

DPP No.# B1 (JEE-MAIN)

Total Marks: 45

Max. Time: 33 min.

Single choice Objective ('-1' negative marking) Q.1 to Q.12

(3 marks, 2 min.)

[36, 24]

Numerical Value Questions ('0' negative marking) Q.13 to Q.15

(3 marks, 3 min.)

[09, 09]

1. Amongst LiCl, RbCl, BeCl₂ and MgCl₂, the compounds with the greatest and the least ionic character, respectively are
(A) LiCl and RbCl (B) RbCl and BeCl₂ (C) RbCl and MgCl₂ (D) MgCl₂ and BeCl₂
2. Which of the following is ionic ?
(A) KHF₂ (s) (B) CaC₂ (s) (C) PCl₅ (s) (D) All
3. Which of the following cannot conduct electricity ?
(A) Ionic compounds in aqueous state (B) Metallic crystals in solid state
(C) Polar covalent compounds in molten state (D) None of above
4. CaCN₂ has :
(A) 2σ bonds, 2π bonds (B) 3σ bonds, 1π bond
(C) 1σ bond, 2π bonds (D) 3σ bonds, 2π bonds
5. In SO₂ molecule, there are two σ-bonds and two π-bonds. The two π-bonds are formed by :
(A) pπ–pπ overlap between S and O atoms
(B) sp²–p overlap between S and O atoms
(C) one by pπ–pπ overlap and other by pπ–dπ overlap
(D) both by pπ–dπ overlap
6. Which of the following cannot be explained on the basis of Fajan's Rules.
(A) Ag₂S is much less soluble than Ag₂O
(B) Fe(OH)₃ is much less soluble than Fe(OH)₂
(C) BaCO₃ is much less soluble than MgCO₃
(D) Melting point of AlCl₃ is much less than that of NaCl
7. Orbital angular momentum of an electron in a particular subshell is $\sqrt{5} \frac{h}{\pi}$. The maximum number of electrons having $s = -\frac{1}{2}$, present in this subshell is :
(A) 7 (B) 9 (C) 11 (D) 18
8. Match list-I with list-II and choose the correct answer.
- | | List-I | | List-II |
|-----|-------------------------------|-----|----------------------|
| (P) | SO ₃ | (1) | Square planar |
| (Q) | ClO ₃ ⁻ | (2) | trigonal bipyramidal |
| (R) | ICl ₄ ⁻ | (3) | pyramidal |
| (S) | PCl ₅ | (4) | trigonal planar |
- Codes :
- | | | | | | | | | | |
|-----|---|---|---|---|-----|---|---|---|---|
| | P | Q | R | S | | P | Q | R | S |
| (A) | 1 | 3 | 4 | 2 | (B) | 4 | 3 | 1 | 2 |
| (C) | 4 | 2 | 1 | 3 | (D) | 1 | 2 | 4 | 3 |
9. Least melting point is shown by the compound :
(A) PbCl₂ (B) SnCl₄ (C) NaCl (D) AlCl₃
10. The average charge on each O atom and average bond order of S–O bond in SO₄²⁻ is :
(A) –1 & 1.67 (B) –1/2 & 1.5 (C) –1/2 & 1.67 (D) –1/2 & 1.33
11. The nodal plane in the π-bond of ethene is located in -
(A) the molecular plane
(B) a plane parallel to molecular plane
(C) a plane perpendicular to the molecular plane which bisects the carbon - carbon sigma bond at right angle
(D) a plane perpendicular to the molecular plane which contains the carbon-carbon σ-bonds

12. Which of the following models best describes the bonding within a layer of the graphite structure ?
 (A) metallic bonding (B) ionic bonding
 (C) non-metallic covalent bonding (D) van der Waals forces
13. A mixture of 4.9 g H_2SO_4 and 200 ml of $\frac{1}{4}$ M H_3PO_3 (basicity = 2) was completely neutralised by x g NaOH. Calculate 5x.
14. A 448 l vessel contains $\text{O}_2(\text{g})$ & $\text{CO}_2(\text{g})$ in 2 : 3 mole ratio at 2 atm & 0°C . Calculate the no. of moles of $\text{CO}_2(\text{g})$ present in the vessel. ($R = 0.0821 \text{ L-atm/mole-K}$)
15. Calculate the maximum total number of electrons in ${}_{31}\text{Ga}$ with spin $+\frac{1}{2}$ which occupy orbitals having atleast one nodal plane.

DPP No. # B2 (JEE-ADVANCED)

Total Marks: 35

Max. Time: 23 min.

Multiple choice objective ('-1' negative marking) Q.1 to Q.5

(4 marks, 2 min.)

[20, 10]

Comprehension ('-1' negative marking) Q.6 to Q.7

(3 marks, 2 min.)

[06, 04]

Numerical Value Questions ('0' negative marking) Q.8 to Q.10

(3 marks, 3 min.)

[09, 09]

- 1.* Which among the following molecules have sp^3d hybridisation with one lone pair of electrons on the central atom ?
 (i) SF_4 (ii) $[\text{PCl}_4]^+$ (iii) XeO_2F_2 (iv) ClOF_3
 (A) (i) (B) (ii) (C) (iii) (D) (iv)
- 2.* Which of the following statement(s) are **incorrect** for H_3BO_3 ?
 (A) It is an odd electron molecule.
 (B) It in water acts as proton donor.
 (C) It in solid state have hydrogen bonding.
 (D) It is a useful primary standard for titrating against acids.
- 3.* Which of the following statement(s) is/are correct from the point of view of molecular orbital?
 (A) Be_2 is not a stable molecule
 (B) He_2 is not stable but He_2^+ is expected to exist
 (C) Bond strength of N_2 is maximum amongst the homonuclear diatomic molecules
 (D) The order of energies of molecular orbitals in F_2 molecule is
 $E(\sigma 2s) < E(\sigma^* 2s) < E(\pi 2p_x) = E(\pi 2p_y) < E(\sigma 2p_z) < E(\pi^* 2p_x) = E(\pi^* 2p_y) < E(\sigma^* 2p_z)$
- 4.* Which of the following statement(s) is/are true for the metallic bond ?
 (A) It is an electrical attraction between delocalised electrons and the positive part of the atom.
 (B) Transition metals may use inner d- electrons along with the outer s- electrons for metallic bonding.
 (C) Strength of metallic bond does not depend on the type of hybrid orbitals participating in metallic bonding.
 (D) Strength of metallic bond is inversely proportional to the radius of metallic atom.
- 5.* Which is /are correct order for net dipole moment :
 (A) $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$ (B) $\text{CH}_3\text{F} > \text{CD}_3\text{F}$
 (C) $\text{SO}_2 > \text{SO}_3$ (D) $\text{CH}_3\text{CH}=\text{CHCl}(\text{cis}) > \text{CH}_3\text{CH}=\text{CHCl}(\text{trans})$

Comprehension

When a H-atom is bonded to a highly electronegative atom with lone pair of electron (say, Z) by a covalent bond, the bond pair of electrons is displaced towards the electronegative atom. When solitary electron of hydrogen atom lies away from it, its nucleus gets exposed and behaves as a bare proton. Such a bare hydrogen nucleus exerts a strong electrostatic attraction on the electronegative atom of the adjacent molecule. This interaction

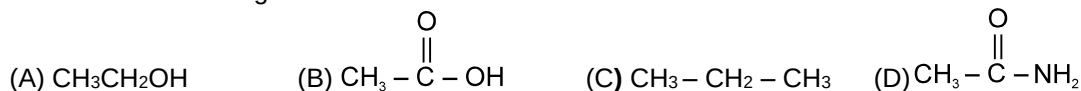


between hydrogen atom of one molecule and the electronegative atom of the other molecules is referred to as hydrogen bond.

Larger the electronegativity of the other atom, greater is the strength of hydrogen bond. For example, electronegativities of F, O and N decrease as $F > O > N$ consequently, strengths of H-bonds decreases. If the size of electronegative atom is large, its attractive force with hydrogen atom will be less and consequently, strength of H-bond will be less. Strength of H-bond increases with the increase in availability of lone pair of electron on the electronegative element. The order of the availability of lone pair of electron is $N > O > F$.

The presence of two hydrogen atoms and two lone pair of electrons in each water molecule results in a three dimensional tetrahedral cage like structure. This accounts for the fact that ice is less dense than water at 0°C . If temperature is increased hydrogen bond starts breaking and molecule come closer. Which increases the density but after 4°C density of water decreases with increase in temperature due to normal thermal expansion.

6. Which of the following substances does not form H-bond with water :



7. Which of the above statement is true :

- I. When ice is melted, hydrogen bond starts breaking & molecule of water come closer by moving into vacant space. As a result, density of water decreases upto 4°C .
 II. Due to open cage like structure, ice has a relatively large volume for a given mass of liquid water.
 III. In ice, there are four water molecules attached tetrahedrally.

- (A) I, II and III (B) I and III (C) II and III (D) II only

8. How many of the following molecules are polar?

- (i) CO_2 (ii) SO_2 (iii) NO_2 (iv) SOCl_2
 (v) COCl_2 (vi) $\text{BeCl}_2(\text{g})$ (vii) TeCl_4 (viii) CCl_4
 (ix) ClO_2

9. The maximum number of electrons that can have principal quantum number, $n = 3$, spin, azimuthal quantum number, $m_s = -1/2$ and $\ell = 2$.

10. How many of the following will exhibit Hydrogen bonding in water ?
 CH_3CN , $\text{C}_6\text{H}_5\text{OH}$, D_2O , H_3PO_3 , SO_3 , CO_2 , F_2 , KF , CH_3COOH , CH_3OCH_3 .

DPP No.# B3 (JEE-MAIN)

Total Marks: 45

Max. Time: 33 min.

Single choice Objective ('-1' negative marking) Q.1 to Q.12

(3 marks, 2 min.)

