11.19 Which of the following statements are true for physisorption?

(A) Extent of adsorption increases with increase in pressure.

(B) It needs activation energy

(C) It can be reversed easily

(D) It occurs at high temperature.

11.20 Identify the reactions that includes inhibtors in the reactions mixture.

(A) $N_2 + 3H_2 \xrightarrow[Mo]{Fe} 2NH_3$

(B) Vegetable Oil + $H_2 \xrightarrow[Cu]{Ni}$ Vegetable ghee.

(C) $N_2 + 3H_2 \xrightarrow[CO/H_2S]{Fe} 2NH_3$

(D) $RCOCl + H_2 \xrightarrow[BaSO_4]{Pd} RCHO + HCl$

11.21 Which of the following are the correct :

(A) A Catalyst remains unchanged in mass and chemical compositions at the end of reactions.

(B) Finely devided state of catalyst is more efficient for the reactions.

(C) Catalyst change equilibrium state of the reaction.

(D) A catalyst changes the entropy and the free energy of a reaction.

11.22 Which of the following are correct statements

(A) Spontaneous adsorption of gases on solid surface is an exothermic process as entropy decreases during adsorption

(B) Formation of micelles takes place when temperature is below Kraft Temperature (T_k) and concentration is above critical micelle concentration (CMC)

(C) A colloid of $Fe(OH)_3$ is prepared by adding a little excess (required to completely precipitate Fe^{3+} ions as $Fe(OH)_3$)) of NaOH in $FeCl_3$ solution the particles of this sol will move towards cathode during electrophoresis.

(D) According to Hardy-Schulze rules the coagulation (flocculating) value of Fe^{3+} ion will be more than Ba^{2+} or Na^+.

11.23 Which of the following is true of Brownian motion ?

(A) The movement is more vigorous for smaller particles.

(B) The movement does not change with time and remains the same for months and years.

(C) The moment does not depend on the temperature

(D) It can be sometimes seen with naked eyes or using a simple microscope at most.

11.24 Which of the following are correct statements ?

(A) Hardy schulz rule is related to coagulation

(B) Brownian moment and Tyndall effect are the characteristic of colloids.

(C) In gel, the liquid is dispersed in liquid

(D) Lower the gold number, more is the protective power of lyophillic sols.

11.25 Identify the correct statement

(A) Brownian motion and tyndall effect is shown by colloidal particles

(B) Gold number is a measure of the protective power of a lyophilic colloid

(C) The colloidal solution with both the dispersed phase and the dispersion medium in liquid state is called a gel.

(D) Hardy-Schulze rule is related with coagulation

SECTION - III : ASSERTION AND REASON TYPE

11.26 **Statement-1 :** All colloidal dispersions give very low osmotic pressure and show very small freezing point depression or boiling point elevation.

Statement-2 : Tyndall effect is due to scattering of light from the surface of colloidal particles.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(C) Statement-1 is True, Statement-2 is False.

(D) Statement-1 is False, Statement-2 is True.

11.27 **Statement-1 :** When $AgNO_3$ is treated with excess of KI, colloidal particles gets attracted towards anode.
Statement-2 : Colloidal particles adsorb common ions and thus become charged.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

11.28 **Statement-1 :** In the coagulation of negatively charged arsenic sulphide sol, the coagulating power decreases in the order, $Al^{3+} > Ba^{2+} > Na^{+}$.
Statement-2 : Generally greater the valence of coagulating ion, the greater is its power of coagulation.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement-2 is False.
(D) Statement-1 is False, Statement-2 is True.

11.29 **Statement-1 :** Isoelectric point is pH at which colloidal can move towards either of electrode
Statement-2 : At isoelectric point, colloidal solution become electrically neutral
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement-2 is False.
(D) Statement-1 is False, Statement-2 is True.

11.30 **Statement-1 :** Gelatin is added to ice cream as a protective agent so as to preserve its smoothness.
Statement-2 : Whipped cream is colloidal in nature.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement-2 is False.
(D) Statement-1 is False, Statement-2 is True.

11.31 **Statement-1 :** Gold number is the measure of protective powers of different colloids.
Statement-2 : The smaller the gold number of lyophilic colloid, the smaller is its protective power.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement-2 is False.
(D) Statement-1 is False, Statement-2 is True.

SECTION - IV : COMPREHENSION TYPE

Comprehension :

Read the following passage carefully and answer the questions.

The Colloidal particles are electrically charged as is indictated by their migration towards cathode or anode under the applied electric field. In a particular colloidal system, all particles carry either positive charge or negative charge.

The electric charge on colloidal particles originate in several ways. According to preferential adsorption theory, the freshly obtained precipitate particles adsorb ions from the dispersion medium, which are common to their lattice and acquire the charge of adsorbed ions. For example, freshly obtained $Fe(OH)_3$ precipitated is dispersed, by a little $FeCl_3$, into colloidal solution owing to the adsorptions of Fe^{3+} ions in preference. Thus sol particles will be positively charged.

In some cases the colloidal particles are aggregates of cations or anions having amphiphilic character. When the ions possess hydrophobic part (hydrocarbon end) as well as hydrophilic part (polar end group), they undergo association in aqueous solution to form particles having colloidal size. The formation of such particles, called micelles plays a very important role in the solubilization of water insoluble substances, (hydrocarbon, oils, fats, grease etc.). In micelles, the polar end groups are directed towards water and the hydrocarbon ends into the centre.

The charge on sol particles of proteins depends on the pH. At low pH, the basic group of protein molecule is ionized (protonated) and at higher pH (alkaline medium), the acidic group in ionized. At Isoelectric pH, characteristic to the protein, both basic and acidic groups are equally ionized.

The stability of colloidal solution is attributed largely to the electric charge of the dispersed particles. This charge causes them to be coagulated or precipitated. On addition of small amount of electrolytes, the ions carrying opposite charge are adsorbed by sol particles resulting in the neutralization of their charge.When the sol particles either with no charge or reduced charge, come closer due to Brownian movement, they aggregate to form bigger particles resulting in their separation from the dispersion medium. This is what is called coagulation or precipitation of the colloidal solution. The coagulating power of the effective ion, which depend on its charge, is expressed in terms of its coagulating value, defined as its minimum concentration (m mol/L) needed to precipitate a given sol.

11.32 A gelatin sol at pH less then the isoelectric value is subjected to an electric field. The sol particles migrate toward

(A) Anode
(B) Cathode
(C) Both anode and cathode
(D) Neither anode nor cathode

11.33 Which of the following ions would have the minimum coagulating value for sol obtained on peptizing $Sn(OH)_4$ by little NaOH solution.

