JEE MAIN SEP 2020 (MEMORY BASED) | 4th Sep. SHIFT-2

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

1. How does a synthetic drug Terfenadine (seldane) work as antihistamine.

(1) Increases stimulation of Histamine

(2) It is a drug that binds to receptor site and inhibit its natural function.

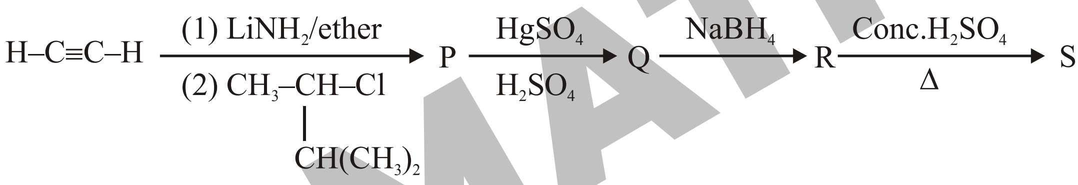
(3) Increases reactivity of Histamine

(4) It is a drug that mimics the natural messenger by switching on the receptor

Ans. (2)

Sol. Seldane act as antihistamine and interfere with the natural action of histamine by competing with histamine for binding sites of receptor.

2. What will be the final product of following reaction sequence ?



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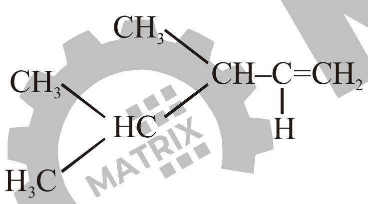

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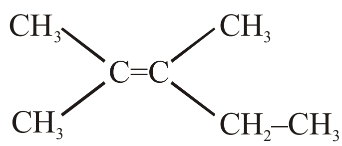

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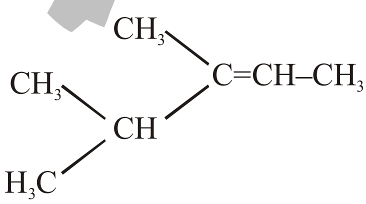

