CHEMICAL BONDING

DEFINITIONS

(May be used in short questions with examples)

(1) Atomic orbital: **(Sargodha 2008)**

It is the region around the nucleus of the atom in which the probability for finding the electrons is maximum. It has no sharp boundaries and can have different shapes. The names of various orbitals are s, p, d and f.

(2) Atomic radius:

It is the average distance between the nucleus of the atom and its outermost shell. It is to be assumed that the atom is spherical. Since the outer boundaries are not sharp for an atom, so atomic radius is not an exact parameter. It is expressed in nm, μm, A° or pm.

(3) Bond angle:

It is the angle between the two bonds of a molecule which are made by one atom with two other atoms. The value of the bond angle depends upon the number of electron pairs, around the central atom in its valence shell. The bond angle of H_2O molecule is 104.5° and of $\ddot{N}H_3$ is 107.5°.

(4) Bond axis:

It is an imaginary line between two bounded nuclei. The electronic clouds making the bond around this imaginary line have maximum density of the electronic cloud on this line.

(5) Bond energies. **(Faisalabad 2007, F. Abad 2012, D.G. Khan 2013)**

It is the average amount of energy which is required to break all the bonds of a particular type in one mole of the substance. It is measured in kJ mol^{-1}. The bond energy of H_2 is 425 kJ mol^{-1}.

(6) Bond length: **(Faisalabad 2007, F. Abad 2012)**

It is average distance between the nuclei of the two bonded atoms. It is also called equilibrium bond distance or compromise distance. The bond distance of H_2 molecule is 74 pm.

(7) Bond pair: **(D. G. Khan 2014)**

It is pair of electrons which is shared between two bonded atoms. This shared pair may be due to mutual sharing or donated by one atom only. In $H_3O^{\oplus}$ there are shared bond pairs.

(8) Bonding molecular orbital: **(Lahore 2014)**

That molecular orbital which is lower in energy than the atomic orbitals and electron density is maximum between the joining line of the two nuclei. σ_{1s} is B.M.O of H_2.

(9) Chemical bond:

It is attractive force which binds two or more atoms, ions, or molecules. It may be due to sharing of electron or transference of electrons. The bond may be ionic covalent or coordinate covalent. NaCl has ionic bond but in $H_3O^{\oplus}$, there are two covalent bonds and one coordinate covalent bond.

(10) Coordinate covalent bond: **(Gujranwala 2009, D.G. Khan 2013)**

That type of a bond which is formed by the sharing of an electron pair, which is donated by one atom only. It is also called donor-acceptor bond. In $NH_3 \longrightarrow BF_3$ there is one bond between N-atom and B-atom which is coordinate covalent.

(11) Covalent bond:

That type of a bond which is produced by the mutual sharing of electrons between the two atoms. The bonds is H_2, O_2, N_2, H – Cl and CH_4 are covalent bonds.

(12) Covalent radius: **(Guj. 2014)**

It is half the distance between the nucleus of the two atoms which have made a covalent bond with each other. This radius is little less than the atomic radius of atom.

(13) Delocalized electrons:

Those electrons which are spread over more than two nuclei of the bonded atoms. This happens when the electron pair of a π-bond shows conjugation, with some other π-bond, a lone pair, a negative charge or a positive charge. The electrons of O_3 molecule are delocalized over three O-atoms.

(14) Diamagnetism:

That property of a substance by which it is not attracted towards the magnetic field due to the absence of unpaired electrons. The ions like $O_2^{2\ominus}$ and $O_2^{2\oplus}$ are diamagnetic. N_2 and F_2 are also diamagnetic.

(15) Dipole moment:

It is the product of bond length and the amount of the charge positive or negative in a dipole. It is a directional quantity and represented by μ. It has units of Debye or mC. The value for H_2O is 1.85 D.

(16) Double covalent bond:

A bond which is formed by the mutual sharing of two electron pairs. In this way, four electrons are responsible to make the bond. In ethane $CH_2 = CH_2$, there are four electrons between two carbon atoms.

(17) Electron affinity: **(Bahawalpur 2011, F. Abad 2014, Lahore 2014)**

It is the minimum amount of energy released, when an electron is added to the outermost orbital of the gaseous atom in its lowest energy state. It is measured in kJ mol^{-1}. The E.A values increase along a period from left to right and decrease from top to bottom in a group.

(18) Electronegativity: **(Bahawalpur 2011, B. Pur 2012)**

It is the tendency of an atom to attract the shared pair of electrons towards itself in a bond. It has no units. It increases from left to right in a period and decrease from upper to downward direction.

(19) Hybrid atomic orbtials:

Those orbitals which are produced by the mixing up of the original orbitals and formation of the new ones having same shape and energy, but different orientations in space. sp, sp^2, sp^3 are various hybridized orbitals.

(20) Hybridization:

It is the process in which atomic orbitals of different energies and different shapes mix up with each other to form equal number of orbitals. These orbitals are identical in all respects. One s and three p obitals of carbon in CH_4 mix up to give four orbitals of equal energy.

(21) Ionization energy: **(F. Abad 2014, Lahore 2014)**

It is the amount of energy which is required to remove the electron from outermost shell of the atom in its gaseous state. It increases from left to right and decreases from top to bottom in Periodic Table. It is measured in kJ mol^{-1}. Hydrogen has is I.P. value as 1312 kJ mol^{-1}.

(22) Ionic bond: **(Lahore 2012)**

That type of a bond which is produced due to the net transference of electron from one atom to the other is called ionic bond. NaCl, KI, CsBr have ionic bonds in them.

(23) Ionic radius:

It is the distance from the nucleus of the ion to the outermost orbital of the ion where the probability for finding the electron is maximum. It is measured in pm. It decreases from left to the right and increases from top to the bottom in a group.

(24) Localized electron:

That pair of electrons which is shared between the atoms and the maximum density of the electronic cloud lies between the two nuclei. The bonding electrons in H_2, O_2, N_2, $CH_3 - CH_3$ are all localized.

(25) Molecular geometry:

It is the arrangement of atoms in a molecule with respect to bond distances from the central atom. It includes the bond angles as well. The molecule of H_2O is bent, of NH_3 is pyramidal and of CH_4 is tetrahedral.

(26) Molecular orbital:

That orbital which has more than one nuclei buried in its electronic cloud is called molecular orbital. In H_2 molecule two protons are buried under the clouds of two electrons and molecular orbital is called σ_{1s}.

(27) Octet rule: **(Lahore 2007)**

The tendency of the atoms to attain a maximum of eight electrons in the valence shell is called octet rule. In H_2O, NH_3 and CH_4, O, N and C-atoms complete their octets.

