

JEE Main 2021 September 1 Shift 2 Chemistry

1. Among following compound how many are paramagnetic in nature $K_2O, Li_2O, MnO, ZnO, Na_2O$

(A) 0

(B) 1

(C) 2

(D) 2

Ans. (B)

Sol. Unpaired electrons must be present for a compound to be paramagnetic. Oxide ion has fully filled orbitals and cation of alkali metal contain fully filled orbitals. MnO contains Mn^{+2} cation which has 5 unpaired electrons. Due to which MnO is paramagnetic.

Compound	Nature
K_2O	diamagnetic
Li_2O	diamagnetic
MnO	paramagnetic
ZnO	diamagnetic
Na_2O	diamagnetic

2. A metal ion M^{+3} have $[Ar]3d^5$ configuration than possible metal is :

(A) Fe

(B) Co

(C) Cr

(D) Mn

Ans. (A)

Sol. $Fe^{3+} = 3d^5 4s^0$

$Co^{3+} = 3d^6 4s^0$

$Cr^{3+} = 3d^3 4s^0$

$Mn^{3+} = 3d^4 4s^0$

$M^{+3} = [Ar]3d^5 4s^0$

$$M = [Ar]3d^64s^2$$

so Z for $M = 26$ and M is Fe .

3. Which one of the following oxides of nitrogen does not have N-N bond

(A) N_2O_4

(B) N_2O

(C) N_2O_3

(D) N_2O_5

Ans. (D)

Sol. N_2O_5 contains an N-O-N bond.

Formula	Resonance structure
N_2O_4	
N_2O	$\ddot{N} = N = \ddot{O} \longleftrightarrow :N \equiv N - \ddot{O}:$
N_2O_3	
N_2O_5	

4. Malachite and calamine are ore of

(A) Zn and Cu

(B) Cu and Zn

(C) Fe and Cu

(D) *Ag and Cu*

Ans. (B)

Sol. Malachite $\Rightarrow \text{CuCO}_3 \cdot \text{Cu(OH)}_2$

Calamine $\Rightarrow \text{ZnCO}_3$

5. Which of the following metal ion have magnetic moment (spin only) 3.78 B. M.

(A) Co^{3+}

(B) Mn^{2+}

(C) V^{3+}

(D) Cr^{3+}

Ans. (D)

Sol. $\mu = \sqrt{n(n+2)} = 3.78 \Rightarrow n = 3$

Metal ion	Electronic configuration	Unpaired electrons
(1) Co^{3+}	$[\text{Ar}]3d^64s^0$	4
(2) Mn^{2+}	$[\text{Ar}]3d^44s^0$	4
(3) V^{3+}	$[\text{Ar}]3d^14s^0$	1
(4) Cr^{3+}	$[\text{Ar}]3d^34s^0$	3

6. Magnetic moment (spin only) of B_2^+ ion is $\times 10^{-2}$ B. M [Given $\sqrt{3} = 1.73$ B. M.]

Ans. 173

Sol. In B_2^+ ion number of electrons = 9

$$\text{B}_2^+ = (\sigma 1s)^2(\sigma^* 1s)^2(\sigma 2s)^2(\sigma^* 2s)^2(\pi 2p_x)^1 = \pi 2p_y^0$$

so, number unpaired electron = 1

$$\mu = \sqrt{n(n+2)} \text{ B. M.}$$

$$\mu = \sqrt{3} \text{ B. M.} = 1.73 = 173 \times 10^{-2} \text{ B. M}$$

7. A bulb of 120 watt emits of light of wavelength 920 nm then number of photons emitted by bulb per second are $[X] \times 10^{20}$, then value of X is

[Report your answer to the nearest integer].

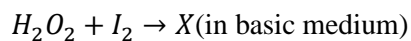
Ans. 6

Sol. Power = 120J/sec

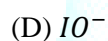
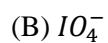
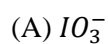
$$E = n \left[\frac{hc}{\lambda} \right]$$

$$n = \left[\frac{120 \times 920 \times 10^{-9}}{6.62 \times 10^{-34} \times 3 \times 10^8} \right] = 5558.9 \times 10^{17} = 5.5589 \times 10^{20}$$

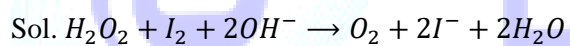
8. In reaction



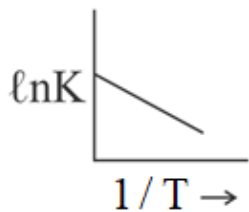
then 'X' is



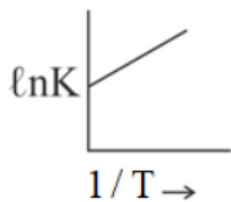
Ans. (C)