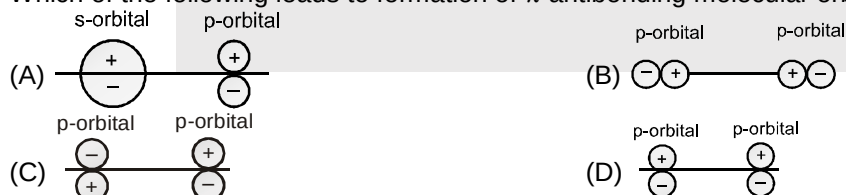
[36, 24]

Numerical Value Questions ('0' negative marking) Q.13 to Q.15

(3 marks, 3 min.)

[09, 09]

1. Which of the following leads to formation of π -antibonding molecular orbital ?



2. How many nodal plane is/are present in σ_{1s} bonding molecular orbital?

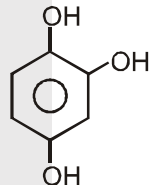
- (A) zero (B) 1 (C) 2 (D) 3

3. Which of the following pairs of species would you expect to have largest difference in magnetic moment?

- (A) O_2 , O_2^+ (B) O_2 , O_2^{2-} (C) O_2^+ , O_2^{2-} (D) O_2^- , O_2^+

4. If the electronic configuration of ${}_5\text{B}$ is written as $1s^5$, then it represents an arrangement with minimum energy. Which of the following is violated in such a case :

- (A) Aufbau principle (B) Pauli's Exclusion principle
 (C) Hund's rule (D) Heisenberg's uncertainty principle.

5. Which of the following is electron-deficient ?
 (A) $(\text{SiH}_3)_2$ (B) $(\text{BH}_3)_2$ (C) PH_3 (D) $(\text{CH}_3)_2$
6. According to molecular orbital theory, the paramagnetism of O_2 molecule is due to the presence of :
 (A) unpaired electrons in the bonding σ molecular orbital.
 (B) unpaired electrons in the antibonding σ molecular orbital.
 (C) unpaired electron in the bonding π molecular orbitals.
 (D) unpaired electrons in the antibonding π molecular orbitals.
7. Select the correct order(s).
 (A) $\text{PH}_3 < \text{AsH}_3 < \text{NH}_3 < \text{SbH}_3$: bond angle (B) $\text{F}_2\text{O} > \text{H}_2\text{O} > \text{Cl}_2\text{O}$: bond angle
 (C) $\text{O}_2 < \text{O}_3 < \text{O}_2^{2-}$: O – O bond length (D) $\text{BF}_3 > \text{BCl}_3 > \text{BBr}_3$: bond angle
8. The smallest bond angle among PF_3 , PCl_3 , PH_3 and PI_3 is in :
 (A) PF_3 (B) PCl_3 (C) PH_3 (D) PI_3
9. Which of the following molecular orbital has nodal planes perpendicular to each other ?
 (A) $\sigma 2s$ (B) $\pi 2p_x$ (C) $\pi^* 2p_x$ (D) $\sigma^* 2p_z$
10. The dipole moments of the given molecules are such that :
 (A) $\text{BF}_3 > \text{NF}_3 > \text{NH}_3$ (B) $\text{NF}_3 > \text{BF}_3 > \text{NH}_3$ (C) $\text{NH}_3 > \text{NF}_3 > \text{BF}_3$ (D) $\text{NH}_3 > \text{BF}_3 > \text{NF}_3$.
11. The type of molecular force of attraction present in the following compound is :

 (A) Intermolecular H-bonding (B) Intramolecular H-bonding
 (C) Both (A) and (B) (D) None of these
12. The electronic configuration of C, if Hund's rule is not necessarily followed, can be :
 (A) $\begin{array}{cc} 2s & 2p \\ \uparrow\downarrow & \uparrow\uparrow\downarrow \end{array}$ (B) $\begin{array}{cc} 2s & 2p \\ \uparrow\downarrow & \uparrow\downarrow\uparrow \end{array}$
 (C) $\begin{array}{cc} 2s & 2p \\ \uparrow\downarrow & \uparrow\downarrow\downarrow \end{array}$ (D) $\begin{array}{cc} 2s & 2p \\ \uparrow\downarrow & \uparrow\downarrow\uparrow\downarrow \end{array}$
13. The dipole moment of HBr is 7.95 debye and the intermolecular separation is $1.94 \times 10^{-10} \text{ m}$. Find the % ionic character in HBr molecule.
14. Find the sum of number of P-P bonds and P-S bonds in a molecule of P_4S_3 .
15. An unknown gas SO_x diffuses slowly than O_2 but faster than SF_2 . Considering that x is a positive integer, find ratio of rate of diffusion of He w.r.t. SO_x .

DPP No.# B4 (JEE-ADVANCED)

Total Marks: 40

Max. Time: 28 min.

Multiple choice objective ('-1' negative marking) Q.1 to Q.5

(4 marks, 2 min.)

[20, 10]

Numerical Value Questions ('0' negative marking) Q.6 to Q.9

(3 marks, 3 min.)

[12, 12]

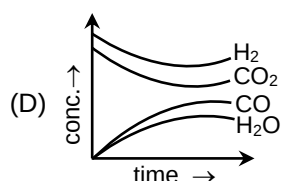
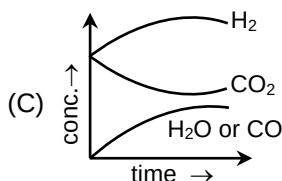
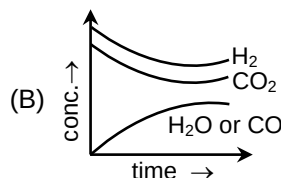
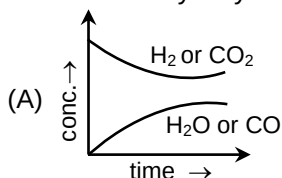
Match the Following (no negative marking) Q.10

(8 marks, 6 min.)

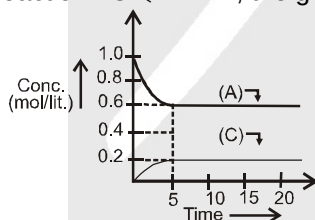
[08, 06]

- 1.* Which of the following reaction(s) is/are follow the relationship, $\log \frac{K_p}{K_c} - \log RT = 0$
- (A) $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$
 (B) $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$
 (C) $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightleftharpoons 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
 (D) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$

- 2.* Which of the following graphs is/are correct for the given reaction ,
 $\text{H}_2(\text{g}) + \text{CO}_2(\text{g}) \rightleftharpoons \text{H}_2\text{O}(\text{g}) + \text{CO}(\text{g})$.
 Assume initially only H_2 & CO_2 are present .



- 3.* The equilibrium of which of the following reactions will not be disturbed by the addition of an inert gas at constant volume and constant temperature ?
 (A) $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$ (B) $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$
 (C) $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightleftharpoons \text{CH}_3\text{OH}(\text{g})$ (D) $\text{C}(\text{s}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + \text{H}_2(\text{g})$
- 4.* The exothermic formation of ClF_3 is represented by the equation :
 $\text{Cl}_2(\text{g}) + 3\text{F}_2(\text{g}) \rightleftharpoons 2\text{ClF}_3(\text{g}) ; \Delta_r H = -329 \text{ J}$
 which of the followings will decrease the quantity of ClF_3 in an equilibrium mixture of Cl_2 , F_2 and ClF_3 .
 (A) Adding F_2 (B) Increasing the volume of container
 (C) Adding inert gas at constant pressure (D) Increasing the temperature
- 5.* For the equilibrium $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}(\text{s}) \rightleftharpoons \text{CuSO}_4 \cdot \text{H}_2\text{O}(\text{s}) + 4\text{H}_2\text{O}(\text{g})$, the equilibrium constant $K_p = 2.56 \times 10^{-10} \text{ atm}^4$ at 27°C . Now, if an air sample 40% saturated with water vapour is exposed to the above reaction at equilibrium, which of the following statement(s) is/are correct :
 Given : Saturated vapour pressure of water at 27°C is 12.5 torr.
 (A) Mass of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ will increase. (B) Mass of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ will decrease.
 (C) Mass of $\text{CuSO}_4 \cdot \text{H}_2\text{O}$ will increase. (D) Mass of $\text{CuSO}_4 \cdot \text{H}_2\text{O}$ will decrease.
6. In how many of the following species, the underlined atom has fractional oxidation number (on an average)?
 N_2O_3 , Fe_3O_4 , $\text{Na}_2\text{S}_4\text{O}_6$, KO_2 , Na_2S_5 , KMnO_4 , MnO_2 , C_3O_2
- 7.* For the reaction $2\text{C} \rightleftharpoons 2\text{A}$, the graph between concentration and time is shown as



what is the value of K_c for the reaction?

- 8.* By how many of the following ways, the concentration of CO_2 can be increased at equilibrium ?
 $\text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \quad \Delta H = +ve$
 (a) By increasing temperature ($V = \text{constant}$) (b) By decreasing volume ($T = \text{constant}$)
 (c) By increasing volume ($T = \text{constant}$) (d) By adding more $\text{CO}(\text{g})$ ($V, T = \text{constant}$)
 (e) By removing $\text{H}_2(\text{g})$ ($V, T = \text{constant}$) (f) By adding inert gas ($P, T = \text{constant}$)
 (g) By adding inert gas ($V, T = \text{constant}$) (h) By increasing pressure ($T = \text{constant}$)
 (i) By addition of catalyst ($P, V, T = \text{constant}$)
9. Consider the following reversible reactions :
 $\text{A} + \text{B} \rightleftharpoons \text{P} ; K_c = 6$
 $2\text{B} + \text{C} \rightleftharpoons 2\text{D} ; K_c = 4$

Hence, what will be the K_c for the reaction, $\text{A} + \text{D} \rightleftharpoons \text{P} + \frac{\text{C}}{2}$.