(28) Polar covalent bond:

That bond which is produced due to the sharing of electrons, but the shared pair is attracted towards one atom due to difference of electronegativity. The molecules of HCl, HBr, H_2O, NH_3 etc. have polar covalent bonds.

(29) Paramagnetism:

That property of a substance by which it is attracted towards magnet due to the presence of unpaired electrons is called paramagnetism. O_2 molecule has two electrons in π_{2y} and π_{2z} as unpaired and so O_2 is paramagnetic.

(30) π-bond:

That bond which is formed by parallel or sideways overlap of atomic orbitals. This bond is weaker than the sigma (σ) bond. In $CH_2 = CH_2$, O = O, there are π-bonds in addition to σ-bonds.

(31) Sigma (σ) bond:

That type of a bond which is formed by the head-on overlapping along the bond axis. The electron density is maximum between the two nuclei. H_2, O_2, N_2, C_2H_6, etc. have all σ-bonds in them.

(32) sp-hybridization:

That type of hybridization in which one s and one p-orbital intermix to form two sp-hybrid orbitals is called sp-hybridization. In CH ≡ CH, both carbon atoms are sp-hybridized.

(33) sp^2-hybridization:

That type of hybridization in which one s and two p-orbitals intermix to form three sp^2-hybrid orbitals is called sp^2-hybridization. In $CH_2 = CH_2$ both carbon atoms are sp^2-hybridized.

(34) sp^3-hybridization:

That type of hybridization in which one s and three p orbitals intermix with each other to form four sp^3-hybridized orbital, is called sp^3-hybridization. In $CH_3 - CH_3$ both carbon atoms are sp^3-hybridized.

(35) Unhybridized atomic orbitals:

Those atomic orbtials in which the individual shapes and energies are retained before the formation of a bond. In H_2, HCl, HBr etc. the orbitals do not undergo hybridization and overlap as such to make σ-bonds.

MULTIPLE CHOICE QUESTIONS (EXERCISE OF THE TEXTBOOK)

MULTIPLE CHOICE QUESTIONS	ANSWER WITH REASONS
(1) An ionic compound A^+B^- is most likely to be formed when: (a) the ionization energy of A is high and electron affinity of B is low (b) the ionization energy of A is low and electron affinity of B is high (c) both the ionization energy of A and electron affinity of B are high (d) both the ionization energy of A and electron affinity of B are low	1. (b) Ionic bond is thought to be produced by complete transference of electrons, from an atom of low ionization energy to another atom with high electron affinity.
(2) The number of bonds in nitrogen molecule is: (a) one σ and one π (b) one σ and two π (c) three sigma only (d) two σ and two π	2. (b) **(Lahore 2005, Rwp-2007, D.G. Khan 2011, Lahore 2012, Guj. 2014, F. Abad 2014, Lahore 2014, D.G. Khan 2014)** The atom of N has three unpaired electrons in outermost subshell. According to M.O.T., the bond order of N_2 molecule is 3. It means that there are three bonds in N_2 molecule. One is σ and two are π.
(3) Which of the following statements is not correct regarding bonding molecular orbitals? (a) Bonding molecular orbitals possess less energy than atomic orbitals from which they are formed (b) Bonding molecular orbitals have low	3. (b) **(Multan 2008)** According to M.O.T., when two atomic orbitals overlap with each other they form two molecular orbitals. One is B.M.O. having lower energy and high electron density between the two nuclei. The other A.B.M.O. is of higher energy and low electron density between the two nuclei.

ANSWERS TO THE SHORT QUESTIONS

General Features of Chemical Bond

Q.1 Bond distance is the compromise distance between two atoms. Justify it. (Gujranwala 2009, Sargodha 2010, D.G. Khan 2011, Guj. 2012, D.G. Khan 2012, Faisalabad 2013, D.G. Khan 2014, Multan 2014, Sarg. 2014)

-1 دو ایٹمز کے درمیان بانڈ کی لمبائی اُن کے صلح صفائی سے ترتیب دی ہوئی لمبائی ہی ہوتی ہے۔ صحیح ثابت کریں۔

Ans: Atoms attract each other and energy of the system is lowered (کم ہونا). When they reach at a certain distance, their forces of attraction are the maximum (زیادہ سے زیادہ). If they are brought further (مزید قریب) closer to this distance, they start repelling each other and energy of the system increases.

It means they have minimum energy (کم سے کم انرجی) at a certain distance. This is the bond distance at which they compromise (سمجھوتا کرنا) with each other to have minimum energy and is called compromise distance (دونوں ایٹمز کا آپس میں سمجھوتا کیا ہوا فیصلہ).

Q.2 Why the distinction between a coordinate covalent bond and a covalent bond vanishes after bond formation in $NH_4^{\oplus}$ and $H_3O^{\oplus}$? (D.G. Khan 2014)

-2 جب NH_3 سے $NH_4^{\oplus}$ اور H_2O سے $H_3O^{\oplus}$ بنتا ہے تو کوویلنٹ بانڈ اور کوآرڈینیٹ کوویلنٹ بانڈ میں فرق مٹ جاتا ہے۔ کیوں؟

Ans: There are four bonds between nitrogen and hydrogen atoms in $NH_4^{\oplus}$. No doubt one of the bonds is coordinate covalent and three bonds are covalent, but every bond has 25% coordinate covalent bond character and 75% covalent bond character.

In $H_3O^{\oplus}$, each bond has 33 % coordinate covalent bond character and 66 % covalent bond character.

Q.3 Why the bond angles of H_2O and NH_3 are not 109.5° like that of CH_4, although O and N-atoms are sp^3-hybridized?

(Faisalabad 2007, Lahore 2009, Gujranwala 2009, B.Pur 2009, Guj. 2012, Sarg. 2014, D.G. Khan 2014, Multan 2014)

-3 H_2O اور NH_3 کے بانڈز کے درمیان زاویے CH_4 کی طرح 109.5° کے برابر نہیں ہیں۔ حالانکہ NH_3 اور H_2O میں آکسیجن اور نائٹروجن کی ہائبرے ڈائزیشن sp^3 ہے۔

Ans: Like CH_4, the molecules of H_2O and NH_3 are also AB_4 type molecules. Carbon, oxygen and nitrogen atoms undergo sp3-hybridization. CH_4 is perfectly tetrahedral (مکمل طور پر چار سائیڈ والی شکل) with the angle of 109.5°. In case of ammonia, there are three bond pairs and one lone pair. Lone pair-bond pair repulsion is greater than bond pair-bond pair repulsion. Due to this reason, angle reduces to 107.5°. In case of H_2O, there are two lone pairs on oxygen.

