

1. The maximum number of electrons that can have principal quantum number, $n = 3$ and spin quantum number, $m_s = -\frac{1}{2}$,

(JEE 2011)

2. The work function (ϕ) of some metals is listed below. The number of metals which will show photoelectric effect when light of 300nm wavelength falls on the metal is **(JEE 2011)**

Metal	Li	Na	K	Mg	Cu	Ag	Fe	Pt	W
ϕ (eV)	2.4	2.3	2.2	3.7	4.8	4.3	4.7	6.3	4.75

3. The atomic masses of He and Ne are 4 and 20 a.m.u., respectively. The value of the Broglie wavelength of He gas at -73°C is M times that of the Broglie wavelength of Ne at 727°C . M is **(JEE 2013)**

Match the Columns

1. According to Bohr's theory

E_n = Total energy K_n = Kinetic energy V_n = Potential energy

r_n = Radius of nth orbit

Match the following:

(JEE 2006)

Column I	Column II
(A) $V_n/K_n = ?$	(p) 0
(B) If radius of nth orbit $\propto E_n^x$, $x = ?$	(q) -1
(C) Angular momentum in lowest orbital	(r) -2
(D) $1/r_n \propto Z^y$, $y = ?$	(s) 1

E7. According to Bohr's Model of hydrogen atom

(a) total energy of the electron is quantized

(b) angular momentum of the electron is quantized and given as

$$\sqrt{l(l+1)} \cdot \frac{h}{2\pi}$$

(c) both (a) and (b)

(d) none of these

7. (c) According to Bohr's model of H-atom, both

(i) total energy of the electron is quantized and

(ii) angular momentum of the electron is quantized and is given as

$$\sqrt{l(l+1)} \cdot \frac{h}{2\pi}$$

and true.

M10. Which one among the following statements is correct?

- (a) An orbital containing an electron having quantum numbers $n = 2$; $l = 0$; $m = 0$ and $s = +1/2$ is spherical.
- (b) The frequency of X-rays is less than that of radio-waves.
- (c) All photons have same energy.
- (d) As intensity of light increases, its frequency also increases.

10. (a) Any orbital with $l = 0$ has spherical symmetry irrespective of the value of its principal quantum number.

E9. Photoelectric emission is observed from a surface for frequencies ν_1 and ν_2 of incident radiations ($\nu_1 > \nu_2$). If the maximum kinetic energy of photoelectrons in the two cases are in the ratio of 2 : 1, then threshold frequency ν_0 is given by

- (a) $\frac{\nu_2 - \nu_1}{2 - 1}$ (b) $\frac{2\nu_1 - \nu_2}{2 - 1}$
 (c) $\frac{2\nu_2 - \nu_1}{2 - 1}$ (d) $\frac{\nu_2 - \nu_1}{2}$

9. (c) $KE_1 = h\nu_1 - h\nu_0$

$KE_2 = h\nu_2 - h\nu_0$

$$\frac{KE_1}{KE_2} = \frac{h(\nu_1 - \nu_0)}{h(\nu_2 - \nu_0)} \quad ; \quad \frac{2}{1} = \frac{\nu_1 - \nu_0}{\nu_2 - \nu_0} \quad ; \quad \nu_0 = \frac{2\nu_2 - \nu_1}{2 - 1} .$$

M8. The ratio of radii of first orbits of H, He⁺ and Li²⁺ is

(a) 1 : 2 : 3

(b) 6 : 3 : 2

(c) 1 : 4 : 9

(d) 9 : 4 : 1

8. (b) $r = \frac{n^2}{Z} \times 0.529 \text{ \AA}$

$$r_{\text{H}} : r_{\text{He}^+} : r_{\text{Li}^{2+}} = 1 : \frac{1}{2} : \frac{1}{3} = \mathbf{6 : 3 : 2}$$

D1. The wave function ψ of 2s – orbital is given by

$$\Psi_{2s} = \frac{1}{2\sqrt{2}\pi} \left(\frac{1}{a_0} \right)^{1/2} \left(2 - \frac{r}{a_0} \right) e^{-r/2a_0}$$

At $r = r_0$, radial node is formed. Which of the following is correct?