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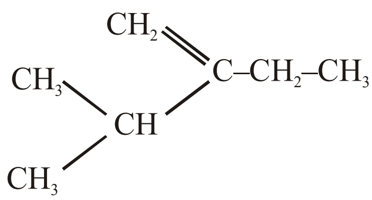
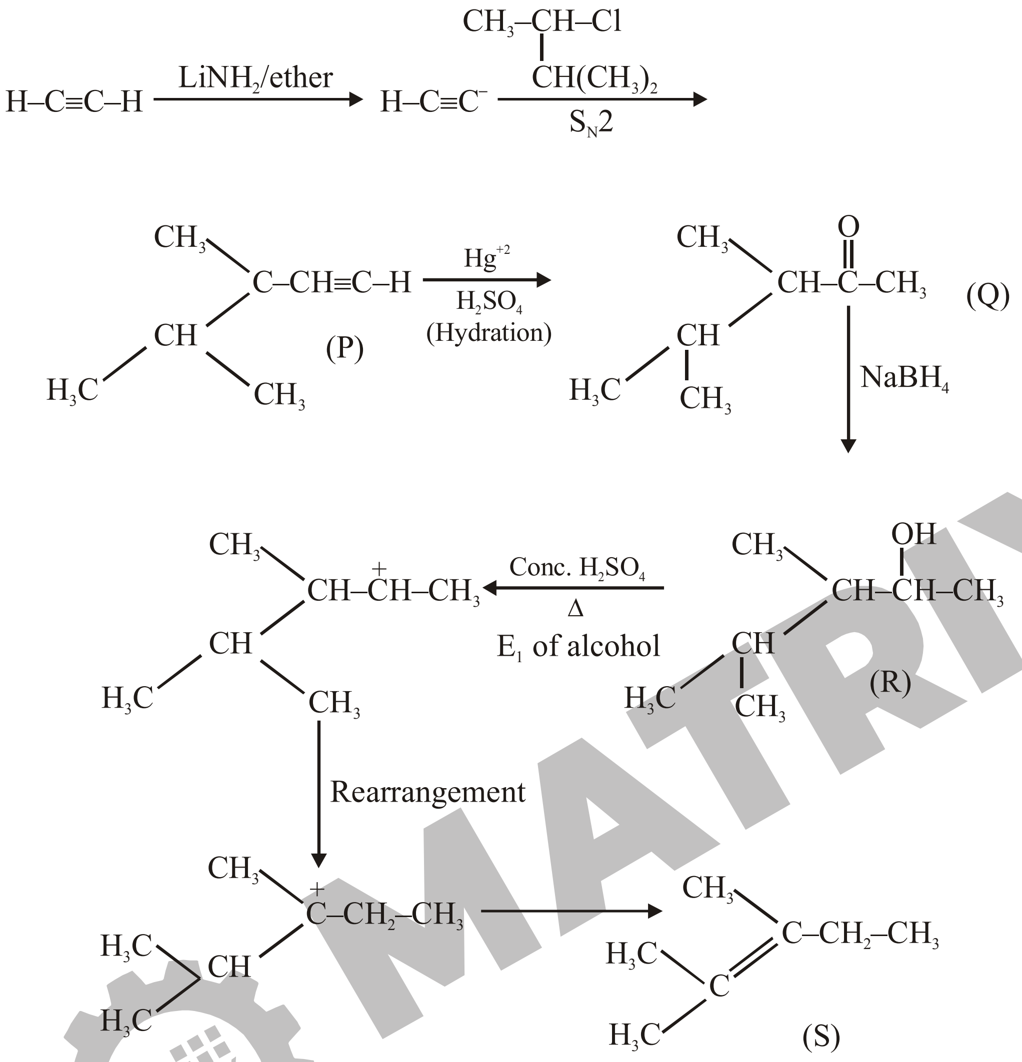
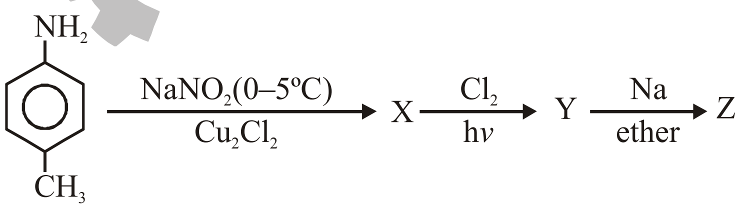


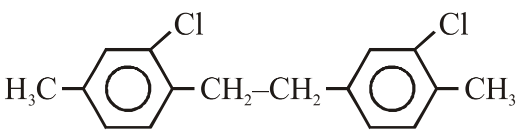
Ans. (2)

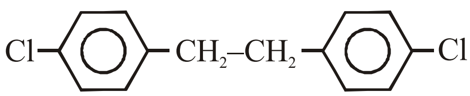
Sol.

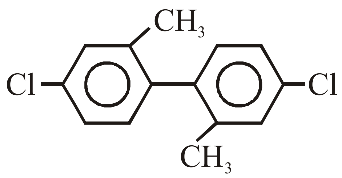


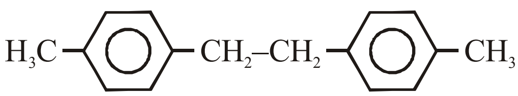
3. Identify end product of following reaction sequence



(1) 

