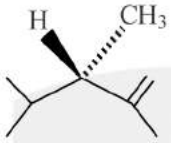
JEE Main Online Exam 2020

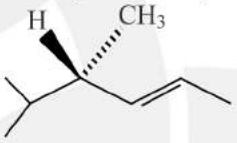
Question with Solutions

3rd September 2020 | Shift-I

CHEMISTRY

Q.1 Which of the following compounds produces an optically inactive compound on hydrogenation ?

(1) 

(2) 

(3) 

(4) 

Ans. **[1]**

Sol.

Optically active → Optically inactive

Q.2 The electronic spectrum of $[Ti(H_2O)_6]^{3+}$ shows a single broad peak with a maximum at 20,300 cm^{-1}. The crystal field stabilization energy (CFSE) of the complex ion, in kJ mol^{-1}, is-

(1) 97 (2) 145.5 (3) 83.7 (4) 242.5

Ans. **[4]**

Sol. $CFSE = 0.4\ \Delta_0$

$$= 0.4 \times \frac{20300}{83.7}$$

$= 97$ kJ/mol.

Q.3 An acidic buffer is obtained on mixing :

(1) 100 mL of 0.1 M CH_3COOH and 100 mL of 0.1 M NaOH

(2) 100 mL of 0.1 M HCl and 200 mL of 0.1 M NaCl

(3) 100 mL of of 0.1 M HCl and 200 mL of 0.1 M CH_3COONa

(4) 100 mL of 0.1 M CH_3COOH and 200 mL of 0.1 M NaOH

Ans. **[3]**

Sol.

$$HCl + CH_3COONa \rightarrow CH_3COOH + NaCl$$

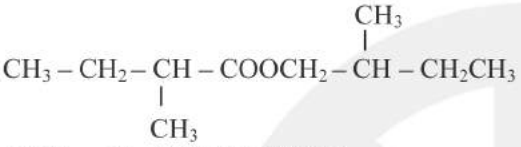
10 mili mol	20 mili mol	—	—
—	10 mili mol	10 mili mol	10 mili mol

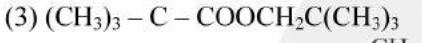
So finally we get mixture of

$CH_3COOH + CH_3COONa$ that will work like acidic buffer solution.

Q.4 An organic compound [A], molecular formula $C_{10}H_{20}O_2$ was hydrolyzed with dilute sulphuric acid to give a carboxylic acid [B] and an alcohol [C]. Oxidation of [C] with $CrO_3 - H_2SO_4$ produced [B]. Which of the following structure are not possible for [A] ?

(1) $CH_3CH_2CH_2COOCH_2CH_2CH_2CH_3$

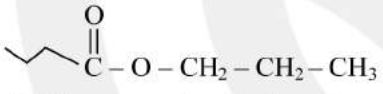
(2) 

(3) 

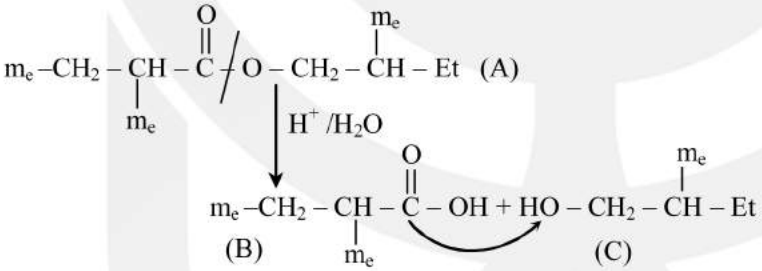
(4) 