(A) Cl^-
(B) SO_4^{2-}
(C) K^+
(D) Ba^{2+}

11.34 How would you obtain a sol of AgI, the particles of which migrate toward cathode under the electric field ?

(A) By adding little excess of KI to $AgNO_3$ solution
(B) By adding little excess of $AgNO_3$ to KI solution
(C) By mixing equal volumes of 0.010 M $AgNO_3$ and 0.010 M KI
(D) None of these

Comprehension # 2

Adsorption is the presence of excess concentration of any particular component at the surface of liquid or solid phase as compared to bulk. This is due to presence of residual forces at the surface of body. In the adsorption of hydrogen gas over a sample of charcoal, 1.12cm³ of $H_2(g)$ measured over S.T.P. was found to adsorb per gram of charcoal. Consider only monolayer adsorption. Density of H_2 is 0.07gm/cc. In another experiment same 1 gm charcoal adsorbs 100ml of 0.5M CH_3COOH to form monolayer and thereby the molarity of CH_3COOH reduces to 0.49.

$$\left(\frac{3\times 47.43}{4\pi}\right)^{1/3} = 2.24.$$

$$(2.24)^2 = 5$$

11.35 Numbers of molecules of hydrogen over 1 gram charcoal are –

(A) 3.01×10^{18}
(B) 3.01×10^{19}
(C) 3.01×10^{21}
(D) 3.01×10^{22}

11.36 What is the radius of adsorb hydrogen molecule –

(A) 2.24×10^{-7} cm
(B) 2.24×10^{-8} cm
(C) 2.24×10^{-9} cm
(D) 2.24×10^{-10} cm

11.37 Specific surface area of charcoal is (cm²/gm) –

(A) 4.72×10^3
(B) 4.72×10^4
(C) 4.72×10^5
(D) 4.72×10^6

11.38 Molecule of acetic acids adsorbed –

(A) 6.023×10^{20}
(B) 6.023×10^{21}
(C) 6.023×10^{22}
(D) 6.023×10^{23}

11.39 Surface area of charcoal adsorbed by each molecule of (acetic acid) is –

(A) 7.8×10^{-19} cm²
(B) 7.8×10^{-18} cm²
(C) 7.8×10^{-17} cm²
(D) 7.8×10^{-16} cm²

Comprehension # 1

The clouds consist of charged particles of water dispersed in air. Some of them are +vely charged, others are –vely charged. When +vely charged clouds come closer they cause lightening and thundering whereas when +ve and –ve charged colloids come closer they cause heavy rain by aggregation of minute particles. It is possible to cause artificial rain by throwing electrified sand or silver iodide from an aeroplane and thus coagulating the mist hanging in air.

11.40 When excess of $AgNO_3$ is treated with KI solution, AgI forms
(A) +ve charged sol (B) –vely charged sol
(C) neutral sol (D) true solution

11.41 AgI helps in artificial rain because :
(A) it helps in condensation process (B) it helps in dispersion process
(C) it helps in coagulation (D) all of them

11.42 Smoke screens consist of
(A) fine particles of TiO_2 dispersed in air by aeroplanes
(B) fine particles of AgI dispersed in air by aeroplanes
(C) fine particles of Al_2O_3 dispersed in air by aeroplanes
(D) None of these

SECTION - V : MATRIX - MATCH TYPE

11.43 Match list I with list II and select the correct answer :

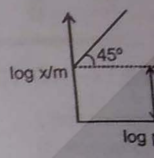
Column I	Column II
(A) Coagulation	(p) Scattering of light
(B) Dialysis	(q) Washing of precipitates
(C) Peptization	(r) Purification of colloids
(D) Tyndall effect	(s) Electrolyte
	(t) Visibility of tail of comets

11.44 Match list I (Colloidal system) with list II (Example)

Column-I	Column-II
(A) Emulsifier	(p) Colloidal solution
(B) Xerogel	(q) Soaps
(C) Colloidal electrolyte	(r) Foil of cellophane
(D) Purple of Cassius	(s) Dextrin
	(t) Gold sol

SECTION - VI : INTE

11.45 At 2 atm pressur



11.46 1 L of 0.6 M ac
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0.5 M. What i

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11.49 Coagulatio
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16.2 x 1

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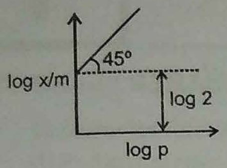
SECTION - VI : INTEGER TYPE

11.45 At 2 atm pressure the value of $\frac{x}{m}$ will be : (log 2 = 0.3010)



11.46 1 L of 0.6 M acetic acid is shaken with 2 g activated carbon. Activated carbon absorbs some acetic acid on its surface only. This process is called adsorption. The final concentration of the solution after adsorption is 0.5 M. What is the amount of acetic acid adsorbed per gram of carbon.

11.47 100 ml of a colloidal solution is completely precipitated by addition of 0.5 ml of 1M NaCl solution, calculate the coagulation value of NaCl.

11.48 On addition of the 1ml. solution of 10% NaCl to 10 ml gold sol in the presence of 0.00399 gm of starch, calculate the gold no.

11.49 Coagulation experiment, 5ml of As_2S_3 is mixed with distilled water and 0.01 M solution of an electrolyte AB so that total volume is 10ml. it was found that all solution containing more than 5 ml of AB coagulate within 5 min. what is the Flocculation value of AB for As_2S_3 sol.

11.50 The volume of nitrogen gas (measured at STP) required to cover a sample of silica gel with a mono-molecular layer is $129 cm^3/g$ of gel. Calculate the surface area per gram of the gel if each nitrogen molecule occupies $16.2 \times 10^{-20} m^2$. (Report your answer after dividing by 10)

11.51 The minimum concentration of an electrolyte required to cause coagulation of a sol is called its flocculation value. It is expressed in millimoles per litre. If the flocculation value of $MgSO_4$ for standard As_2S_3 sol is 3.33. How many milligrams of $MgSO_4$ is to be added to 20 ml standard As_2S_3 sol so that flocculation just starts ?

INORGANIC CHEMISTRY

SECTION-I (TOPIC WISE PROBLEMS)

TOPIC
1

SECTION - I :

1.1 Consider
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(II) A met
(III) Diam
(IV) The
Select th
(A) I, II,

1.2 There a
element
(i) 'p' ha
(ii) 'r' is
(iii) 's' e
(A) (i) a

1.3_ Which
(A) Ge
(B) Me
(C) Ar
(D) At

1.4 The s
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TOPIC 1

PERIODIC TABLE & PERIODICITY IN PROPERTIES

SECTION - I : STRAIGHT OBJECTIVE TYPE

1.1 Consider the following statements;

(I) Rutherford name was associated with the development of periodic table.

(II) A metal M having electronic configuration $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}, 4s^1$ is d-block element.

(III) Diamond is not an element.

(IV) The electronic configuration of the most electronegative element is $1s^2, 2s^2, 2p^5$,

Select the correct option from the given codes.1

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

1.2 There are four elements 'p', 'q', 'r' and 's' having atomic numbers Z-1, Z, Z+1 and Z+2 respectively. If the element 'q' is an inert gas, select the correct answers from the following statements.

