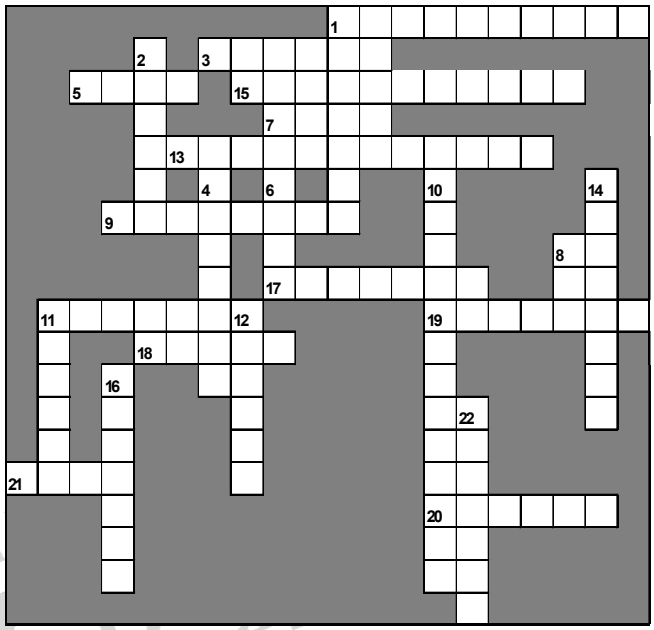
Road to IIT is pretty straight, you just need to take **first step** in the right direction & then continue moving on it.

ELEMENTS AND PROPERTIES OF SUBSTANCES



ACROSS

1. Used as promotor for manufacturing of NH_3 by Haber's process.
3. Used in preparation of wires & water pipes and also alloyed with Sn & Zn to form some important alloys.
5. Its oxide is used in making sindhur & also used as an antiknocking agent in fuels.
7. Substance used to make electric iron electrically insulated.
9. Ancient Egyptians made, black eye make up with this element.
11. A pale yellow material used in vulcanization of rubber.
13. Pure common salt is not, but common salt with impurities of $MgCl_2$ is _____ compound.
15. Quick lime, (CaO) when kept in open absorbs moisture from atmosphere and forms hydroxide $Ca(OH)_2$. This means CaO is _____.
17. Because of this property metals are used to form wires.
18. First group elements are soft_____.
19. Study of hydrocarbons & their derivatives is known as _____.
20. Along with chromium, this metal is a major component of the alloy Nichrome.
21. Metal which is an important component of blood.

DOWN

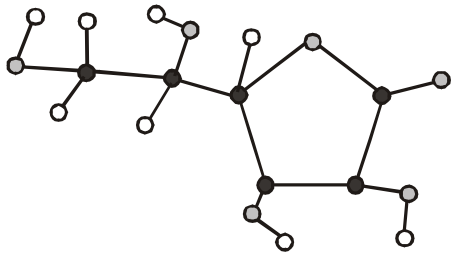
1. Metal which is liquid at room temperature & used in thermometers.
2. The most beautiful gem diamond is made of_____.
4. Its alloy is used as a low melting plug for automatic fire sprinkler system.
6. A soft, valuable metal, its purity is measured in carats.
8. It is present with lead in solder.
10. Alum (phitcari) on getting exposed gets converted to powder by loosing water of hydration by this property.
11. Frequently used in jewelry, this metal is the best conductor of heat and electricity.
12. Radioactive element, discovered by madam curie.
14. Which precious metal is used as drug in chemotherapy for treatment of cancer.
16. Element which is used as fuel in nuclear reaction.
22. Name of an element & a valley near San Jose.

Only one correct :

1. A certain positive ion A^{+2} has 22 neutrons and 18 electrons. What is the mass number of most abundant isotope of A

(A) 42 (B) 38 (C) 40 (D) none

2. Examine the model of vitamin C and determine the molecular formula. In the model shown, the black sphere = C atom, ○ sphere = H atom, ◎ Sphere = O atom.



(A) $C_8H_6O_6$ (B) $C_6H_8O_6$ (C) $C_6H_{10}O_6$ (D) none

3. In a scale of 10^{-18}m , match the particle with respect to their probable size

List-I	**List-II**
(P) Atom	(1) 1,000
(Q) Nucleus	(2) 10,000
(R) Proton	(3) 100,000,000

Code :

	P	Q	R
(A)	1	2	3
(B)	3	2	1
(C)	1	3	2
(D)	2	3	1

More than one may be correct :

4. Specie 'X' with mass number 37 contains 11.1% more neutrons as compared to electrons, then what is the **INCORRECT** representation of specie 'X' ?

