Chemistry JEE Solutions 2022

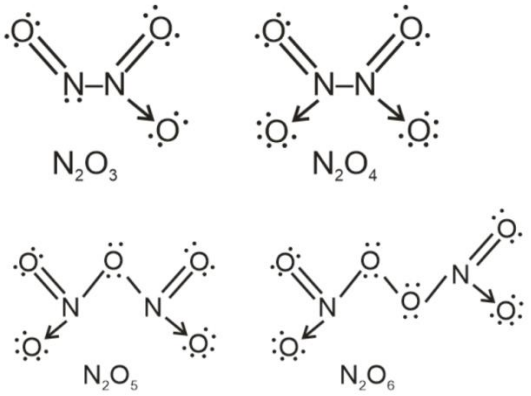
Chemistry

1. Out of N_2O_3,N_2O_4,N_2O_5 and N_2O_6. How many of them contain N–N bond

(1) 1 (2) 2

(3) 3 (4) 4

Sol. Answer (2)



Only N_2O_3 and N_2O_4 contains N–N bond

2. Photochemical smog contains?

(1) O_3 (2) N_2

(3) SF_4 (4) F_2

Sol. Answer (1)

Photochemical smog contains O_3, PAN, nitric oxide, acrolein and formaldehyde.

3. Which of the following is a basic oxide

(1) Al_2O_3 (2) SiO_2

(3) Na_2O (4) NO_2

Sol. Answer (3)

Metal oxides $\Rightarrow$ basic

Non-metal oxides $\Rightarrow$ Acidic

Hence, Na_2O is a basic oxide

NO_2, SiO_2 are acidic oxides

Al_2O_3 is an amphoteric oxide

4. Which of the following set of Quantum numbers is valid?

(1) n ℓ m s
4 3 0 1/2

(2) n ℓ m s
3 3 2 1/2

(3) n ℓ m s
2 1 -2 1/2

(4) n ℓ m s
1 1 0 1/2

Sol. Answer (1)

n can take integral values, ℓ can take values from 0 to (n –1), m_ℓ can takes values from $-\ell$ to $+\ell$ including zero and s is either $+\frac{1}{2}$ or $-\frac{1}{2}$

Hence, following quantum numbers are correct:

$n = 4 \quad \ell = 3 \quad m_\ell = 0 \quad s = \frac{+1}{2}$

5. There are three isotopes of hydrogen, identify the difference between them.

(1) Number of protons

(2) Number of electrons in neutral state

(3) Electronic configuration in neutral state

(4) Number of neutron

Sol. Answer (4)

	^1_1H	^2_1H	^3_1H
	protium	deuterium	Tritium
No of neutrons	0	1	2
(A-Z)			

Hence, they differ in the number of neutrons.

6. $FeO + SiO_2 \rightarrow FeSiO_3$

SiO_2 and $FeSiO_3$ are respectively

(Considering the extraction of copper)

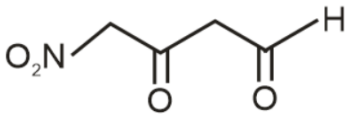
(1) Flux & slag (2) Slag and flux

(3) Gangue & flux (4) Gangue and slag

Sol. Answer (1)

$$\underset{\text{Basic impurity}}{FeO} + \underset{\substack{\text{Acidic}\\\text{Flux}}}{SiO_2} \longrightarrow \underset{\substack{\text{Slag}\\\text{(fusible mass)}}}{FeSiO_3}$$

7. The correct IUPAC name of the compound



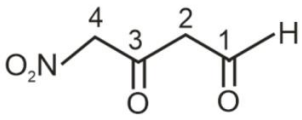
(1) 1-formly-4-nitrobutanal

(2) 4-nitro-3-oxo-butanal

(3) 4-oxo-3-nitrobutanal

(4) 3-oxo-4-nitropropanal

Sol. Answer (2)



4-nitro-3-oxobutanal

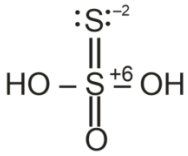
–CHO group has highest priority. Hence it will be our principal functional group.

8. In which of the following compounds sulphur shows two different oxidation states

(1) $H_2S_2O_3$ (2) $H_2S_2O_6$

(3) $H_2S_2O_7$ (4) $H_2S_2O_8$

Sol. Answer (1)



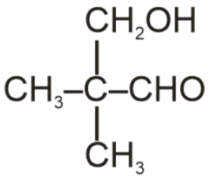
$H_2S_2O_3$ (Thiosulphuric acid)

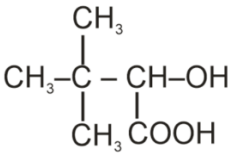
Sp^2hybridized S is more electronegative than sp^3hybridized S.