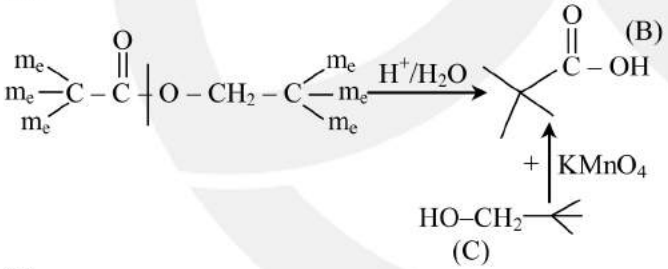
Ans. **[4]**

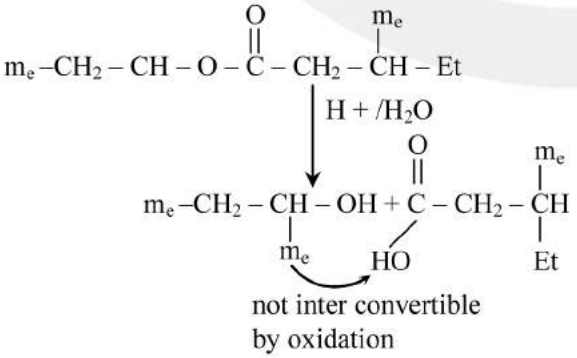
Sol.

(1) 

Total 8 'C' → so molecular formula not matched.

(2) 

(3) 

(4) 

not inter convertible by oxidation

Q.5 Aqua regia is used for dissolving noble metals (Au, Pt, etc.). The gas evolved in this process is-

(1) N_2O_5 (2) N_2O_3 (3) N_2 (4) NO

Ans. **[4]**

Sol. $Au + HNO_3 + 4HCl \rightarrow HAuCl_4 + NO + 2H_2O$

Q.6 The complex that can show optical activity is-

(1) *trans*-$[Fe(NH_3)_2(CN)_4]^-$

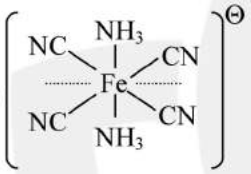
(2) *cis*-$[CrCl_2(ox)_2]^{3-}$ (ox = oxalate)

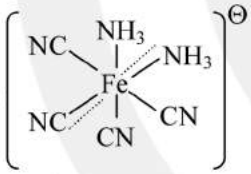
(3) *cis*-$[Fe(NH_3)_2(CN)_4]^-$

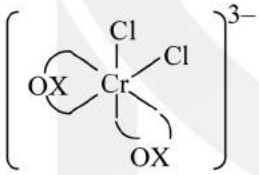
(4) *trans*-$[Cr(Cl_2(ox)_2]^{3-}$

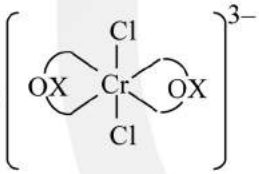
Ans. **[2]**

Sol.

(1)  optically inactive

(2)  optically inactive

(3)  optically active

(4)  optically inactive

Q.7 Thermal power plants can lead to-

(1) Acid rain (2) Eutrophication

(3) Blue baby syndrome (4) Ozone layer depletion

Ans. **[1]**

Sol. Thermal power plants lead to acid rain.

Q.8 Henry's constant (in kbar) for four gases α, β, γ and δ in water at 298 K is given below :

	α	β	γ	δ
K_H	50	2	2×10^{-5}	0.5

(density of water = 10^3 kg m^{-3} at 298 K)

This table implies that -

(1) α has the highest solubility in water at a given pressure

(2) solubility of γ at 308 K is lower than at 298 K

(3) The pressure of a 55.5 molal solution of γ is 1 bar

(4) The pressure of a 55.5 molal solution of δ is 250 bar

Ans. [4]

Sol. $P_\gamma = K_H X_Y$

$$P_\gamma = 2 \times 10^{-15} \times \frac{55.5}{55.5 + \frac{1000}{18}} = 2 \times 10^{-5} \text{ K bar}$$

$$= 2 \times 10^{-2} \text{ bar}$$

(2) $P_\delta = K_H X_\delta$

$$P_\delta = 0.5 \times \frac{55.5}{55.5 + \frac{1000}{18}} = 249 \text{ K bar} = 249 \text{ bar}$$

(3) On increasing temperature solubility of gases decreases

(4) $K_H \downarrow$ solubility $\uparrow$ and lowest K_H is for γ.

Q.9 Of the species, NO, NO^+, NO^{2+} and NO^-, the one with minimum bond strength is-

(1) NO^{2+} (2) NO^+ (3) NO (4) NO^{-0}

Ans. [4]

Sol. Bond order of $NO^{2+} = 2.5$

Bond order of $NO^+ = 3$

Bond order of NO = 2.5

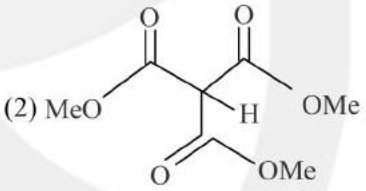
Bond order of $NO^- = 2$

Bond order α bond strength

Q.10 Which one of the following compounds possesses the most acidic hydrogen ?