(i) 'p' has most negative electron gain enthalpy in the respective period.

(ii) 'r' is an alkali metal

(iii) 's' exists in +2 oxidation state.

(A) (i) and (ii) only (B) (ii) and (iii) only (C) (i) and (iii) only (D) (i), (ii) and (iii)

1.3_ Which of the following statements is INCORRECT ?

(A) Generally the radius trend and the ionization energy trend across a period are opposites.

(B) Metallic and covalent radii of potassium are 2.3 Å and 2.03Å respectively.

(C) Amongst Li^-, Be^- , B^- and C^- , Li^- is least stable ion .

(D) Atomic and ionic radii of Niobium and Tantalum are almost same

1.4 The statement that is not correct for the periodic classification of elements is :

(A) The properties of elements are the periodic functions of their atomic numbers.

(B) Non–metallic elements are lesser in number than metallic elements.

(C) The first ionisation energies of elements along a period do not vary in a regular manner with increase in atomic number.

(D) For transition elements the d–subshells are filled with electrons monotonically with increase in atomic number.

1.5 The electron gain enthalpies of halogens in kJ mol^{-1} are as given below :

F = – 332, Cl = – 349, Br = – 324, I = – 295.

The less negative value for F as compared to that of Cl is due to :

(A) Strong electron-electron repulsions in the compact 2p-sub shell of F.

(B) Weak electron -electron repulsions in the bigger 3p-sub shell of Cl

(C) Smaller electronegativity value of F than Cl

(D) (A) & (B) both

1.6_ Which of the following statements is correct ?

(A) There is regular increase in negative value of electron gain enthalpy with increasing atomic number from left to right in the period.

(B) Electropositive nature of elements decrease with increasing atomic number from left to right in the period.

(C) Ionisation energies of elements decreases from left to right in the period.

(D) Effective nuclear charge of elements decreases from left to right in the period.

1.7 Which of the following statements is wrong for the transition elements ?

(A) Transition elements are placed from 3rd to 6th period.
(B) Last electron enters in $(n-1)$ d orbital.
(C) Exhibits variable valency.
(D) General electronic configuration is $(n-1)\,d^{1-10}\,ns^{0-2}$.

1.8 If the same element is forming oxides in different oxidation states then :

(A) That oxide will be neutral in nature in which element will be in its highest oxidation state.
(B) That oxide will be highest acidic in nature in which element will be in its highest oxidation state.
(C) That oxide will be amphoteric in nature in which element will be in its highest oxidation state.
(D) That oxide will be highly basic in nature in which element will be in its highest oxidation state.

1.9 The increasing order of acidic nature of Li_2O, BeO, B_2O_3, CuO is :

(A) $Li_2O < BeO < CuO < B_2O_3$
(B) $BeO < CuO < B_2O_3 < Li_2O$
(C) $Li_2O < CuO < BeO < B_2O_3$
(D) $B_2O_3 < CuO < BeO < Li_2O$

1.10 Consider the following statements and arrange in the order of true/false as given in the codes.

S_1 : In modern periodic table each block contains a number of columns equal to the number of electrons that can occupy that sub-shell.
S_2 : The greatest increase in ionization enthalpy is experienced on removal of electron from core noble gas configuration.
S_3 : The size of the isoelectronic species is effected by electron-electron interaction in the outer orbitals.
S_4 : Any thing that influences the valence electrons will affect the chemistry of the element and the valence shell is not affected by nuclear mass.

(A) FFTT (B) TTFT (C) FTFT (D) TTTT

1.11 Consider the following statements and arrange in the order of true/false as given in the codes.

S_1 : $Na_2O_2 < MgO < ZnO < P_4O_{10}$: Acidic property.
S_2 : $Na < Si > Mg < Al$: First ionisation energy.
S_3 : $F > Cl > Br$: Electron affinity.

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

SECTION - II : MULTIPLE CORRECT ANSWER TYPE

1.12 Select the correct statement(s).

(A) The value of electron gain enthalpy of an element can be negative or positive.
(B) In the periodic table, metallic character of the elements increases down the group and decreases across the period.
(C) Ionization enthalpy of an atom is equal to electron gain enthalpy of cation.
(D) The Cl^- and Ca^{2+} are isoelectronic species but first one is bigger in size than the second.

1.13 Which of the following statement(s) is(are) correct ?

(A) The electron affinity for sulphur is more exothermic than that for oxygen.
(B) Successive ionization energies of an atom always increase.
(C) First ionization energy of As is greater than that of Se.
(D) Chlorine has larger atomic size as well as electron affinity than that of fluorine

1.14 Which of the following pair(s) represent(s) the isoelectronic species ?

(A) S^{2-} & Sc^{3+} (B) SO_2 & NO_3^- (C) N_2 & CN^- (D) NH_3 & H_3O^+

1.15 Which of the following represent(s) the correct order of electron affinities ?

(A) $F > Cl > Br > I$ (B) $C < N < Cl < F$ (C) $N < C < O < F$ (D) $C < Si > P > N$

1.16 Which of the following statement(s) is(are) true ?

(A) Ionisation energy $\propto \frac{1}{\text{Screening effect}}$

(B) The first ionisation energies of Be and Mg are more than ionisation energies of B and Al respectively

(C) Atomic and ionic radii of Niobium and Tantalum are almost same

(D) Metallic and covalent radii of potassium are 2.3 Å and 2.03Å respectively.

1.17 Select the incorrect statement(s).

(A) IE_1 of nitrogen atom is less than IE_1 of oxygen atom.

(B) Electron gain enthalpy of oxygen is less negative than selenium.

(C) Electronegativity on Pauling scale is 2.8 times the electronegativity on Mulliken scale.

(D) Cr^{6+} is smaller than Cr^{3+}.

SECTION - III : ASSERTION AND REASON TYPE

1.18 **STATEMENT-1 :** The 5th period of periodic table contains 18 elements not 32.

STATEMENT-2 : $n = 5$, $\ell = 0, 1, 2, 3$. The order in which the energy of available orbitals 4d , 5s and 5p increases is 5s < 4d < 5p and the total number of orbitals available are 9 and thus 18 electrons can be accomodated.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

1.19 **Statement-1 :** In general, for an element, $IE_1 < IE_2 < IE_3$ ....

Statement-2 : After the removal of each successive electron, remaining electrons are held more tightly by the nucleus. So removal of next electron becomes difficult.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

1.20 **STATEMENT-1 :** Third ionisation energy of phosphorus is larger than sulphur.

STATEMENT-2 : There is a larger amount of stability associated with filled s- and p- sub–shells (a noble gas electron configuration) which corresponds to having eight electrons in the valence shell of an atom or ion.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

1.21 **STATEMENT-1 :** Manganese (atomic number 25) has a less favourable electron affinity than its neighbours on either side because .