(a) $r_0 = 2a_0$

(b) $2r_0 = a_0$

(c) $r_0 = 3a_0$

(d) None of these is correct

1. (a) At $r = r_0$ $\Psi_{2s}^2 = 0$

It is possible only when $2 - \frac{r}{a_0} = 0$

$\therefore r_0 = 2a_0$

D1. An electron is accelerated through V voltage. Its de Broglie wavelength is

- (a) $\frac{h}{\sqrt{2m \cdot eV}}$ (b) $\frac{12.27}{\sqrt{V}} \text{ \AA}$
(c) $\left[\frac{150}{V}\right]^{\frac{1}{2}} \text{ \AA}$ (d) all of these

1. (d) $\lambda = \frac{h}{\sqrt{2m \text{ KE}}}$; (K.E. = $e \cdot V$); $\lambda = \left[\frac{h}{\sqrt{2m \cdot e \cdot V}}\right] = \left[\frac{h^2}{2m \cdot eV} \times 10^{20}\right]^{\frac{1}{2}} \text{ \AA}$
 $= \left[\frac{150}{V}\right]^{\frac{1}{2}} \text{ \AA} = \frac{12.27}{\sqrt{V}} \text{ \AA}$

E97. The calculated value of magnetic moment of ${}_{26}\text{Fe}^{3+}$ is

- (a) 3.89 B.M (b) 1.73 B.M
(c) 4.90 B.M (d) 5.92 B.M

97. (d) Magnetic moment = $\sqrt{n(n+2)}$ B.M where n is the number of unpaired electrons.

For Fe^{3+} ion $n = 5$ so, $\mu = \sqrt{5(5+2)} = \sqrt{35}$ B.M

E73. If the K.E. of a particle is doubled, its de Broglie wavelength becomes

- (a) 2 times (b) 4 times
(c) $\sqrt{2}$ times (d) $\frac{1}{\sqrt{2}}$ times

73. (d) $\frac{\lambda_1}{\lambda_2} = \sqrt{\frac{E_2}{E_1}}$ where 'E' is the K.E. of a particle.

As per the above relation, when K.E. is doubled, its wavelength becomes $\frac{1}{\sqrt{2}}$ times.

E73. Which of the following statement is correct in relation to the hydrogen atom?

- (a) 3s-orbital is lower in energy than 3p-orbital.
- (b) 3p-orbital is lower in energy than 3d-orbital.
- (c) 3s and 3p-orbitals are of lower energy than 3d-orbitals.
- (d) 3s, 3p and 3d-orbitals all have same energy.

73. (d) Energy of single electron system is only depend on the principle quantum number, so that energy of different orbitals of same principle quantum number is same.

M84. The work function for a metal is 4 eV. To emit a photo-electron of zero velocity from the surface of the metal, the wavelength of incident light should be

(a) 2700 Å

(b) 1700 Å

(c) 5900 Å

(d) 3100 Å

84. (d) $\frac{hc}{\lambda} = w_0 + \text{KE}$ (but $\text{KE} = 0$) ; $\lambda = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{4 \times 1.6 \times 10^{-19}} = 3.1 \times 10^{-7} \text{ m}$
= 3100 Å.

E37. Which one of the following set of quantum numbers is not permitted?

- (a) $n = 3, l = 3, m = 0, s = +\frac{1}{2}$ (b) $n = 3, l = 2, m = +2, s = -\frac{1}{2}$
(c) $n = 3, l = 1, m = -1, s = -\frac{1}{2}$ (d) $n = 3, l = 0, m = 0, s = +\frac{1}{2}$.