(1) $H_3C - C \equiv C - H$

(2)



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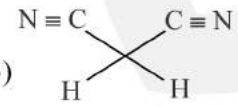
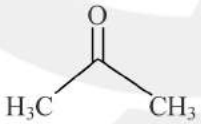
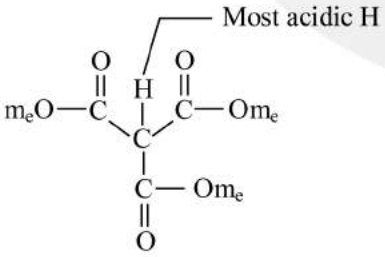


(4)



Ans. [2]

Sol.



Due to presence of 3 (–R) groups

Q.11 The atomic number of the element unnilennium is-

(1) 108 (2) 109 (3) 102 (4) 119

Ans. **[2]**

Sol. 1 0 9

un nil enn

Hence correct name → unnilennium

Q.12 Glycerol is separated in soap industries by-

(1) Steam Distillation (2) Distillation under reduced pressure

(3) Fractional distillation (4) Differential extraction

Ans. **[2]**

Sol. Glycerol is separated by reduced pressure distillation in soap industries.

Q.13 If the boiling point of H_2O is 373 K, the boiling point of H_2S will be-

(1) greater than 300 K but less than 373 K

(2) less than 300 K

(3) more than 373 K

(4) equal to 373 K

Ans. **[2]**

Sol. Boiling point of H_2S < Boiling point of H_2O

(213 K) (373 K)

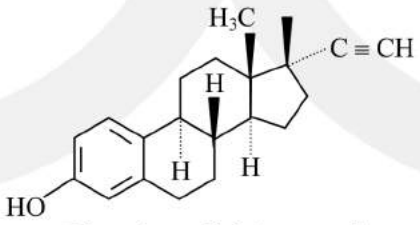
Q.14 The antifertility drug "Novestrol" can react with-

(1) Br_2/water ; $ZnCl_2$/HCl ; $FeCl_3$ (2) Alcoholic HCN ; NaOCl ; $ZnCl_2$/HCl

(3) $ZnCl_2$/HCl ; $FeCl_3$; Alcoholic HCN (4) Br_2/water ; $ZnCl_2$/HCl ; NaOCl

Ans. **[1]**

Sol.



Ethynylestradiol (novestrol)

gives

(1) $Br_2 + H_2O$ test

(2) Lucas test with $ZnCl_2$ + HCl

(3) $FeCl_3$ test of phenolic group

Q.15 Tyndall effect is observed when-

(1) The diameter of dispersed particles is similar to the wavelength of light used

(2) the diameter of dispersed particles is much smaller than the wavelength of light used

(3) The refractive index of dispersed phase is greater than that of the dispersion medium

(4) The diameter of dispersed particles is much larger than the wavelength of light used

Ans. **[1]**

Sol. The diameter of disperseed particles is similar to wavelength of light used.

Q.16 The mechanism of S_N^1 reaction is given as :

$$R-X \longrightarrow \underset{\text{Ion pair}}{R^{\oplus}X^{\ominus}} \longrightarrow \underset{\text{Separated ion pair}}{R^{\oplus} \,||\, X^{\ominus}} \xrightarrow{Y^{\ominus}} R-Y + X^{\ominus}$$

Solvent

A student writes general characteristics based on the given mechanism as-

(a) The reaction is favoured by weak nucleiphiles

(b) $R^{\oplus}$ would be easily formed if the substituents are bulky

(c) The reaction is accompained by racemization

(d) The reaction is favoured by non-polar solvents

Which observations are correct ?

