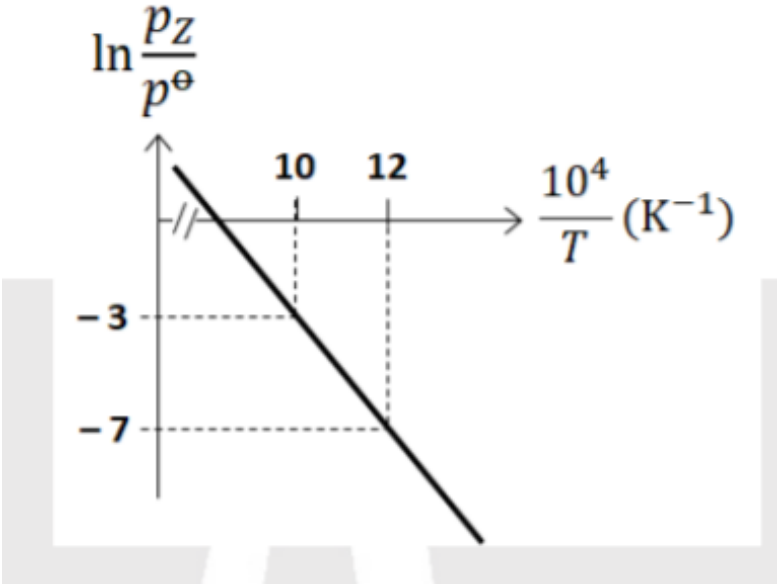
8. For the reaction , $X(s) \leftrightarrow Y(s) + Z(g)$, the plot of $\ln \frac{pz}{p^\theta}$ versus $\frac{10^4}{T}$ is given below (in solid line), where p_z is the pressure (in bar) of the gas at temperature T and p^θ= 1bar



(Given, $\frac{d(\ln K)}{d\left(\frac{1}{T}\right)} = -\frac{\Delta H^\theta}{R}$, where the equilibrium constant , $K = \frac{p_z}{p^\theta}$ and the gas

constant, R=8.314$JK^{-1}mol^{-1}$

The value of ΔS^{θ}(in $jmol^{-1}$) for the given reaction at 1000K is --------`

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9. The boilingpoint of water in a 0.1 molal silver nitrate solution(solutionA) is $x^{\circ}C$. To this solution A, an equal volume of 0.1 molal aqueous barium chloride solution is added to make a mew solution B. The difference in the boiling points of water in the two solutions A

and B is $y \times 10^{-2} {}^{\circ} C$

(Assume: Densities of the solutions A and B are the same as that of water and soluble salts dissociate completely.

Use:molal elevation constant (Ebullioscopic constant),$K_b = 0.5 K kg mol^{-1}$ Boiling point of pure water as $100^{\circ} C$)

The value of x is ---------.

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10. The boilingpoint of water in a 0.1 molal silver nitrate solution(solutionA) is $x^\circ C$. To this solution A, an equal volume of 0.1 molal aqueous barium chloride solution is added to make a mew solution B. The difference in the boiling points of water in the two solutions A and B is $y \times 10^{-2^\circ} C$

(Assume: Densities of the solutions A and B are the same as that of water and soluble salts dissociate completely.

Use:molal elevation constant (Ebullioscopic constant),$K_b = 0.5 K kg mol^{-1}$ Boiling point

of pure water as $100^{\circ} C$)

The value of $|y|$ is --------.