10. Match the following.

Reaction (Homogeneous gaseous phase)		Degree of dissociation of reactant in terms of equilibrium constant	
A	$A + B \rightleftharpoons 2C$	(p)	$(\sqrt{k})/(1 + \sqrt{k})$
B	$2A \rightleftharpoons B + C$	(q)	$(\sqrt{k})/(2 + \sqrt{k})$
C	$A + B \rightleftharpoons C + D$	(r)	$2k/(1 + 2k)$
D	$AB \rightleftharpoons \frac{1}{2}A_2 + \frac{1}{2}B_2$	(s)	$\frac{2\sqrt{k}}{1 + 2\sqrt{k}}$

DPP No. B5 (JEE-MAIN)

Total Marks: 45

Max. Time: 33 min.

Single choice Objective ('-1' negative marking) Q.1 to Q.12

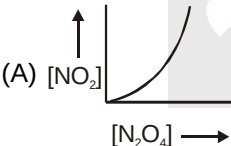
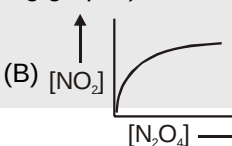
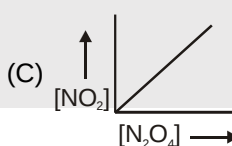
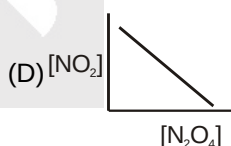
(3 marks, 2 min.)

[36, 24]

Numerical Value Questions ('0' negative marking) Q.13 to Q.15

(3 marks, 3 min.)

[09, 09]

1. For the reaction : $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ at 360 K, the value of $K_c = 0.4$ mole lit^{-1} . The value of K_p for the reaction at the same temperature would be :
(A) 12 atm (B) 1.2 atm (C) 1.2×10^3 atm (D) 1.33×10^{-2} atm
2. For the equilibrium $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ in a closed vessel, K_p is found to be double of K_c . This is attained when :
(A) $T = 2$ K (B) $T = 17.22$ K (C) $T = 24.36$ K (D) $T = 6.09$ K
3. For the given reaction at equilibrium :
 $AgNO_3(s) \rightleftharpoons Ag(s) + NO_2(g) + \frac{1}{2}O_2(g)$
If total pressure at equilibrium is P, then K_p for the given reaction will be :
(A) $K_p = \frac{2}{3^{3/2}} P^{3/2}$ (B) $K_p = \frac{2}{3^{1/2}} P^{1/2}$ (C) $K_p = \frac{1}{3^{2/3}} P^{3/2}$ (D) $K_p = \frac{1}{3^{2/3}} P^{3/2}$
4. The number of moles of chromite ore ($FeCr_2O_4$) that can be produced by allowing 0.2 moles of Fe, 0.3 moles of Cr and 0.4 moles of O_2 to combine according to the following reaction :
 $Fe + 2Cr + 2O_2 \longrightarrow FeCr_2O_4$
(A) 0.2 (B) 0.15 (C) 0.9 (D) 0.3
5. The graph which will be representing all the equilibrium concentrations for the reaction
 $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ will be :
(the concentrations of $N_2O_4(g)$ and of $NO_2(g)$ for which the following reaction will be at equilibrium will lie on which of the following graphs)
- (A)  (B)  (C)  (D) 
6. In a reversible chemical reaction having two reactants in equilibrium with one product, if the initial concentration of both the reactants is doubled, then the equilibrium constant will :
(A) also be doubled (B) be halved
(C) become one fourth (D) remain the same.
7. The number of Br^- ions in 2.67 gram $AlBr_3$ is ($N_A = 6 \times 10^{23}$) :
(A) 1.5×10^{22} (B) 1.8×10^{21} (C) 6×10^{21} (D) 18×10^{21}
8. Volume of H_2 evolved at STP on complete reaction of 27g of aluminium with excess of aqueous NaOH would be:
 $Al + NaOH + H_2O \longrightarrow Na[Al(OH)_4] + H_2$
(A) 22.4 litres (B) 44.8 litres (C) 67.2 litres (D) 33.6 litres

9. For the reaction $A(g) + B(g) \rightleftharpoons C(g)$ at equilibrium, the partial pressure of the species are $P_A = 0.15$ atm, $P_C = P_B = 0.30$ atm. If the capacity of reaction vessel is reduced, the equilibrium is re-established. In the new situation, partial pressure A and B become twice. What is the partial pressure of C :
 (A) 0.3 atm (B) 0.6 atm (C) 1.2 atm (D) 1.8 atm
10. At low pressure, if $RT = 2\sqrt{a \cdot P}$, then the volume occupied by one mole of vander Waal's gas is :
 (A) $\frac{2RT}{P}$ (B) $\frac{2P}{RT}$ (C) $\frac{RT}{2P}$ (D) $\frac{2RT}{P}$
11. The value of K_{P_1} and K_{P_2} for the reactions
 $X \rightleftharpoons Y + Z$ (1) and $A \rightleftharpoons 2B$ (2)
 are in the ratio of 9 : 1. If the degree of dissociation of X and A be equal, then total pressure at equilibrium (1) and (2) are in the ratio
 (A) 3 : 1 (B) 1 : 9 (C) 36 : 1 (D) 1 : 1
12. A reaction mixture containing H_2 , N_2 and NH_3 has partial pressure 2 atm, 1 atm and 3 atm respectively at 725 K. If the value of K_P for the reaction, $N_2 + 3H_2 \rightleftharpoons 2NH_3$ is $4.28 \times 10^{-5} \text{ atm}^{-2}$ at 725 K, in which direction the net reaction will go :
 (A) Forward (B) Backward
 (C) No net reaction (D) Direction of reaction cannot be predicted
13. If the density of a gas sample is 4 g/L at pressure 1.2×10^5 Pa. Find out the value of V_{RMS} (in m/s)
14. If the de-Broglie wavelength of electron in p^{th} orbit of He^+ ion is 11.66 Å, find the value of p. Given radius of 1st orbit of H-atom is 0.53 Å.
15. The number of vacant hybrid orbitals which participate in the formation of 3-centre 2 electron bonds i.e., banana bonds in diborane structure is :

DPP No. # B6 (JEE-ADVANCED)

Total Marks: 41

Max. Time: 27 min.

Multiple choice objective ('-1' negative marking) Q.1 to Q.6

(4 marks, 2 min.)

[24, 12]

Numerical Value Questions ('0' negative marking) Q.7 to Q.9

(3 marks, 3 min.)

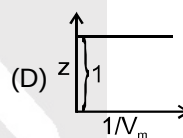
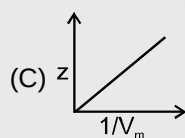
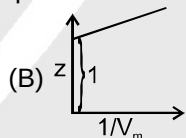
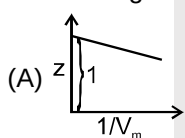
[09, 09]

Match the Following (no negative marking) Q.10

(8 marks, 6 min.)

[08, 06]

- 1.* For a real gas under low pressure conditions, which of the following graph is/are incorrect ?



- 2.* An industrial fuel, 'water gas', which consists of a mixture of H_2 and CO can be made by passing steam over red-hot carbon. The reaction is $C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$, $\Delta H = +131 \text{ kJ}$. The yield of CO and H_2 at equilibrium would be shifted to the product side by
 (A) raising the partial pressure of the steam (B) adding hot carbon
 (C) raising the temperature (D) reducing the volume of the system
- 3.* Which of the following can act both as a Bronsted acid & a Bronsted base (amphiprotic species) :
 (A) NH_3 (B) $H_2PO_3^-$ (C) HCO_3^- (D) OH^-
- 4.* Which of the following statements is/are incorrect at $25^\circ C$:
 (A) pK_a for H_3O^+ is 15.74 (B) Percentage dissociation of water is $1.8 \times 10^{-9} \%$
 (C) $pK_a + pK_b = pK_w$ for HCl & ClOH (D) pK_b for OH^- is -1.74
- 5.* Which of the following increases with dilution at a given temperature :
 (A) pH of 10^{-3} M acetic acid solution
 (B) pH of 10^{-3} M aniline solution
 (C) degree of dissociation of 10^{-3} M acetic acid solution
 (D) degree of dissociation of 10^{-3} M aniline solution

- 6.* Which of following solutions can act as buffer ?
 (A) NaHS + Na₂S (B) NaNO₃ + HNO₃
 (C) H₃PO₄ + NaH₂PO₄ (D) KCl + KOH
7. The density of an equilibrium mixture of N₂O₄ and NO₂ at 1 atm and $\frac{2400}{7}$ K is 1.84 g/L. Calculate K_c for the equilibrium : N₂O₄(g) $\rightleftharpoons$ 2NO₂(g)
8. The total number of different kind of buffers obtained during the titration of H₃AsO₄ with NaOH are :
9. How many of the following species on mixing with water produce acidic solutions ?
 FeCl₃ ; CuSO₄ ; CO₂ ; NaCl ; KCN ; NH₄Cl ; C₆H₅NH₃⁺Cl⁻ ; BCl₃, CaCO₃;
10. Match the column :

	Column-I		Column-II
(A)	NaCl (aq.)	(p)	Significant cationic hydrolysis
(B)	CH ₃ COONH ₄ (aq.)	(q)	Significant anionic hydrolysis
(C)	K ₂ SO ₄ . Al ₂ (SO ₄) ₃ . 24H ₂ O (aq.)	(r)	Acidic (pH < 7)
(D)	NaCN (aq)	(s)	Basic (pH > 7)
		(t)	pH is independent of concentration

Given : $K_{a1} = 5 \times 10^{-7}$, $K_{a2} = 5 \times 10^{-11}$ for H₂CO₃
 $K_a(\text{CH}_3\text{COOH}) = 1.8 \times 10^{-5}$; $K_b(\text{NH}_4\text{OH}) = 1.8 \times 10^{-5}$

DPP No.# B7 (JEE-MAIN)

Total Marks: 45

Max. Time: 33 min.