Due to this increased repulsion (بڑھتی ہوئی دفع کرنے کی قوت) of two lone pairs, the angle further reduces to 104.5°.

Q.4 π-bonds are more diffused than σ-bonds. Justify it.

(Sargodha 2009, Multan 2009, B.Pur 2009, Faisalabad 2009, Guj. 2010, Faisalabad 2010, Multan 2011, Guj. 2012, Rwp. 2012, D.G. Khan 2012, Lahore 2012, D.G. Khan 2013, Federal Board 2013, Lahore 2014, F. Abad 2014, Guj. 2014, B. Pur 2014, Sahiwal 2014)

-4 π-بانڈ، σ-بانڈ کے مقابلہ میں الیکٹرانز کے بادل کے حوالے سے زیادہ بکھراہٹ کا شکار کیوں ہوتا ہے؟

Ans: The σ-bond is formed by head to head overlap (ایک کا سر ادوسرے کے سرے پر چڑھ جانے) of two half-filled atomic orbitals. The electronic cloud density is symmetrical

(الیکٹرانز کے بادل کا گہرا پن ایک جیسا ہوتا ہے) along the bond axis. The electronic cloud density of π-bond is not symmetrical along the bond axis. It consists of two regions, above and below the bond axis. So π-bond is more diffused (بکھرا ہوا).

Q.5 The abnormality of bond length and bond strength in HI is less prominent than that of HCl. Give reason. (Lahore 2007, D.G. Khan 2011, R. Pindi 2012, D.G. Khan 2014)

-5 HI کا مالیکیول بانڈ کی لمبائی اور بانڈ کی مضبوطی روٹین سے ہٹ کر رکھتا ہے لہٰذا یہ ایک قسم کا غیر معمولی پن کا مرتکب ہے۔ لیکن یہ غیر معمولی پن HCl کے مقابلہ میں کم کیوں ہے؟

Ans: Chlorine has higher electronegativity than iodine. So, the polarities of HCl and HI bonds are unequal. Therefore, abnormality (غیر معمولی) of bond length and bond strength of HCl is more prominent (نمایاں) than HI.

Q.6 Solid sodium chloride does not conduct electricity, but, when electric current is passed through molten sodium chloride or its aqueous solution, electrolysis takes place. Give reason.

-6 NaCl ٹھوس حالت میں تو نہیں لیکن جب پانی میں سولیوشن بنے یا پگھلی ہوئی حالت میں ہو تو برقی رو کی گزرنے دیتا ہے۔ وجہ کیا ہے؟

Ans: In solid NaCl, the oppositely charged ions are fixed at their positions. So they do not conduct electricity (برق رو کو گزرنے نہیں دیتے) in the solid state. In the molten state or solution state the ions are free to move towards the respective electrodes.

Q.7 The melting points, boiling points, heat of vaporizations and heat of sublimation of electrovalent compounds are higher as compared to those of covalent compounds. Why? (Lahore 2012)

-7 آئنک مرکبات کے M.P، B.P، ΔH_v اور ΔH_s کو ویلنٹ مرکبات کے مقابلہ میں زیادہ کیوں ہوتے ہیں؟

Ans: Electrovalent or ionic compounds have high melting and boiling points due to the close packing (قریب قریب پیکنگ) of oppositely charged ions. The positively charged ions are surrounded (گھرے ہونا) by negatively charged ions and vice versa. That is why, they have very high melting points, boiling points, heat of vaporizations and heats of sublimation.

Q.8 What is octet rule? (Rwp. 2008, Multan 2011, Multan 2012, Lahore 2012, Sahiwal 2014)

-8 آٹھ کا قانون کیا ہے؟

Ans: Some of the elements of the period table have a tendency to have eight electrons in their outermost shell during the formation of ionic, covalent or coordinate covalent bonds. This tendency is called octet rule (آٹھ کا قانون) and is obeyed by the elements of second and third period (دوسرے اور تیسرے پیریڈ کے عناصر اس کے مطابق کام کرتے ہیں).

Q.9 Most of the elements of the periodic table attain the electronic configuration of inert gases during bond formation. Justify it.

-9 پیریڈک ٹیبل کے زیادہ تر عناصر بانڈز بنانے کے دوران اِنرٹ گیسوں کی طرح الیکٹرانز کی تقسیم اختیار کر لیتے ہیں۔ کیوں؟

Ans: Inert gases (تعامل نہ کرنے والی گیسیں) are not reactive due to complete octet (آٹھ مکمل ہے) except He. Most of the s- and p-block elements may attain eight electrons in the outermost orbitals. They do so either by losing, gaining or sharing the electrons.

Q.10 Why positively charged ions are mostly smaller in sizes than their neutral atoms? (Rwp. 2008, Lahore 2008, Sarg. 2011)

-10 جن آئنز پر مثبت چارج ہوتا ہے وہ اپنے ہی نیوٹرال ایٹمز کے مقابلہ میں سائز میں چھوٹے کیوں ہوتے ہیں؟

Ans: By the removal of electrons (الیکٹرانز کے ہٹانے سے) the cloud of outermost orbitals becomes thin. In this way, the remaining electrons are accommodated (جگہ پانا) in smaller space. The nuclei have better attractive forces for them, and so the sizes are decreased as compared to the neutral atoms.

Q.11 Greater the amount of positive charge on the ion, smaller the size of the ion. Why?

-11 کسی مثبت آئن پر جتنا چارج زیادہ ہوتا ہے اُتنا ہی سائز کم ہوتا ہے۔ کیوں؟

Ans: When we go on removing the electrons from outermost orbitals, the outermost electronic clouds (سب سے باہر والے الیکٹرانز کا بادل) become more and more thin (پتلا ہوتا جاتا ہے). The rest of electrons can be accommodated in smaller volume. So, these electrons come near to the nucleus.

Periodicity of Properties

Q.12 Why the atomic sizes decrease from left to the right in a period? Can they be measured precisely? (Lah 2009, F. Abad 2012, Guj. 2014)

-12 ایک پیریڈ میں ایٹمز کا سائز بائیں سے دائیں جاتے ہوئے کم کیوں ہوتا جاتا ہے؟

Ans: From left to the right in a period, the nuclear charges increase and number of shells remain the same. Moreover, the shielding effect (رکاوٹ کا اثر دینے والا) remains the same. So, the atomic sizes decrease from the left to the right is a period. They cannot be measured precisely because there is no sharp boundary of electronic cloud.

Q.13 Why the atomic radii increase down the group?
(Sarg 2005, Rwp 2007, Multan 2007, Fd. 2008, Lahore 2009, Sargodha 2009, F. Abad 2012)

-13 ایٹمی نصف قطر گروپ میں نیچے کی جانب جاتے ہوئے کیوں بڑھتے ہیں؟

Ans: The number of shells increase along with the increasing shielding effect down the group. These two factors are dominant (غالب آتے ہیں) in increasing the sizes. No doubt, the nuclear charges are increased, but this is not a dominant factor.