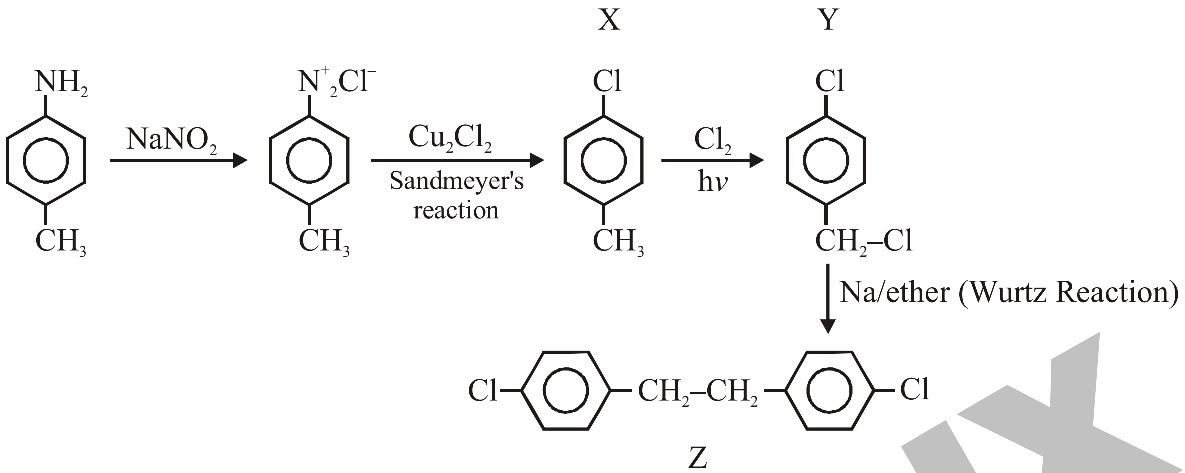
(2) 

(3) 

(4) 

Ans. (2)

Sol.



4. Which of the following complex show maximum paramagnetism?

[PPh_3 = triphenyl phosphine, ox^{2-} = oxalato, gly^{-} = glycinato]

(1) $[Co(ox)_2(NH_3)_2]^{-}$ (2) $[Fe(en)(bipy)(NH_3)_2]^{2+}$

(3) $[Pd(gly)(PPh_3)_2]^{+}$ (4) $[Ti(H_2O_6)]^{3+}$

Ans. (4)

Sol.

Complex	Electronic configuration	No. of unpaired e^-
(1) $[Co(ox)_2(NH_3)_2]^{-}$	$Co^{3+} = 3d^6 \Rightarrow t_{2g}^{6}, e_g^{0}$	0
(2) $[Fe(en)(bipy)(NH_3)_2]^{2+}$	$Fe^{2+} = 3d^6 \Rightarrow t_{2g}^{6}, e_g^{0}$	0
(3) $[Pd(gly)(PPh_3)_2]^{+}$	$Pd^{2+} = 4d^8 \Rightarrow d_{yz}^2, d_{zx}^2, d_{z^2}^2, d_{xy}^2, d_{x^2-y^2}^0$	0
(4) $[Ti(H_2O)_6]^{3+}$	$Ti^{3+} = 3d^1 \Rightarrow t_{2g}^{1}, e_g^{0}$	1

5. In hydrogen spectrum shortest wavelength for Lyman series line is λ, then find longest wavelength of Balmer series line in He^+ ion spectrum.

(1) λ (2) $\frac{9}{5}\lambda$ (3) $\frac{5}{9}\lambda$ (4) $\frac{4}{9}\lambda$

Ans. (2)

Sol. For hydrogen atom :

For Lyman series $n_1 = 1$ & $n_2 = \infty$

$$\frac{1}{\lambda_H} = R_H \left[\frac{1}{1} - \frac{1}{\infty}\right] \text{ So, } \lambda = \frac{1}{R_H}$$

For He^+ ion

Balmer series $n_1 = 2$ & $n_2 = 3$

$$\frac{1}{\lambda_{He^+}} R_H \times Z^2 \left[\frac{1}{4} - \frac{1}{9}\right]$$

$$\frac{1}{\lambda_{He^+}} = R_H \times 4 \times \frac{5}{36}$$

$$\frac{1}{\lambda_{He^+}} = \frac{5}{9} R_H = \left(\frac{5}{9}\right)\frac{1}{\lambda}$$

$$\left(\lambda_{He^+}\right) = \frac{9}{5}\lambda$$

6. An alkaline earth metal sulphate is soluble in water while its hydroxide is not soluble in water and its oxide does not form rock salt structure, then metal is :

(1) Be (2) Mg (3) Ca (4) Sr

Sol. $BeSO_4$ Soluble in water

$Be(OH)_2$ Insoluble in water

Structure of BeO is Hexagonal Wurtzite.