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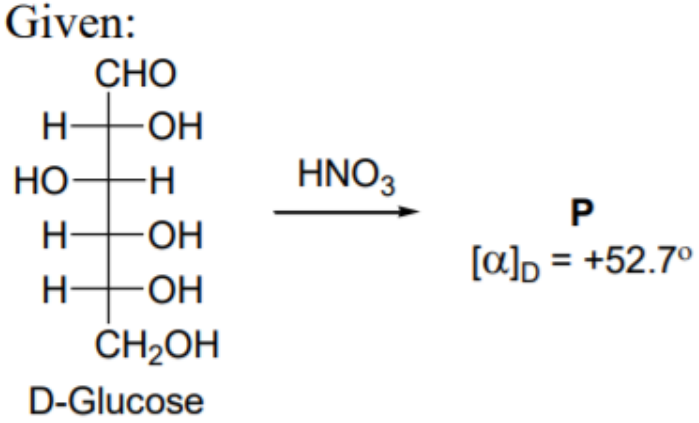
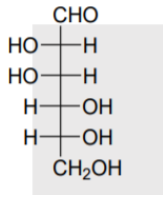
11.

Given:

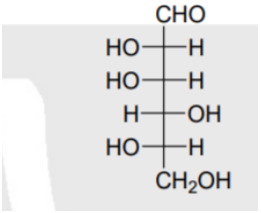


The compound, which on reaction with HNO_3 will give the product having degree of rotation, $[\alpha]_D$= `-52.7^@ is(are)

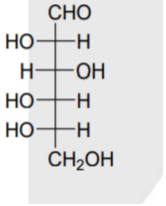
(A)

A. 

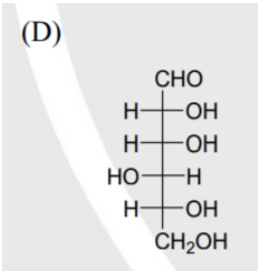
(B)

B. 

(C)

C. 

(D)

D. 

Answer:

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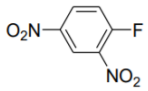
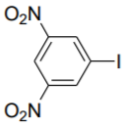
12. The reaction of Q with PhSNa yields an organic compound(major product) that gives positive Carius test on treatment with Na_2O_2 followed by addition of $BaCl_2$. The correct option(s) for Q is(are)

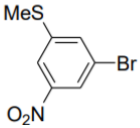
A. (A)



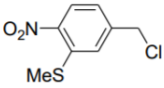
B. (B)



(C)

C. 

(D)

D. 

Answer:

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13. The correct statement(s) related to colloids is(are)

A. The process of precipitating colloidal sol by an electrolyte is called peptization

B. Colloidal solution freezes at higher temperature than the true solution at the same concentration

C. Surfactants form micelle above critical micelle concentration(CMC). CMC depends on temperature

D. Micelles are macromolecular colloids

Answer:

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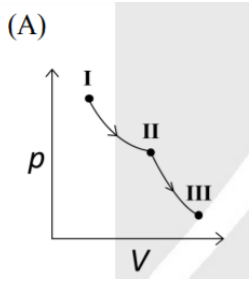
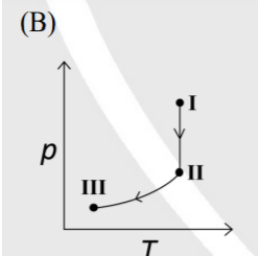
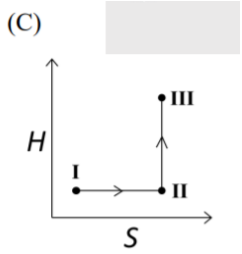
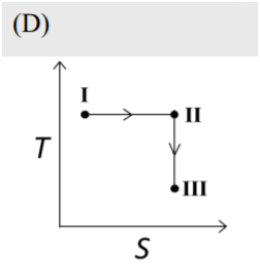
14. An ideal gas undergoes a reversible isothermal expansion from state I to state II followed by a reversible adiabatic expansion from state II to state III. The correct plot(s) representing the changes from state I to state III is(are)

A.



B. 

C. 

D. 