Single choice Objective ('-1' negative marking) Q.1 to Q.12

(3 marks, 2 min.)

[36, 24]

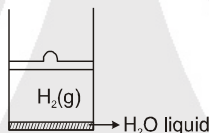
Numerical Value Questions ('0' negative marking) Q.13 to Q.15

(3 marks, 3 min.)

[09, 09]

1. Several acids are listed below with their respective equilibrium constants :
 $\text{HF(aq)} + \text{H}_2\text{O(l)} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{F}^-(\text{aq})$ $K_a = 7.2 \times 10^{-4}$
 $\text{HS}^-(\text{aq}) + \text{H}_2\text{O(l)} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{S}^{2-}(\text{aq})$ $K_a = 1.3 \times 10^{-11}$
 $\text{CH}_3\text{COOH(aq)} + \text{H}_2\text{O(l)} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{CH}_3\text{COO}^-(\text{aq})$ $K_a = 1.8 \times 10^{-5}$
 Which is the strongest acid and which acid has the strongest conjugate base ?
 (A) HF and HF (B) HF and HS⁻ (C) HS⁻ and HF (D) HS⁻ and CH₃COOH
2. What is the percent ionization of a 0.01 M HCN solution : Given $K_a = 6.4 \times 10^{-9}$.
 (A) 8×10^{-4} % (B) 0.08 % (C) 8×10^{-3} % (D) 0.8 %
3. The following equilibria are given :
 $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ K_1
 $\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$ K_2
 $\text{H}_2 + \frac{1}{2}\text{O}_2 \rightleftharpoons \text{H}_2\text{O}$ K_3
 The equilibrium constant of the reaction :
 $2\text{NH}_3 + \frac{5}{2}\text{O}_2 \rightleftharpoons 2\text{NO} + 3\text{H}_2\text{O}$ in terms of K_1 , K_2 and K_3 is :
 (A) $\frac{K_1 K_2}{K_3}$ (B) $\frac{K_1 K_2^2}{K_3}$ (C) $\frac{K_2 K_3^3}{K_1}$ (D) $K_1 K_2 K_3$
4. Calculate pH of following solutions :
 (a) 10^{-2} N H₂SO₄ (b) 10^{-2} M Ba(OH)₂
 (A) 1.7, 12.3 (B) 2, 12 (C) 1.7, 12 (D) 2, 12.3
5. pH of a strong acid solution is 3. On dilution, its pH changes to 5. How many times the dilution has taken place :
 (A) 2 times (B) 100 times
 (C) 5/3 times (D) this is not possible with dilution
6. pH of 10^{-8} N NaOH solution is :
 (A) 7.2 (B) 6.8 (C) 6.98 (D) 7.02

7. A solution is prepared by urea and water. If mole fraction of water is 0.8 in the solution. Find the ratio of mass of urea & water.
 (A) $\frac{5}{6}$ (B) $\frac{6}{5}$ (C) $\frac{1}{1}$ (D) $\frac{4}{1}$
8. Which of the following salts does not undergo hydrolysis :
 (A) $\text{CH}_3\text{COONH}_4$ (B) $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ (C) KCl (D) KCN
9. Which of the following complex is non-ionizable in aqueous solution ?
 (A) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ (B) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$ (C) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ (D) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$
10. Which of the following ligands is expected to be bidentate ligand?
 (A) Thiocyanate (B) Oxalate (C) Ethanamine (D) Ethanenitrile
11. Maximum coordination number of EDTA is
 (A) 4 (B) 5 (C) 6 (D) 8
12. The ambidentate as well as monodentate ligand is :
 (A) $\text{NH}_2\text{--NH}_2$ (B) OCN^- (C) N_3^- (D) gly
13. If the number of N-atoms in 1 molecule of Hyponitrous acid is x and the basicity of Boric acid is y, find the sum (x + y).
14. Calculate % degree of dissociation of 0.5 M NH_3 at 25°C in a solution of pH = 12
15. Hydrogen gas saturated with water vapour is confined under a piston in a container with confined volume 10 litres as shown. The container also contains some liquid water. The partial pressure of H_2 over liquid water is 80 cm of Hg column. If now the piston is moved such that confined volume is doubled, then find final total pressure over water liquid in the container. (aq. tension = 20 cm of Hg column) (Neglect volume of liquid H_2O). (Report your answer as y, where $y = \frac{\text{Total pressure in cm of Hg}}{10}$)



DPP No. # B8 (JEE-ADVANCED)

Total Marks: 39

Max. Time: 27 min.

Multiple choice objective ('-1' negative marking) Q.1 to Q.4

(4 marks, 2 min.)

[16, 08]

Comprehension ('-1' negative marking) Q.5 to Q.6

(3 marks, 2 min.)

[06, 04]

Numerical Value Questions ('0' negative marking) Q.7 to Q.9

(3 marks, 3 min.)

[09, 09]

Match the Following (no negative marking) Q.10

(8 marks, 6 min.)

[08, 06]

- 1.* Which of the following statement(s) is/are correct ?
 (A) The electronic configuration of Cr is $[\text{Ar}] 3d^5 4s^1$. (Atomic number of Cr = 24).
 (B) The magnetic quantum number may have a negative value.
 (C) In silver atom, 23 electrons have a spin of one type and 24 of the opposite type. (Atomic number of Ag = 47)
 (D) The average oxidation state of nitrogen in HN_3 is -3.
- 2.* Which of the following complex(s) ions obeys Sidgwick's effective atomic number (EAN) rule ?
 (A) $[\text{Fe}(\text{CN})_6]^{3-}$ (B) $[\text{Fe}(\text{CN})_6]^{4-}$ (C) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (D) $[\text{Ni}(\text{CO})_4]$
- 3.* Which of the following complex(s) will give white precipitate with BaCl_2 solution ?
 (A) $[\text{Cr}(\text{NH}_3)_5\text{SO}_4]\text{Cl}$ (B) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{NO}_2$ (C) $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$ (D) $[\text{Cr}(\text{NH}_3)_5\text{Br}]\text{SO}_4$
- 4.* The 'brown ring' formed at the junction of two layers in the test of nitrate is due to the formation of a complex ion, $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$. Which of the following statement(s) is/are correct for this complex. $[\mu = 3.87 \text{ B.M.}]$?
 (A) Oxidation state of Fe is +1 and NO exists as NO^+ .
 (B) The complex ion is in octahedral geometry as attained by sp^3d^2 hybridisation
 (C) The complex is paramagnetic and has three unpaired electrons due to transfer of electron from NO to Fe^{2+} .
 (D) The complex is in octahedral geometry as attained by d^2sp^3 hybridisation.

Comprehension # (Q.5 to 6)

According to crystal field theory, a stronger ligand produces larger Δ . Due to this electrons get paired up in the presence of strong ligands. Hence, a metal ion in a complex with same coordination number show different magnetic behaviour in the presence of different ligands.

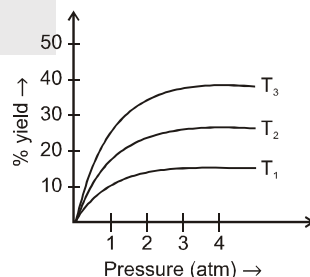
The splitting of d orbitals along with presence of empty orbitals and electrons may result into colour of complexes.

5. Which of the following complexes is a paramagnetic inner orbital complex?
(A) $[\text{Fe}(\text{CN})_6]^{4-}$ (B) $[\text{CoCl}_4]^{2-}$ (C) $[\text{Cu}(\text{NH}_3)_4]^{2+}$ (D) $[\text{Ni}(\text{CN})_4]^{2-}$
6. Which of the following pair of species is coloured in aqueous solution?
(A) CuSO_4 , CaCl_2 (B) CuSO_4 , CuCl (C) KMnO_4 , CuSO_4 (D) CuCl_2 , ZnCl_2
7. Number of bidentate monoanionic ligands among the following are :
Acetylacetonato, Oxalato, Dimethylglyoximato, Glycinato, Azido, Ethylenediaminetetracetato, Propylenediamine
8. Number of complexes that are paramagnetic in nature with number of unpaired electrons ($n \geq 2$) are :
1. $[\text{MnCl}_4]^{2-}$ 2. $[\text{Mn}_2(\text{CO})_{10}]$ 3. $[\text{V}(\text{CO})_6]^-$ 4. $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$
5. $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ 6. $[\text{Co}(\text{NH}_3)_2(\text{H}_2\text{O})_4]\text{Cl}_2$ 7. $[\text{Ni}(\text{CN})_4]^{2-}$ 8. $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$
9. $\text{K}_3[\text{Cr}(\text{CN})_6]$
9. Number of chelate rings in $[\text{Cr}(\text{ox})_3]^{3-} = a$
Number of chelate rings in $[\text{Co}(\text{en})(\text{NH}_3)_2(\text{Py})_2]^{3+} = b$
Number of chelate rings in $[\text{Fe}(\text{EDTA})]^- = c$
Number of chelate rings in brown ring complex $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})]\text{SO}_4 = d$
Calculate the value of $(a + b + c + d)$ is.....
10. Match the compounds of List I with the appropriate Hybridisation in List II.