(A) $^{37}_{17}Cl^-$ (B) $^{37}_{17}Cl$ (C) $^{35}_{17}Cl^-$ (D) $^{35}_{17}Cl$

Matrix match type

5.

Column-I	**Column-II**
(A) Charge on electron	(P) 1.6022×10^{-19}C
(B) e/m_e	(Q) 1.758820×10^{11} Ckg^{-1}
(C) Mass of proton, m_p	(R) 1.00867 u
(D) Mass of neutron, m_n	(S) 1.00727 u
	(T) 4.8×10^{-10} esu

6. Match the following

Column-I	**Column-II**
(A) the physical property of metal that allows it to be drawn into wire	(P) Element
(B) a single particle composed of two or more atoms	(Q) Physical property
(C) a property that can be observed without changing the chemical formula of a substance	(R) Molecule
(D) a substance that cannot be broken down into simple substances.	(S) Ductility
	(T) Malleability

Integer Type :

7. From the following :

Sugar solution, air, copper, silver, gold, water, glucose, oxygen gas, hydrogen, ammonia, carbon dioxide, smoke, dust, brass, soap solution, bronze

Estimate total number of -

(i) pure substances = x

(ii) Homogeneous mixtures = y

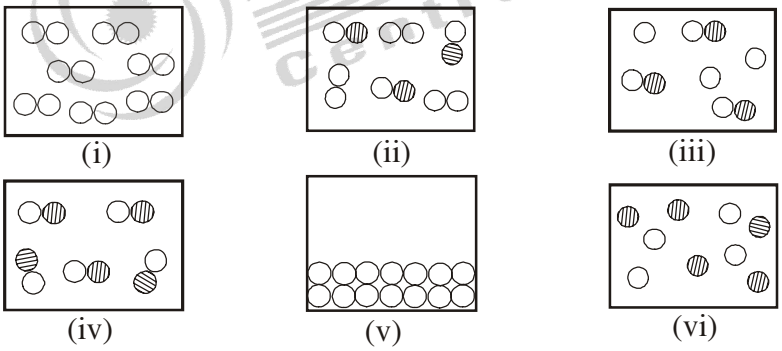
(iii) Heterogeneous mixture = z.

Find x – z + y

Fill your answer as sum of digits till you get the single digit answer.

8. A certain anion carries -9.6×10^{-19} Coulombs of static electric charge. Calculate the number of electronic charges present on it.

9. Match each description below with the following microscopic picture. More than one picture may fit for each description. A picture may be used more than once or not used at all :



(A) the gaseous compound

(B) the mixture of two gases element

(C) the solid element

(D) the mixture of a gaseous element and gases compound

10. Complete the following table

Element	Symbol	Protons	Neutrons	Electrons	Mass number
	^{32}S				
		30			65
			20	20	

Only one correct :

1. Which species carry the maximum charge ?
(A) proton (B) β-particle (C) α-particle (D) Hydronium ion

2. The ratio between the neutrons present in nitrogen atom and silicon atoms with mass number 14 & 28 is
(A) 7 : 3 (B) 3 : 7 (C) 1 : 2 (D) 1 : 1

3. Two particles (X) & (Y) have the composition as shown in the table

Particle	No. of electron	No. of neutron	No. of proton
(X)	18	16	16
(Y)	18	18	17

The particle (X) & (Y) are :-
(A) Isotopes of each other (B) Isobars of each
(C) Isotone of each other (D) Isoelectronic ions

4. Ozone is isoelectronic with
(A) NOF (B) NO_2^- (C) Both (A) & (B) (D) None of these

More than one may be correct :

5. Identify those which are isosteric with each other
(A) Na^+ (B) Mg^{2+} (C) Al^{+3} (D) O^{2-}

6. Identify the element which are isotones of $_8O^{16}$
(A) $_7N^{14}$ (B) $_7N^{15}$ (C) $_6C^{14}$ (D) $_9F^{17}$

7. N_2 is isoelectronic with
(A) CO (B) NO^+ (C) C_2^{2-} (D) CH_4

Integer Type :

8. An element has same number of neutrons as total number of protons or total number of electrons. What will be the neutron excess ?