Answer: A:B:D

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15. The correct statement(s) related to the metal extraction processes is(are)

A. A mixture of PbS and PbO undergoes self-reduction to produce Pb and SO_2

B. In the extraction process of copper from copper pyrites, silica is added to produce copper silicate

C. Partial oxidation of sulphide ore of copper by roasting, followed by self-reduction produces blister copper

D. In cyanide process, Zinc powder is utilized to precipitate gold from $Na\left[Au(CN)_2\right]$

Answer:

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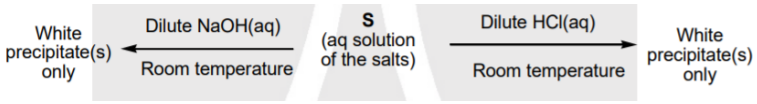
16. A mixture of two salts is used to prepare a solution S, which gives the following results:



The correct option(s) for the salt mixture is(are)

A. $Pb(NO_3)_2$ and $Zn(NO_3)_2$

B. $Pb(NO_3)_2$ and $Bi(NO_3)_3$

C. $Ag(NO_3)$ and $Bi(NO_3)_3$

D. $Pb(NO_3)_2$ and $Hg(NO_3)_2$

Answer:

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17. The maximum number of possible isomers(including stereoisomers) which may be formed on mono-bromination of 1-methylcyclohex-1-ene using Br_2 and UV light is----------.

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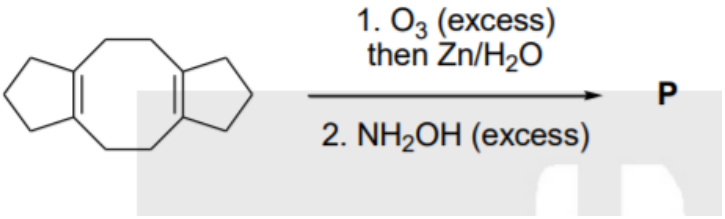
18. In the reaction given below, the total number of atoms having sp^2 hybridization in

the major product P is----------`



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19. The total number of possible isomers for $\left[Pt(NH_3)_4Cl_2\right]Br_2$ is ----------.

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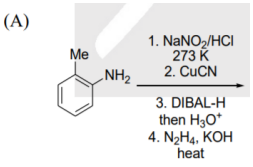
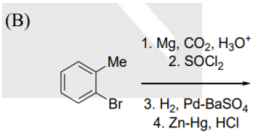
20. The reaction sequence(s) that would lead to o-xylene as the major product is(are)

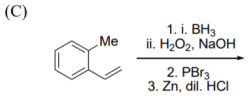
A.



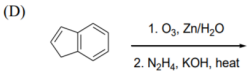
B.



C.



D.



Answer:

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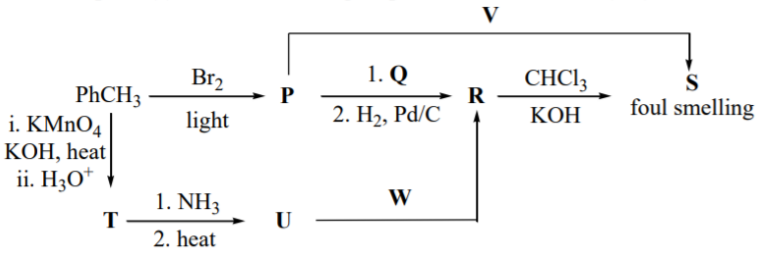
21. Correct option(s) for the following sequence of reactions is(are)



A. Q=KNO_2, W=$LiAlH_4$

B. R= benzenamine, V=KCN

C. Q=$AgNO_2$, R= phenylmethanamine

D. W=$LiAlH_4$, V=AgCN

Answer:

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22. For the following reaction

$2X + Y \xrightarrow{K} P$

the rate of reaction is $\frac{d[P]}{dt} = K[X]$. Two moles of X are mixed with 1mole of Y to make 1.0L of solution. At 50s, 0.5mole of Y is left in the reaction mixture. The correct statement(s) about the reaction is(are)

A. The rate constant,K, of the reaction is

$13.86 \times 10^{-4} s^{-1}$

B. Half -life of X is 50s

C. At 50s, $-\frac{d[X]}{dt}$ =

$13.86 \times 10^{-3} molL^{-1} s^{-1}$

D. At 100s, $-\frac{d[Y]}{dt}$ =

$3.46 \times 10^{-3} molL^{-1} s^{-1}$

Answer:

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23. Some standard electrode potentials at 298K are given below:

Pb^{2+}/Pb	–0.13 V
Ni^{2+}/Ni	–0.24 V
Cd^{2+}/Cd	–0.40 V
Fe^{2+}/Fe	–0.44 V

To a solution containing 0.001M of X^{2+} and 0.1M of Y^{2+}, the metal rods X and Y are inserted (at298K) and connected by a conducting wire. This resulted in dissolution of X. The correct combinations of X and Y, respectively is (are)

(Given: Gas constant, $R = 8.314 JK^{-1}mol^{-1}$,

Faraday constant,F= 96500Cmol^{-1})

A. Cd and Ni

B. Cd and Fe

C. Ni and Pb

D. Ni and Fe

Answer:

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24. The pair(s) of complexes where in both exhibit tetrahedral geometry is(are)

A. $[FeCl_4]^-$ and $[Fe(CO)_4]^{2-}$

B. $[Co(CO)_4]^-$ and $[CoCl_4]^{2-}$

C. $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$

D. $[Cu(py)_4]^+$ and $[Cu(CN)_4]^{3-}$

Answer:

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25. The correct statement(s) related to oxoacids of phosphorous is(are)

A. Upon heating, H_3PO_3 undergoes disproportionation reaction to produce H_3PO_4 and PH_3

B. While H_3PO_3 can act as reducing agent, H_3PO_4 canot

C. H_3PO_3 is a monobasic acid.

D. The H atom of P-H bond in H_3PO_3 is not ionizable in water

Answer:

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26. At 298K, the limiting molar conductivity of a weak monobasic acid is $4 \times 10^2 Scm^2 mol^{-1}$. At 298K, for an aqueous solution of the acid the degree of dissociation is α and the molar conductivity is $y \times 10^2 Scm^2 mol^{-1}$. At 298K, upon 20times dilution with water, the molar conductivty of the solution becomes $3y \times 10^2 Scm^2 mol^{-1}$ The value of α is

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27. At 298K, the limiting molar conductivity of a weak monobasic acid is $4 \times 10^2 Scm^2 mol^{-1}$. At 298K, for an aqueous solution of the acid the degree of dissociation is α and the molar conductivity is $y \times 10^2 Scm^2 mol^{-1}$. At 298K, upon 20times dilution with water, the molar conductivty of the solution becomes $3y \times 10^2 Scm^2 mol^{-1}$ The value of y is

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28. Reaction of xg of Sn with HCl quantitatively produced a salt. Entire amound of the salt reacted with yg of nitrobenzene in the presence of required amount of HCl to produce 1.29g of an organic salt(quantitatively).

(Use Molar masses (in gmol^(-1)) of H,C,N,O,Cl and Sn as 1,12,14,16,35 and 119 respectively). The value of x is ----------.

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29. Reaction of xg of Sn with HCl quantitatively produced a salt. Entire amound of the salt reacted with yg of nitrobenzene in the presence of required amount of HCl to produce 1.29g of an organic salt(quantitatively).

(Use Molar masses (in $gmol^{-1}$) of H,C,N,O,Cl and Sn as 1,12,14,16,35 and 119 respectively). The value of is ----------.y

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30. A sample (5.6g) containing iron is completely dissolved in cold dilute HCl to prepare a 250ml of solution. Titration of 25.0ml of this solution requires 12.5ml of 0.03M $KMnO_4$ solution to reac the end point. Number of moles of Fe^{2+} present in 250ml solution is $X \times 10^{-2}$(consider complete dissolution of $FeCl_2$). The amont of iron present in the sample is y% by weight

Assume: $KMnO_4$ reacts with Fe^{2+} in the solution

Use: Molear mass of iron as $56gmol^{-1}$ The value of X is------.