Q.14 Cationic radius is smaller than the parent atom, while anionic radius is larger than parent atom. Why?
(Multan Board 2004, Lahore 2009, B.Pur 2009, Lahore 2010, Guj. 2010, Multan 2011, B. Pure 2012, Lhr 2014)

-14 مثبت آئن کا نصف قطر ایٹم سے چھوٹا اور منفی آئن کا ایٹم سے بڑا ہوتا ہے۔ کیوں؟

Ans: The radius of the positive ions becomes less, because the effective nuclear charge (نیوکلیس کا وہ چارج جو اثر انداز ہو سکتا ہے) on the ion increases. Greater the positive charge on the ion, smaller the radius. Similarly, the radius of negative ion or anion becomes more than neutral atom because increasing electron makes the outermost shell to swell up (پھول جانا).

Q.15 Compare the radius of chloride ion with its parent atom. Give reasons.
(Sargodha 2008, Guj. 2008, Guj. 2013)

-15 Cl^- کے نصف قطر کا Cl° ایٹم سے مقابلہ کریں اور وجہ بتائیں۔

Ans: $Cl^\ominus$ is bigger in size than Cl°, due to swelling of 3p subshell for its additional electron.

In Cl° there are $5e^-$ in 3p orbital but for $Cl^\ominus$ there are $6e^-$ in 3p orbital.

Q.16 Ionization energy of the element is the binding energy of the nucleus and the electron. Why is it measured when the atom is in the gaseous state?
(D.G. Khan 2012, F. Abad 2012, Lahore 2013)

-16 I.E ایک عنصر میں نیوکلیس اور سب سے باہر والے الیکٹران کے درمیان قوت کشش کی مقدار ہے اس کی پیمائش کرتے وقت ایٹم کا گیس کی حالت ہونا لازمی کیوں ہے؟

Ans: The outermost electrons are attracted by the nucleus. If the atom is closer to some other atom of its own kind or of different kinds, then the outermost electrons are being attracted or repelled by other species as well. In that situation (ان حالات میں), it is not possible to guess (اندازہ لگانا ممکن نہیں ہے) the forces of attractions within the nucleus and the outermost electron (کم ہوتے ہوئے I.E کا سبب).

Q.17 Why the ionization energies decrease down the group although the nuclear charges increase? **(Rawalpindi 2005) (Model Paper, F.A-2007)**
(Gujranwala 2008, Faisalabad 2008, B.Pur 2009, Multan 2009, Sargodha 2010, D.G. Khan 2011, Multan 2011, Bahawalpur 2011, D.G. Khan 2012, F. Abad, 2012, B. Pure 2012, Lahore 2013, Guj. 2013, Faisalabad 2013, Lahore 2014, Sahiwal 2014, B. Pur 2014)

-17 کسی گروپ میں اوپر سے نیچے آتے ہوئے I.E کم ہوتی ہے حالانکہ ایٹمز میں نیوکلیس کے چارجز بڑھتے ہیں۔

Ans: When we go down the group, the number of shells increase (شیلز بڑھتے ہیں) and shielding effects (ڈھال کا کام کرنے والے الیکٹران کا اثر) also increase. These two factors decrease the force of attraction between the nucleus and the outermost electrons and is a cause of decreasing ionization energy.

Q.18 Ionization energy is index to the metallic character. Why?
(Multan 2009, Lahore 2013, Faisalabad 2013, Sahiwal 2014)

-18 کسی عنصر کی I.E کی قیمت اس کے میٹل ہونے یا نہ ہونے کی دلیل کیسے فراہم کرتی ہے؟

Ans: Metals have losely held electrons, which are delocalized (ایک جگہ قائم نہ رہنے والے) and are responsible (ذمہ دار) for the properties of metals. So, metals have low ionization energies.

Q.19 Why the ionization energies of III-A group elements are less as compared to II-A, although the values should increase from left to the right in a period?
(Model Paper-2006-07, B.P. 2008, Multan 2009, D.G. Khan 2011, Sahiwal 2014)

-19 III-A گروپ کے عناصر کی I.E II-A گروپ سے کم ہیں۔ حالانکہ I.E. کی قیمتیں بائیں سے دائیں بڑھتی ہیں۔

Ans: The II-A group elements have outermost completely filled s-orbital. The electron removal is difficult and I.E values are higher than expectations (اُمیدوں سے). Elements of III-A group have outermost p-orbitals having one unpaired electron which is easier to remove.

Q.20 Why second I.P. of an element is always greater than first I.P.
(Federal Board 2013, Sahiwal 2014, Sarg. 2014)

-20 دوسرا I.P ہمیشہ پہلے I.P سے زیادہ کیوں ہوتا ہے؟

Ans: Second electron is removed from a positive ion and its inner level. It is difficult to do so, hence more energy is required to develop the second positive charge on an atom. Moreover, the positively charged ion are smaller in size and second electron removal is different.

Q.21 Define electronegativity. How does it vary in Periodic Table?
(Guj. 2010, Rwp. 2010, Faisalabad 2010, Rwp. 2011, Faisalabad 2011, M. Pure 2012, D.G. Khan 2012, Multan 2013, Lahore 2014, Multan 2014)

-21 الیکٹرونیگیٹیویٹی کی تعریف کریں یہ پیریڈک ٹیبل میں کس طرح تبدیل ہوتی ہے؟

Ans: The tendency (رجحان) of an atom to attract shared pair of electrons towards itself in a bond is called electronegativity.

Electronegativity has no units. Electronegativity decreases from top to bottom (اوپر سے نیچے کم ہونا) in a group and increase from left to right in the periods. Fluorine has maximum value of electronegativity *i.e.*, 4.0. It is on the top right of the Periodic Table.

Q.22 Why the electron affinities of II-A are less than those of I-A?
(Model Paper, Faisalabad 2011, M. Pure 2012, B. Pure 2013)

-22 II-A گروپ کی الیکٹران افنٹی I-A گروپ کے عناصر سے کم کیوں ہوتی ہے؟

Ans: The elements of II-A have fulfilled outermost s-orbitals (سب سے باہر والا s- آربیٹال بھرا ہوا ہے), so electron has to be accommodated (جگہ بنانا) in the higher orbitals. Their electron affinities (الیکٹرانز کے لئے رغبت) are positive. The elements of I-A can accommodate incoming electron in partially filled s-orbital (جزوی طور پر بھرا ہوا s- آربیٹال).

