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PAPER-1 (B.E./B. TECH.)

2023

COMPUTER BASED TEST (CBT) Questions & Solutions

Date: 08 April, 2023 (SHIFT-2) | TIME : (3.00 p.m. to 6.00 p.m)

Duration: 3 Hours | Max. Marks: 300

SUBJECT: CHEMISTRY

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PART : CHEMISTRY

61. Given below are two statements:

Statement – I : In redox titration, the indicators used are sensitive to change in pH of the solution.

Statement – II : In acid-base titration, the indicators used are sensitive to change in oxidation potential.

In the light of the above statements, choose the **most appropriate** answer from the options given below:

- (1) Both Statement I and Statement II are incorrect
- (2) Statement I is incorrect but Statement II is correct
- (3) Both Statement I and Statement II are correct
- (4) Statement I is correct but Statement II is incorrect

Ans. NTA (1)

Reso (1)

Sol. (I) In redox titration indicators are sensitive to change in oxidation potential.

(II) In acid-base titration, indicators are used which are sensitive to pH.

62. In Hall – Heroult process, the following is used for reducing Al_2O_3 :

- (1) CaF_2
- (2) Na_3AlF_6
- (3) Graphite
- (4) Magnesium

Ans. NTA (3)

Reso (3)

Sol. Electrolytic reduction (Hall-Heroult process) :

The purified Al_2O_3 is mixed with Na_3AlF_6 (cryolite) or CaF_2 (fluorspar) which lowers the melting point of the mixture and brings conductivity. The fused matrix is electrolysed. Steel cathode and graphite anode are used. **The graphite anode is useful here for reduction to the metal. The overall reaction may be taken as :**

$$2\text{Al}_2\text{O}_3 + 3\text{C} \longrightarrow 4\text{Al} + 3\text{CO}_2$$

The electrolysis of the molten mass is carried out in an electrolytic cell using carbon electrodes.

In hall Heroult process graphite is act as reducing agent

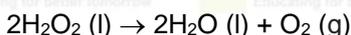
63. Which of the following can reduce decomposition of H_2O_2 on exposure to light

- (1) Alkali
- (2) Dust
- (3) Urea
- (4) Glass containers

Ans. NTA (3)

Reso (3)

Sol. H_2O_2 decomposes slowly on exposure to light.



In the presence of metal surfaces or traces of alkali (present in glass containers), the above reaction is catalysed. It is, therefore, stored in wax-lined glass or plastic vessels in dark. **Urea can be added as a stabiliser.** It is kept away from dust because dust can induce explosive decomposition of the compound

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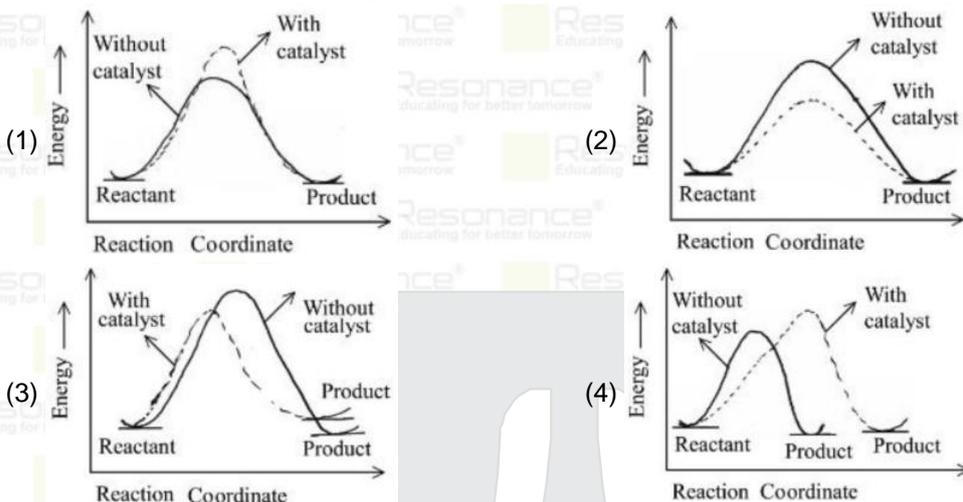
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64. The correct reaction profile diagram for a positive catalyst reaction.