STATEMENT-2 : The manganese has stable, $[Ar]^{18}$ $3d^5$ $4s^2$ electrons configuration.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

1.22 **Statement-1 :** Electron gain enthalpy always becomes less negative as we go down a group in Modern periodic table.

Statement-2 : Size of the atom increases on going down the group in Modern periodic table and the added electron would be farther from the nucleus.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

SECTION - IV : COMPREHENSION TYPE

COMPREHENSION # 1

The periodicity is related to the electronic configuration. That is, all chemical and physical properties are a manifestation of the electronic configurations of the elements.

The atomic and ionic radii generally decrease in a period from left to right. As a consequence, the ionization enthalpies generally increase and electron gain enthalpies become more negative across a period. In other words, the ionization enthalpy of the extreme left element in a period is the least and the electron gain enthalpy of the element on the extreme right is the highest negative. This results into high chemical reactivity at the two extremes and the lowest in the centre. Similarly down the group, the increase in atomic and ionic radii result in gradual decrease in ionization enthalpies and a regular decrease (with exception in some third period elements) in electron gain enthalpies in the case of main group elements.

These properties can be related with the:
(i) reducing and oxidising behaviour of the elements
(ii) metallic and non-metallic character of element
(iii) acidic, basic, amphoteric and neutral character of the oxides of the elements.

1.23 The correct order of the metallic character is:
(A) B > Al > Mg > K (B) Al > Mg > B > K (C) Mg > Al > K > B (D) K > Mg > Al > B

1.24 Which of the following statements is incorrect ?
(A) In general metallic character increases down the group and decreases across a period.
(B) In general reducing property decreases down the group and increases across a period.
(C) In general, the oxide formed by the element on extreme right of the periodic table is the most acidic.
(D) Chemical reactivity of non-metals in terms of oxidising power increases from nitrogen to fluorine across the period.

1.25 Among Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acid strength is :
(A) $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$
(B) $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$
(C) $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$
(D) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

1.26 Which of the following pairs show reverse properties on moving along a period from left to right and from top to bottom in a group ?
(A) Atomic radius and electron gain enthalpy (negative value)
(B) Nuclear charge and ionisation enthalpy
(C) Ionisation enthalpy and electron gain enthalpy (negative value)
(D) None of the above.

COMPREHENSION - 2

The elements of group 1 describe, more clearly than any other group of elements, the effects of increasing the size of atoms or ions on the physical and chemical properties. The chemical and physical properties of the elements are closely related to their electronic structures and sizes. These metals are highly electropositive and thus form very strong bases, and have quite stable oxo-salts. In the manufacturing of sodium hydroxide, chlorine and sodium carbonate, the sodium chloride is used as starting material.

1.27 Which is not correctly matched ?
(1) Basic strength of oxides ; $Cs_2O < Rb_2O < K_2O < Na_2O < Li_2O$
(2) Stability of peroxides ; $Na_2O_2 < K_2O_2 < Rb_2O_2 < Cs_2O_2$
(3) Stability of bicarbonates ; $LiHCO_3 < NaHCO_3 < KHCO_3 < RbHCO_3 < CsHCO_3$
(4) Melting point ; $NaF < NaCl < NaBr < NaI$
(A) 1 and 4 (B) 1 and 3 (C) 1 and 2 (D) 2 and 3

1.28 Which of the following acts as an oxidising as well as reducing agent ?
(A) Na_2O (B) NaO_3 (C) NaNO (D) $NaNO_2$

Comprehension # 3

The first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionisation enthalpies (in kJ mol^{-1}) and the (Δ_{eg} H) electron gain enthalpy (in kJ mol^{-1}) of a few elements are given below :

	Elements	$\Delta_i H_1$	$\Delta_i H_2$	$\Delta_{eg} H$
(A)	P	520	7300	- 60
(B)	Q	419	3051	- 48
(C)	R	1681	3374	- 328
(D)	S	1008	1846	- 295
(E)	T	2372	5251	+ 48
(F)	U	738	1451	- 40

1.29 The least reactive element is :
(A) P (B) Q (C) R (D) T

1.30 The most reactive metal is :
(A) P (B) Q (C) S (D) U

1.31 The most reactive non- metal is:
(A) R (B) S (C) P (D) U

Comprehension # 4

The amount of energy required to remove the most loosely bound electron from an isolated gaseous atom is called as first ionization energy (IE_1). Similarly the amount of energies required to knock out second, third etc. electrons from the isolated gasesous cation are called successive ionization energies and $IE_3 > IE_2 > IE_1$.
(i) Nuclear charge (ii) Atomic size (iii) penetration effect of the electrons (iv) shielding effect of the inner electrons and (v) electronic configurations (exactly half filled & completely filled configurations are considered extra stable) affect the ionisation energies.
On the other hand, the amount of energy released when a neutral isolated gaseous atom accepts an extra electron to form gaseous anion is called electron affinity.

$O(g) + e^- \xrightarrow{\text{Exothermic}} O^-(g)\ ;\ \Delta H_{eg} = -141\ \text{kJ mol}^{-1}$ .... (a)

$O^-(g) + e^- \xrightarrow{\text{Endothermic}} O^{2-}(g)\ ;\ \Delta H_{eg} = +780\ \text{kJ mol}^{-1}$ .... (b)

In (b) the energy has to be supplied for the addition of second electron due to electrostatic repulsion between an anion and extra electron (same charged species). The electron affinity of an element depends upon (i) atomic size (ii) nuclear charge & (iii) electronic configuration. In general, ionisation energy and electron affinity increases as the atomic radii decrease and nuclear charge increases across a period. In general, in a group, ionisation energy and electron affinity decrease as the atomic size increases.
The members of third period have some higher (e.g. S and Cl) electron affinity values than the members of second period (e.g. O and F) because second period elements have very small atomic size. Hence there is a tendency of electron-electron repulsion, which results in less evolution of energy in the formation of corresponding anion.

1.32 Which one of the following statements is correct ?
(A) The elements like F, Cl, Br etc having high values of electron affinity act as strong oxidising agent.
(B) The elements having low values of ionisation energies act as strong reducing agent.
(C) The formation of $Be^-(g)$ from Be (g) is an endothermic process
(D) All of these

1.33 Which one of the following statements is incorrect in relation to ionisation enthalphy ?
(A) Ionization enthalpy increases for each successive valence shell electron.
(B) The greatest increase in ionizaiton enthalpy is experienced on removal of electron from core of noble gas configuration.
(C) End of valence electrons is marked by a big jump in ionization enthalpy.
(D) Removal of electron from orbitals bearing lower n value is easier than from orbital having higher n value.