37. (a) If $n = 3, l \neq 3$

M45. It ' λ_0 ' is the threshold wavelength for photoelectric emission, ' λ ' the wavelength of light falling on the surface of a metal and ' m ' is the mass of the electron, then the velocity of ejected electron is given by

- (a) $\left[\frac{2h}{m} (\lambda_0 - \lambda) \right]^{1/2}$ (b) $\left[\frac{2hc}{m} (\lambda_0 - \lambda) \right]^{1/2}$
- (c) $\left[\frac{2hc}{m} \left(\frac{\lambda_0 - \lambda}{\lambda_0 \lambda} \right) \right]^{1/2}$ (d) $\left[\frac{2h}{m} \left(\frac{1}{\lambda_0} - \frac{1}{\lambda} \right) \right]^{1/2}$

45. (c) $h\nu = h\nu_0 + \text{KE}$ i.e. $\frac{hc}{\lambda} = \frac{hc}{\lambda_0} + \frac{1}{2}mv^2$

$$v = \left(\frac{2hc}{m} \left(\frac{1}{\lambda} - \frac{1}{\lambda_0} \right) \right)^{1/2}$$

E58. Assuming Rydberg's constant (R_H) to be 109670 cm^{-1} , the longest wavelength line in the Lyman series of the hydrogen spectrum is

- (a) 1215.8 \AA (b) 1025.8 \AA
(c) 972.6 \AA (d) 949.8 \AA

58. (a) $\frac{1}{\lambda} = R_H Z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right) = 109670 \left(\frac{1}{1} - \frac{1}{4} \right) = \frac{3}{4} (109670) \text{ cm}^{-1}$

$\lambda = 1215.8 \times 10^{-8} \text{ cm}$ i.e., $\lambda = \mathbf{1215.8 \text{ \AA}}$

E27. The total number of electrons in a sub-shell designated by azimuthal quantum number, l is given as

(a) $2l + 1$

(b) l^2

(c) $4l + 2$

(d) $2l + 2$

27. (c)

E6. Bohr's theory is not valid for the species

- | | | | |
|-----|---------------------|-----|----------------------|
| (a) | H atom | (b) | He ⁺ ion |
| (c) | Li ⁺ ion | (d) | Li ²⁺ ion |

6. (c) Li⁺ ion is not a monoelectronic system.

E20. Ultra violet light of 6.2 eV falls on aluminium surface (work function = 4.2 eV). The kinetic (in Joule) of the fastest electron emitted is approximately

- (a) 3.2×10^{-21} (b) 3.2×10^{-19}
(c) 3.2×10^{-17} (d) 3.2×10^{-15}

20. (b) $h\nu = \phi + \text{KE}$

$$6.2 = 4.2 + \text{KE}$$

$$\text{KE} = 2\text{eV} = 2 \times 1.6 \times 10^{-19} \text{ J} = \mathbf{3.2 \times 10^{-19} \text{ J.}}$$

E33. The de-Broglie wavelength (in m) of the electron ejected out when the radiation of energy 'E' strikes on the metal surface having threshold frequency equal to half of incident frequency is

- (a) $0.6947 \times 10^{-18}/\sqrt{E}$ (b) $0.6947 \times 10^{-18} \times \sqrt{E}$
 (c) $6.6 \times 10^{-34} E$ (d) $6.6 \times 10^{-34}/\sqrt{E}$

33. (a) $h\nu = h\nu_0 + KE$

$$E = \frac{E}{2} + KE \quad ; \quad \therefore \text{K.E} = \frac{E}{2}$$

$$\therefore h\nu_0 = \frac{h\nu}{2} = \frac{E}{2}$$

$$\therefore \lambda = \frac{h}{\sqrt{2mKE}} = \frac{6.6 \times 10^{-34}}{\sqrt{2 \times 9.1 \times 10^{-31} \times \frac{E}{2}}} = \frac{0.6947 \times 10^{-18}}{\sqrt{E}}$$

E34. From the given sets of quantum numbers, the one that is inconsistent with the theory is

(a) $n = 3, l = 2, m = -3, s = +\frac{1}{2}$ (b) $n = 4, l = 3, m = 3, s = +\frac{1}{2}$

(c) $n = 2, l = 1, m = 0, s = -\frac{1}{2}$ (d) $n = 4, l = 3, m = 2, s = +\frac{1}{2}$

34. (a) When $l = 2$

Volume of $m = -2, -1, 0, 1, 2$.

E9. If nitrogen had the electronic configuration of $1s^7$, it would have energy lower than that of the normal ground state configuration of $1s^2 2s^2 2p^3$ because the electrons would be closer to the nucleus. But $1s^7$ is not observed because it violates:

(a) Heisenberg uncertainty. (b) Hund's rule.