Ans. NTA (2)
Reso (2)

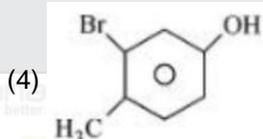
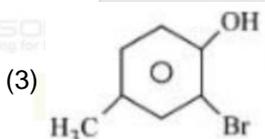
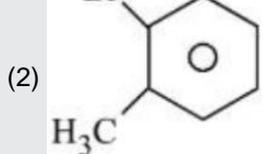
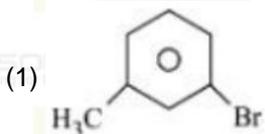
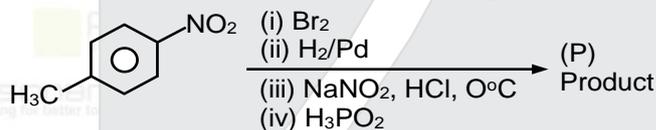
Sol. A catalyst drives the reaction through a low energy path and hence E_a is less. That is, the function of the catalyst is to lower down the activation energy.

E_a = Energy of activation in absence of catalyst.

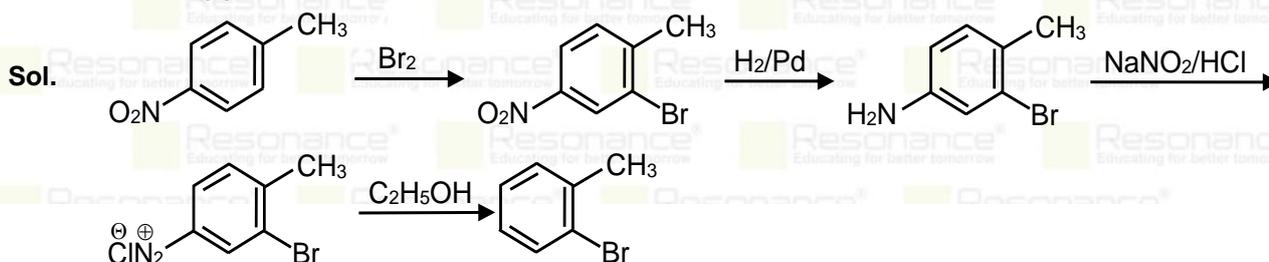
E'_a = Energy of activation in presence of catalyst.

$E_a - E'_a$ = lowering of activation energy by catalyst.

65. The product (P) formed from the following multistep reaction is:



Ans. NTA (2)
Reso (2)



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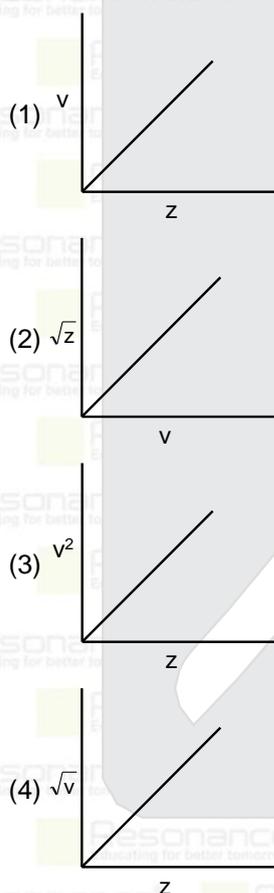
66. For a good quality cement, the ratio of lime to the total of the oxides of Si, Al and Fe should be as close as to
 (1) 1 (2) 2 (3) 4 (4) 3

Ans. NTA (2)
 Reso (2)

Sol. For a good quality cement, the ratio of silica (SiO_2) to alumina (Al_2O_3) should be between 2.5 and 4 and the ratio of lime (CaO) to the total of the oxides of silicon (SiO_2) aluminium (Al_2O_3) and iron (Fe_2O_3) should be as close as possible to 2.

67. Henry Moseley studied characteristic X-ray spectra of elements. The graph which represents his observation correctly is

Given ν = frequency of X-ray emitted
 Z = atomic number



Ans. NTA (4)
 Reso (4)

Sol. During bombardment of electron on metal surface.

$$Z \propto \sqrt{\nu}$$

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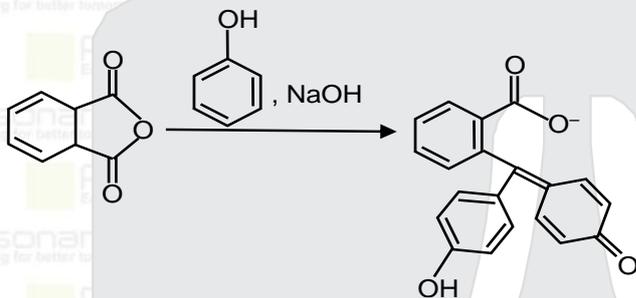
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68. A compound 'X' when treated with phthalic anhydride in presence of concentrated H₂SO₄ yields 'Y'. 'Y' is used as an acid / base indicator. 'X' and 'Y' are respectively
- (1) Anisole, methyl orange
 - (2) Toluidine, Phenolphthalein
 - (3) Carboic acid, Phenolphthalein
 - (4) Salicylaldehyde, Phenolphthalein