1.34 Considering the elements F, Cl, O and N, the correct order of their electron affinity values is :
(A) F > Cl > O > S (B) F > O > Cl > S (C) Cl > F > S > O (D) O > F > S > Cl

SECTION - V : MATRIX - MATCH TYPE

1.35 For each of the following orders as listed in Column-I pick the correct observation(s) listed in Column-II.

Column-I	Column-II
(A) C > N	(p) More favourable (exothermic) electron affinity.
(B) Se > Br	(q) The higher first ionization energy.
(C) Mg > K	(r) The larger size.
(D) F > Cl	(s) The higher electronegativity .
	(t) The higher number of valence electrons.

1.36 Match the values of ionization energy and electron gain enthalpy listed in column **I** with characteristic(s) of elements listed in column **II**.

Column – I	Δ_iH_1 ,	Δ_iH_2 ,	$\Delta_{eg}H$ (in KJ mol^{-1})	Column – II
(A)	2372	5251	+ 48	(p) Element which acts as a strong reducing agent
(B)	419	3051	– 48	(q) Element which exists as a monoatomic molecule.
(C)	1681	3374	– 333	(r) Least reactive non-metal
(D)	1008	1846	– 295	(s) Element which acts as a strong oxidising agent.
				(t) Element which oxide is a stronger basic in nature.

1.37 Match the increasing orders given in column **I** with the property(ies) given in column **II**.

Column – I	Column – II
(A) $Na^+ < F^- < O^{2-} < N^{3-}$	(p) Electronegativity
(B) $Li^+ < Na^+ < K^+ < Rb^+ < Cs^+$	(q) Nuclear charge
(C) O < S < F < Cl	(r) Size
(D) $Cl^- < K^+ < Ca^{2+} < Sc^{3+}$	(s) Electron affinity
	(t) Ionisation energy

SECTION - VI : INTEGER TYPE

1.38 Give the atomic number of the inert gas atom in which the total number of d-electrons is equal to the difference in the number of total p- and s-electrons.

1.39_ The Lanthanides and Actinides are placed in group number :

1.40 A metal has electronic configuration $[Ar]^{18}\ 3d^7\ 4s^2$. On the basis of this electronic configuration find out the group number.

1.41_ Amongst the following, the total number of orders which are correct with respect to the property indicated against each is :

(i) Mg > Al > Si > P ; Covalent radius
(ii) $Na^+ < O^{2-} < F^- < N^{3-}$; Ionic size.
(iii) $Al^{3+} < Mg^{2+} < Li^+ < K^+$; Ionic size
(iv) C < Si > P > N ; Electron affinity value.
(v) N < C < O < F ; Electron affinity value
(vi) F > Cl > Br > I ; Electron affinity value
(vii) Si > Mg > Al > Na ; First ionisation energy
(viii) O > F > N > C ; Second ionisation energy
(ix) N > P > Sb > As ; Third ionisation energy

1.42 An ion having a 4+ charge and a mass of 51.99 amu has two electrons with n = 1, eight electrons with n = 2, and ten electrons with n = 3. Give the total number of protons present in the nucleus of the atom of metal.

1.43 Total Number of elements which are belong to same period (III).
Li, Na, Mg, F, Ne,Sc, P, Ar

1.44_ The value of n (i.e. principal quantum number) for the valence shell of palladium is (atomic number = 46) :

TOPIC
2

SECTION - I : STRAIG

2.1 Select the most ior
CrO_5, Mn_2O_7, PbO
(A) CrO_5, Mn_2O_7

2.2 In which of the foll
(A) IO_4^- , ICl_4^- , IF

2.3 In which of the fo
(A) NO_2 , N_3^-, IC

2.4 The correct orde
(A) $BeCl_2$ < Mg
(C) $BeCl_2$ < Ba

2.5 The BF_3 is a pl
(A) B – F bond
(B) Boron aton
(C) Nitrogen is
(D) BF_3 has n

2.6_ Which one of
atom ?
(A) ClF_3

2.7 Intermolecul
(A) SiH_4 an
(C) $H-\overset{\overset{O}{\|}}{C}$

2.8 Which of
(A) NO_2^+,

2.9 Anhydro
Lattice E
ΔH hydr
ΔH hyd
Identify
(A) It w
(B) Th
(C) Th
(D) N

2.10_ What
(A) B
(C) E

TOPIC 2

CHEMICAL BONDING

SECTION - I : STRAIGHT OBJECTIVE TYPE

2.1 Select the most ionic and most covalent compounds respectively from the following.
CrO_5, Mn_2O_7, PbO, P_4O_{10}, SnO_2
(A) CrO_5, Mn_2O_7 (B) PbO, Mn_2O_7 (B) CrO_5, P_4O_{10} (D) SnO_2, CrO_5

2.2 In which of the following sets the central atom of each member involves sp^3 hybridisation ?
(A) IO_4^-, ICl_4^-, IF_4^+ (B) XeO_3, XeO_4, XeF_4 (C) SO_3, SO_3^{2-}, SO_4^{2-} (D) PCl_4^+, BF_4^-, ClO_4^-

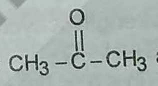
2.3 In which of the following groups all the members have linear shape ?
(A) NO_2, N_3^-, ICl_2^+ (B) N_3^-, I_3^-, NO_2^+ (C) XeF_2, C_2H_2, SO_2 (D) CO_2, $BeCl_2$, $SnCl_2$

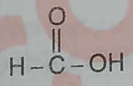
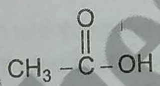
2.4 The correct order of the increasing ionic character is :
(A) $BeCl_2 < MgCl_2 < CaCl_2 < BaCl_2$ (B) $BeCl_2 < MgCl_2 < BaCl_2 < CaCl_2$
(C) $BeCl_2 < BaCl_2 < MgCl_2 < CaCl_2$ (D) $BaCl_2 < MgCl_2 < CaCl_2 < BeCl_2$

2.5 The BF_3 is a planar molecule where as NF_3 is pyramidal because :
(A) B – F bond is more polar than N – F bond.
(B) Boron atom is bigger than nitrogen atom.
(C) Nitrogen is more electronegative than boron.
(D) BF_3 has no lone pair but NF_3 has a lone pair of electrons.

2.6 Which one of the following species is planar and non-polar with two lone pairs of electrons on the central atom ?
(A) ClF_3 (B) XeF_5^- (C) PCl_5 (D) BrF_5

2.7 Intermolecular hydrogen bond is present in which of the following pair of molecules ?
(A) SiH_4 and SiF_4

(B) 
$CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ and $CHCl_3$

(C) 
$H-\overset{O}{\overset{\|}{C}}-OH$ and 
$CH_3-\overset{O}{\overset{\|}{C}}-OH$

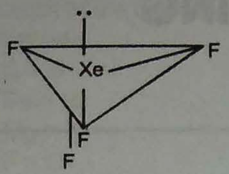
(D) CH_3OCH_3 and H_2O_2

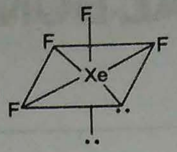
2.8 Which of the following are isoelectronic and isostructural ?
(A) NO_2^+, CO_2 (B) NO_3^-, BF_3 (C) NH_3, CH_3^- (D) All of these.