9. If an element is represented by (A, Z) e.g. Ni_{28}^{60} can be written as (60, 28)
Among the following, find the total number of possible isotopic pairs formed by the given atoms.
(232, 90); (228, 88) ; (228, 89) ; (228, 90); (224, 88); (216, 84); (210, 84) ; (213, 84)

10. Find the number of elements which are isodiaphers of $_{92}U^{238}$
$_{90}Th^{234}$, $_{90}Th^{232}$, $_{93}Np^{237}$, $_{96}Cm^{247}$

Only one correct :

1. Principal, azimuthal and magnetic quantum numbers are respectively related to **[3]**

(A) size, shape and orientation (B) shape, size and orientation

(C) size, orientation and shape (D) none of these

2. Degenerate atomic orbitals have **[3]**

(A) equal energy (B) nearly equal energy

(C) different energy (D) none of the above

3. How many maximum electrons can be described by the quantum numbers n = 5, $\ell = 2$ in a particular atom? **[3]**

(A) 2 (B) 6 (C) 10 (D) 14

4. If an electron has spin quantum number of $+\frac{1}{2}$ and magnetic quantum number of –1, then it cannot be present in - **[3]**

(A) f-orbital (B) d-orbital (C) p-orbital (D) s-orbital

5. When the quantum number n,*l*,m,s are represented by 3,3,2,+1/2, the symbolism for the electron is - **[3]**

(A) 3s (B) 3d

(C) 3f (D) impossible set of quantum number

6. For a 6s electron the values of n,*l*,m,s respectively could be: **[3]**

(A) 6,4,4,+1/2 (B) 1,0,0,+1/2 (C) 6,1,0,+1/2 (D) 6,0,0, +1/2

7. Any p-orbital can accomodate up to **[3]**

(A) four electrons (B) Two electrons with parallel spin

(C) Six electrons (D) Two electrons with opposite spin

8. Which one of the following sets of quantum numbers (n,*l*,m,s) represents an impossible arrangement? **[3]**

(A) 3,2,–2,+1/2 (B) 4,0,0,+1/2 (C) 3,2,–3,+1/2 (D) 5,3,0,–1/2

9. Which type of orbital is designated by n = 2, $\ell = 3$, $m_\ell = -2$? **[3]**

(A) 4p (B) 4d (C) 4f (D) None

Match the column

10. ('*l*' and '*m*' are respectively the azimuthal and magnetic quantum numbers) **[6]**

	Column I		**Column II**
(A)	Total number of values of (*l*) for a shell	(P)	0, 1, 2, ...(n–1)
(B)	Values of (*l*) for a shell	(Q)	+*l*, ...+2, +1, 0, –1, –2, ...–*l*
(C)	Total number of values of (*m*) for a subshell	(R)	(2*l* + 1)
(D)	Values of (*m*) for a subshell	(S)	n

Only one correct :

1. Which of the following statements regarding subshell filling order for a neutral atom is/are correct ?

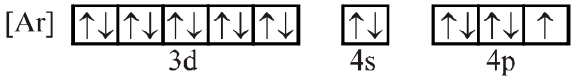
(I) Electrons are assigned to the 4s subshell before they are assigned to the 3d subshell **[3]**

(II) Electrons are assigned to the 4f subshell before they are assigned to the 6s subshell

(III) Electrons are assigned to the 4d subshell before they are assigned to the 5p subshell

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

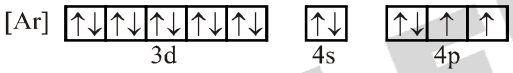
2. Which is a possible set of quantum numbers for the unpaired electron in the orbital box diagram below ? **[3]**



(A) $n = 1, \ell = 1, m_\ell = -1, m_s = +1/2$ (B) $n = 4, \ell = 1, m_\ell = -1, m_s = +1/2$

(C) $n = 4, \ell = 2, m_\ell = -2, m_s = +1/2$ (D) $n = 4, \ell = 0, m_\ell = 0, m_s = +1/2$

3. Which element has the following ground state electronic configuration ? **[3]**



(A) Se (B) As (C) S (D) Ge

4. Hund's rule states that the most stable arrangement of electrons (for a ground state electron configuration) **[3]**

(A) has three electrons per orbital, each with identical spins

(B) has m_ℓ values greater than or equal to +1

(C) has the maximum number of unpaired electrons, all with the same spin in degenerate orbital

(D) has two electrons per orbital, each with opposing spins

5. The Pauli exclusion principle states that **[3]**

(A) no two electrons in an atom can have the same four quantum numbers

(B) electrons can have either ±1/2 spins

(C) electrons with opposing spins are attracted towards each other

(D) None of these

6. Choose the correct option for the quantum numbers of the last electron of $3p^6$. **[3]**

(A) 4, 0, 0, +1/2 (B) 3, 1, –1, –1/2 (C) 4, 1, 0, $-\frac{1}{2}$ (D) 3, 0, 1, $\frac{1}{2}$