Ans. NTA (3)

Reso (3)

Sol. Carboic acid = phenol



69. Which of these reactions is not a part of breakdown of ozone in stratosphere ?

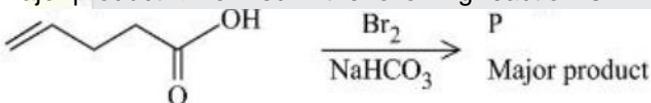
- (1) $\text{Cl}\dot{\text{O}} \longrightarrow \text{ClO}_2(\text{g}) + \text{Cl}\dot{\text{I}}(\text{g})$
- (2) $\text{CF}_2\text{Cl}_2(\text{g}) \xrightarrow{\text{UV}} \text{Cl}\dot{\text{I}}(\text{g}) + \dot{\text{C}}\text{F}_2\text{Cl}(\text{g})$
- (3) $\text{Cl}\dot{\text{O}}(\text{g}) + \text{O}(\text{g}) \longrightarrow \text{Cl}\dot{\text{I}}(\text{g}) + \text{O}_2(\text{g})$
- (4) $\text{Cl}\dot{\text{I}}(\text{g}) + \text{O}_3(\text{g}) \longrightarrow \text{Cl}\dot{\text{O}}(\text{g}) + \text{O}_2(\text{g})$

Ans. NTA (1)

Reso (4)

Sol. Formation of Ozone hole proceed with the decomposition of chlorofluorocarbons and formation of $\dot{\text{C}}\text{l}$ radical.

70. Major product 'P' formed in the following reaction is:



- (1)
- (2)
- (3)
- (4)

Ans. NTA (2)

Reso (2)

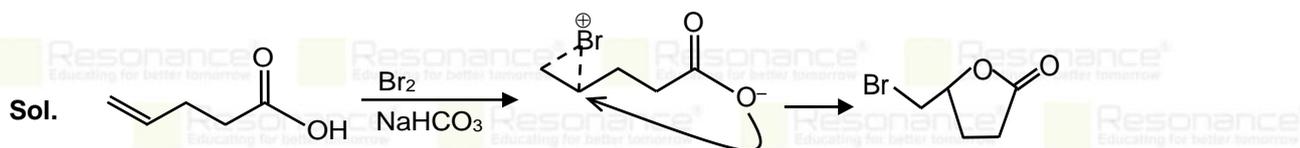
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71. Match List I with List II

List I		List II	
Natural amino acid		One letter code	
A.	Glutamic acid	I.	Q
B.	Glutamine	II.	W
C.	Tyrosine	III.	E
D.	Tryptophan	IV.	Y

Choose the correct answer from the options given below:

- (1) A-II, B-I, C-IV, D-III
- (2) A-III, B-IV, C-I, D-II
- (3) A-IV, B-III, C-I, D-II
- (4) A-III, B-I, C-IV, D-II

Ans. **NTA (4)**

Reso (4)

Sol. Based on fact.

72. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R

Assertion A: Sodium is about 30 times as abundant as potassium in the oceans.

Reason R: Potassium is bigger in size than sodium.

In the light of the above statements, choose the correct answer from the options given below

- (1) A is true but R is false
- (2) A is false but R is true
- (3) Both A and R are true but R is NOT the correct explanation of A
- (4) Both A and R are true and R is the correct explanation of A

Ans. **NTA (4)**

Reso (4)

Sol. **Statements-I** sodium is about 30 times abundant as potassium in oceans.

Statements-II size of sodium is smaller than potassium.

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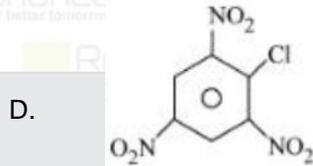
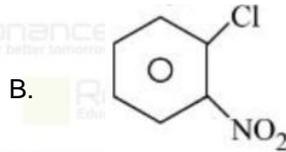
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73. The correct order of reactivity of following haloarenes towards nucleophilic substitution with aqueous NaOH is



Choose the correct answer from the options given below:

- (1) A > B > D > C
- (2) C > A > D > B
- (3) D > C > B > A
- (4) D > B > A > C

Ans. **NTA (4)**
Reso (4)

Sol. Chlorobenzene undergoes aromatic nucleophilic substitution via carbanion intermediate in such a reaction greater the -M group (-NO₂, -CN etc) at O & P position greater the stability of carbanion intermediate and faster the rate of reaction.