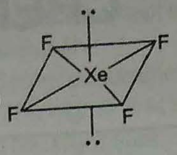
2.9 Anhydrous $AlCl_3$ is covalent. From the data given below
Lattice Energy = 5137 KJ/mol.
ΔH hydration for Al^{3+} = – 4665 KJ/mol
ΔH hydration for Cl^- = – 381 KJ/mol
Identify the correct statement.
(A) It will remain covalent in aqueous solution
(B) The solution will consist of Al^{3+} & Cl^-
(C) The solution will consist of hydrated Al^{3+} & Cl^-
(D) None of these

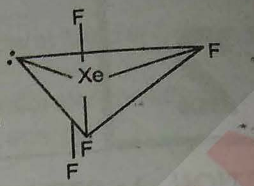
2.10 What is the hybridisation of boron atoms in compound $Mg[B_2O(OH)_6]$?
(A) Both sp^3 (B) One sp^2 and other sp^3
(C) Both sp^2 (D) One sp^3 and other sp^3d

2.11 Which is the right structure of XeF_4 ?

(A)


(B)


(C)


(D)


2.12 Match the ionization processes listed in column-I with the changes observed as listed in column-II. For this use the codes given below :

Column-I	Column-I
(a) $N_2 \longrightarrow N_2^+$	(p) Bond order increases and magnetic property is changed
(b) $O_2^+ \longrightarrow O_2^{2+}$	(q) Bond order decreases and magnetic property is not changed
(c) $B_2 \longrightarrow B_2^+$	(r) Bond order increases and magnetic property is not changed
(d) $NO^- \longrightarrow NO$	(s) Bond order decreases and magnetic property is changed

Note : Here change in magnetic property refers to change from diamagentic to paramagentic or paramagnetic to diamagnetic.

	a	b	c	d
(A)	s	p	r	q
(B)	s	p	q	r
(C)	r	q	s	p
(D)	p	s	q	r

2.13 Which of the following statements are correct ?

(I) Both melting and boiling points of H_2O are higher than those of H_2Te.
(II) In both N_2O_5 and N_2O_4 all N–O bond lengths are equivalent.
(III) In both crystalline $NaHCO_3$ and $KHCO_3$, HCO_3^- forms only dimeric anion through hydrogen bond.
(IV) Amongst B_2, C_2, N_2^- and O_2, N_2^- and O_2 on further ionization (losing single electron) form thermodynamically more stable species.

(A) (I) and (II) (B) (III) and (IV) (C) (II) and (III) (D) (I) and (IV)

2.14 The increasing order of the strength of hydrogen bond in the following mentioned linkages is :

(i) O—H---S (ii) S—H---O (iii) F—H---F⁻ (iv) F—H---O

(A) (i) < (ii) < (iv) < (iii) (B) (ii) < (i) < (iv) < (iii) (C) (i) < (ii) < (iii) < (iv) (D) (ii) < (i) < (iii) < (iv)

2.15 According to Molecular orbital theory which of the following is correct ?

(A) LUMO level for C_2 molecule is σ_{2p_x} orbital (B) In C_2 molecules both the bonds are π bonds
(C) In C_2^{2-} ion there is one σ and two π bonds (D) All the above are correct

2.16 Consider the following statements and arrange in the order of true/false as given in the codes.

S_1 : In AB_2L_2 type, the BAB bond angle will be always greater than normal tetrahedral.
S_2 : Maleic acid has higher Ka_1 value than fumaric acid due to intramolecular hydrogen bonding.
S_3 : In ClO_3^-, NH_3 and XeO_3, the hybridisation and the number of lone pair(s) on central atoms are same.

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

2.17 **Consider the following statements and arrange in the order of true/false as given in the codes.**

S_1 : In ICl_2^-, ClF_3 and $TeCl_4$, the number of lone pair(s) of electrons on central atoms are 3, 2 and 1 respectively.
S_2 : Amongst NO, C_2, O_2^-, He_2^+, the increasing order of bond dissociation energies is $He_2^+ < O_2^- < C_2 <$ NO.
S_3 : Amongst CO, CO_2, CO_3^{2-}, CH_3OH, the correct order from the weakest to the strongest carbon-oxygen bond is $CH_3OH < CO_3^{2-} < CO_2 < CO$
S_4 : The hybridisation of boron in Cl_2BBCl_2 is the same which nitrogen has in ClNO molecule.

(A) TTTT (B) TTTF (C) TFTF (D) FTTF

2.18 **Consider the following statements and arrange in the order of true/false as given in the codes.**

S_1 : N_2H_4 is pyramidal about each N atom.
S_2 : NH_2OH is pyramidal about the N atom and bent about the O atom.
S_3 : CH_3COCl is trigonal planar about the carbon atom (attached to O and Cl).

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

2.19 **Consider the following statements and arrange in the order of true/false as given in the codes.**

S_1 : The hydrogen bond in salt, KHF_2 is stronger than that in gaseous HF.
S_2 : The dipole moment of CH_3F is greater than that of CH_3Cl.
S_3 : sp^2 hybrid orbitals have equal s and p character.
S_4 : Two types of bonds present in B_2H_6 are covalent and three centre-two electron bonds.

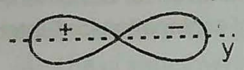
(A) T T F F (B) T F F T (C) F F F T (D) F F T T

SECTION - II : MULTIPLE CORRECT ANSWER TYPE

2.20 Select the correct statement(s) with respect to the $p\pi$–$d\pi$ dative bond.

(A) In $(Ph_3Si)_2O$, the Si — O — Si group is nearly linear.
(B) Silanols such as $(CH_3)_3$ SiOH are stronger protonic acids then their carbon analogs.
(C) Trisilysl phosphine $(H_3Si)_3P$ is planar.
(D) ClO_4^- does not polymerise at all.

2.21 Which of the following statement(s) is/are correct for $2p_y$ orbital :



(A) +ve and –ve signs represent sign of amplitude of electron wave.
(B) Probability of finding the electrons along xz plane is zero.
(C) +ve sign represents maximum probability of finding electron and –ve sign represents minimum probability of finding electrons.
(D) $2p_y$ orbital contains one radial node.

2.22 Which of the following orbitals can form π bond, if internuclear axis is y-axis?

(A) $p_x + d_{xy}$ (B) $p_z + d_{xz}$ (C) $d_{yz} + d_{yz}$ (D) $d_{xz} + d_{xz}$

2.23 Which of the following species are correctly matched with their geometries according to the VSEPR theory?

(A) $BrF_6^+ \rightarrow$ octahedral. (B) $SnCl_5^- \rightarrow$ trigonal bipyramidal.
(C) $ClF_2^- \rightarrow$ linear. (D) $IF_4^+ \rightarrow$ see-saw.