7. Select set of quantum number which is possible for maximum number of electrons in an atom **[3]**

(A) $n = 5, \ell = 0, m = 0, s = +\frac{1}{2}$ (B) $n = 5, \ell = 2, m = 0$

(C) $n = 3, m = 0, s = -\frac{1}{2}$ (D) $n = 5, m = 0, s = +\frac{1}{2}$

8. **Statement-1 :** For n = 2 the values of ℓ may be 0, 1 and m may be 0, ±1. **[4]**
Statement-2 : For each value of n, there are 0 to (n – 1) possible values of ℓ, for each value of ℓ there are 0 to ± ℓ values of m.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

Match the column :

9. **[6]**

	Column-I	**Column-II**	
(A)	No. of electrons in Na(11) having m = 0	(P)	7
(B)	No. of electrons in S(16) having (n + ℓ) = 3	(Q)	15
(C)	No. of maximum possible electrons having s = +1/2 spin in Cr(24)	(R)	8
		(S)	12

Subjective :

10. Imagine a universe in which the four quantum no. can have the same possible values as in our universe except that azimuthal quantum no. (l) can have integral values from 0, 1, 2 .... n + 1. **[5]**

(a) Find the no. of electron n = 1 & 2 shell.

(b) Predict the electronic configuration for elements with atomic no. 15 & 25 using aufbau (n + l) rule.

1. Consider the ground state of Cr (Z = 24). The numbers of electrons with the azimuthal quantum number l = 1 and 2 respectively are **[3]**

(A) 16 and 4 (B) 12 and 5 (C) 12 and 4 (D) 16 and 5

2. The total number of electrons in Cr atom for which m = 0 **[3]**

(A) 1 (B) 8 (C) 12 (D) 16

3. How many maximum possible set(s) of quantum no. are possible for 6th electron of Fe **[3]**

(A) 1 (B) 3 (C) 6 (D) 10

4. The maximum no. of electron in phosphorous atom for which n + l + m = 3 will be - **[3]**

(A) 6 (B) 5 (C) 4 (D) 3

5. Which of the following have maximum number of unpaired electron - **[3]**

(A) Na^+ (B) N^{3-} (C) Fe^{3+} (D) Cr^{3+}

MATCH THE COLUMN

Match the column : **[6]**

6.

Column-I	**Column-II**
(A) Fe^{+2}	(P) Set of quantum no. for last e^- n = 2, ℓ=1, m = 1, s= $+\frac{1}{2}$
(B) Mn^{+4}	(Q) Magnetic moment (μ) = zero.
(C) Zn^{+2}	(R) Spin multiplicity (SM) = 4
(D) Na^+	(S) Total no. of exchange pair in 3d-subshell = 10
	(T) Paramagnetic

Subjective

7. H-atom have infinite shells, write total number of shells which does not contain f-subshell. **[4]**

8. Calculate Z_{eff} for last valence shell electron in fluorine (F). **[5]**

9. In multielectronic atom, maximum number of degenerated orbitals present in 3rd shell **[5]**

10. Calculate Z_{eff} for 3s electron in vanadium(23). **[5]**

Only one correct :

1. In lanthanum (Z = 57), the 57 the electron enters in a **[3]**

(A) 6p orbital (B) 5d orbital (C) 6s orbital (D) 4f orbital

2. In Mendeleev periodic table total no. of groups are : **[3]**

(A) 8 (B) 9 (C) 18 (D) 12

3. Atomic number of the inert gas of 7^{th} period = 118. Which is correct IUPAC name of last element halogen family in 7^{th} period - **[3]**

(A) Ununoctium (B) Ununnilium (C) Ununennium (D) Ununseptium

4. Three element X, Y, Z are following Doberiner's Triad rule. If the atomic weight of X and Y are 10 and 26 respectively, then atomic weight of Z will be **[3]**

(A) 34 (B) 40 (C) 42 (D) 18

5. The valence shell of the element X contains 1 electron in 5s subshell and below that shell, 4 electrons in 4d subshell. The element belongs to which group (IUPAC) in periodic table- **[3]**

(A) 4^{th} group (B) 5^{th} group (C) 6^{th} group (D) 7^{th} group

More than one correct

6. An element have electronic configuration as $1s^2$, $2s^2$, $2p^6$, $3s^2$,$3p^6$, $4s^2$, $3d^7$. **[3]**

Correct statement regarding element is -

(A) Element must be Co

(B) Element belongs to group no. '9' according to the long form of periodic table

(C) Maximum no. of electrons in element having m = +1 are 6

(D) Element have magnetic moment 15 B.M.