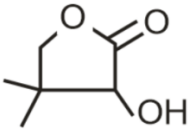
Hence it shows –2 oxidation state.

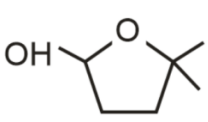
9. Isobutyraldehyde $\xrightarrow[K_2CO_3]{HCHO}$ A $\xrightarrow{CN^-}$ B $\xrightarrow{H_3O^+}$ P

The product P is

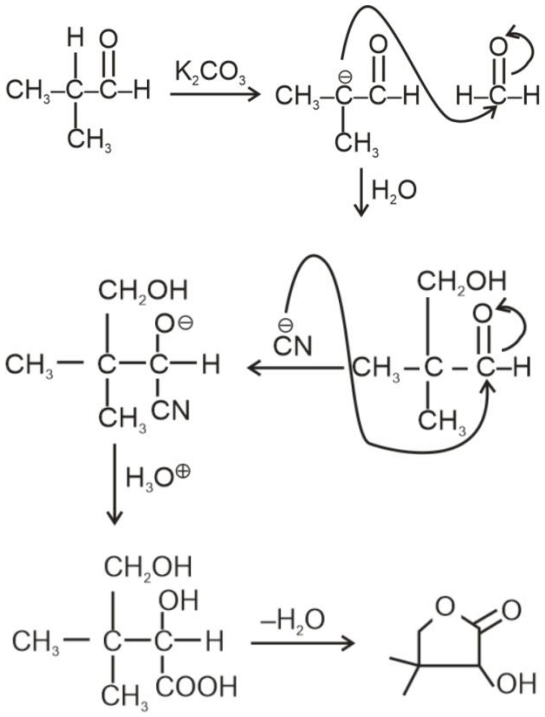
(1) 

(2) 

(3) 

(4) 

Sol. Answer (3)



10. Find empirical formula of a compound which contains 74%C, 17.3% N and 8.7% H by mass

(1) C_4H_6N (2) C_5H_7N

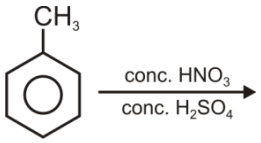
(3) C_3H_5N (4) $C_4H_5N_2$

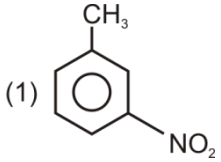
Sol. Answer (2)

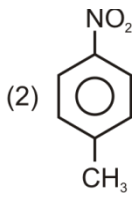
Element	mass%	Atomic mass	moles	simplest ratio
C	74	12	$\frac{74}{12} = 6.16$	$\frac{6.16}{1.23} = 5$
N	17.3	14	$\frac{17.3}{14} = 1.23$	$\frac{1.23}{1.23} = 1$
H	8.7	1	$\frac{8.7}{2} = 8.7$	$\frac{8.7}{1.23} = 7$

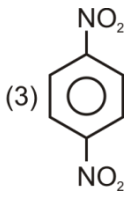
Empirical formula = C_5H_7N

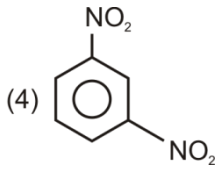
11.



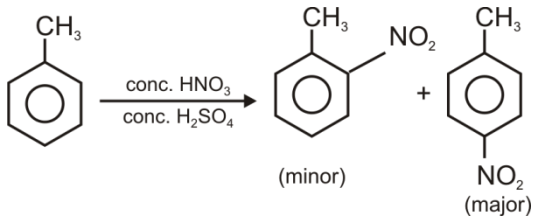
(1) 

(2) 

(3) 

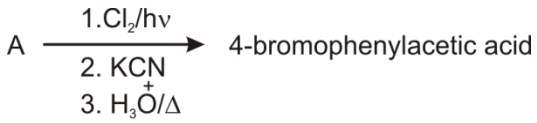
(4) 

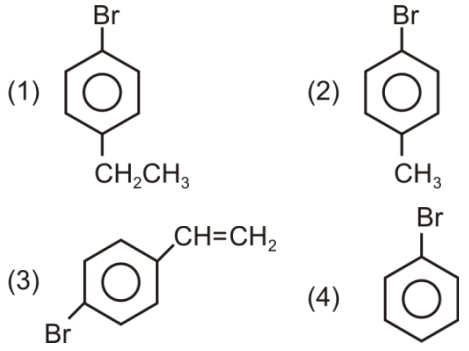
Sol. Answer (2)