(c) Pauli's exclusion principle. (d) Bohr postulates of stationary orbits.

9. (c)

E10. If uncertainty in position and momentum are equal then uncertainty in velocity is:

(a) $\sqrt{\frac{h}{\pi}}$

(b) $\sqrt{\frac{h}{2\pi}}$

(c) $\frac{1}{2m} \sqrt{\frac{h}{\pi}}$

(d) none of these

10. (c) $\Delta x \times \Delta P \geq \frac{h}{4\pi}$

$$\Delta P \geq \sqrt{\frac{h}{4\pi}} \quad \therefore \Delta x = \Delta P$$

$$m \cdot \Delta v \geq \sqrt{\frac{h}{4\pi}} \quad ; \quad \Delta v = \frac{1}{2m} \sqrt{\frac{h}{\pi}}$$

E62. Among KO_2 , AlO_2^- , BaO_2 and NO_2^+ , unpaired electron is present in

(a) NO_2^+ , BaO_2

(b) KO_2 and AlO_2^-

(c) KO_2 only

(d) BaO_2 only

62. (c) Superoxides (O_2^-) have one unpaired electron each and are, therefore, paramagnetic. Oxide ions (O^{2-}) and peroxides (O_2^{2-}) do not have any unpaired electrons and hence are diamagnetic.

M63. Molecular size of ICl and Br_2 are nearly same but boiling point of ICl is about 40° higher than Br_2 . This is due to

- (a) $\text{I}-\text{Cl}$ bond is stronger than $\text{Br}-\text{Br}$ bond.
- (b) Ionisation energy of $\text{I} <$ ionisation energy of Br .
- (c) ICl is polar whereas Br_2 is non-polar.
- (d) Size of I is larger than that of Br .

63. (c)

M64. The correct order of increasing bond angles is

- (a) $\text{PF}_3 < \text{PCl}_3 < \text{PBr}_3 < \text{PI}_3$ (b) $\text{PI}_3 < \text{PCl}_3 < \text{PBr}_3 < \text{PF}_3$
(c) $\text{PI}_3 < \text{PBr}_3 < \text{PCl}_3 < \text{PF}_3$ (d) $\text{PCl}_3 < \text{PBr}_3 < \text{PI}_3 < \text{PF}_3$

64. (a) As the size of surrounding atom increases the electronic repulsion increases bond angle increases.

E1. The hybridisation and shape of ClO_3^- is

- (a) sp^3 and tetrahedral (b) sp^3 and triangular pyramidal
(c) sp^3 and triangular planar (d) sp^3d and trigonal bipyramidal

1. (b)

E2. Which of the following statements are correct?

I. Bond order of NO is 2.5 II. Bond order of NO⁺ is 3.0

III. Bond order of O₂ is 1.5 IV. Bond order of CO is 3.0

(a) I, II, III

(b) I, II, IV

(c) I, III, IV

(d) II, III, IV

2. (b) $BO = \frac{1}{2}(N_b - N_a)$ $N_b =$ Number of bonding electrons.

$N_a =$ Number of antibonding electrons.

E84. The correct order of increasing covalent character of the following is

- (a) $\text{SiCl}_4 < \text{AlCl}_3 < \text{CaCl}_2 < \text{KCl}$
- (b) $\text{KCl} < \text{CaCl}_2 < \text{AlCl}_3 < \text{SiCl}_4$
- (c) $\text{AlCl}_3 < \text{CaCl}_2 < \text{KCl} < \text{SiCl}_4$
- (d) none of these

84. (b)

M93. Which of the following is planar?

- (a) XeO_4
- (b) XeO_2F_2
- (c) XeO_3F_2
- (d) XeF_4

93. (d) XeO_4 – tetrahedral

XeO_3F_2 – trigonal bipyramidal

XeO_2F_2 – trigonal bipyramidal

XeF_4 – square planar.

M71. Which of the following has the maximum number of unpaired electrons?