Q.23 Why the first electron affinity for most of the elements is negative, while the second electron affinity for all the elements is positive?
(Model Paper-2006-07, Mirpur-2006, Bahawalpur 2008, Sarg 2009, Faisalabad 2011, M. Pure 2012, B. Pure 2013)

-23 عناصر کی پہلی الیکٹران افنٹی منفی ہوتی ہے اور دوسری مثبت ہوتی ہے۔ کیوں؟

Ans: Most of the elements of the Periodic Table have the capacity (گنجائش) to accommodate the electrons in one of the outermost orbitals. They feel stability (استحکام محسوس کرتے ہیں) by gaining the electrons and evolve the energy.

When the second electron is given to the uninegative ions (آئن جن پر ایک منفی چارج ہو), it is repelled by the negative ion and energy has to be provided. So, the second electron affinity of all the elements is positive.

Types of Bonds

Q.24 An ionic bond is expected to be formed between the elements of I-A and II-A on one hand, while VI-A and VII-A on the other hand. Comment.
(M. Pure 2012, Faisalabad 2013)

-24 I-A اور II-A گروپس کے عناصر VI-A اور VII-A گروپس کے عناصر سے مل کر ہی آئنک بانڈز کیوں بناتے ہیں؟

Ans: The ionic bond should be formed between those elements in which one of them has low I.E value and other has high electron affinity value. The elements of the I-A and II-A have a low I.E. values. The elements of the VI-A and VII-A have high electron affinities. So, the bonds between them are expected (اُمید کیا جانا) to be ionic.

Q.25 How do you justify that all the bonds between I-A and II-A with VI-A and VII-A are not equally ionic? **(M. Pure 2012)**

-25 آپ کیسے صحیح ثابت کریں گے کہ I-A، II-A گروپس کے عناصر جب VI-A اور VII-A گروپس کے عناصر سے بانڈز بناتے ہیں۔ تو تمام بانڈز برابر آئنک صفات نہیں رکھتے۔

Ans: The I.E. values of the I-A are less than II-A. The E.A. of VII-A are greater than VI-A. So, the bond between I-A and VII-A should be ionic to a good extent. The bonds between II-A and VI-A should be poorly ionic (جو اچھا آئنک نہ ہو). It means that all the above mentioned compounds are not equally ionic (تمام اس قسم کے مرکبات میں آئنک کیریکٹر ایک جیسا نہیں ہوتا).

Q.26 How does the electronegativity difference decide the nature of ionic bond?
(Lahore 2007, Rwp. 2008, F.d 2009, Sarg. 2011, D.G. Khan 2013, B. Pure 2013, Faisalabad 2013, Guj. 2014)

-26 کسی طرح سے الیکٹرونیگیٹیویٹی کا فرق بانڈ کے آئنک ہونے کا فیصلہ کرتا ہے؟

Ans: When the electronegativity difference (کا فرق E.N.) between two bonded atoms is 1.7 or more than that, then the bond is said to be ionic (آئنک کہا جاتا ہے), otherwise covalent. The % age of ionic character is more than 51 % when the electronegativity difference is 1.7. Bonds having electronegativity difference less then 1.7 are called polar covalent bonds (کوویلنٹ کہا جاتا ہے).

Q.27 No bond in chemistry is 100 % ionic. Justify it.
(Model Paper-2006-07, Faisalabad 2007,)

-27 کیمسٹری میں کوئی بھی بانڈ 100% آئنک نہیں ہے۔ صحیح ثابت کریں۔

Ans: The maximum difference of electronegativity (زیادہ سے زیادہ کا فرق E.N.) between two bonded atoms is 3.2 *i.e.*, for CsF. According to Pauling's formula, the %age of ionic character comes out to be 92 % in CsF. No bond in chemistry has ionic character more than 92 %. It mean that no bond in chemistry is 100 % ionic.

Q.28 Why sigma bond is stronger than pi-bond? **(Lhr-2005, Lhr-2006, Rwp-2007, F. Abad 2007, Multan 2007, Sargodha 2008, Fd. 2009, Guj. 2009, Guj. 2011, Sarg. 2011, Guj. 2012, B. Pur 2014, Sarg. 2014)**

-28 σ-بانڈ، π-بانڈ سے مضبوط کیوں ہوتا ہے؟

Ans: The electrons making the sigma bond are supposed (فرض کیا جاتا) to have their electron density very close to the joining line of two nuclei. So nuclei are tightly bound (سختی سے باندھے ہوئے). Electrons of the pi-bond are above and below the joining line. They are more diffused (بکھرے ہوئے) and so cannot hold the two nuclei with a greater force. Anyhow, the double bond which is σ and π is stronger than a single σ-bond.

Q.29 Why $\ddot{N}H_3$ and $\ddot{P}H_3$ give coordinate covalent bonds with $H^{\oplus}$?
(Model Paper, Bahawalpur 2007, 2008, Guj. 2009, Faisalabad 2011, Rwp. 2011, B. Pure 2012, B. Pure 2013, Guj. 2013, D.G. Khan 2013)

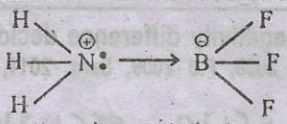
-29 $\ddot{N}H_3$ اور $\ddot{P}H_3$ کیوں $H^{\oplus}$ سے مل کر کوآرڈی نیٹ کوویلنٹ بانڈز بناتے ہیں؟

Ans: $\ddot{N}H_3$ and $\ddot{P}H_3$ have lone pairs of electrons, which can be donated (دیا جا سکتا) to $H^{\oplus}$ to make a coordinate covalent bond. In this way, $NH_4^{\oplus}$ and $PH_4^{\oplus}$ are produced which have perfect tetrahedral structures (مکمل طور پر چار سائیڈز والی شکل) and all the four bonds have perfectly equal status (چاروں بانڈز کا معیار ایک ہے). Anyhow, one of the bonds is called co-ordinate covalent and three as covalent.

Q.30 Why a coordinate covalent bond is produced between NH_3 and BF_3, but no such bad is produced between two similar atoms?
(Sarg. 2010, Rwp. 2010, Multan 2012, Lahore 2014, Lahore 2014)

-30 $\ddot{N}H_3$ اور BF_3 مل کر co-ordinate کوویلنٹ بانڈ بناتے ہیں۔ لیکن دو ایک جیسے ایٹمز مل کر ایسا بانڈ نہیں بناتے۔ کیوں؟

Ans: BF_3 is neutral compound but it is electron deficient (الیکٹران کی کمی رکھنے والا). The octet of B is not complete (B کا آٹھا پورا نہیں ہے). It has only six electrons in the outermost orbital of "B" in BF_3. It accepts (قبول کرتا ہے) the electron pair from :NH_3 to complete its octet, and the following compound is produced.