Match the column :

7. Match List-I (atomic number of elements) with List-II (position of element in periodic table) **[4]**

List-I		**List-II**
(A) 19	(P)	p-block
(B) 22	(Q)	f-block
(C) 32	(R)	d-block
(D) 64	(S)	s-block

8. **[4]**

Column-I (Electronic configuration of element)	**Column-II (Correct description)**
(A) $1s^1$, $2s^2$, $2p^2$, $3s^1$	(P) s or p block element
(B) $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^1$	(Q) III period element
(C) $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $3d^5$, $4s^1$	(R) Group number VI in the long form periodic table
(D) $1s^2$, $2s^1$, $2p^3$, $3s^1$, $3p^3$, $4s^1$	(S) d-block element
	(T) Valence shell electron ≥ 3

Subjective :

9. What are the blocks groups and period for the following E.C. in periodic table : **[16]**

(a) $1s^2\ 2s^2\ 2p^6\ 3s^1\ 3p^3\ 3d^2$ (b) $1s^2\ 2s^1\ 2p^1$

(c) $1s^2$ (d) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2$

(e) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$ (f) $[Xe]\ 6s^2\ 5d^1$

(g) Actinium: $[Rn]\ 6d^1\ 7s^2$ (h) Thorium: $[Rn]\ 6d^2\ 7s^2$

10. What is the value of $(n + \ell)$ for the unpaired e^- in an atom of an element which is present in the third period and seventeenth group of the periodic table.

Only one correct :

1. For the element X, student Surbhi measured its radius as 102 nm, Mr.Gupta as 113 nm and Mr. Agarwal as 100 nm using same apparatus. Their teacher explained that measurements were correct by saying that recorded values by three students were **[3]**

(A) Crystal, vander Waal and covalent radii (B) Covalent, crystal and vander Waal radii
(C) Vander Waal, ionic and covalent (D) None is correct

2. Which of the following combination contains only isoelectronic series : **[3]**

(A) N^{3-}, O^{2-}, Cl^-, Ne (B) F^-, Ar, S^{2-}, Cl^-
(C) P^{3-}, S^{2-}, Cl^-, Ar (D) N^{3-}, F^-, O^{2-}, Ar

3. Which among the following species has the same number of electrons in its outermost as well as penultimate shell ? **[3]**

(A) Mg^{2+} (B) O^{2-} (C) F^- (D) Ca^{2+}

4. The specie having smallest ionic radius is :- **[3]**

(A) Al^{3+} (B) Ba^{2+} (C) K^+ (D) Mg^{2+}

More than one correct :

5. The correct order of radii is : **[4]**

(A) N < Be < B (B) $F^- < O^{2-} < N^{3-}$
(C) Na > Li < K (D) $Fe^{2+} > Fe^{3+} > Fe^{4+}$

6. Choose the **correct** statement. **[5]**

(A) Be and Al are not in same group.
(B) All the transition metal correspond to d-block.
(C) Be and Al are having lot of similarities in their properties.
(D) The atomic radius gradually decreases from Sc to Zn.

Subjective :

7. A monoatomic anion of unit charge contain 45 neutrons and 36 electrons. What is atomic mass number of element and in which group of periodic table does it lie. **[4]**

8. Arrange in decreasing order of atomic size : Na, Cs, Mg, Si, Cl.

9. In the ionic compound KF, the K^+ and F^- ions are found to have practically radii, about 1.34 Å each. What do you predict about the relative covalent radii of K and F?

10. Which one of the following pair would have a large size : **[6]**

(i) K or K^+ (ii) Br or Br^- (iii) O^{2-} or F^- (iv) Li^+ or Na^+
(v) P or As (vi) Na^+ or Mg^{+2}

Only one correct :

1. Find the highest ratio of IP values of given pair of elements : **[3]**

(A) He : Ne (B) Ne : Ar (C) He : Xe (D) Kr : Xe

2. Which one of the following electronic configuration of an atom has the highest ionisation energy. **[3]**

(A) $1s^2 2s^2 2p^3$ (B) $1s^2 2s^2 2p^6 3s^1$ (C) $1s^2 2s^2 2p^6$ (D) $1s^2 2s^2 2p^5$

3. Give the correct order of initials **T** (true) or **F** (false) for following statements. **[3]**

(I) Top positions of Lother-Mayer's atomic volume curve are occupied by Alkali metals.

(II) Number of elements presents in the fifth period of the periodic table are 32.

(III) 2^{nd} I.P. of Mg is less than the 2^{nd} I.P. of Na.