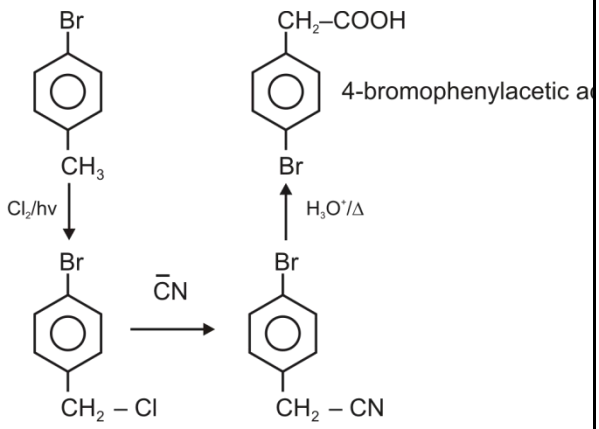
Option (2) is correct answer

12. Consider the following reaction





Sol. Answer (2)



Option (2) is correct answer

13. A sugar 'X' is hydrolysed forms isomers one of the compound form is laevorotatory then 'X' can be

(1) Maltose (2) Sucrose

(3) Lactose (4) Dextrose

Sol. Answer (2)

Sucrose (Dextrorotatory) on hydrolysis gives equimolar mixture of D-(+)- Glucose (Dextrorotarory) and D-(–)- Fructose (Laevorotatory) and net rotation of PPL is in anti-clock wise direction. Therefore this reaction is called inversion of sugar, So compound X is sucrose.

14. The correct statement about photochemical smog is,

(1) It is caused by chemical reaction of Hydrocarbon

(2) Reducing in Nature

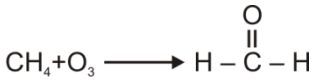
(3) It is caused by SO_2 dust

(4) Humid climate

Sol. Answer (1)

Photochemical smog or Los Angeles smog is oxidising in nature, produced in warm, dry and sunny climate on reaction of hydrocarbon, nitrogen oxide in sun light or UV light.

Eg. NO_2, O_3, PAN, aldehydes etc.



$NO + O_3 \rightarrow NO_2 + O_2$

15. The pH of a buffer solution of acetic acid is 4.

Find the value of $\frac{\left[CH_3COO^-\right]}{\left[CH_3COOH\right]}$

Given K_a of acetic acid = 1.3×10^{-5}

(1) 2.3 (2) 10.2

(3) 0.13 (4) 1.5

Sol. Answer (3)

pH of acidic buffer solution,

$K_a = 1.3\times10^{-5}$

$pK_a == 5 - \log 1.3$

= 4.89

$pH = pK_a + \log\frac{[salt]}{[acid]}$

$4 = 4.89 + \log\frac{\left[CH_3COO^-\right]}{\left[CH_3COOH\right]}$

$\log\frac{\left[CH_3COO^-\right]}{\left[CH_3COOH\right]} = 4.00 - 4.89$

= –0.89

$\frac{\left[CH_3COO^-\right]}{\left[CH_3COOH\right]} = 0.13$

16. Nature of colloidal solution of $Fe(OH)_3$is

(1) Neutral (2) Positive

(3) Negative (4) Amphoteric

Sol. Answer (2)

$Fe(OH)_3$is positively charged colloid due to adsorption of Fe^{3+} according to preferential absorption theory

$FeCl_3 \rightarrow Fe^{3+} + 3Cl^-$

$Fe^{3+} + 3H_2O \rightarrow Fe(OH)_3 + 3H^+$

$Fe(OH)_3 + Fe^{3+} \rightarrow Fe(OH)_3 \,|\, Fe^{3+}$

17. Consider the structure of SF4 the no. of lone pair, position of lone pair and no. of lone pair-bond pair repulsion respectively are

(1) 1, equatorial position, 4

(2) 2, axial position, 4

(3) 1, axial position, 3

(4) 1, equatorial position, 6

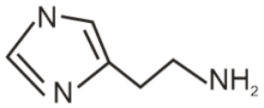
Sol. Answer (1)