Similar atoms cannot donate and accept electrons.

ایک ہی قسم کے ایٹمز ایک دوسرے کو الیکٹرانز لیتے یا دیتے نہیں ہیں۔

VSEPR Theory

Q.31 Why CO_2 and CS_2 have linear structure?

(Lahore 2005, Guj. 2008, Guj. 2011, Lahore 2013, D.G. Khan 2014)

-31 CO_2 اور CS_2 کی ساختوں میں سیدھا پن کیوں ہے؟

Ans: Carbon has four electrons in the outermost orbitals. It makes two sigma and two pi-bonds with two oxygen atoms. It means that it has two double bonds. Carbon has no lone pair in CO_2. So CO_2 is AB_2 type molecule having the linear structure

$$O = C = O \qquad S = C = S$$

Two dipoles cancel the effect of each other (دونوں ڈائی پولز ایک دوسرے کے اثر کو زائل کر دیتے ہیں) and it behaves as non-polar.

Q.32 Why the lone pairs of electrons on an atom occupy greater space? Give example of NH_3.

(Rawalpindi 2007, Lahore 2009, Rwp. 2011, R. Pindi 2012, Faisalabad 2013, Guj. 2014, Rwp. 2014)

-32 ایک ایٹم کے اوپر پڑا ہوا اکیلا الیکٹرانز کا جوڑا زیادہ جگہ گھیرتا ہے۔ کیوں؟

Ans: The lone of electrons of the central atom is only attracted by the nucleus of the central atom. It creates more forces of repulsion due to nearness (قربت) of nucleus and occupies (جگہ لیتا ہے) greater space as compared to the bond pair. The lone pair on N-atom of NH_3, pushes three bond pairs and the bond angle decreases upto 107.5°.

Q.33 Why the repulsion between the electron pair around the central atom is in the following order? Give reason. (Rawalpindi 2009, Guj. 2012)

lone pair-lone pair > lone pair-bond pair > bond pair-bond pair

-33 الیکٹرانز کے جوڑوں کے درمیان جو دفع کرنے کی طاقت ہوتی ہے اس کی ترتیب مندرجہ ذیل ہے۔ وجہ بتائیں۔

Ans: A lone pair is closer to the nucleus of the central atom as compared to the bond pair. So two lone pairs on the central atom are closely spaced (کم درمیانی فاصلے والے) as compared to a bond pair and a lone pair. Since the distance between two bond pairs is greater, so the repulsion is minimum.

Valence Bond Theory

Q.34 On the hybridization of the carbon atom, the promotion of the electrons requires the energy but hybridized carbon atom is more stable than unhybridized state. Why?

-34 کاربن کا ایٹم hybridization کے عمل کے دوران اپنے الیکٹران کو زیادہ انرجی والے آربٹ میں لے جاتا ہے لیکن اس کے باوجود hybridized کاربن کا ایٹم زیادہ استحکام پذیر ہے۔ کیوں؟

Ans: This promotion of electron (الیکٹران کا اوپر والے آربیٹال میں جانا) needs energy. But simultaneously (ساتھ ہی) hybridization of orbital (آربیٹالز کا مکس ہونا) takes place, which is energy releasing process (انرجی خارج کرنے والا). This hybridization process is more exothermic than endothermicity of process of electron promotion.

So the hybridized carbon atom with the promoted electron is more stable.

Q.35 How the four sp^3-hybridized orbitals of carbon are directed in space, to give a tetrahedral structure? (D.G. Khan 2013)

-35 چار سائڈز والی ساخت رکھنے والے کاربن ایٹم کے sp^3 آربیٹالز سپیس میں کس طرح اپنے رخ متعین کرتے ہیں؟

Ans: The sp^3 orbitals are directed in space along the corners of a tetrahedron. They are so to have minimum repulsive forces (کم سے کم دفع کرنے والی قوتیں ہوں). The structure has four corners (کونے), four faces (چار سائیڈز), six edges (چھ کنارے) and six angles (چھ زاویے).

Q.36 Why the covalent bonds are directional? Give the structure of $\ddot{N}H_3$. (Multan 2008, Guj. 2014)

-36 کوویلنٹ بانڈ سمتی طرز کے کیوں ہوتے ہیں؟

Ans: Covalent bonds are produced due to overlapping of orbitals which have particular directions (خاص سمتیں) around the nucleus of atoms. They have bond angles. So, after making bonds they have definite directions. There are four electron pairs around N-atom. One of them is lone pair. It pushes bond pairs and pyramide of $\ddot{N}H_3$ is developed.

Q.37 Why the molecule of BF_3 is triangular planar? (Guj. 2008, Lahore 2013, D.G. Khan 2013)

-37 BF_3 کا مالیکیول تین کونوں اور ایک پلین میں رہنے والا کیوں ہے؟

Ans: 'B' has three electrons in the outermost orbitals. It promotes (آگے لے کر جانا) the electron from 2s orbital to one of the 2p orbitals. Boron undergoes (سہنا) sp^2-hybridization. Three sp^2-hybridized orbitals lie in one plane (ایک پلین میں) and adjust themselves at angle of 120°. Three F atom make three sigma bonds which lie in one plane. So, the molecule of BF_3 is planar (ہموار).

Molecular Orbital Theory

Q.38 When two oxygen atoms approach each other, they produce two bonds but one of the bonds is sigma and other is π. Justify it.

-38 جب دو عدد O-ایٹمز آپس میں بانڈ زبناتے ہیں تو ان میں سے کیوں ایک σ اور دوسرا π ہوتا ہے؟

Ans: Two electrons of oxygen in p-orbital are unpaired (جو جوڑا نہ ہو). These p-orbitals are perpendicular (ایک دوسرے پر عموداً کھڑے ہیں) to each other. The two p-orbitals of two O-atom do the head-on overlapping to form a sigma bond. Other two p-orbtials are parallel (متوازی). These parallel p-orbitals do the side away overlapping (سائیڈز کو ایک دوسرے کے اوپر رکھ کر) to form a π-bond.

Q.39 Why the energy of the ABMO is greater than the BMO? (Mirpure 2004, Lahore 2008, D.G. Khan 2012, Guj. 2013)

-39 ABMO کی انرجی BMO کی انرجی سے زیادہ کیوں ہوتی ہے؟

Ans: In BMO, the electron density is maximum on the joining line of two nuclii, so, the nucleus-nucleus repulsion is minimum and the system is stable. In ABMO, the electron density is not between the two nuclei but on right and left of bonded atoms.