(IV) A p-orbital can take maximum of six electrons.

(A) TFTF (B) TFFT (C) FFTF (D) TTFF

4. In crystal of which of the following ionic compound, would you expect the maximum distance between centre of cation and anion. **[3]**

(A) CsF (B) CsI (C) LiI (D) LiF

5. The ionic radii of F, F^-, O^{2-} are in the order of : **[3]**

(A) $O^{2-} < F^- < F$ (B) $F^- > O^{2-} > F$

(C) $O^{2-} > F^- > F$ (D) $O^{2-} = F^- > F$

6. The ionic radii of N^{3-}, O^{2-} and F^- are respectively given by : **[3]**

(A) 1.36, 1.40, 1.71 (B) 1.36, 1.71, 1.40

(C) 1.71, 1.40, 1.36 (D) 1.71, 1.36, 1.40

Assertion & Reason :

7. **Statement-1** : The ionisation potential of Sn is greater than Pb. **[3]**

Statement-2 : Usually ionisation energy decreases down the group.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

8. **Statement-1** : $(I.E.)_n$ of an atom is always greater than $(I.E.)_{n-1}$ (n is integer number) **[3]**

Statement-2 : ne/Z ratio decreases on successive elimination of electrons.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

9. ***Arrange the following periodic properties with justification.*** **[5]**

(a) Increasing order of first ionization energy N, O, F

(b) Increasing order of ionization energy Cl^-, K^+, S^{-2}, Ca^{2+}

(c) Increasing order of ionization energy Li^+, Be^+, B^+, C^+, N^+, O^+, F^+

(d) Increasing order of ionization energy Fe, Fe^{+2}, Fe^{+3}

(e) Increasing order of first ionization potential Mg, Al, Si, Na

10. Arrange the following in increasing order of radii **[8]**

(i) I, I^+, I^-

(ii) C, N, Si, P

(iii) O^{2-}, N^{3-}, F^-

(iv) Be^{+2}, Cl^-, S^{2-}, Na^+, Mg^{2+}

(v) B, Be, Li, Na

(vi) Cl^-, S^{2-}, Ca^{2+}

(vii) Mg^{2+}, Al^{3+}, Na^+, O^{2-}, F^-

(viii) S, O, Se, F

Only one correct :

Q.1 Which transition involves maximum amount of energy (M is a metal) **[3]**

(A) $M^{-}(g) \longrightarrow M(g) + e$ (B) $M(g) \longrightarrow M^{+}(g) + e$

(C) $M^{+}(g) \longrightarrow M^{+2}(g) + e$ (D) $M^{+2}(g) \longrightarrow M^{+3}(g) + e$

Q.2 The first five ionization energies of an element are 9.1, 16.2, 24.5, 35 and 205.7 eV respectively. Then number of valence electron in the atom is **[3]**

(A) 2 (B) 3 (C) 4 (D) 5

Q.3 The correct order of electron affinity for the different families is **[3]**

(A) Halogen > carbon > nitrogen > oxygen

(B) Halogen > oxygen > nitrogen > carbon

(C) Halogen > nitrogen > carbon > oxygen

(D) Halogen > oxygen > carbon > nitrogen

Q.4 $A_0/2$ atoms of X (g) are converted into X^{+} (g) by energy E_1. $A_0/2$ atoms of X (g) are converted into X^{-}(g) by energy E_2. Hence ionisation potential and electron affinity of X (g) are **[3]**

(A) $\frac{2E_1}{A_0}.\frac{2(E_1-E_2)}{A_0}$ (B) $\frac{2E_1}{A_0},\frac{2E_2}{A_0}$ (C) $\frac{(E_1-E_2)}{A_0}.\frac{2E_2}{A_0}$ (D) None

Q.5 First, second and third I.P. values are 10 eV, 15 eV and 150 eV. Element can be **[3]**

(A) Be (B) B (C) F (D) Na

Q.6 Which of the following case the size ratio is minimum : **[3]**

(A) Li^{-} / Li (B) H^{-} / H

(C) Na^{-} / Na (D) Can not be predicted

Q.7 Which of the following process is associated with best possibility of the energy release. **[3]**

(A) $Li \longrightarrow Li^{+} + e^{-}$ (B) $O^{-} + e^{-} \longrightarrow O^{2-}$

(C) $Cl^{+} + e^{-} \longrightarrow Cl$ (D) $Be + e^{-} \longrightarrow Be^{-}$

Assertion & Reason :

Q.8 **Statement-1:** Nitrogen atom has higher ionization energy than fluorine atom. **[3]**

Statement-2: Nitrogen atom has extra stable electronic configuration due to half filled p-subshell.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

True & False :

Q.9 State True or False with explanation for the following questions **[3]**

(a) E.A. of $M^+(g)$ ion and I.E. of M(g) atom are equal.