7. Calculate CFSE for complex $[Co(H_2O)_3F_3]$ [Given $\Delta_0 < P$]

(1) $-0.8\Delta_0$ (2) $-0.4\Delta_0$ (3) $-1.2\Delta_0$ (4) $-2.4\Delta_0$

Ans. (4)

Sol. $[Co(H_2O)_3F_3]$ $Co^{3+} = 3d^6 4s^0 \Rightarrow t_{2g}^{2,1,1}, eg^{1,1}$

$CFSE = [-0.4n_{t_{2g}} + 0.6n_{eg}]\Delta_0$

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

$= -0.4\Delta_0$

8. 100 ml solution of each 0.1 M AuCl and 0.1M AgCl is electrolysed by passing 1 amp current for 15 minute, then which of the following will be deposited at electrode ?

[Given $Au^+ (aqs) + e^- \rightarrow Au \;\; E^0 = 1.69$ V]

[$Ag^+ (aqs) + e^- \rightarrow Ag \;\; E^0 = 0.80$ V]

(1) Only Au (2) Only Ag (3) Both Au and Ag (4) None of Au and Ag

Ans. (1)

Sol. $\text{Charge}(q) = \frac{it}{96500} = \frac{1\times15\times60}{96500} = \frac{900}{96500} = \frac{9}{965} = F = 0.0093\ F$

No. of moles of $Au^+ = 0.01$ & No. of moles of $Ag^+ = 0.01$

Species with higher value of SRP will get deposited first at cathode.

$Au^+(aq.) + e^- \rightarrow Au(s)$

as 0.0093 mole of electrons are present therefore, 0.0093 moles will be deposited out of 0.01 moles for Au

9. In which of the following reaction, Hybridisation of underline atom gets changed

(1) $\underline{X}eF_4 + SbF_5 \longrightarrow$ (2) $H_3\underline{P}O_2 \xrightarrow{\text{disproportionation}}$

(3) $H_2\underline{S}O_4 + NaCl \longrightarrow$ (4) $\underline{N}H_3 + BF_3 \longrightarrow$

Ans. (1)

Sol. (1) $\underset{sp^3d^2}{XeF_4} + SbF_5 \longrightarrow \underset{sp^3d}{[XeF_3]^+}[SbF_6]^-$

(2) $\underset{sp^3}{H_3PO_2} \longrightarrow \underset{sp^3}{H_3PO_4} + PH_3$

(3) $\underset{sp^3}{H_2SO_4} + NaCl \longrightarrow \underset{sp^3}{NaHSO_4} + 2HCl$

(4) $\underset{sp^3}{NH_3} + BF_3 \longrightarrow \begin{array}{ccc} & H & & F \\ & | & & | \\ H- & N & :\rightarrow & B-F \\ & | & & | \\ & H & & F \\ & sp^3 & & \end{array}$

10. In colloidal solution of blue ink which of the following reagent is mixed to stablise it

H_2O, Egg, CH_3COOH and HCl

(1) H_2O (2) Egg albumin (3) CH_3COOH (4) HCl

Ans. (2)

Sol. Blue ink is a colloidal sol, so it can be stabilised by material like protein / natural gum / egg albumin.