List-I (Complex)	List-II (Hybridisation)
(A) $[\text{Cr}(\text{H}_2\text{O})_3(\text{NO}_2)_3]$	(p) sp^3d^2
(B) $[\text{Ni}(\text{H}_2\text{O})_2\text{Cl}_2(\text{en})]$	(q) d^2sp^3
(C) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$	(r) sp^3
(D) $[\text{Ni}(\text{CO})_4]$	(s) dsp^2

DPP No.# B9 (JEE-MAIN)**Total Marks: 45****Max. Time: 33 min.****Single choice Objective ('-1' negative marking) Q.1 to Q.12****(3 marks, 2 min.)****[36, 24]****Numerical Value Questions ('0' negative marking) Q.13 to Q.15****(3 marks, 3 min.)****[09, 09]**

1. Calculate the pH of solution obtained by mixing 100 ml of 0.01 M HCl solution & 100 ml of 0.02 M H_2SO_4 solution.
(A) 1.6 (B) 1.82 (C) 2 (D) 1.7
2. The preparation of $\text{SO}_3(\text{g})$ by reaction $\text{SO}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightleftharpoons \text{SO}_3(\text{g})$ is an exothermic reaction. If the preparation follows the following temperature-pressure relationship for its % yield, K_1 , K_2 and K_3 are the equilibrium constant for the given reaction at temperature T_1 , T_2 and T_3 respectively. The correct option is :
(A) $T_3 > T_2 > T_1$ (B) $T_3 < T_2 < T_1$ (C) $K_1 = K_2 = K_3$
(D) Nothing could be predicted about temperature through given information.
3. In which of the following cases, the aqueous solution is not basic :
I. BeCl_2 II. LiCN III. $(\text{NH}_4)_2\text{C}_2\text{O}_4$ IV. $\text{C}_5\text{H}_6\text{NBr}$ V. NaF
(A) II & V only (B) I & IV only (C) I, III & IV (D) I & III Only
4. $[\text{Co}(\text{NO}_2)_3\text{Cl}_3]$ and $[\text{Co}(\text{ONO})_3\text{Cl}_3]$ shows :
(A) linkage isomerism (B) geometrical isomerism
(C) coordination isomerism (D) none of the above



5. $\text{[Co(NH}_3)_5\text{Br]SO}_4$ and $\text{[Co(NH}_3)_5\text{SO}_4\text{]Br}$ are examples of which of the following type of isomerism ?
 (A) Linkage (B) Geometrical (C) Ionization (D) Optical isomerism
6. Fac-Mer isomerism is associated with which one of the following complexes ? (M = central metal)
 (A) $\text{[M(AB)}_2\text{]}$ (B) $\text{[Ma}_3\text{b}_3\text{]}$ (C) $\text{[M(AA)}_3\text{]}$ (D) $\text{[Ma}_2\text{b}_2\text{cd]}$
7. Which of the following will not show geometrical isomerism ?
 (A) $\text{[Cr(NH}_3)_4\text{Cl}_2\text{]Cl}$ (B) $\text{[Co(en)}_2\text{Cl}_2\text{]Cl}$ (C) $\text{[Co(NH}_3)_5\text{NO}_2\text{]Cl}_2$ (D) $\text{[Pt(NH}_3)_2\text{Cl}_2\text{]}$
8. Among the following which is not the π -bonded organometallic compound?
 (A) $\text{K[PtCl}_3(\eta^2 - \text{C}_2\text{H}_4)]$ (B) $\text{Fe}(\eta^5 - \text{C}_5\text{H}_5)_2$ (C) $\text{Cr}(\eta^6 - \text{C}_6\text{H}_6)_2$ (D) $(\text{C}_2\text{H}_5)_4\text{Pb}$
9. The pair of species with the same bond order is :
 (A) O_2^{2-} , B_2 (B) O_2^+ , NO^+ (C) NO , CO (D) N_2 , O_2
10. Among the following metal carbonyls, the C–O bond length is largest in :
 (A) $\text{[Mn(CO)}_6\text{]}^+$ (B) $\text{[V(CO)}_6\text{]}^-$ (C) $\text{[Cr(CO)}_6\text{]}$ (D) $\text{[Fe(CO)}_5\text{]}$
11. Which of the following is optically active ?
 (A) $\text{[Pt(Br)(Cl)(N}_3\text{)(SCN)]}^{2-}$ (B) $\text{trans-[Co(en)}_2\text{(SCN)}_2\text{]}^{\oplus}$
 (C) $\text{fac-[Co(H}_2\text{O)}_3\text{F}_3\text{]}$ (D) $\text{[Co(gly)}_3\text{]}$
12. Which of the following statements is INCORRECT ?
 (A) Complex $\text{[Co(NH}_3)_4(\text{H}_2\text{O)Cl]Br}_2$ can show both hydrate as well as ionization isomerism.
 (B) Complex $\text{[Co(NH}_3)_5(\text{H}_2\text{O)](NO}_3)_3$ can show hydrate isomerism.
 (C) Complex $\text{[Pt(NH}_3)_4\text{][PtCl}_6\text{]}$ cannot show coordination isomerism.
 (D) $\text{[Co(NH}_3)_4(\text{NO}_2\text{)Cl]Cl}$ can show both ionization as well as linkage isomerism.
13. Find the solubility of As_2S_3 in a 10^{-2}M Na_2S solution assuming no hydrolysis of cationic or anionic part.
 Given : K_{sp} for $\text{As}_2\text{S}_3 = \frac{1}{625} \times 10^{-24}$. Report your answer as Y where : solubility (in mol/L) = $Y \times 10^{-11}$.
14. The bond order of the underlined species; $\text{NOH}\underline{\text{SO}}_4$ is :
15. What is the spin only magnetic moment value (in Bohr magneton units) of $\text{[V(CO)}_6\text{]}^-$

DPP No. # B10 (JEE-ADVANCED)

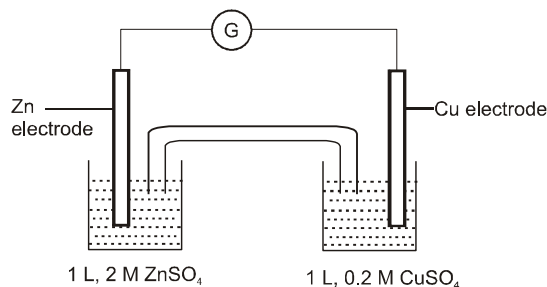
Total Marks: 39

Max. Time: 27 min.

Multiple choice objective ('–1' negative marking) Q.1 to Q.4	(4 marks, 2 min.)	[16, 08]
Comprehension ('–1' negative marking) Q.5 to Q.6	(3 marks, 2 min.)	[06, 04]
Numerical Value Questions ('0' negative marking) Q.7 to Q.9	(3 marks, 3 min.)	[09, 09]
Match the Following (no negative marking) Q.10	(8 marks, 6 min.)	[08, 06]

- 1.* Consider the following relations for EMF of an electrochemical cell :
 (i) $\text{EMF of cell} = (\text{Oxidation potential of anode}) - (\text{Reduction potential of cathode})$
 (ii) $\text{EMF of cell} = (\text{Oxidation potential of anode}) + (\text{Reduction potential of cathode})$
 (iii) $\text{EMF of cell} = (\text{Reduction potential of anode}) + (\text{Reduction potential of cathode})$
 (iv) $\text{EMF of cell} = (\text{Oxidation potential of anode}) - (\text{Oxidation potential of cathode})$
 Which of the above relation(s) is/are correct
 (A) (i) (B) (ii) (C) (iii) (D) (iv)
- 2.* Among the following samples, the same number of molecules are in :
 (A) 28 g of N_2 (B) 27 g of H_2O (C) 46 g of $\text{C}_2\text{H}_5\text{OH}$ (D) 56 g of C_4H_8
- 3.* For the cell $\text{Ti} | \text{Ti}^+ (0.001 \text{ M}) || \text{Cu}^{2+} (0.1 \text{ M}) | \text{Cu}$. E_{cell} at 25°C is 0.83 V, which can be increased-
 (A) by increasing $[\text{Cu}^{2+}]$ (B) by increasing $[\text{Ti}^+]$
 (C) by decreasing $[\text{Cu}^{2+}]$ (D) by decreasing $[\text{Ti}^+]$
- 4.* Make out the right combination of cell and condition for the spontaneity :
 (A) $\text{Pt}(\text{H}_2) | \text{HCl} | \text{Pt}(\text{H}_2)$; $P_1 > P_2$ (B) $\text{Zn} | \text{Zn}^{2+}(\text{C}_1) || \text{Zn}^{2+}(\text{C}_2) | \text{Zn}$; $\text{C}_2 > \text{C}_1$
 P_1 1M P_2
 (C) $\text{Pt}(\text{Cl}_2) | \text{Cl}^-(\text{C}_1) || \text{Cl}^-(\text{C}_2) | \text{Pt}(\text{Cl}_2)$; $\text{C}_2 > \text{C}_1$ (D) $\text{Pt}(\text{H}_2) | \text{HCl}(\text{C}_1) || \text{HCl}(\text{C}_2) | \text{Pt}(\text{H}_2)$; $\text{C}_2 > \text{C}_1$
 1 atm 1 atm 1 atm 1 atm

Comprehension # 2



Given $E^\circ_{\text{Zn}^{2+}|\text{Zn}} = -0.76 \text{ V}$, $E^\circ_{\text{Cu}^{2+}|\text{Cu}} = 0.34 \text{ V}$

Now, answer the following questions :

5. The emf of cell at 200K is : [Given : $\frac{2.303 \times R}{F} = 2 \times 10^{-4}$ and assume that E° values are independent of temperature.]
 (A) 1.7 V (B) 1.08 V (C) 1.09 V (D) 1.10 V
6. At what conc of Cu^{2+} , emf of the cell will be zero (at 298K) : (Assume concentration of Zn^{2+} to remain same, $\log 2 = 0.3$ & $\frac{2.2}{0.059} = 37.3$)
 (A) 1×10^{-37} (B) 1.19×10^{-20} (C) 3.78×10^{-4} (D) 0.0068
7. At a certain temperature, the equilibrium constant (K_c) is 4/9 for the reaction :
 $\text{CO(g)} + \text{H}_2\text{O(g)} \rightleftharpoons \text{CO}_2\text{(g)} + \text{H}_2\text{(g)}$
 If we take 10 mole of each of the four gases in a one-litre container, what would be the equilibrium mole percent of H_2 (g), Report your answer by dividing 10.
8. Which of the following aqueous solutions have pH > 7 at 25°C :
 CuSO_4 , KOH , AlCl_3 , HCOOH , $\text{K}_2\text{C}_2\text{O}_4$, Na_2S ,
 CO_2 , KHCO_3 , $\text{C}_6\text{H}_5\text{NH}_3\text{Cl}$
9. How many of the following metals will not displace Hydrogen (H_2) from HCl ?
 Zn, Hg, Fe, Ag, Mg, Au, Cu, Li, Cs.
10. Match Matrix ($E^\circ_{\text{Ag}^+/\text{Ag}} = 0.8$, $K_{\text{SP}}(\text{AgCl}) = 10^{-10}$).