74. The statements which are true about antagonists from the following is/are:

- A. They bind to the receptor site.
- B. Get transferred inside the cell for their action.
- C. Inhibit the natural communication of the body.
- D. Mimic the natural messenger.

Choose the correct answer from the options given below:

- (1) A and C
- (2) B only
- (3) A and B
- (4) A, C and D

Ans. **NTA (1)**
Reso (1)

Sol. **NCERT Fact based.**

75. Arrange the following gases in increasing order of van der Waals constant 'a'

- A. Ar
- B. CH₄
- C. H₂O
- D. C₆H₆

Choose the correct option from the following.

- (1) B, C, D and A
- (2) D, C, B and A
- (3) A, B, C and D
- (4) C, D, B and A

Ans. **NTA (3)**
Reso (3)

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Sol. Vander wall constant a depends on intermolecular force of attraction so correct order of a is



Gas Vander-waal constant "a" (atm. L². mol⁻²)

Ar 1.355

C₆H₆ 18.57

CH₄ 2.253

H₂O 5.536

76. Which of the following have same number of significant figures ?

A. 0.00253

B. 1.0003

C. 15.0

D. 163

Choose the correct answer from the options given below

(1) A, C and D only

(2) B and C only

(3) C and D only

(4) A, B and C only

Ans. NTA (1)

Reso (1)

Sol. Number

signification figure

(i) 0.00252

3

(ii) 1.0003

5

(iii) 15.0

3

(iv) 163

3

77. Match List I with List II

List I Coordination Complex		List II Number of unpaired electrons	
A.	[Cr(CN) ₆] ³⁻	I.	0
B.	[Fe(H ₂ O) ₆] ²⁺	II.	3
C.	[Co(NH ₃) ₆] ³⁺	III.	2
D.	[Ni(NH ₃) ₆] ²⁺	IV.	4

Choose the correct answer from the options given below:

(1) A-II, B-I, C-IV, D-III

(2) A-II, B-IV, C-I, D-III

(3) A-IV, B-III, C-II, D-I

(4) A-III, B-IV, C-I, D-II

Ans. NTA (2)

Reso (2)

Sol. complex ion

Configuration

number of unpaired electron

(i) Cr(CN)₆³⁻ 24Cr³⁺ = 3d³ ⇒ t_{2g}^{1,1,1}, e_g^{0,0} 3

(ii) [Fe(H₂O)₆]²⁺ 26Fe²⁺ = 3d⁶ ⇒ t_{2g}^{2,1,1}, e_g^{1,1} 4

(iii) [Ni(NH₃)₆]²⁺ 28Ni²⁺ = 3d⁸ ⇒ t_{2g}^{2,2,2}, e_g^{1,1} 2

(iv) [Co(NH₃)₆]³⁺ 27Co³⁺ = 3d⁶ ⇒ t_{2g}^{2,2,2}, e_g^{0,0} 0

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78. The descending order of acidity for the following carboxylic acid is –

- A. CH₃COOH
- B. F₃C–COOH
- C. ClCH₂–COOH
- D. FCH₂–COOH
- E. BrCH₂–COOH

Choose the correct answer from the options given below:

- (1) B > D > C > E > A
- (2) B > C > D > E > A
- (3) E > D > B > A > C
- (4) D > B > A > E > C

Ans. NTA (1)

Reso (1)

Sol. –I effect of F > Cl > Br and greater the extent of –I effect, greater the acidity.

79. Given below are two statements:

Statement – I : Methyl orange is a weak acid.

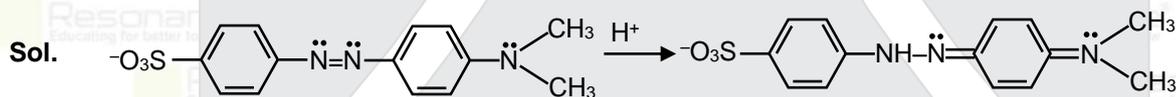
Statement – II : The benzenoid form of methyl orange is more intense/deeply coloured than the quinonoid form.