11. If temperature changes from 27ºC to 42ºC then no. of molecule having energy greater than threshold energy become five times, then find activation energy (Ea) of reaction (in kJ)

[Given ln 5 = 1.6094 & R = 8.314 $\frac{J}{Mole \times k}$]

Ans. 84.30 kJ

Sol. $k = Ae^{-\frac{Ea}{RT}}$

$$\ln\left(\frac{K_2}{K_1}\right) = \frac{Ea}{R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

$$\ln(5) = \frac{Ea}{8.314}\left[\frac{1}{300} - \frac{1}{315}\right]$$

$$1.6094 = \frac{Ea}{8.314}\left[\frac{15}{300 \times 315}\right]$$

$$Ea = 84297.55$$

$$= 84.2975 \text{ kJ}$$

$$= 84.30 \text{ kJ}$$

12. In 100 mL, 0.1N $Na_2CO_3.xH_2O$ solution. Mass of solute is 1.43 gram, then value of X is:

Ans. (10.00)

Sol. Equivalent of solute(e) = 0.1×0.1

$e = n \times n_f \quad n_f = \text{n factor} = 2$

Mole of solute ($Na_2CO_3.xH_2O$) = $[0.1 \times 0.1]\frac{1}{2}$

Mass of $Na_2CO_3.xH_2O = [0.1 \times 0.1]\frac{1}{2} \times [106 + 18x] = 1.43$

$\Rightarrow \quad [106 + 18x = 286]$

$18x = 180$

$x = 10$

13. For the following redox reactions

(i) $2Fe^{2+} + H_2O_2 + 2H^+ \longrightarrow n_1A + n_2B$

(ii) $2MnO_4^- + 6H^+ + 5H_2O_2 \longrightarrow n_3X + n_4Y + n_5Z$

Find the sum of coefficient $(n_1 + n_2 + n_3 + n_4 + n_5)$

Ans. (19.00)

Sol. (i) $2Fe^{2+} + H_2O_2 + 2H^+ \longrightarrow 2Fe^{3+} + 2H_2O$

(ii) $2MnO_4^- + 5H_2O_2 + 6H^+ \longrightarrow 2Mn^{2+} + 5O_2 + 8H_2O$

So sum of $(n_1 + n_2 + n_3 + n_4 + n_5) = 2 + 2 + 2 + 5 + 8 = 19$

14. During roasting and calcination emitted gases produce which of the following effects.

(1) Photochemical smog, acid rain

(2) Acid Rain, Global warming

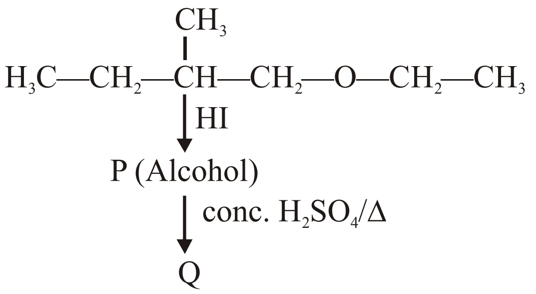
(3) Photochemical smog, Global warming

(4) Acid Rain, ozone deplition

Ans. (2)

Sol. CO_2 & SO_2 are emitted during roasting and calcination and these gases produce acid rain and also increase global warming.