- (a) Mg^{2+} (b) Ti^{3+}
(c) Fe^{2+} (d) V^{3+}

71. (c)

M74. According to MO theory which of the following statement about the magnetic character and bond order is correct regarding O_2^+ ?

- (a) Paramagnetic and bond order $< \text{O}_2$.
(b) Paramagnetic and bond order $> \text{O}_2$.
(c) Diamagnetic and bond order $< \text{O}_2$.
(d) Diamagnetic and bond order $> \text{O}_2$.

74. (b)

E76. Which concept best explains that o-nitrophenol is more volatile than p-nitrophenol?

- (a) Resonance (b) Steric hinderance
(c) Hydrogen bond (d) Hyperconjugation

76. (c) o-nitrophenol has intramolecular H-bonding while p-nitrophenol has intermolecular H-bonding.

M77. Which species has the maximum number of lone pair of electrons on the central atom?

- (a) ClO_3^- (b) XeF_4
(c) SF_4 (d) I_3^-

77. (d) In I_3^- , central atom has 3 lone pair and two bond pair.

D78. The electronegativity difference between N and F is greater than that between N and H yet the dipole moment of NH_3 (1.5 D) is larger than that of NF_3 (0.2 D). This is because

(a) in NH_3 as well as NF_3 the atomic dipole and bond dipole are in opposite directions.

(b) in NH_3 the atomic dipole and bond dipole are in the opposite directions whereas in NF_3 these are in the same direction.

(c) in NH_3 as well as in NF_3 the atomic dipole and bond dipole are in the same direction.

(d) in NH_3 the atomic dipole and bond dipole are in the same direction whereas in NF_3 these are in opposite directions.

78. (d)

E116. The shape of ICl_5 is

- (a) triangular bipyramidal (b) octahedral
(c) square pyramidal (d) pentagonal planar

116. (c) ICl_5 has sp^3d^2 hybridisation with 5 bond pairs and 1 lone pair, hence shape is square pyramidal.

E119. In XeF_2 , XeF_4 and XeF_6 the number of lone pair of electrons on Xe is respectively

(Atomic numbers: F = 9, Xe = 54)

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

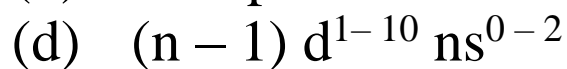
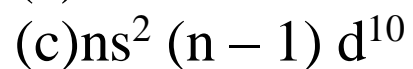
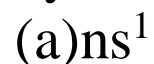
119. (d) XeF_2 : Xe has got 2 bond pairs and 3 lone pairs.

XeF_4 : Xe has got 4 bond pairs and 2 lone pairs.

XeF_6 : Xe has got 6 bond pairs and 1 lone pair.

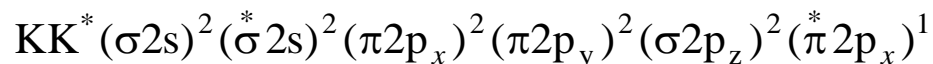
E36. The general electronic configuration of transition elements is given

by

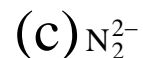
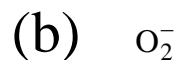
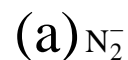


36. (d)

E39. Molecular orbital electronic configuration for X_2^{n-} anion is



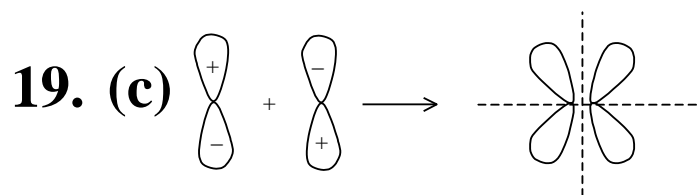
The anion X_2^{n-} is



39. (a)

M19. Which of the following MO has two nodal planes perpendicular to each other

- (a) σ_{2s} (b) $\pi 2p_x$
 (c) $\pi^* 2p_y$ (d) $\sigma^* 2p_z$



E20. The maximum number of H-bonds in which water molecule can participate is

- (a) 1 (b) 3
 (c) 2 (d) 4

20. (d)