2.24_ Select that pair(s) in which bond angle of first member is higher than second one.

(A) BrO_3^-, ClO_3^- (B) AsI_3, SbI_3 (C) $SbBr_3$, SbI_3 (D) NF_3, NH_3

2.25 Which charge for the N_2 molecule would give a bond order of 2.5 ?

(A) + 1 (B) +2 (C) –1 (D) –2

2.26 Which of the following species is/are polar in nature ?

(A) XeF_4 (B) XeF_6 (C) $XeOF_4$ (D) XeF_5^-

2.27* Resonating structures have same :

(A) Atomic arrangements (B) Electronic arrangements
(C) Total charge (D) Sigma bond

2.28_ There is S–S linkage in :

(A) $S_2O_3^{2-}$ (B) $S_2O_4^{2-}$ (C) $S_2O_5^{2-}$ (D) $S_2O_7^{2-}$

2.29 In which of the following pairs, the hybridisation of the central atoms is same ?

(A) ClF_3, ClF_3O (B) ClF_3O, ClF_3O_2
(C) $(ClF_2O)^+$, $(ClF_4O)^-$ (D) $(ClF_4O)^-$ $(XeOF_4)$

2.30* The odd electron molecules among the following is/are :
(A) NO_2 (B) NO (C) ClO_2 (D) CO

2.31 In which pair(s) is(are) the stronger bond found in the first species ?
(A) O_2^-, O_2 (B) N_2, N_2^+ (C) NO^+, NO^- (D) CO, O_2^{2+}

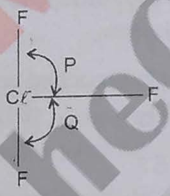
2.32_ Which of the following statements is/are true ?
(A) It is impossible to satisfy the octet rule for all atoms in XeF_2.
(B) $MgSO_4$ is soluble in water because hydration energy of $MgSO_4$ is higher in comparision to its lattice energy.
(C) The bond in NO^+ should be stronger than the bond in NO^-.
(D) For ozone molecule, one oxygen-oxygen bond is stronger than the other oxygen-oxygen bond.

2.33 Hydrogen bonding is present in which of the following species ?
(A) CH_3NH_2 (B) CH_3^- (C) CH_3COOH (D) $CCl_3CH(OH)_2$

SECTION - III : ASSERTION AND REASON TYPE

2.34 **Statement-1 :** In general, boiling points rise with increasing molecular weights of the hydrides of 14th group elements because
Statement-2 : The additional mass requires higher temperature for rapid movement of the molecules and the larger number of electrons in the heavier molecules provide larger London forces.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

2.35 **STATEMENT-1 :** In tetrahedral hybridisation i.e., in sp^3 hybridisation all p–orbitals are involved and no p–orbital is left for forming π–bonds.
STATEMENT-2 : Central atom can not form double bonds in the molecules or species having sp^3 hybridisation.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

2.36 **STATEMENT-1 :**  bond angle P = bond angle Q but not precisely 90°.

STATEMENT-2 : The molecule is slightly bent T -shaped and there is repulsion between lone pairs of electrons.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

2.37 **Statement-1 :** Bond order in a molecule can assume any value positive or negative, integral or fractional when number of electrons in bonding molecular orbitals is greater than that in anti-bonding orbitals.
Statement-2 : Bond order depends on the number of electrons in the bonding and antibonding orbitals.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

2.38 **STATEMENT-1 :** NO^+ and CN^- both have same bond order and magnetism (i.e. magnetic property).
STATEMENT-2 : NO^+ and CN^- are isoelectronic species.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

SECTION - IV : COMPREHENSION TYPE

Read the following comprehension carefully and answer the questions.

Comprehension # 5

Between ionic and covalent bonds, there are large majority of bonds, in which the bonding electrons are shared unequally between two atoms but are not completely transferred. Such bonds are said to be polar covalent bonds and the bond polarity is due to difference in electronegativity, the ability of an atom in a molecule to attract the shared electrons in a covalent bond.

The measure of net polarity is a quantity called the dipole moment, μ, which is defined as the magnitude of the charge Q at either end of the molecular dipole times the distance r between the charges : $\mu = Q \times r$.
Molecular polarities give rise to some of the forces that occur between molecules and these forces are of several different types including dipole-dipole forces, London dispersion forces, and hydrogen bonds.
All these intermolecular forces are electrical in origin and result from the mutual attraction of unlike charges or the mutual repulsion of like charges.

2.39 Which of the following statements is incorrect ?
(A) Out of trimethylamine and trimethylphosphine, trimethylamine has higher dipole moment.
(B) Out of $(SiH_3)_2O$ and $(CH_3)_2O$, $(SiH_3)_2O$ is more basic.
(C) The critical temperature of water is higher than that of O_2 because the H_2O molecule has dipole moment.
(D) Intermolecular hydrogen bonding increases the enthalpy of vaporization of a liquid due to the increase in the attraction between molecules.

2.40 Which of the following statements is true ?
(A) The dipole moment of NF_3 is more than NH_3.
(B) trans-2, 3-dichloro-2-pentene does not have net permanent dipole moment.
(C) Carbon tetrachloride has no net dipole moment because of its regular tetrahedral structure.
(D) Dipole moment is zero for sulphurdioxide molecule.

2.41 In which of the following mixtures, the London dispersion force acts as major intermolecular force of attraction?
(A) Sodium chloride and water.
(B) Cyclohexane and carbontetrachloride.
(C) Water and ethyl alcohol.
(D) Benzene and acetone.

Comprehesion # 1

In the valence bond theory, hybridisation of orbitals is an integral part of bond formation. Hybridisation consists of mixings or linear combination of the "pure" atomic orbitals in such a way as to form new hybrid orbitals such as sp, sp^2, sp^3, sp^3d, sp^3d^2 etc.
Now answer the following questions:

2.42_ Which one of the following molecular geometries (i.e. shapes) is not possible for the sp^3d^2 hybridisation ?
(A) Capped octahedral (B) Octahedral (C) Square planar (D) Square pyramidal

2.43_ Which of the following atomic orbitals does not participitate in trigonal bipyramidal hybridisation i.e. sp^3d hybridisation?
(A) s (B) $d_{x^2-y^2}$ (C) p_x (D) p_y

2.44_ Which of the following are isostructural ?
NO_3^-, (I) CO_3^{2-}, (II) ClO_3^-, (III) SO_3, (IV) XeO_3 (V)
(A) (I) and (IV) (B) (II) and (V) (C) (III) and (IV) (D) (IV) and (V)

Comprehension : 2

Nitrogen, oxygen and fluorine are the higly electronegative elements. When they are tied to a hydrogen atom to form covalent bond , the electrons of the covalent bond are shifted towards the more electronegative atom. This partially positively charged hydrogen atom forms a bond with the other electronegative atom. This bond is called as hydrogen bond and is weaker than covalent bond. For example, in HF molcule, the hydrogen bond exists between hydrogen atom of one molecule and fluorine atom of another molecule as depicted :

$$---H^{\delta+}-F^{\delta-}---H^{\delta+}-F^{\delta-}---H^{\delta+}-F^{\delta-}$$

Here, hydrogen bond acts as a bridge between atoms which holds one atom by covalent bond and the other by hydrogen bond. Hydrogen bond is represented by a dotted line (– – –) while a solid line represents the covalent bond. Thus, hydrogen bond can be defined as the attractive force which binds hydrogen atom of one molecule with the electronegative atom (F, O or N) of another molecule.