دو نیوکلائی کو ملانے والی فرضی لائن کے گرد الیکٹرانز کے بادل کا گاڑھا پن زیادہ ہو۔

In ABMO, the electronic clouds (الیکٹرانز کے بادل) are on the right and left of two nuclei. In this way, the nucleus-nucleus repulsion is there and the system is unstable (غیر مستحکم).

Q.40 **In the molecule of N_2, there are three bonds. One of them is sigma and the two are π. Justify it.** **(M. Pure 2012)**

-40 N_2 کے مالیکیول میں تین بانڈز ہوتے ہیں ان میں ایک σ اور دو π کیوں ہوتے ہیں؟

Ans: Nitrogen has three electrons unpaired (بغیر جوڑا بنے). When two nitrogen atoms approach (پہنچنا) each other, then p-orbitals do the head-on overlapping (سرے ایک دوسرے کے اوپر آتے ہیں) to form a sigma bond. Other two p-orbitals on each nitrogen atom do the parallel p-overlapping to form two π-bonds.

Q.41 **What is the sequence of molecular orbitals in nitrogen molecule? Is it diamagnetic?** **(Model Paper-2006-07, Bahawalpur 2008, D.G. Khan 2013)**

-41 N_2 کے مالیکیول میں M.O کی انرجی کے لحاظ سے ترتیب کیا ہے؟ کیا یہ ڈایامیگنیٹک ہے؟

Ans: The spectroscopic techniques (سپکٹروسکوپی کے فن) have verified (تصدیق کرنا) the following arrangement of molecular orbitals in the case of N_2 molecule

$$\sigma_{(2s)} < \sigma^*_{(2s)} < \pi_{(2py)} = \pi_{(2pz)} < \sigma_{(2px)} < \pi^*_{(2py)} = \pi^*_{(2pz)} < \sigma^*_{(2px)}$$

There are no unpaired electron so it is diamagnetic.

Q.42 **Throw light on the term bond order?**
(Guj. Board 2005, B. Pur Board 2005, Bahawalpur 2007, Lahore 2007, B.P. 2008, M. Pur 2012, D.G. Khan 2012, Lahore 2014, Lahore 2014, Lahore 2014)

-42 بانڈ آرڈر کے تصور پر روشنی ڈالیں۔

Ans: This term is related with the bond formation according to molecular orbital theory. It is the difference (فرق) of the electron pairs in bonding molecular orbitals and anti-bonding molecular orbitals. The bond order (بانڈز کی تعداد) of He is zero, of hydrogen is one, of oxygen is two and of nitrogen is three.

Q.43 **How MOT justifies that He atoms cannot make the He_2? Helium is diamagnetic in nature. Justify.**
(Rawalpindi 2005, Model Paper Multan 2007, Multan 2008, F. Abad 2008, Sarg. 2009, Faisalabad 2010, Lahore 2011, Rwp. 2013, Multan 2013, Lahore 2014, Sarg. 2014)

-43 MOT کیسے ثابت کرتی ہے کہ He_2 کا مالیکیول نہیں بن سکتا۔ نیز He گیس مقناطیسی میدان سے اثرانداز کیوں نہیں ہوتی۔

Ans: When two He atoms approach each other, they give two molecular orbitals *i.e.*, σ_{1s} and σ^*_{1s}. Two electrons go to σ_{1s} and other two go to σ^*_{1s}. In this way the number of bonding electrons is equal to the number of antibonding electrons. The bond order becomes zero. Hence He_2 does not exist.

Q.44 **Why MOT is superior to VBT? (Faisalabad Board 2004, Multan 2009, Guj 2011, Lahore 2011, Sarg. 2011, Multan 2013, Sarg. 2014, D.G. Khan 2014, Lahore 2014)**

-44 MOT کیوں اعلیٰ درجہ کی تھیوری ہے VBT سے؟

Ans: Molecular orbital theory tells us the reason for no bond between noble gases. It also tells us the number of bonds whether sigma or pi in N_2 and O_2. Moreover, it tells about the paramagnetic (مقناطیسی میدان کی طرف کشش رکھنا) and diamagnetic (مقناطیسی میدان سے بھاگنا) nature of the substance, but V.B.T. does not gives such answers.

Bond Dissociation Energy

Q.45 Why the bond energies of the multiple bonds are greater than those of single bonds? (Guj. 2013)

-45 دوہرے یا تیہرے بانڈز کو توڑنے کی انرجی اکیلے بانڈ سے زیادہ کیوں ہوتی ہے؟

Ans: The four electrons in a double bond can tight (باندھ کے رکھنا) the nuclei in a better way, then two electrons in a single bond. In the case of triple bond, six electrons are joining the two nuclei, so, the bond is even stronger than the double.

Q.46 Why the actual bond dissociation energy of HCl molecule is greater than theoretical bond dissociation energy?

(D.G. Khan 2011, F. Abad 2012, Guj. 2013, Multan 2013)

-46 HCl کی تجرباتی طور پر معلوم کی گئی بانڈ کو توڑنے کی انرجی اس کے علمی قیمت والی انرجی سے زیادہ کیوں ہے؟

Ans: HCl is not 100 % covalent. The molecule of HCl is partially ionic (جزوی آئنک). Additional forces of attraction are created in H and Cl. These additional forces make the bond stronger (بانڈ کو مضبوط بنا دیتی ہیں).

Dipole Moment

Q.47 The dipole moment is the property of those molecules in which there is a polarity. Justify it. (Rwp. 2009, Rwp. 2012)

-47 Dipole moment اُن مالیکیولز کی صفات ہے جن میں پولز بنتے ہیں۔ صحیح ثابت کریں۔

Ans: Dipole moment is the product of the internuclear distance (نیوکلائی کا درمیانی فاصلہ) and the charge on any one of the poles (کسی ایک پول کا چارج), $\mu = d \times e$. The poles are only created (اُس وقت پیدا ہوتے ہیں), when there is a difference of electronegativity. If the molecule is non-polar, then there is no dipole moment.

Q.48 Dipole moment of CO_2 is zero but that of CO is 0.12 Debye. Why?

(Azad Jammu & Kashmir Board 2005, Rwp. 2008, Fd. 2009, Lahore 2012)

-48 CO_2 کا ڈائی پول مومنٹ صفر ہے جبکہ CO کا 0.12D ہے۔ کیوں؟

Ans: CO_2 is a linear molecule and the two dipoles cancel the effect of each other (ایک دوسرے کے اثر کو زائل کرنا). In CO there is a single dipole directed from carbon to oxygen and it is not cancelled.

Q.49 The dipole moments of CO_2 and CS_2 are zero and that of H_2O is 1.85 D and SO_2 is 1.61 D. Why?