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

Ans. **[2]**

Sol. S_N^1 favours

(a) The reaction is favoured by weak nucleophiles

(b) $R^{\oplus}$ would be easily formed if the substituents are bulky

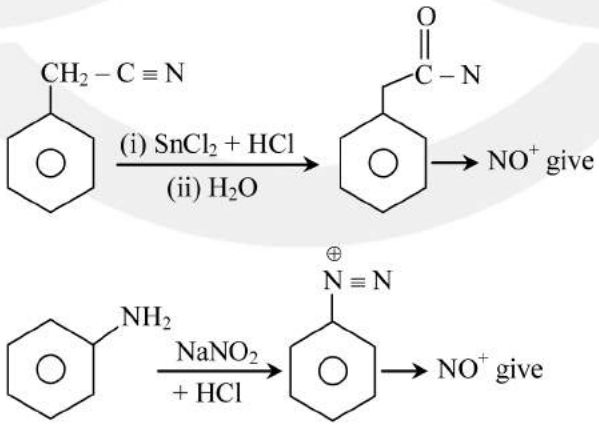
(c) The reaction is accumpained by recemization

Q.17 The Kjeldahl method of Nitrogen estimation fails for which of the following reaction products ?

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

Ans. **[4]**

Sol. Kjeldahl method is used for N estimation But not given by 'Diazo' compounds.



Q.18 Let C_{NaCl} and C_{BaSO_4} be the conductances (in S) measured for saturated aqueous solutions of NaCl and $BaSO_4$, respectively, at a temperature T.
Which of the following is false ?
(1) $C_{NaCl} >> C_{BaSO_4}$ at a given T
(2) $C_{NaCl}(T_2) > C_{NaCl}(T_1)$ for $T_2 > T_1$
(3) Ionic mobilities of ions from both salts increase with T
(4) $C_{BaSO_4}(T_2) > C_{BaSO_4}(T_1)$ for $T_2 > T_1$

Ans. **[2]**

Sol. Dissolution of $BaSO_4$ is and endothermic reaction 50 on increasing temperature number of ions of $BaSO_4$ decrease so it's conduction also decrease.

Q.19 It is true that :
(1) A second order reaction is always a multistep reaction
(2) A zero order reaction is a single step reaction
(3) A first order reaction is always a single step reaction
(4) A zero order reaction is a multistep reaction

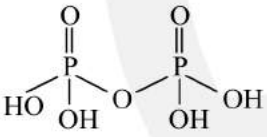
Ans. **[4]**

Sol. Zero order reaction is multiple step reaction.

Q.20 In a molecule of pyrophosphoric acid, the number of P – OH, P = O and P – O – P bonds/moiety (ies) respectively are :
(1) 4, 2 and 0
(2) 2, 4 and 1
(3) 4, 2 and 1
(4) 3, 3 and 3

Ans. **[3]**

Sol. Pyrophosphoric acid.



P – OH linkages = 4
P = O linkages = 2
P – O – P linkages = 1

Q.21 The mole fraction of glucose ($C_6H_{12}O_6$) in an aqueous binary solution is 0.1. The mass percentage of water in it, to the nearest integer, is _____ .

Ans. **[47]**

Sol. $X_{C_6H_{12}O_6} = 0.1$
Let total mole is 1 mol then mole of glucose will be 0.1 and mole of water will be 0.9

$$\text{so mass \% of water} = \frac{0.9\times18}{0.1\times180+0.9\times18}\times100$$
$$= 47.36$$

Q.22 The volume strength of 8.9 M H_2O_2 solution calculated at 273 K and 1 atm is _____. (R = 0.0821 L atm K^{-1} mol^{-1}) rounded off to the nearest integer)

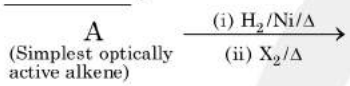
Ans. **[100]**

Sol. Volume strength of H_2O_2 at 1 atm

273 kelvin = M × 11.2 = 8.9 × 11.2 = 99.68

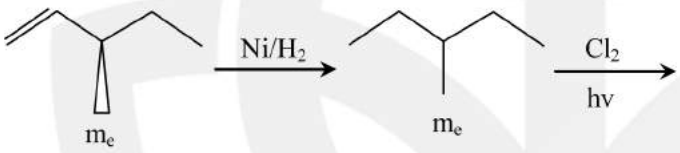
Ans. : 100

Q.23 The total number of monohalogenated organic products in the following (including stereoisomers) reaction is _____ .