E11. The bond length in o_2^+ , o_2 , o_2^- and o_2^{2-} follows the order

- | | | | |
|-----|----------------------------------|-----|----------------------------------|
| (a) | $o_2^{2-} > o_2^- > O_2 > o_2^+$ | (b) | $o_2^+ > O_2 > o_2^- > o_2^{2-}$ |
| (c) | $O_2 > o_2^- > o_2^{2-} > o_2^+$ | (d) | $o_2^- > o_2^{2-} > o_2^+ > O_2$ |

11. (a)

M12. The shape of XeO_3 is

- | | |
|-----------------------|-----------------|
| (a) T-shaped | (b) Tetrahedral |
| (c) Triangular planar | (d) Pyramidal |

12. (d) The state of hybridisation of Xe in XeO_3 is sp^3 . Three corners of tetrahedron are occupied by the three O-atoms and the fourth corner is occupied by lone pair. Therefore shape of XeO_3 is pyramidal.

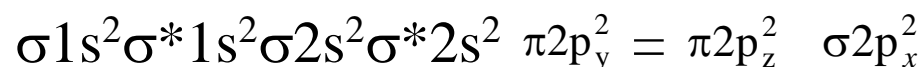
- E24.** Electron affinity is positive when
- (a) O^- is formed from O
 - (b) O^{2-} is formed from O^-
 - (c) O^+ is formed from O
 - (d) electron affinity is always a negative value

24. (b)

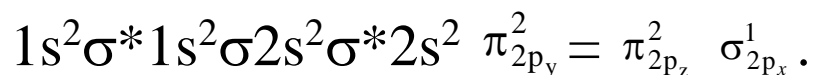
E62. In the formation of N_2^+ from N_2 , the electron is lost from a

- (a) σ -orbital
- (b) π -orbital
- (c) σ^* -orbital
- (d) π^* -orbital

62. (a) M.O. configuration of N_2 is:



M.O. configuration of N_2^+ is:



E69. Which of the following have identical bond order:

- (a) O_2^{2+} (b) NO^+
(c) CN^- (d) CN^+

69. (a, b, c)

$$O_2^{2+} : B. O. = 3, NO^+ - B.O. = 3, CN^- - B. O. = 3.$$

$$CN^+ - B. O. = 2.5$$

E6. The most acidic among the following oxides is

- (a) MnO (b) MnO_2
(c) Mn_3O_4 (d) Mn_2O_7

6. (d) Mn_2O_7 : Acidity of oxides increases with oxidation number of metal.

E58. The dipole moment (in Debye units) of m–dichlorobenzene is 1.72.

What is the value of dipole moment for o–dichlorobenzene?

(a) 0 (b) 3.42

(c) 2.4 (d) 2.98

$$\mathbf{58. (d) \mu_R = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2 \cos 120^\circ}}$$
$$= \sqrt{\mu^2} \quad (\mu_1 = \mu_2 = \mu)$$

$$\mu = \mu_R = 1.72$$

$$\mu_R = \sqrt{\mu_1^2 + \mu_2^2 + 2\mu_1\mu_2 \cos 60^\circ}$$
$$= \sqrt{2\mu^2 + 2\mu^2 \frac{1}{2}} \quad (\mu_1 = \mu_2 = \mu)$$

$$= \sqrt{3} \times \mu$$

$$= \sqrt{3} \times 1.72 = \mathbf{2.98 \text{ D.}}$$

E57. The observed dipole moment of HCl molecule is 1.03 D. If H–Cl bond distance is 1.275 Å and electronic charge is 4.8×10^{-10} e.s.u. The % polarity in HCl will be

- (a) $1.275 \times 1.03 \%$ (b) $\frac{4.8 \times 1.275 \times 10^{-8}}{1.03} \%$
 (c) $\frac{1.03 \times 100}{4.8 \times 1.275} \%$ (d) $\frac{4.8 \times 10^{-10}}{1.03} \times 100 \%$

57. (c) Percentage polarity = $\frac{\text{observed dipole moment of molecules} \times 100}{\text{calculated dipole moment}} \%$

Here observed dipole moment of HCl = 1.03 D

Calculated dipole moment of HCl = $4.8 \times 10^{-10} \times 1.275 \times 10^{-8} = 4.8 \times 1.275$
 D

Therefore, % polarity = $\frac{1.03}{4.8 \times 1.275} \times 100 \%$.