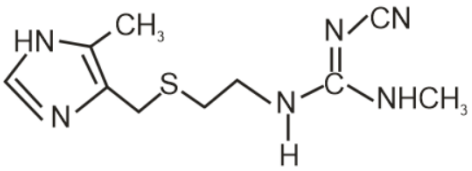
No. of lone pairs = 1

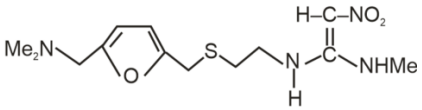
Position of lone pairs = equatorial position

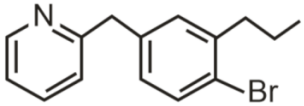
No. of lone pair – bond pair repulsion = 4

18. The structure of Tagamet (cimetidine)

(1) 

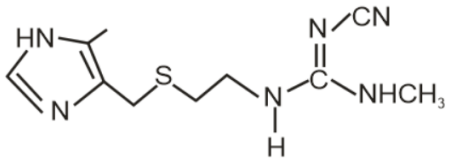
(2) 

(3) 

(4) 

Sol. Answer (2)

Tagamet (Cimetidine) is



19. Consider the following complexes

$[Fe(CN)_6]^{3-}$, $[Ni(CN)_4]^{2-}$ and $[Fe(CN)_6]^{4-}$

How many complexes is/are paramagnetic?

Sol. Answer (1)

$[Fe(CN)_6]^{3-}$

e^- configuration of $Fe^{+3} = [Ar]3d^5 4s^o$

$t_{2g}^5\ e_g^0 \Rightarrow 1$ unpaired $e^- \Rightarrow$ paramagnetic

$[Ni(CN)_4]^{2-}$

e^- configuration of $Ni^{+2} = [Ar]3d^8 4s^o$

$t_{2g}^6\ e_g^2 \Rightarrow 0$ unpaired $e^- \Rightarrow$ diamagnetic

$[Fe(CN)_6]^{4-}$

e^- configuration of $Fe^{+2} = [Ar]3d^6 4s^o$

$t_{2g}^6\ e_g^0 \Rightarrow 0$ unpaired $e^- \Rightarrow$diamagnetic

20. If for $Sn^{+4} + 4e^- \rightarrow Sn$ $E^0_{Sn^{+4}/Sn} = 0.0203\,V$

and for $Sn^{+2} + 2e^- \rightarrow Sn$ $E^0_{Sn^{+2}/Sn} = -0.14\,V$

What is value of $E^o_{Sn^{+4}/Sn^{+2}}(in\,V)$

Sol. Answer (0.1806)

$Sn^{+4} + 4e^- \rightarrow Sn \qquad E^o_{Sn^{+4}/Sn} = 0.0203\,V$

$Sn \longrightarrow Sn^{+2} + 2e^- \qquad E^o_{Sn/Sn^{+2}} = 0.14\,V$

$Sn^{+4} + 2e^- \rightarrow Sn^{+2} \qquad E^o_{Sn^{+4}/Sn^{+2}} = ?$

$n_3E^o_{Sn^{+4}/Sn^{+2}} = n_1E^o_{Sn^{+4}/Sn} + n_2\,E^0_{Sn/Sn^{+2}}$

$E^0_{Sn^{+4}/Sn^{+2}} = \dfrac{4(0.0203) + 2(0.14)}{2}$

= 0.1806 V

21. The half-life of substance is 200 days. Find the % activity of remaining substance after 83 days if it decays through first order kinetics.

[Round off to the nearest integer]

Sol. Answer (15)

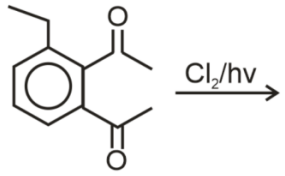
$$t_{1/2} = 200\,\text{days} \Rightarrow \lambda = \frac{\ln 2}{t_{1/2}}$$

$$\ln\frac{[N]_0}{[N]_t} = \lambda t$$

$$\Rightarrow [N]_t = [N]_0\, e^{-\lambda t} = 0.75\ [N]_0$$

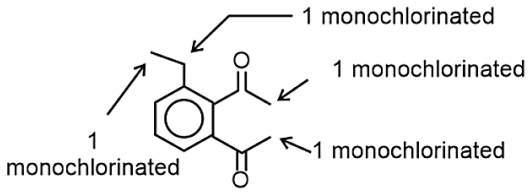
$\therefore$ % activity of the remaining substance = 15%

22.



Number of carbon atoms to which Cl is attached

Sol. Answer (4)



Total no. of monohalogenated products = 4

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