In the light of the above statements, choose the **most appropriate** answer from the options given below:

- (1) Statement I is incorrect but Statement II is correct
- (2) Both Statement I and Statement II are incorrect
- (3) Both Statement I and Statement II are correct
- (4) Statement I is correct but Statement II is incorrect

Ans. NTA (2)

Reso (2)



Benzenoid form of anion
(yellow in colour)

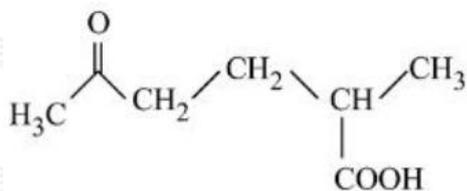
Quinonoid form of the anion
(Pinkish red in colour)

Methyl orange is basic in nature



Yellow Red

80. The correct IUPAC nomenclature for the following compound is:



- (1) 5-Methyl-2-oxohexan-6-oic acid
- (2) 2-Methyl-5-oxohexanoic acid
- (3) 5-Formyl-2-methylhexanoic acid
- (4) 2-Formyl-5-methylhexan-6-oic acid

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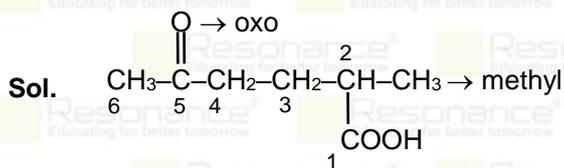
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Ans. NTA (2)

Reso (2)



2-Methyl-5-oxohexanoic acid

81. If the boiling points of two solvents X and Y (having same molecular weights) are in the ratio 2:1 and their enthalpy of vaporizations are in the ratio 1:2, then the boiling point elevation constant of X is M times the boiling point elevation constant of Y. The value of m is _____ (nearest integer).

Ans. NTA (8)

Reso (8)

Sol.
$$\Delta T_b = K_b m \quad K_b = \frac{RT_b^2 \times M_{\text{solvent}}}{1000 \times \Delta H_{\text{vap}}}$$

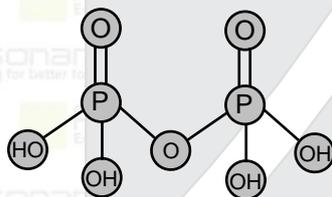
$$\frac{(\Delta T_b)_X}{(\Delta T_b)_Y} = \left[\frac{(T_b)_X}{(T_b)_Y} \right]^2 \times \frac{M_X}{M_Y} \times \frac{\Delta H_Y}{\Delta H_X} = \left(\frac{2}{1} \right)^2 \left(\frac{1}{1} \right) \times \frac{2}{1} = 8$$

82. The ratio of sigma and π bonds present in pyrophosphoric acid is _____.

Ans. NTA (6)

Reso (6)

Sol. Pyrophosphoric acid \Rightarrow $\text{H}_4\text{P}_2\text{O}_7$



$\text{H}_4\text{P}_2\text{O}_7$

Pyrophosphoric acid

Number of σ bond = 12

Number of π bond = 2

83. The number of atomic orbitals from the following having 5 radial nodes is _____.

7s, 7p, 6s, 8p, 8d

Ans. NTA (3)

Reso (3)

Sol. Number of radial node = $(n-l-1)$

orbital

(i) 7s

(ii) 7p

(iii) 8s

(iv) 8d

(v) 6s

number of radial node = $(n-l-1)$

$$(7-0-1) = 6$$

$$(7-1-1) = 5$$

$$(8-0-1) = 7$$

$$(8-2-1) = 5$$

$$(6-0-1) = 5$$

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84. For complete combustion of ethane,
 $C_2H_4(g) + 3O_2(g) \longrightarrow 2CO_2(g) + 2H_2O(l)$
 the amount of heat produced as measured in bomb calorimeter is 1406 kJ mol^{-1} at 300K . The minimum value of $T\Delta S$ needed to reach equilibrium is $(-)$ _____ kJ . (Nearest integer)

Given : $R = 8.3 \text{ JK}^{-1} \text{ mol}^{-1}$

Ans. **NTA (1411)**
Reso (1401)

Sol. For equilibrium $\Delta G = 0$

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

$$T\Delta S = \Delta H = \Delta E + \Delta n_g RT$$

$$\Delta H = 1406 + [-2] \times 8.314 \times 10^{-3} \times 300$$

$$= 1401 \text{ kJ/mol}$$

85. The solubility product of $BaSO_4$ is 1×10^{-10} at 298K . The solubility of $BaSO_4$ in $0.1 \text{ M } K_2SO_4(aq)$ solution is _____ $\times 10^{-9} \text{ gL}^{-1}$ (nearest integer).