E10. F — Xe — F bond angle in XeO_2F_2 is approximately

- (a) 90° (b) 120°
(c) 180° (d) $109^\circ 28'$

10. (c) Oxygen and lone pair will occupy equatorial positions and fluorine will occupy axial positions in trigonal bipyramidal geometry due to sp^3d hybridization

E15. Which one of the following statements is incorrect about the species KO_2 , K_2O_2 and O_2 ?

(a) KO_2 and K_2O_2 are diamagnetic while O_2 is paramagnetic.

(b) KO_2 and O_2 are paramagnetic while K_2O_2 is diamagnetic.

(c) Bond length increases in the order : $\text{O}_2 < \text{O}_2^- < \text{O}_2^{2-}$.

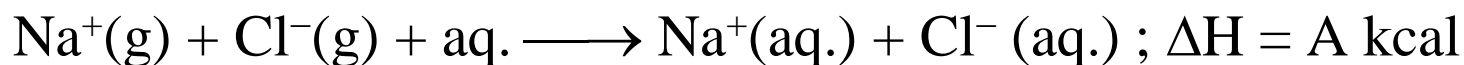
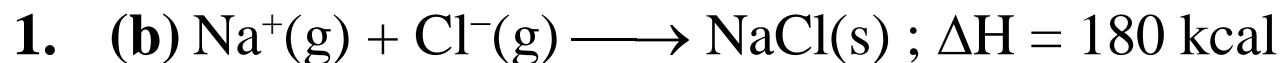
(d) Bond enthalpy decreases in the order : $\text{O}_2 > \text{O}_2^- > \text{O}_2^{2-}$.

15. (a) O_2 and O_2^- are paramagnetic whereas O_2^{2-} is diamagnetic.

Bond order decreases in the following order: $\text{O}_2 > \text{O}_2^- > \text{O}_2^{2-}$.

M1. The lattice energy of solid NaCl is 180 kcal/mol. The dissolution of the solid in water in the form of ions is endothermic to the extent of 1 kcal/mol. If the solution energies of Na⁺ and Cl⁻ are in the ratio 6 : 5, what is the enthalpy of hydration of Cl⁻ ion?

- (a) -81.4 kcal mol⁻¹ (b) -97.5 kcal mol⁻¹
 (c) 82.6 kcal mol⁻¹ (d) +100 kcal mol⁻¹



$$\Delta\text{H}_{\text{solution}} = \Delta\text{H}_{\text{lattice}} + \Delta\text{H}_{\text{hydration}}$$

$$\therefore 1 = 180 + \Delta\text{H}_{\text{hydration}}$$

$$\therefore \Delta\text{H}_{\text{hydration}} = -179 \text{ kcal} = A$$

$$\Delta\text{H}_{\text{Na}^+}(\text{hydration}) + \Delta\text{H}_{\text{Cl}^-}(\text{hydration}) = A$$

$$\Delta\text{H}_{\text{Cl}^-}(\text{hydration}) = \frac{5A}{11} = \frac{5 \times (-179)}{11} = -81.4 \text{ kcal.}$$

E12. Which of the following compound has zero dipole moment?

(a) Cis but-2-ene

(b) Trans but-2-ene

(c) But-1-ene

(d) 2-methylprop-1-ene

12. (b) Dipole moment is a vector quantity. It gets cancelled in the case of trans but-2-ene.