(Lahore Board 2004, Multan 2008, F. Abad 2008, Guj. 2009, Lahore 2012, Lahore 2013, Federal 2013, Rwp. 2014, Sahiwal 2014, B. Pur 2014)

-49 CO_2 کا ڈائی پول مومنٹ صفر ہے جبکہ پانی کا 1.85D ہے۔ کیوں؟ حالانکہ دونوں مالیکیولز تین تین ایٹمز پر مشتمل ہیں؟

Ans: The oxygen atom in water is sp^3-hybridized. Two lone pairs at the corners of a tetrahedron repel two bond pairs and bond angle becomes 104.5°. So it is an angular molecule (زاویہ بنانے والا) and shows dipole moment. SO_2 is also angular. In CO_2 and CS_2 carbon is sp-hybridized and two sp-hybridized orbitals are at 180°. The structures are linear and two dipoles cancel the effect of each other.

Q.50 Define dipole moment and give its units.

(Rwp. 2010, Multan 2012, Lahore 2012, Lahore 2014)

-50 ڈائی پول موومنٹ کی تعریف کریں اور اس کی اکائیاں بیان کریں۔

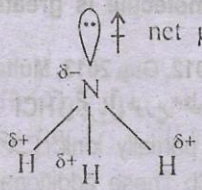
Ans: It is the product of bond distance and charge on anyone of the poles.

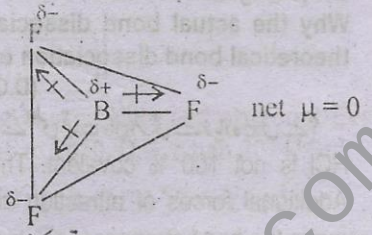
$\mu = d \times e$. In S.I. units it is expressed in mC and non S.I. units are Debye.

Q.51 NH_3 and BF_3 are both tetra-atomic molecules, but the dipole moment of BF_3 is zero, while that of NH_3 is 1.49 D. Justify it. (Guj. 2014)

-51 NH_3 اور BF_3 دونوں مالیکیولز چار چار ایٹمز پر مشتمل ہیں۔ لیکن BF_3 کا ڈائی پول مومنٹ صفر ہے اور NH_3 کا 1.49 D ہے۔ کیوں؟

Ans: NH_3 is a pyramidal structure (مخروطی شکل). The net dipole moment is directed towards the directions of the lone pair.





BF_3 is triangular planar (تین کونوں والی ایک سطح پر). It has three dipoles which cancel the effect of each other.

Q.52 How the measurement of dipole moment can help us to identify the cis and trans geometrical isomers?

-52 کسی طرح کر کے ڈائی پول مومنٹ کی پیمائش cis اور trans مرکبات کو پہچاننے میں ہماری مدد کرتی ہے؟

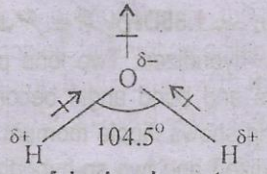
Ans: Geometrical isomers differ from each other in the relative position (اضافی جگہیں) of groups in space. If the polar groups are on the same side, then the net dipole moment develops.

If the polar groups are on the opposite sides, then they cancel the effect of each other, completely (مکمل طور پر) or partially (جزوی طور پر). In this way, the net dipole moment will be zero or less than that of cis isomers.

Q.53 The bent structure of H_2O shows that it should have a dipole moment. Comment. (D.G. Khan 2014)

-53 پانی کی ساخت ایک جھکے ہوئے مالیکیول کا منظر ہے اس کا ڈائی پول مومنٹ ہونا چاہیے اس پر بحث کریں۔

Ans: H_2O is a triatomic molecule. Its two bonds are exactly similar. If the molecule of H_2O would have been linear, then the net dipole moment would have been zero (نیٹ ڈائی پول مومنٹ زیرو ہوتا ہے). Actually H_2O molecule is bent. The two dipoles don't cancel the effect of each other. So, it has a net dipole moment. The following diagram makes the idea clear



Q.54 How the %age of ionic character of the polar bond can be determined? (Multan Board 2005)

-54 ایک پولر بانڈ میں آئنک صفات کی فی صد مقدار کیسے ماپتے ہیں؟

Ans: If we can measure the dipole moment of a diatomic molecule in the laboratory and the actual bond length, then the % age of ionic character (% آئنک کریکٹر کی) can be calculated by using the formula

$$\% \text{ ionic character} = \frac{\mu_{observed}}{\mu_{ionic}} \times 100$$

μ_{ionic} is obtained by multiplying the bond length with the charge of electron.

Q.55 Why the dipole moment of CH_4 and SO_3 are zero?

(Multan 2008, Guj. 2013, F.Abad 2014)

-55 CH_4 کا ڈائی پول مومنٹ صفر کیوں ہے؟

Ans: There are the symmetries of molecules which make than non-polar. CH_4 is perfectly tetrahedral molecule. The dipole of each C – H bond cancels the effect of other. So, net μ of CH_4 is zero. SO_3 is triangular planar molecule and three dipoles cancel the effect of each other.

Q.56 Compare bond strength of polar and non-polar bonds.

(Rwp. 2010, D.G. Khan 2014)

-56 پولر اور نان پولر بانڈز کی طاقت کا مقابلہ کریں۔

Ans: The polar bonds, (due to more strength) have higher bond energies than the non-polar bonds. The bond energy changes with the extent of polarity (پولر بننے کی حد کے پیشِ نظر) of the molecule. Stronger the dipole, greater is the bond energy. Therefore, the strength of the H–X types of bonds in halogen acids is in the order;

H–F > H–Cl > H–Br > H–I.

Similarly M.P. and B.P of ionic compounds are higher than covalent compounds.

Q.57 Why the radius of an atom cannot be determined precisely?

(Sarg. 2010, Guj. 2010)

-57 ایک ایٹم کا نصف قطر بالکل ٹھیک ٹھیک نہیں نکالا جا سکتا۔ کیوں؟

Ans: The revolving of electrons (گھومتے ہوئے الیکٹرانز) around the nucleus are not in definite orbits. Rather there are orbitals. **An orbital is the space around the nucleus, where probability for finding the electron is maximum. So, precise size is not available.**

Q.58 Why ionic compounds do not show the phenomenon of isomerism.

(Sargodha 2010)

-58 کیوں آئنک مرکبات آئسومیریزم نہیں دیتے؟

Ans: Ionic compounds are not consisted of discrete (اپنی جگہ نمایاں) molecules. An ion is surrounded by many oppositely charged ions in crystal lattice. Isomerism is the phenomena in which more than one way are to write down the structures. That is only possible if the atoms have covalent bonds in them.