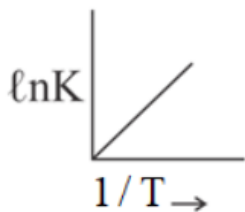
9. For endothermic reaction which is correct graph



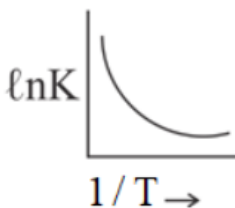
(A)



(B)



(C)



(D)

Ans. (A)

Sol. $\Delta G = \Delta H - T\Delta S$

$$-RT \ln K_{eq} = \Delta H - T\Delta S$$

$$\ln K_{eq} = \left[\frac{-\Delta H}{R} \right] \frac{1}{T} + \left[\frac{\Delta S}{R} \right] \frac{1}{T}$$

$$\text{Slope} = \frac{-\Delta H}{R}$$

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10. For a reaction $\Delta H = -158.73 \text{ kJ/mol}$, $\Delta S = -58.1 \text{ J/K}$ $T = 298 \text{ K}$, then value of ΔG (in kJ) is :

[Report your answer to nearest integer]

Ans. 141

Sol. $\Delta G = \Delta H - T\Delta S$

$$= -158.73 - \frac{298(-58.1)}{1000} = -158.73 + 17.31 = 141.4 \text{ kJ}$$

11. What is the sum of oxidation number of Ag in $[Ag(NH_3)_2]^+$ and $[Ag(CN)_2]^-$ is

Ans. 2

Sol. $[Ag(NH_3)_2]^+$; $[Ag(CN)_2]^-$

The sum of the oxidation states of all atoms in a species is equal to charge present on that species. In both the molecules silver oxidation state is +1.

12. Number of sodium atom present in 8 gram of sodium is $[X] \times 10^{23}$, then value of 'X' is.. [Take $N_A = 6 \times 10^{23}$] [Report your answer to nearest integer]

Ans. 2

Sol. Number of moles of sodium = $\left[\frac{8}{23}\right]$

Number of sodium atoms = $\left[\frac{8}{23}\right] \times 6.023 \times 10^{23} = 2.09 \times 10^{23}$

13. Colour of Fe^{2+} and Fe^{3+} ion in aqueous solution is respectively?

- (A) Green, Yellow
- (B) Brown, Yellow
- (C) Red, Brown
- (D) Yellow, Green

Ans. (A)

Sol.

Configuration	Example	Colour
$3d^6$	Fe^{+2}	Green
$3d^5$	Fe^{+3}	Yellow

14. For a octahedral aqueous complex of a metal ion $CFSE = -0.8\Delta_0$ and Magnetic moment (spin only) = $3.87BM$, then metal ion is :

- (A) Co^{2+}
- (B) Mn^{4+}
- (C) V^{2+}
- (D) Cr^{3+}

Ans. (A)

Sol. CFSE for octahedral complex = $[-0.4n_{t_{2g}} + 0.6n_{e_g}]\Delta_0 + n(P)$

As $\mu=3.87 BM$

so number unpaired electrons = 3.

Metal ion	configuration	CFSE
$Co^{2+} = 3d^7$	$t_{2g}^{2,2,1}, e_g^{1,1}$	$CFSE = -0.8\Delta_0$
$Mn^{4+} = 3d^3$	$t_{2g}^{1,1,1}, e_g^{0,0}$	$CFSE = -1.2\Delta_0$
$V^{2+} = 3d^3$	$t_{2g}^{1,1,1}, e_g^{0,0}$	$CFSE = -1.2\Delta_0$
$Cr^{3+} = 3d^3$	$t_{2g}^{1,1,1}, e_g^{0,0}$	$CFSE = -1.2\Delta_0$

15. Chemical formula of phosgene is :

- (A) $COCl_2$
- (B) $CaOCl_2$
- (C) $CaCO_3$
- (D) $COCl$

Ans. (A)

Sol. Phosgene: $COCl_2$

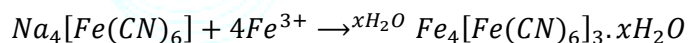
IUPAC Name : Carbonyl dichloride

16. What is added to potassium ferrocyanide (Lassigne nitrogen test) to give Prussian blue colour.

- (A) $FeCl_3$
- (B) $FeCl_2$
- (C) $CoCl_3$
- (D) $CoCl_2$

Ans. (A)