	Column – I		Column – II
(A)	$\text{Pt}, \text{H}_2 (0.1 \text{ bar}) \text{H}^+ (0.1 \text{ M}) \text{H}^+ (1 \text{ M}) \text{H}_2 (0.01 \text{ bar}), \text{Pt}$	(p)	Concentration cell
(B)	$\text{Ag} \text{AgCl} (\text{KCl}, 0.1\text{M}) \text{Ag}^+ (0.01\text{M}) \text{Ag}$	(q)	$E_{\text{cell}} > 0$
(C)	$\text{Cu} \text{Cu}^{2+} (0.1 \text{ M}) \text{Cu}^{2+} (0.01 \text{ M}) \text{Cu}$	(r)	$E^\circ_{\text{cell}} = 0$ but cell is working.
(D)	$\text{Pt}, \text{Cl}_2 (1\text{bar}) \text{HCl} (0.1 \text{ M}) \text{NaCl} (0.1\text{M}) \text{Cl}_2, \text{Pt} (1 \text{ bar})$	(s)	non working condition

DPP No.# B11 (JEE-MAIN)

Total Marks: 45

Max. Time: 33 min.

Single choice Objective ('-1' negative marking) Q.1 to Q.12

(3 marks, 2 min.)

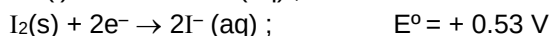
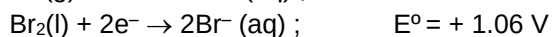
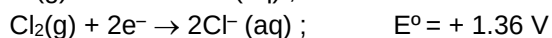
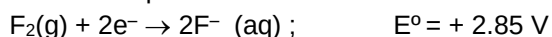
[36, 24]

Numerical Value Questions ('0' negative marking) Q.13 to Q.15

(3 marks, 3 min.)

[09, 09]

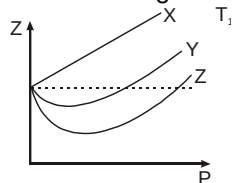
1. Standard reduction potentials of the half reactions are given below :



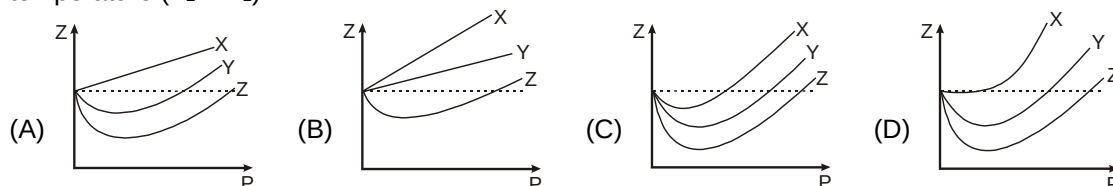
The strongest oxidising and reducing agents respectively are :

- (A) F_2 and I^- (B) Br_2 and Cl^- (C) Cl_2 and Br^- (D) Cl_2 and I_2

2. Z vs P graph is plotted for 1 mole of three different gases X, Y and Z at temperature T_1 .

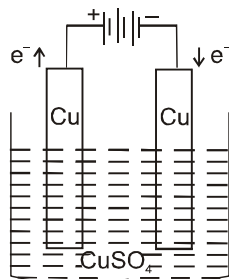


Then, which of the following graph is incorrect if the above plot is made for 1 mole of each gas at T_2 temperature ($T_2 < T_1$) :



3. The emf of the following Daniell cell at 298 K is E_1
 $\text{Zn} | \text{ZnSO}_4 (0.01\text{M}) || \text{CuSO}_4 (1.0\text{M}) | \text{Cu}$
 When concentration of ZnSO_4 is 1.0 and that of CuSO_4 is 0.01 M, the EMF changed to E_2 . What is the relationship between E_1 and E_2 ?
 (A) $E_1 > E_2$ (B) $E_1 < E_2$ (C) $E_1 = E_2$ (D) $E_2 = 0, E_1 \neq 0$
4. If the E°_{cell} for a given reaction has a negative value, then which of the following gives the correct relationships for the values of ΔG° and K_{eq} ?
 (A) $\Delta G^\circ > 0$; $K_{\text{eq}} > 1$ (B) $\Delta G^\circ < 0$; $K_{\text{eq}} > 1$ (C) $\Delta G^\circ < 0$; $K_{\text{eq}} < 1$ (D) $\Delta G^\circ > 0$; $K_{\text{eq}} < 1$
5. Two aqueous solutions A and B containing solute CuSO_4 and NaBr respectively were electrolysed using platinum electrodes. The pH of the resulting solutions will show a/an :
 (A) Increase in both the solutions (B) Decrease in both the solutions
 (C) Increase in A and decrease in B (D) Decrease in A and increase in B
6. Electrolysis of which of the following aqueous solutions results in electrolysis of water only?
 (A) NaF (B) KCl (C) RbBr (D) LiI
7. When a quantity of electricity is passed through CuSO_4 solution, 0.16 g of copper gets deposited. If the same quantity of electricity is passed through acidulated water, then the volume of H_2 liberated at STP will be [Given : at wt. of $\text{Cu} = 64$] :
 (A) 4.0 cm^3 (B) 56 cm^3 (C) 604 cm^3 (D) 8.0 cm^3
8. What is the time (in sec) required for depositing all the silver present in 125 mL of 1 M AgNO_3 solution by passing a current of 241.25 A ? ($1 \text{ F} = 96500 \text{ C}$)
 (A) 10 (B) 50 (C) 1000 (D) 100
9. 10^{-2} mole of NaOH was added to 10 litre of water at 25°C . The pH will change by :
 (A) 4 (B) 3 (C) 11 (D) 10
10. The resistance of a $\frac{\text{M}}{10}$ KCl solution is 250Ω . The molar conductance of the solution if the electrodes in the cell are 7 cm apart and each has an area of 7 sq. cm will be:
 (A) $20 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ (B) $40 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ (C) $50 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$ (D) $80 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$
11. The conductivity of 0.1 N NaOH solution is 0.022 S cm^{-1} . To this solution equal volume of 0.1 N HCl solution is added which results into decrease of conductivity of solution to 0.0055 S cm^{-1} . The equivalent conductivity of NaCl solution in $\text{S cm}^2 \text{ equiv}^{-1}$ is :
 (A) 0.011 (B) 110 (C) 0.0055 (D) 55.0
12. Which of the following correctly represents the equivalent conductivity of Aluminum sulphate ($\Lambda_{\text{eq}}(\text{Al}_2(\text{SO}_4)_3)$) where equivalent conductivities of Al^{+3} and SO_4^{-2} are λ_1 and λ_2 respectively?
 (A) $\lambda_1 + \lambda_2$ (B) $3\lambda_1 + 2\lambda_2$ (C) $\lambda_1 / 3 + \lambda_2 / 2$ (D) $2\lambda_1 + 3\lambda_2$

13. Find total moles of S_8 obtained if all S from 3 mole of S_4N_4 and 196 g H_2SO_4 and 128 g SO_2 is converted into S_8 .
14. In the adjacent diagram the electrolytic cell contains 1 L of an aqueous 1 M Copper (II) sulphate solution. If 0.4 mole of electrons are passed through the cell, the molar concentration of copper ion after passage of the charge will be :



15. How many of the following metals have positive standard oxidation potential (SOP) ?
Zn, Cu, Mg, Rb, Al, Ag

DPP No. # B12 (JEE-ADVANCED)

Total Marks: 40

Max. Time: 26 min.

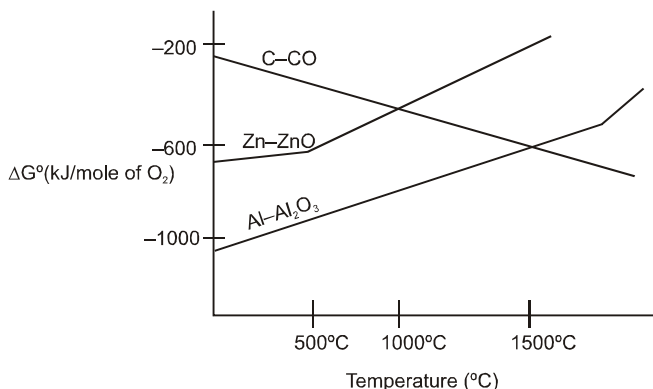
Multiple choice objective ('-1' negative marking) Q.1 to Q.5	(4 marks, 2 min.)	[20, 10]
Comprehension ('-1' negative marking) Q.6 to Q.7	(3 marks, 2 min.)	[06, 04]
Numerical Value Questions ('0' negative marking) Q.8 to Q.9	(3 marks, 3 min.)	[06, 06]
Match the Following (no negative marking) Q.10	(8 marks, 6 min.)	[08, 06]

- 1.* In electrolysis of Al_2O_3 by Hall-Heroult process :
(A) cryolite $Na_3[AlF_6]$ lowers the melting point of Al_2O_3 and increases its electrical conductivity.
(B) Al is obtained at cathode and probably CO_2 at anode
(C) electrolysis is carried out in aqueous medium
(D) anode consist of graphite
- 2.* Which of the following statement(s) is/are correct ?
(A) Main function of the collectors in metallurgy is make the ore hydrophobic.
(B) Silver is obtained by a hydrometallurgical operation.
(C) Lime stone is used as flux in the extraction of iron from haematite ore.
(D) None of these
- 3.* Which of the following complexe(s) is / are diamagnetic ?