Given : Molar mass of $BaSO_4$ is 233 g mol^{-1}

Ans. **NTA (233)**
Reso (233)

Sol. $BaSO_4(s) \rightleftharpoons Ba^{2+} + SO_4^{2-}$
 $s \qquad \qquad s + 0.1$

$$K_{sp} = s \times 0.1$$

$$s = 10^{-9} \text{ mole/litre} = 233 \times 10^{-9} \text{ g/litre}$$

86. Coagulating value of the electrolytes $AlCl_3$ and $NaCl$ for As_2S_3 are 0.09 and 50.04 respectively. The coagulating power of $AlCl_3$ is x times the coagulating power of $NaCl$. The value of x is _____.

Ans. **NTA (556)**
Reso (556)

Sol. Coagulating power $\propto \frac{1}{\text{Coagulating value}}$

$$\frac{\text{Coagulating power of } AlCl_3}{\text{Coagulating power of } NaCl} = \frac{\text{Coagulating value of } NaCl}{\text{Coagulating value of } AlCl_3}$$

$$= \frac{50.04}{0.09} = 556$$

87. The number of incorrect statements from the following is _____
- A. The electrical work that a reaction can perform at constant pressure and temperature is equal to the reaction Gibbs energy.
- B. E°_{cell} is dependent on the pressure.
- C. $\frac{dE^\circ_{\text{cell}}}{dT} = \frac{\Delta_r S^\circ}{nF}$
- D. A cell is operating reversibly if the cell potential is exactly balanced by an opposing source of potential difference.

Ans. **NTA (1)**
Reso (1)

Sol. E°_{cell} is defined at constant temperature and 1 bar pressure.

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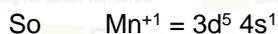
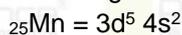
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88. The observed magnetic moment of the complex $[\text{Mn}(\text{NCS})_6]^{x-}$ is 6.06 BM. The numerical value of x is _____ .

Ans. NTA (4)

Reso (4)

Sol. On the basic magnetic moment number of unpaired electron = 6



89. The number of species from the following carrying a single lone pair on central atom Xenon is _____ .

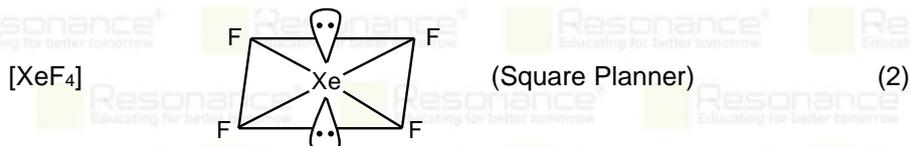
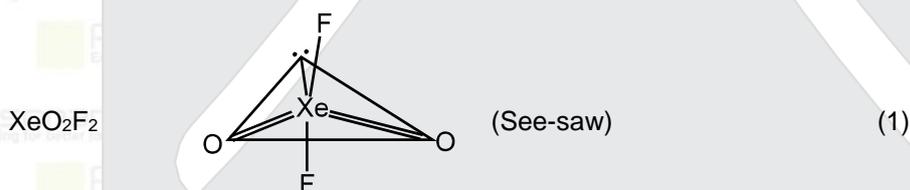
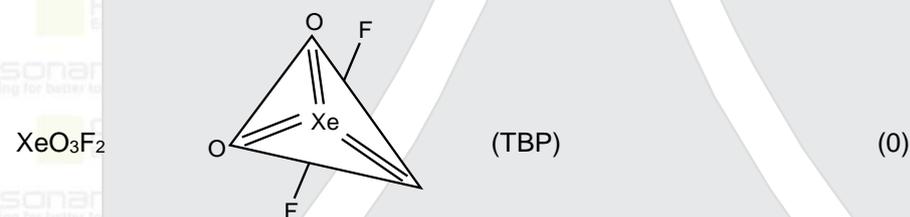


Ans. NTA (4)

Reso (4)

Sol. XeO_3 , XeOF_4 , XeO_2F_2 , XeOF_4 , XeF_5^-

number of lone pair of electron on central atom :



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90. The sum of oxidation state of the metals in $\text{Fe}(\text{CO})_5$, VO^{2+} and WO_3 is _____ .

Ans. NTA (10)

Reso (10)

Sol. $[\text{Fe}(\text{CO})_5]$ oxidation number of Fe = 0

VO^{2+} oxidation number of V = +4

WO_3 oxidation number of W = +6



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