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31. A sample (5.6g) containing iron is completely dissolved in cold dilute HCl to prepare a 250ml of solution. Titration of 25.0ml of this solution requires 12.5ml of 0.03M $KMnO_4$ solution to reac the end point. Number of moles of Fe^{2+} present in 250ml solution is $X \times 10^{-2}$(consider complete

dissolution of $FeCl_2$). The amont of iron present in the sample is y% by weight

Assume: $KMnO_4$ reacts with Fe^{2+} in the solution

Use: Molear mass of iron as $56gmol^{-1}$ The value of is------.y

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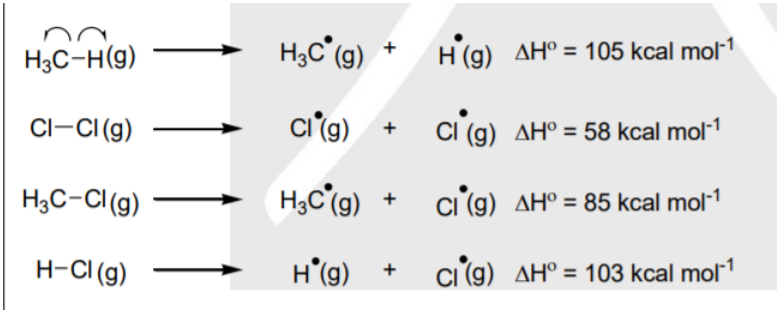
32. The amount of energy required to break a bond is same as the amount of energy released when the same bond is formed. In

gaseous state, the enrgy required for hololytic cleavage of a bond is called Bond Dissociation Energy(BDE) or Bond Strength. BDE is affected by s-character of the bond and the stability of the radicals formed. Shorter bonds typically stronger bonds. BDEs for some bonds are given below:



Correct match of the C-H bonds(shown in

bold) in column J with their BDE in column K is

Column **J** Molecule	Column **K** BDE (kcal mol^{-1})
(P) **H–**$CH(CH_3)_2$	(i) 132
(Q) **H–**CH_2Ph	(ii) 110
(R) **H–**$CH{=}CH_2$	(iii) 95
(S) **H–**$C{\equiv}CH$	(iv) 88

A. P-iii,Q-iv,R-ii,S-i

B. P-i,Q-ii,R-iii,S-iv

C. P-iii,Q-ii.R-i,S-iv

D. P-ii,Q-i,R-iv,S-iii

Answer:

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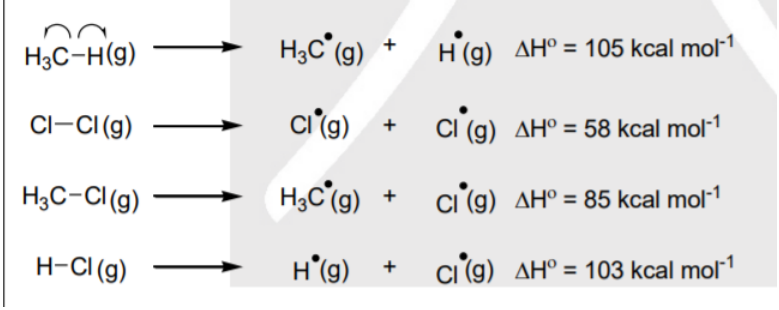
33. The amount of energy required to break a bond is same as the amount of energy released when the same bond is formed. In gaseous state, the enrgy required for hololytic cleavage of a bond is called Bond Dissociation Energy(BDE) or Bond Strength. BDE is affected by s-character of the bond and the stability of the radicals formed. Shorter bonds typically stronger bonds. BDEs for some bonds are given below:



For the following reaction

$$CH_4(g) + Cl_2(g) \xrightarrow{light} CH_3Cl(g) + HCl(g)$$

the correct statement is

A. Initiation step is exothermic with

$$\Delta H^\circ = -58 kcal mol^{-1}$$

B. Propagation step involving $\dot{C}H_3$ formation is exothermic with

$$\Delta H^\circ = -2 kcal mol^{-1}$$

C. Propagation step involving CH_3Cl formation is endothermic with $\Delta H^\circ = +27 kcal mol^{-1}$

D. The reaction is exothermic with $\Delta H^\circ = -25 kcal mol^{-1}$

Answer:

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34. The reaction of $K_3\left[Fe(CN)_6\right]$ eith freshly prepared $FeSO_4$ solution procues a dark blue precipitate caleed Turnbull's blue. Reaction of $K_4\left[Fe(CN)_6\right]$ with the $FeSO_4$ solution in complete absence of air produces a white precipitate X, which turns blue in air. Mixing the $FeSO_4$ solution with $NaNO_3$, followed by a slow addition of concentrated H_2SO_4 through the side of the test tube produces a brown ring.

Precipitate X is

A. $Fe_4\left[Fe(CN)_6\right]_3$

B. $Fe\left[Fe(CN)_6\right]$

C. $K_2Fe\left[Fe(CN)_6\right]$

D. $KFe\left[Fe(CN)_6\right]$

Answer:

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35. The reaction of $K_3\left[Fe(CN)_6\right]$ eith freshly prepared $FeSO_4$ solution procues a dark blue precipitate caleed Turnbull's blue. Reaction of

$K_4[Fe(CN)_6]$ with the $FeSO_4$ solution in complete absence of air produces a white precipitate X, which turns blue in air. Mixing the $FeSO_4$ solution with $NaNO_3$, followed by a slow addition of concentrated H_2SO_4 through the side of the test tube produces a brown ring.

Among the following, the brown ring is due to the formation of

A. $[Fe(NO)_2(SO_4)_2]^{-2}$

B. $[Fe(NO)_2(H_2O)_4]^{3+}$

C. $[Fe(NO)_4(SO_4)_2]$

D. $\left[Fe(NO)(H_2O)_5\right]^{2+}$

Answer:

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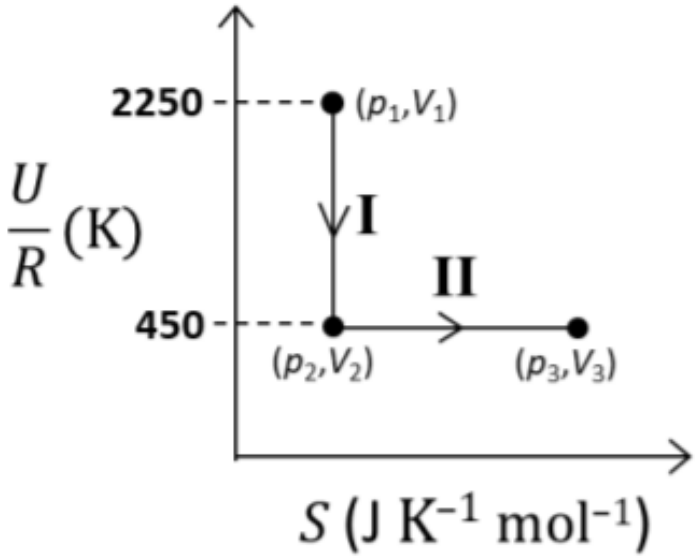
36. 1 mole of an ideal gas at 900K, undergoes 1 reversible processes, I followed by II, as shown below. If the work done by the gas in the 2 processes are same, the value of $\ln\left(\frac{V_3}{V_2}\right)$ is ---- .



(Given: molar heat capacity at constant volume, $C_{V,m}$ of the gas is $\frac{5}{2}R$)

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37. Consider a helium(He) atom that absorbs a photon of wavelength 330nm. The change in

the velocity (in cms^{-1}) of He atom after the photon absorption is------.

(Assume: Momentum is consrves when photon is absorder.

Use:Plank constant=$6.6 \times 10^{-34} Js$, Avogadro number= $6 \times 10^{23} mol^{-1}$, molar mass of He= $4gmol^{-1}$

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38. Ozonolysis of ClO_2 produces an oxide of chlorine. The average oxidation state of

chlorine in this oxide is------.

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