2.45 What would be correct about bonding in chloral hydrate $CCl_3CH(OH)_2$?
(A) Only intra molecular H-bonding
(B) Only inter molecular H-bonding
(C) Both inter and intra molecular H-bonding
(D) No hydrogen bonding

2.46 If boiling point of ortho–nitro phenol and para nitro phenol are t_1 and t_2 respectively and mixture of these two are heated at temperature 't' where 't' is between these two temperature. Vapours will significantly contains
(A) Ortho nitro phenol
(B) Para nitro phenol
(C) Both ortho and para nitro phenol
(D) None of these

2.47 What statement is **incorrect** about D_2O (solid)
(A) It will float in D_2O liquid
(B) It will sink in H_2O liquid
(C) It has maximum density at 4°C
(D) It has less volume than H_2O solid for same mass of both compound.

Comprehension # 3

The distribution of electrons among various molecular orbitals is called the electronic configuration of the molecule which provides us the following very important informations about the molecule .

(A) Stability of molecule : The molecule is stable if number of bonding moleculer orbital electrons (N_b) is greater than the number of antibonding molecular orbital electrons (N_a).

(B) Bond order : Bond order = $\frac{1}{2}(N_b - N_a)$

A positive bond order means a stable molecule while a negative or zero bond order means an unstable molecule.

(C) Nature of the bond : Bond order 1 , 2 and 3 corresponds to single, double and triple bonds respectively.

(D) Bond length : Bond length decreases as bond order increases.

(E) Magnetic nature : Molecular orbitals in a molecule are doubly occupied, the substance is diamagnetic and if one or more molecular orbitals are singly occupied, it is paramagnetic.

2.48 Which of the following statements is incorrect ?
(A) Among O_2^+, O_2 and O_2^- the bond length decreases as $O_2^- > O_2 > O_2^+$
(B) He_2 molecule does not exist as the bonding and anti-bonding orbitals cancel each other .
(C) C_2, O_2^{2-} and Li_2 are diamagnetic
(D) In F_2 molecule, the energy of σ_{2p_z} is more than π_{2p_x} and π_{2p_y}

2.49 The following molecules / species have been arranged in the order of their increasing bond orders. Identify the correct order.
(I) O_2 ; (II) O_2^- ; (III) O_2^{2-} ; (IV) O_2^+
(A) III < II < I < IV
(B) IV < III < II < I
(C) III < II < IV < I
(D) II < III < I < IV

2.50 N_2 has greater dissociation energy than N_2^+, where as O_2 has a lower dissociation enrgy than O_2^+ because:
(A) Bond order is reduced when O_2 is ionized to O_2^+ and bond order is increased when N_2 is ionized to N_2^+
(B) Bond order is increased when O_2 is ionized to O_2^+ and bond order is decreased when N_2 is ionized to N_2^+
(C) Bond order is decreased when O_2 is ionized to O_2^+ and bond order is decreased when N_2 is ionized to N_2^+
(D) None of these

Comprehension # 4

Chemical bonding between two atoms is necessarily associated with an electrical moment arising out of the difference in electronegativity of two atoms. This means that every bond carries with it an electrical moment called the "bond moment". The dipole moment of a molecule is really the vectorial sum of the individual bond moment present in it. To compute the dipole moment it is necessary to find out the values of various bond moment. in the following table dipole moment of different bonds are as given.

Bond	$\overrightarrow{H—C}$	$\overrightarrow{C—Cl}$	$\overrightarrow{C=O}$
Bond moments	0.4 D	1.5 D	2.5 D

The group moments of few group as given

Group	NO_2	OH	CN	CH_3
direction of dipole	toward N	towards O	toward N	away from CH_3
Dipole moment	4D	1.6 D	3.8 D	0.4 D

2.51 The bond angle in H_2S is 97° and its dipole moment is 1.5 D. The S – H bond distance is 0.15 nm There fore approximate percentage ionic character of S – H bond is (neglect the effect of dipole moment of lone pair on sulphur atom in H_2S). (Given [$\cos 97^\circ = -0.12$] and $\sqrt{0.88} = 0.94$)
(A) 32 % (B) 16 % (C) 84 % (D) 10 %

2.52 In CH_3CCl_3 (I), $CHCl_3$ (II) and CH_3Cl (III) the normal tetrahedral bond angle is maintained. Also given $\cos 70.5^\circ = \frac{1}{3}$ Therefore dipole moments of the given compounds are. (given due to – I effect of Cl, the Bond moment of H—C bond directed toward the H in $CHCl_3$)
(A) I = 1.9 D , II = 1.9 D , III = 1.7 D
(B) I = 1.9 D , II = 1.7 D , III = 1.9 D
(C) I = 1.9 D , II = 1.7 D , III = 1.7 D
(D) I = 1,9 D , II = 1.1 D , III = 1.9 D

2.53 In the acetone molecule considering the normal planer structure, the observed dipole moment of acetone molecule is –
(A) 2.9 D (B) 2.75 D (C) 3 D (D) None of these

SECTION - V : MATRIX - MATCH TYPE

2.54

Column- I	Column- II
(A) XeF_4	(p) sp^3d, see-saw geometry
(B) SF_4	(q) sp^3d^2 square planar
(C) SF_6	(r) sp^3d^3 distorted octahedral geometry
(D) XeF_6	(s) sp^3d^2 octahedral geometry

2.55 Match the molecules/species listed in column I with characteristic(s) listed in column II.

Column - I	Column - II
(A) ClF_5, BrF_4^+, IF_6^-	(p) All molecules/ions are polar in nature.
(B) ClF_3, BrF_2^+, ICl_4^-	(q) All molecules/ions have same number of lone pair(s) and identical shape.
(C) XeF_2, ICl_2^-, I_3^-	(r) All molecules/ions have same oxidation state of central atoms.
(D) $ClOF_3$, ClF_4^+, $IO_2F_2^-$	(s) All molecules/ions have same hybridisation of central atoms
	(t) All molecules/ions are isoelectronic species