Sol. $6NaCN + FeSO_4 \rightarrow Na_4[Fe(CN)_6]$



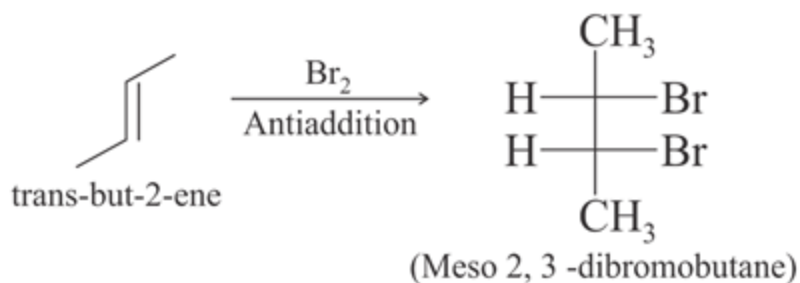
Ferric ferrocyanide (Prussian blue complex)

17. Stereoisomer that are formed electrophilic addition of bromine to trans but-2-ene.

- (A) (\pm) 2,3-dibromobutane
- (B) Meso-2,3-dibromobutane
- (C) $(+)$ 2,3 -dibromobutane
- (D) 2,2 -dibromobutane

Ans. (B)

Sol. The reaction takes place via formation of cyclic bromonium ion, hence, the nucleophile attacks from the opposite side of the cyclic ring. Hence, the addition is antiaddition.

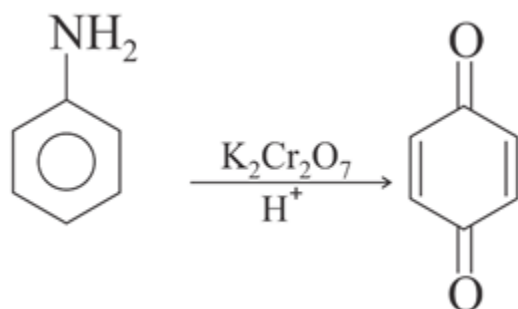
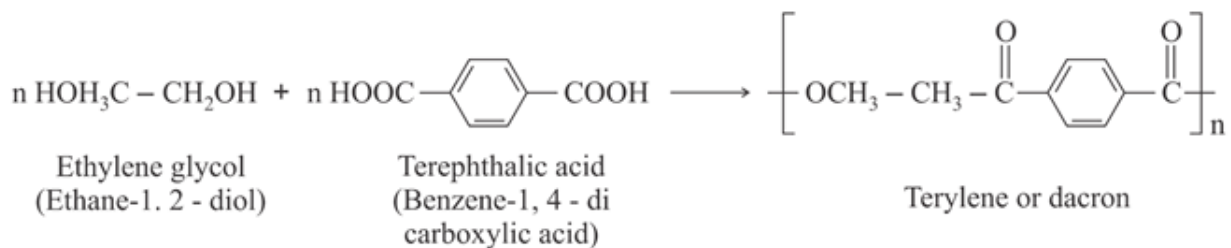


18. Monomer of Dacron:

- (A) glyptal
- (B) Salicylic acid
- (C) Isoprene
- (D) Terephthalic acid

Ans. (D)

Sol.



19.

- (A) Nitrobenzene
- (B) Acetophenone
- (C) Quinol
- (D) Para Benzoquinone

Ans. (D)

Sol: Aniline undergoes oxidation with potassium dichromate and gives para benzoquinone.

20. BOD of clean water is :

(A) 7ppm

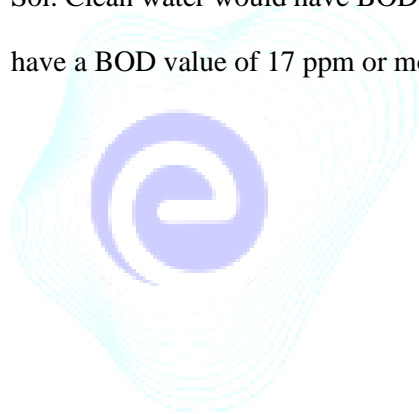
(B) 5 ppm

(C) 3ppm

(D) 9ppm

Ans. (C)

Sol. Clean water would have BOD value of less than 5 ppm whereas highly polluted water could have a BOD value of 17 ppm or more.



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