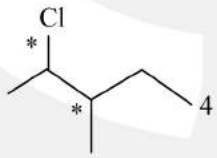


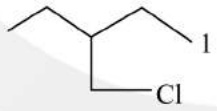
Ans. **[8]**

Sol.

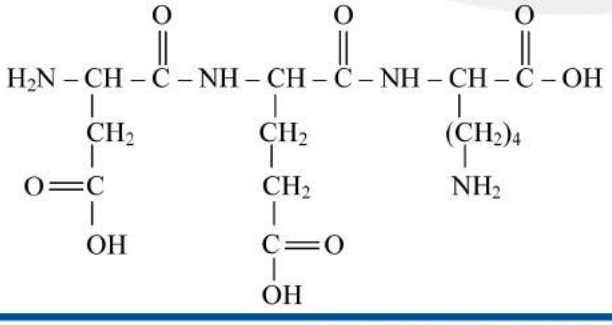


Simplest
O. A. Alkene





Alter
str. of Tri peptide



Q.24 The photoelectric current from Na (work function, $w_0 = 2.3$ eV) is stopped by the output voltage of the cell Pt(s) | H_2(g, 1 bar) | HCl (aq., pH = 1) | AgCl(s) | Ag(s).
The pH of aq. HCl required to stop the photoelectric current from K($w_0 = 2.25$ eV), all other conditions remaining the same, is _____ $\times 10^{-2}$ (to the nearest integer).

Given $2.303\ \frac{RT}{F} = 0.06$ V ; $E^0_{AgCl|Ag|Cl^-} = 0.22$ V

Ans. **[1.42]** NTA official Ans. 58

Sol. $\frac{1}{2}H_2 \rightarrow H^+ + e^\ominus$

$e^\ominus + AgCl_{(s)} \rightarrow Ag_{(s)} + Cl^\ominus$

$\frac{1}{2}H_2 + AgCl_{(s)} \rightarrow H^+_{(aq)} + Ag_{(s)} + C^\ominus_{(aq)}$

$$E = \varepsilon^0 - \frac{.06}{1}\log\frac{[H^+]\,[Cl^\ominus]}{P_{H_2}^{\frac{1}{2}}}$$

$$E = 0.22 - .06\log\frac{(10^{-1})(10^{-1})}{1^{\frac{1}{2}}}$$

$E = 0.22 + .12 = .34$ volt

$\Rightarrow$ total energy of photon will be (for Na) = 2.3 + 0.34 = 2.64 eV

$\Rightarrow$ stopping potential required for K

= 2.64 – 2.25 = 0.39 volt

$$E = \varepsilon^0 - \frac{.06}{1}\log\frac{[H^+]\,[Cl^-]}{P_{H_2}^{\frac{1}{2}}}$$

as $[H^+] = [Cl^\ominus]$ so

$$0.39 = 0.22 - .06\log\frac{[H^+]^2}{1^{\frac{1}{2}}}$$

$0.17 = +.12$ pH

pH = 1.4155 $\Rightarrow$ 1.42

Q.25 An element with molar mass 2.7×10^{-2} kg mol^{-1} forms cubic unit cell with edge length 405 pm. If its density is 2.7×10^3 kg m^{-3}, the radius of the element is approximately _____ $\times 10^{-12}$ m (to the nearest integer).

Ans. **[143]**

Sol. $$d = \frac{z\left(\frac{M}{N_A}\right)}{a^3}$$

$$2.7 \times 10^3 = z\,\frac{\left(\frac{2.7\times10^{-2}}{6\times10^{23}}\right)}{(405\times10^{-12})^3}$$

$$2.7 \times 10^3 = z \frac{(2.7\times10^{-2})}{6\times10^{23}(4.05\times10^{-10})^3}$$

$$2.7 \times 10^3 = z \frac{(2.7\times10^{-2})}{6\times10^{23}\times66.43\times10^{-30}}$$

$3.98 = z$

$z \approx 4$ structure is fcc

$$\frac{a}{\sqrt{2}} = 2r$$

$$r = \frac{a}{2\sqrt{2}} = \frac{\sqrt{2}a}{4} = \frac{1.414\times405\times10^{-12}}{4}$$

$r = 143.16 \times 10^{-12}$