15. Identify the end product of following reaction sequence

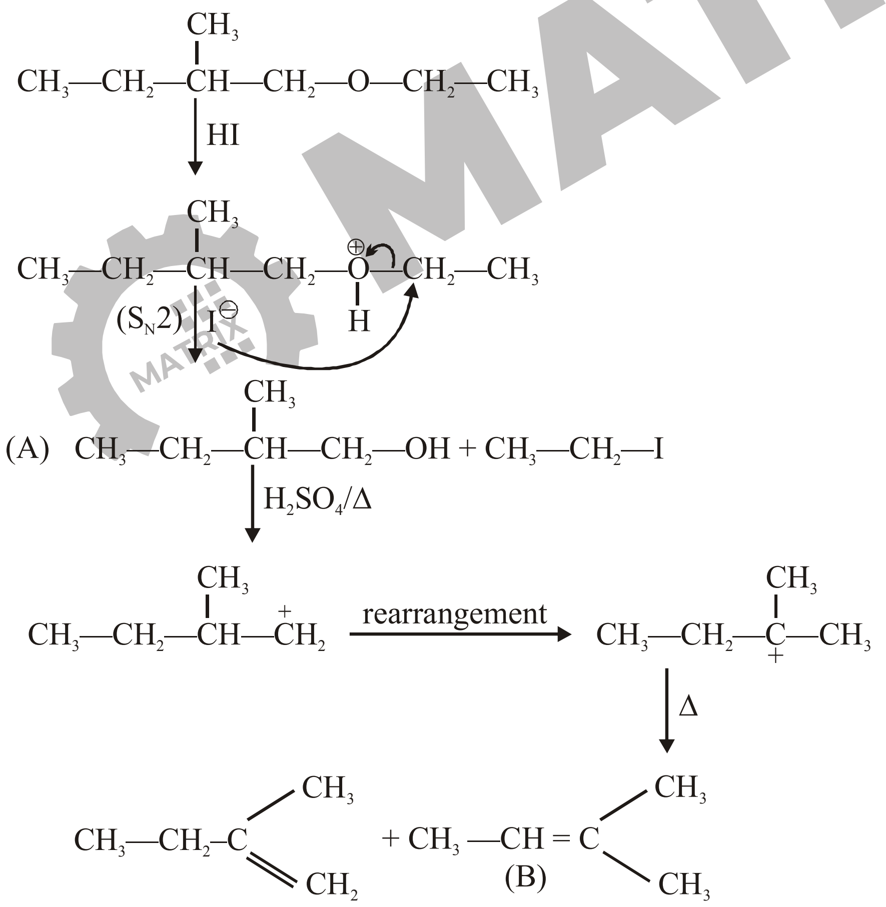


(1) $CH_3—CH_2—C(CH_3)=CH_2$ (2) $CH_3—CH=C(CH_3)—CH_3$

(3) $CH_2=CH—CH_2—CH_2—CH_3$ (4) $CH_2 – CH_2 – CH = CH – CH_3$

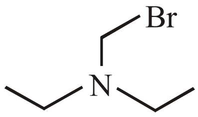
Ans. (2)

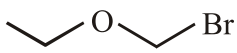
Sol.

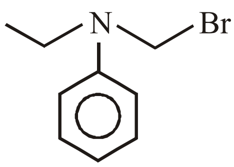


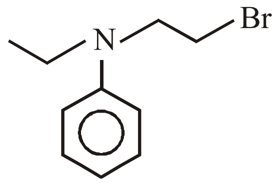
Major product

16. Which one of the following is most reactive towards aq. $AgNO_3$.

(1) 

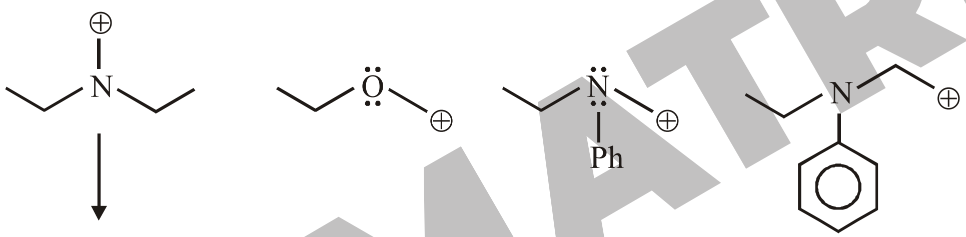
(2) 

(3) 

(4) 

Ans. (1)

Sol. Reaction with aq. $AgNO_3$ of alkyl halides is an example of S_N1 reaction. Rate of S_N1 reaction depend upon stability of carbocation.

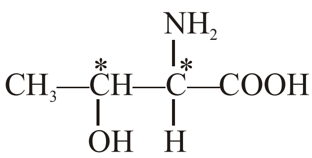


Most stable by +R effect of $-\ddot{N}<$ (amine)

17. How many chiral centres are present in Threonine.

(1) 5 (2) 2 (3) 4 (4) 3

Ans. (2)

Sol. 

Threonine has two chiral carbon atom.

18. Identify the complex in which only one d orbital is used in the hybridisation.

(1) $[Ni(CN)_4]^{2-}$ (2) $[Fe(CN)_6]^{3-}$ (3) $[Co(en)_3]^{3+}$ (4) $[FeF_6]^{3-}$

Ans. (1)

Sol.