M4. $N_0/2$ atoms of $X(g)$ are converted into $X^+(g)$ by energy E_1 . $N_0/2$ atoms of $X(g)$ are converted into $X^-(g)$ by energy E_2 . Hence, ionization potential and electron affinity of $X(g)$ are: (N_0 is Avogadro Number)

(a) $\frac{2E_1}{N_0}, \frac{2(E_1 - E_2)}{N_0}$

(b) $\frac{2E_1}{N_0}, \frac{2E_2}{N_0}$

(c) $\frac{(E_1 - E_2)}{N_0}, \frac{2E_2}{N_0}$

(d) $2E_1, 2E_2$

4. (d) $X(g) \longrightarrow X^+(g) + e$

If I is ionization energy then

$$\frac{1}{2}(I) = E_1$$

$$I = 2E_1$$

If E is electron affinity then

$$\frac{1}{2}(E) = E_2$$

$$E = 2E_2$$

E20. Sodium sulphate is soluble in water but barium sulphate is sparingly soluble because

- (a) the hydration energy of Na_2SO_4 is more than its lattice energy while the lattice energy of BaSO_4 is more than its hydration energy.
- (b) the lattice energy has no role to play in solubility
- (c) the lattice energy of Na_2SO_4 is more than its hydration energy
- (d) none of these

20. (a)

E5. A diatomic molecule has a dipole moment of 1.92 D and a bond length of 2.0 Å. What is the percentage ionic character in the molecule if $e = 4.8 \times 10^{-10}$ esu?

- | | | | |
|-----|-----|-----|-----|
| (a) | 33% | (b) | 25% |
| (c) | 20% | (d) | 50% |

5. (c) % ionic characters = $\frac{\text{observed dipole moment}}{\text{calculated dipole moment assuming 100\% ionic character}} \times 100$

$$= \left[\frac{1.92 \text{ D}}{(4.80 \times 10^{-10}) \times (2 \times 10^{-8} \text{ cm})} \right] \times 100$$

$$= \frac{1.92 \text{ D}}{(4.8 \times 2) \text{ D}} \times 100 = \mathbf{20\%}.$$

E7. In which one of the following compounds, the percentage ionic character in the bonds is least.

- (a) MgS (b) MgCl₂
(c) NaCl (d) Na₂S

7. (a) MgS has the least ionic character due to smaller size of Mg²⁺ ion and larger size of S²⁻ ion.

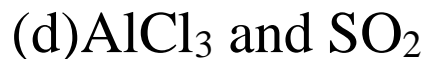
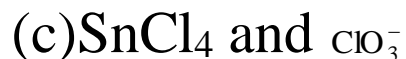
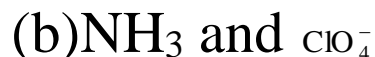
E10. If the electronegativity difference between two atoms A and B is 2.0, then the percentage ionic character in the molecule is

- (a) 40% (b) 46% (c) 23% (d) >50%

10. (b)

$$\begin{aligned}\% \text{ ionic character} &= 16(\Delta E.N) + 3.5(\Delta E.N)^2 \\ &= 16(2) + 3.5(2)^2 \\ &= 46\end{aligned}$$

E12. Which pair is isostructural and possesses same number of lone pair of electron on central atom?



12. (a)

E6. Arrange the following compounds in order of increasing dipole moment:

(i) toluene

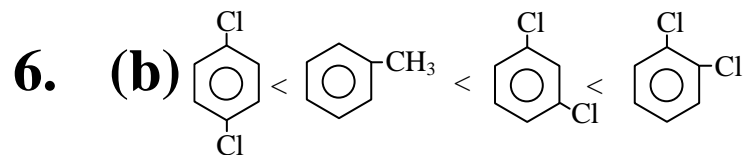
(ii) m-dichlorobenzene

(iii) o-dichlorobenzene

(iv) p-dichlorobenzene

(a) (i) < (iv) < (ii) < (iii) (b) (iv) < (i) < (ii) < (iii)

(c) (iv) < (i) < (iii) < (ii) (d) (iv) < (ii) < (i) < (iii)

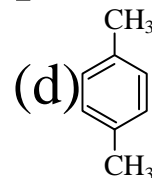
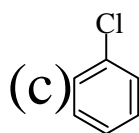
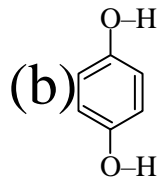
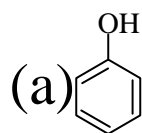


E7. The hydrogen bond is strongest in which one of the following?

- (a) F—H — — — F (b) O—H — — — S
 (c) S—H — — — F (d) F—H — — — O

7. (a)

M12. Select the structures which have a permanent dipole moment?



12. (a, b, c)