$[Pt(NH_3)_4]^{2+}$	$[Co(SCN)_4]^{2-}$	$[Cu(en)_2]^{2+}$	$[HgI_4]^{2-}$
square planar	tetrahedral	square planar	tetrahedral
(i)	(ii)	(iii)	(iv)
(A) (i)	(B) (ii)	(C) (iii)	(D) (iv)
- 4.* BCl_3 does not exist as dimer but BH_3 exist as dimer (B_2H_6) because:
(A) Chlorine is more electronegative than hydrogen
(B) There is $p\pi-p\pi$ back bonding in BCl_3 but BH_3 does not contain such bonding
(C) Large sized chlorine atoms do not fit between the small boron atoms whereas small sized hydrogen atoms get fitted between boron atoms
(D) All are correct reason
- 5.* Which one of the following statements is/are correct ?
(A) Tin is extracted by carbon reduction (smelting)
(B) Aluminium is extracted by Hall's process which involves carbon reduction.
(C) Extraction of lead does not involve bessemerisation
(D) Gold is extracted by cyanide process

Comprehension

The Ellingham diagram for zinc, aluminium and carbon converting into corresponding oxide as shown below:



6. At 1000°, ΔG° for $\text{Al} \rightarrow \text{Al}_2\text{O}_3$ is $-910 \text{ kJ/mole of O}_2$ and ΔG° for $\text{C} \rightarrow \text{CO}$ is $-430 \text{ kJ/mole of O}_2$. What will be ΔG° of reduction of 1 mole Al_2O_3 by carbon at 1000°C.
 (A) + 720 kJ (B) + 480 kJ (C) + 960 kJ (D) +240 kJ
7. At what temperature zinc has more affinity for oxygen than carbon :
 (A) 1000°C (B) 1500°C (C) 500°C (D) All have equal affinity
8. Which of the following ores do not contain more than one metal in their composition. Argentite, Barytes, Magnesite, Fluorspar, Carnalite, Dolomite, Chalcocite, Asbestos, Calamine.
9. Among the following metals how many metals are extracted by self-reduction method from their respective ores. Hg, Zn, Cu, Al, Mg, Pb, Fe, Sn.

10. Match the column:

	Column – I		Column – II
(A)	Chalcopyrites	(p)	Self – reduction
(B)	Galena	(q)	Sulphur containing ore
(C)	Argentite	(r)	Carbon reduction
(D)	Malachite	(s)	Leaching followed by displacement method.

DPP No.# B13 (JEE-MAIN)

Total Marks: 45

Max. Time: 33 min.

Single choice Objective ('-1' negative marking) Q.1 to Q.12

(3 marks, 2 min.)

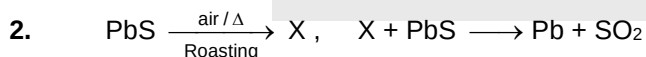
[36, 24]

Numerical Value Questions ('0' negative marking) Q.13 to Q.15

(3 marks, 3 min.)

[09, 09]

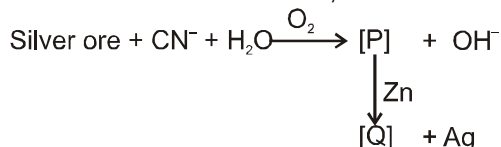
1. Which of the following is a **wrong** order with respect to the property mentioned against each:
 (A) $(\text{NO})^- > (\text{NO}) > (\text{NO})^+$ [Bond length]
 (B) $\text{H}_2 > \text{H}_2^+ > \text{He}_2^+$ [Bond energy]
 (C) $\text{O}_2^{2-} > \text{O}_2 > \text{O}_2^{2+}$ [Paramagnetic moment]
 (D) $\text{NO}_2^+ > \text{NO}_2 > \text{NO}_2^-$ [Bond angle]



'X' is :

- (A) PbO (B) PbO₂ (C) PbO and PbSO₄ (D) PbO₂ and PbO

3. In the process of extraction of silver,



Identify the complexes [P] and [Q].

- (A) $\text{P} = [\text{Ag}(\text{CN})_4]^-$, $\text{Q} = [\text{Zn}(\text{CN})_4]^{2-}$ (B) $\text{P} = [\text{Ag}(\text{CN})_4]^-$, $\text{Q} = [\text{Zn}(\text{CN})_6]^{4-}$
 (C) $\text{P} = [\text{Ag}(\text{CN})_4]^{3-}$, $\text{Q} = [\text{Zn}(\text{CN})_4]^{2-}$ (D) $\text{P} = [\text{Ag}(\text{CN})_2]^-$, $\text{Q} = [\text{Zn}(\text{CN})_4]^{2-}$

4. Blister copper is refined by stirring molten impure metal with green logs of wood because such a wood liberates hydrocarbon gases (like CH_4). This process X is called _____ and it is used to purify the metal that initially contain impurities of Y. Y is _____.
- (A) X = poling, Y = CuO_2 (B) X = cupellation, Y = CuO
(C) X = cupellation, Y = ZnO (D) X = poling, Y = Cu_2O

5. In which of the following coordination entities the magnitude of Δ_0 (CFSE in octahedral field) will be minimum? (At No Co = 27).

(A) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (B) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (C) $[\text{Cr}(\text{CN})_6]^{3-}$ (D) $[\text{Cr}(\text{en})_3]^{3+}$

6. Match List-I (complex ions) with List-II (CFSE) and select the correct answer using the codes given below the lists :

	List-I		List-II
(P)	$[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$	1.	$0.6 \Delta_0$
(Q)	$[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$	2.	$0.4 \Delta_0$
(R)	$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	3.	0
(S)	$[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$	4.	$1.2 \Delta_0$

Code :

	P	Q	R	S		P	Q	R	S
(A)	3	1	2	4	(B)	1	2	3	4
(C)	4	3	2	1	(D)	None of these			

7. Match column I with column II and select the correct answer using the codes given below the lists :

	Column I		Column II
I.	Cyanide process.	(a)	Ultra pure Ge
II.	Froth floatation process.	(b)	Pine oil.
III.	Electrolytic reduction.	(c)	Extraction of Al.
IV.	Zone refining.	(d)	Extraction of Au.

- (A) I-(c), II-(a), III-(d), IV-(b) (B) I-(d), II-(b), III-(c), IV-(a)
(C) I-(c), II-(b), III-(d), IV-(a) (D) I-(d), II-(a), III-(c), IV-(b)

8. The **weakest acid** amongst the following is :

(A) HClO_4 (B) HClO_3 (C) HClO_2 (D) HClO

9. Give the correct order of initials **T** or **F** for following statements. Use **T** if statement is true and **F** if it is false.

S₁ : The slag obtained during the extraction is lighter and has lower melting point than the metal (Fe or Cu).

S₂ : Froth floatation process may be used to increase the concentration of mineral chalcopyrites.

S₃ : High purify metals can be obtained by zone refining method if the impurity has lower melting point.

(A) T, T, T (B) T, F, T (C) F, T, T (D) F, F, F

10. A **pale blue liquid** is obtained by equimolar mixture of two gases at -30°C .

(A) N_2O (B) N_2O_3 (C) N_2O_4 (D) N_2O_5

11. Which of the following gases can be dried by **concentrated H_2SO_4** ?

(A) HCl (B) HBr (C) HI (D) H_2S

Sol. HCl is dried over conc. H_2SO_4 . Because HBr , HI and H_2S are oxidised by H_2SO_4 .

सान्द्र H_2SO_4 पर HCl शुष्क हो जाता है, क्योंकि H_2SO_4 द्वारा HBr , HI तथा H_2S ऑक्सीकृत हो जाते हैं।

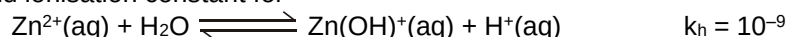
12. Which of the following oxidations can be carried out by **O_3** but not by **H_2O_2** ?

(A) HI to I_2 (B) KI/KOH to KIO_3 (C) PbO to PbO_2 (D) H_2S to S

13. In the disproportionation reaction of NaOH with one molecule of P_4 , number of molecules of NaOH reacting are

14. What is the coordination number of aluminium in mineral cryolite ?

15. The acid ionisation constant for



Determine the pH of $10^{-3}(\text{M})$ aqueous solution of ZnCl_2 .

DPP No. # B14 (JEE-ADVANCED)

Total Marks: 40

Max. Time: 28 min.

Multiple choice objective ('-1' negative marking) Q.1 to Q.5

(4 marks, 2 min.)

[20, 10]

Numerical Value Questions ('0' negative marking) Q.6 to Q.9

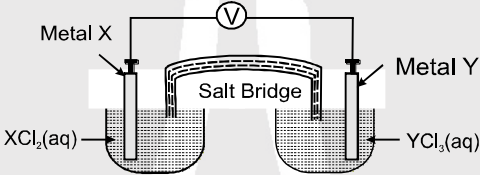
(3 marks, 3 min.)

[12, 12]

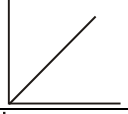
Match the Following (no negative marking) Q.10

(8 marks, 6 min.)