(b) EA_1 of sulphur is more than EA_1 of oxygen.

(c) I.E. of Pb is more than Sn even though Pb is larger atom than Sn.

Subjective :

Q.10 (a) Which has greater IE_1 ? Na^+ or Ne. Explain **[3]**

(b) Which has greater IE_2 ? O or N. Explain

(c) Which has greater IE_2? Li or Be. Explain

Race on Lewis-Structure :

1. CO
2. CO_2
3. NO_2^-
4. NO_3^-
5. CCl_3^-
6. $COCl_2$
7. N_3^-
8. O_3
9. CH_3Cl
10. NH_4^+
11. NH_2Cl
12. OCN^-
13. CN^-
14. SCN^-
15. HCN
16. HNC
17. SiF_4
18. $SnCl_3^-$
19. BF_4^-
20. BH_4^-
21. BeF_4^{2-}
22. H_3O^+
23. SO_3
24. SO_2
25. CO_3^{2-}
26. NO_2Cl
27. NOCl
28. F_2O
29. SO_4^{2-}
30. PO_4^{3-}

Only one correct :

1. If y-axis is the approaching axis between two atoms, then which of the set of orbitals can not form the π bond between two atoms in general. **[3]**

(A) $p_z - p_z$ (B) $p_x - p_x$ (C) $p_x - p_y$ (D) None of these

2. The maximum number of bond and π-bond can be formed between two atoms are respectively. **[3]**

(A) 4, 3 (B) 3, 2 (C) 2, 3 (D) 3, 1

3. Which of the following set of overlap can not provide π-bond formation. **[3]**

(A) 3d and 2p (B) 2p and 3p (C) 2p and 2p (D) 3p and 1s

4. The ratio of number of σ-bond to π-bond in N_2 and CO molecules are **[3]**

(A) 2.0 , 2.0 (B) 2, $\frac{1}{2}$ (C) $\frac{1}{2}$, $\frac{1}{2}$ (D) $\frac{1}{2}$, 2

More than one may be correct :

5. If the molecular axis is Z then which of the following overlapping is not possible.

(A) $p_z + p_z = \sigma$ bond (B) $p_x + p_y = \pi$ bond

(C) $p_x + p_x = \pi$ bond (D) $p_y + p_y = \pi$ bond

Paragraph for question nos. 6 to 8

Different types of bonds are formed in the chemical compounds. These bond have different strength and bond energies associated with them. These bonds are formed with atoms in different environments.

6. Which of the following bond has highest bond energy? **[9]**

(A) σ-bond (B) π-bond (C) Hydrogen bond (D) None of these

7. Which of the following overlapping is involved in formation of only σ-bond

(A) s-p overlapping (B) p-d overlapping

(C) d-d overlapping (D) p-p overlapping

8. Which of the following hydrides is thermally least stable?

(A) H_2O (B) H_2Te (C) H_2S (D) H_2Se

9. Match the column : **[4]**

	Column I		**Column II**
(A)	$NH_3.BF_3$	(P)	Ionic bond
(B)	CO	(Q)	Covalent bond
(C)	NH_4Cl	(R)	Co-ordinate bond
(D)	KI_3	(S)	3 lone pair on any one atom

10. If molecular axis is X then which of the following overlapping will form π bond.

$p_z + p_z$, $p_x + p_x$, $p_x + p_y$, $S + p_z$, $p_y + p_y$

Q. 1 Draw the structure of the following molecules / ions.

(1) XeF_2

(2) XeF_4

(3) XeF_5^-

(4) $XeOF_4$

(5) PCl_3

(6) PCl_5

(7) SF_2

(8) SF_6

(9) IF_3

(10) IF_5

(11) IF_7

(12) OF_2

(13) NO_3^-

(14) ClO_4^-

(15) SF_4

(16) I_3^+

(17) ClO_3^-

(18) OCl_2

(19) $SnCl_3^-$

(20) HPO_3^{2-}

(21) SO_3^{2-}

(22) IO_3^-

(23) XeO_3

(24) XeF_4

(25) ClO_4^-

(26) NO_2^-

(27) PCl_4^+

(28) $POCl_3$

(29) SO_4^{2-}

(30) XeF_5^+

1. The compound MX_4 is tetrahderal. The number of < XMX angles in the compound is **[3]**
(A) Three (B) Four (C) Five (D) Six