Complex	**Electronic Configuration**	**Hybridisation**
(1) $[Ni(CN)_4]^{2-}$	$Ni^{2+} = 3d^8 \Rightarrow d^2_{yz}, d^2_{zx}, d^2_{z^2}, d^2_{xy}, d^0_{x^2-y^2}$	dsp^2
(2) $[Fe(CN)_6]^{3-}$	$Fe^{3+} = 3d^5 \Rightarrow t_{2g}2,2,1, eg^{0,0}$	d^2sp^3
(3) $[Co(en)_3]^{3+}$	$Co^{3+} = 3d^6 \Rightarrow t_{2g}{}^{2,2,2}, eg^{0,0}$	d^2sp^3
(4) $[FeF_6]^{3-}$	$Fe^{3+} = 3d^5 \Rightarrow t_{2g}{}^{1,1,1}, eg^{1,1}$	sp^3d^2

19. Which of the following process is not endothermic ?

(1) $H_{(g)} + e^- \rightarrow H^-_{(g)}$ (2) $Ar_{(g)} + e^- \rightarrow Ar^-_{(g)}$

(3) $O^- + e^- \rightarrow O^{2-}_{(g)}$ (4) $Na_{(g)} \rightarrow Na^+_{(g)} + e^-$

Ans. (1)

Sol. $H_{(g)} + e^- \xrightarrow{\text{exothermic}} H^-_{(g)}$ $\Delta H_{eg} = (-)ve$

$O^-_{(g)} + e^- \xrightarrow{\text{endothermic}} O^{2-}_{(g)}$ $\Delta H_{eg} = (+)ve$

$Ar_{(g)} + e^- \xrightarrow{\text{endothermic}} Ar^-_{(g)}$ $\Delta H_{eg} = (+)ve$

$Na_{(g)} \xrightarrow{\text{endothermic}} Na^+_{(g)} + e^-$ IE = (+)ve

20. 5 mole of an ideal gas of volume V is expanded against vacuum to make its volume 2 times, then work done by the gas is:

(1) $-RT(V_2 - V_1)$ (2) $-RT\, ln\left(\frac{V_2}{V_1}\right)$ (3) Zero (4) $Cv[T_2 - T_1]$

Ans. (3)

Sol. $W = -P_{ext}\Delta V$

In expansion against vacuum $P_{ext} = 0$

So work done is zero.

21. Given

(i) $A \rightleftharpoons B + C \quad K_{eq}(1)$

(ii) $B + C \rightleftharpoons P \quad K_{eq}(2)$

then K_{eq} for reaction $A \rightleftharpoons P$ is

(1) $K_{eq}(1) . K_{eq}(2)$ (2) $\frac{K_{eq}(1)}{K_{eq}(2)}$ (3) $K_{eq}(1) + K_{eq}(2)$ (4) $K_{eq}(1) - K_{eq}(2)$

Ans. (1)

Sol. On adding Reaction 1st and Reaction 2nd we get.

$A \rightleftharpoons P \qquad K_{eq} = K_{eq}(1) . K_{eq}(2)$

22. Osmotic pressure of NaCl solution is 0.1 atm and Glucose solution is 0.2 atm. If 1 L of NaCl solution and 2 L of Glucose solution is mixed at same temperature, then osmotic pressure of resulting solution is 'X' $\times 10^{-3}$ atm. then value of 'X' in nearest integer is

Ans. 167

Sol. $\Pi = i\,CRT = i\left[\frac{n}{V}\right]RT$

$$\Pi_{final} = \frac{(\pi_1 V_1) + (\pi_2 V_2)}{V_1 + V_2}$$

$$\Pi_{final} = \frac{(0.1 \times 1) + (0.2 \times 2)}{3}$$

$$= \frac{(0.1 + 0.4)}{3} = \frac{0.5}{3} = \frac{500}{3} \times 10^{-3}\,\text{atm}$$

so X = 167