[08, 06]

- 1.* Which of the following is/are examples of **disproportionation** reactions ?
 (A) $\text{Ag}(\text{NH}_3)_2^+ + 2\text{H}^+ \longrightarrow \text{Ag}^+ + 2\text{NH}_4^+$ (B) $\text{Cl}_2 + \text{OH}^- \longrightarrow \text{ClO}^- + \text{Cl}^- + \text{H}_2\text{O}$
 (C) $\text{Cu}_2\text{O} + 2\text{H}^+ \longrightarrow \text{Cu} + \text{Cu}^{+2} + \text{H}_2\text{O}$ (D) $2\text{HCuCl}_2 \xrightarrow{\text{dil. with H}_2\text{O}} \text{Cu} + \text{Cu}^{2+} + 4\text{Cl}^- + 2\text{H}^+$
- 2.* Which of the following statement(s) is/are **correct** ?
 (A) The pH of 1.0×10^{-8} M solution of HCl is 8.
 (B) The conjugate base of H_2PO_4^- is HPO_4^{2-}
 (C) Autoprotolysis constant of water increases with temperature.
 (D) Basic strength of NaOH, KOH and CsOH can be compared in water.
- 3.* The following diagram shows an electrochemical cell in which the respective half cells contain aqueous 1.0 M solutions of the salts XCl_2 and YCl_3 . Given that :
 $3\text{X(s)} + 2\text{Y}^{3+}(\text{aq}) \longrightarrow 3\text{X}^{2+}(\text{aq}) + 2\text{Y(s)}$ $E_{\text{cell}} > 0$
- 
- Which of the following statements is **correct** ?
 (A) The electrode made from metal X has positive polarity.
 (B) Electrode Y is the cathode
 (C) The flow of electrons is from Y to X
 (D) The reaction at electrode X is an oxidation
- 4.* For an elementary reaction $a\text{A} \longrightarrow \text{product}$, the graph plotted between $\log \left[\frac{-d[\text{A}]}{dt} \right]$ vs $\log C_A$ gives a straight line with intercept equal to 0.6 and showing an angle of 45° with origin, then :
 (A) rate constant = 3.98 time^{-1} (B) rate constant = $3.98 \text{ mol L}^{-1} \text{ t}^{-1}$
 (C) $a = 1$ (D) $a = 2$
- 5.* For the reaction $2\text{A} + \text{B} \longrightarrow \text{C}$ with the rate law $\frac{d[\text{C}]}{dt} = k [\text{A}]^1 [\text{B}]^{-1}$ and started with A and B in stoichiometric proportion. Which is/are **true** ?
 (A) unit of k is Ms^{-1} (B) $[\text{A}]$, $[\text{B}]$ and $[\text{C}]$ all will be linear functions of time
 (C) $[\text{C}] = 2kt$ (D) $[\text{C}] = kt$
6. How many of the following metals will displace Hydrogen (H_2) from HCl ?
 Zn, Hg, Fe, Ag, Mg, Au, Cu, Li, Cs.
- 7.* Which of the following aqueous solutions have **pH < 7** at 25°C :
 CuSO_4 , KOH , AlCl_3 , HCOOH , $\text{K}_2\text{C}_2\text{O}_4$, Na_2S ,
 CO_2 , KHCO_3 , $\text{C}_6\text{H}_5\text{NH}_3\text{Cl}$
8. The half lives of decomposition of gaseous CH_3CHO at constant temperature but at initial pressure of 364 mm and 170 mm Hg were 410 second and 880 second respectively. Hence **order of reaction** is
- 9.* The order of a reaction $\text{A} \rightarrow \text{product}$, in which half the reagent is reacted is half an hour, three quarters in one hour and seven - eighth in one and half hours is

10. Match the following for a 1st order reaction $A \rightarrow \text{products}$ with time on the x axis.

	Column I		Column II
(A)	[A] v/s time	(p)	
(B)	$-\frac{d[A]}{dt}$ v/s [A]	(q)	
(C)	$-\frac{d[A]}{dt}$ v/s time	(r)	
(D)	log [A] v/s time	(s)	

DPP No.# B15 (JEE-MAIN)

Total Marks: 45

Max. Time: 33 min.

Single choice Objective ('-1' negative marking) Q.1 to Q.12

(3 marks, 2 min.)

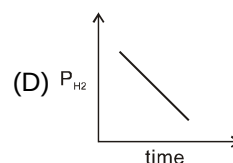
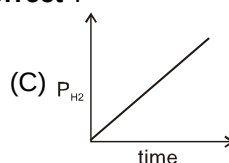
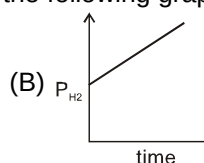
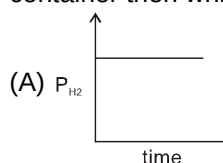
[36, 24]

Numerical Value Questions ('0' negative marking) Q.13 to Q.15

(3 marks, 3 min.)

[09, 09]

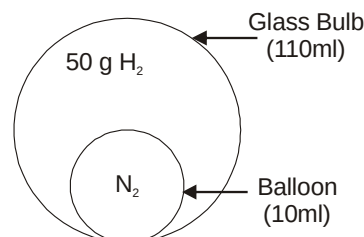
1. Among the following statements which is **INCORRECT**: (QUA(INO)) [Made by VIJ Sir-2012-13] [M]
 (A) In the preparation of compounds of Xe, Bartlett had taken O_2PtF_6 as a base compound because both O_2 and Xe have almost same ionisation enthalpy.
 (B) Nitrogen does not show allotropy.
 (C) A brown ring is formed in the ring test for NO_3^- ion. It is due to the formation of $[Fe(H_2O)_5(NO)]^{2+}$
 (D) On heating with concentrated NaOH solution in an inert atmosphere of CO_2 , red phosphorus gives PH_3 gas.
2. XeF_2 reacts with PF_5 to give :
 (A) XeF_6 (B) $[XeF]^+ [PF_6]^-$ (C) XeF_4 (D) $[PF_4]^+ [XeF_3]^-$
3. The reaction of XeF_6 with silica (SiO_2) gives :
 (A) XeO_3 and SiF_4 (B) XeF_4 and SiF_4 (C) $XeOF_2$ and SiF_4 (D) $XeOF_4$ and SiF_4
4. XeF_4 on reaction with H_2O produces :
 (A) Xe, XeO_3 , O_2 and HF (B) XeO_3 , HF and O_2 only
 (C) Xe, XeO_3 and F_2 (D) Xe, XeO_3 and O_2 only
5. The rate expression for reaction $A(g) + B(g) \rightarrow C(g)$ is **rate** = $k[A]^{1/2}[B]^2$. What change in rate if initial concentration of A and B increase by factor 4 and 2 respectively ?
 (A) 4 (B) 6 (C) 8 (D) None of these
6. An alloy of iron and carbon is treated with sulphuric acid, in which only iron reacts :
 $2Fe(s) + 3H_2SO_4(aq) \rightarrow Fe_2(SO_4)_3(aq) + 3H_2(g)$
 If a sample of alloy weighing 140 g gave 6 g of hydrogen, what is the percentage of **iron** in the alloy ?
 (A) 40% (B) 60% (C) 80% (D) 30%
7. Decomposition of HI (g) on Gold surface is zero order reaction. Initially, few moles of H_2 are present in container then which of the following graph is **correct** ?



8. A first order reaction is 75% completed in 100 minutes. How long time will it take for its 87.5% completion?
 (A) 125 min (B) 150 min (C) 175 min (D) 200 min

9. Calculate the volume of **balloon** if 25 g H_2 is further added in glass bulb at constant temperature.

- (A) 7.45 ml
 (B) 8.125 ml
 (C) 4.2 ml
 (D) 6.875 ml



10. For the reaction, $2NO_2 \longrightarrow N_2O_2 + O_2$, rate expression is as follows $-\frac{d[NO_2]}{dt} = K[NO_2]^n$, where $K = 3 \times 10^{-3} \text{ mol}^{-1} \text{ L sec}^{-1}$. If the rate of formation of oxygen is $1.5 \times 10^{-4} \text{ mol L}^{-1} \text{ sec}^{-1}$, then the molar concentration of NO_2 in mole L^{-1} is :
 (A) 1.5×10^{-4} (B) 0.0151 (C) 0.214 (D) 0.316

11. Temperature of solution of acetic acid increases from 25°C to 90°C which of the following will **increases**?
 (A) pK_w of water (B) only H^+ concentration
 (C) pH & pOH both (D) H^+ & OH^- concentration both

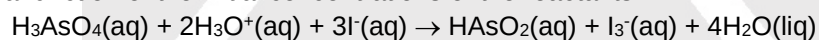
12. The Vander Waal's parameters for gases W, X, Y and Z are :

Gas	a (atm $L^2 \text{ mol}^{-2}$)	b (L mol^{-1})
W	4.0	0.027
X	8.0	0.030
Y	6.0	0.032
Z	12.0	0.027

Which of these gases has the highest critical temperature ?

- (A) W (B) X (C) Y (D) Z

13. Consider the following chemical reaction and the corresponding kinetic data showing the initial reaction rate as a function of the initial concentrations of the reactants :



Initial Rate $\times 10^{-5} \text{ (M/sec)}$	$[H_3AsO_4]$	$[H_3O^+]$	$[I^-]$
3.7	0.001	0.01	0.10
7.4	0.001	0.01	0.20
7.4	0.002	0.01	0.10
3.7	0.002	0.005	0.20

Using the data, establish the correct reaction composite order.

14. How long will it take to produce 0.3 mole of HNO_2 by following reaction if an average current of 1 amp passes through the cell ? $NO_3^- + 3H_3O^+ + 2e^- \longrightarrow HNO_2 + 4H_2O$, $E^\circ = 0.94 \text{ V}$
15. The number of different metals present in the ore copper pyrites is :