2. What is hybridisation of central atom of anionic part of PBr_5 in crystalline state. **[3]**
(A) sp^2 (B) sp^3 (C) sp (D) not applicable

3. What is the difference between bond angles in cationic species of PCl_5 and PBr_5 in solid state.
(A) 60° (B) 109°28′ (C) 0° (D) 90° **[3]**

4. All possible bond angles in anionic part of PCl_5 are. **[3]**
(A) 109° 28′ only (B) 90°, 180° (C) 90°, 120° , 180° (D) 72°, 90°, 180°

5. Which of the following species does not exist? **[3]**
(A) XeF_3^- (B) XeF_4 (C) XeF_5^- (D) XeF_6

6. **Statement-1** : CH_4 and CH_2F_2 are having regular tetrahedron geometry. **[3]**
Statement-2 : Both are having same hybridization.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

More than may be correct

7. Which of following pair of species is having different hybridisation but same shape. **[3]**
(A) $BeCl_2$ and CO_2 (B) CO_2 and SO_2 (C) SO_2 and I_3^+ (D) ICl_2^- and BeH_2

Paragraph for question nos. 8 to 9

Hybridisation is the mixing of atomic orbital of comparable energy and the number of hybrid orbitals formed is equal to the number of pure atomic orbitals mixed up and hybrid orbitals are occupied by σ-bond pair and lone pair. **[9]**

8. Which of the following geometry is most likely to not form from sp^3d hybridisation of the central atom.
(A) Linear (B) Tetrahedral (C) T-Shaped (D) See-Saw

9. "The hybrid orbitals are at angle of X° to one another" this statement is not valid for which of the following hybridisation.
(A) sp^3 (B) sp^2 (C) sp^3d^2 (D) sp

10. Match the column: **[10]**

	Column -I (Type of orbital)		**Column-II (Orbitals involved in hybridisation)**
(A)	d_{z^2} -orbital	(P)	sp^3 (Tetrahedral)
(B)	s - orbital	(Q)	sp^3d^2 (Octahedral)
(C)	$d_{x^2-y^2}$ - orbital	(R)	sp^3d (TBP)
(D)	p_y - orbital	(S)	dsp^2 (square planar)

1. H_2SO_4
2. C_3O_2
3. $(CN)_2$
4. $Na_2S_4O_6$
5. Cl_2O_7
6. P_4
7. P_4O_6
8. P_4O_{10}
9. O_2F_2 (dimer form of OF)
10. S_3O_9
11. N_2O_5
12. $S_2O_7^{2-}$
13. N_2F_4
14. N_2O_3
15. SiO_2
16. $HClO_4$
17. $CaCN_2$
18. $CuSO_4.5H_2O$
19. P_4S_{10}
20. $RbIO_2$
21. CsH_2PO_2
22. $NaIO_3$
23. NH_4OCN
24. $H_2S_2O_4$
25. $NaHSO_3$
26. $H_2PO_3^-$
27. $H_2P_2O_5^{2-}$
28. Dithionate ion ($S_2O_6^{2-}$)
29. Trithionate ion ($S_3O_6^{2-}$)
30. Thionyl chloride ($SOCl_2$)
31. Sulpuryl chloride (SO_2Cl_2)
32. Pyrophosphoric acid ($H_4P_2O_7$)
33. Meta phosphoric acid (HPO_3)
34. Peroxy phosphoric acid (H_3PO_5)
35. Ammonium phosphite
36. Sodium hydrogen phosphate
37. Sodium dihydrogen phosphate
38. Sodium dihydrogen pyrophosphate
39. Potassium bicarbonate ($KHCO_3$)
40. Calcium carbide (CaC_2)
41. Peroxy diphophoric acid ($H_4P_2O_8$)
42. Hyponitrous acid ($H_2N_2O_2$)
43. Oleum ($H_2S_2O_7$)
44. Marshall's acid ($H_2S_2O_8$)
45. Caro's acid (H_2SO_5)

1. A : tetracyanomethane B : carbondioxide C : benzene D : 1,3- buta-di-ene
Ratio of σ and π bonds is in order : **[3]**
(A) A = B < C < D (B) A = B < D < C (C) A = B = C = D (D) C < D < A < B

2. The geometry of ammonia molecule can be best described as **[3]**
(A) nitrogen at one vertex of a regular tetrahedron, the other three vertices being occupied by the three hydrogens
(B) nitrogen at the centre of the tetrahedron, three of the vertices being occupied by three hydrogens
(C) nitrogen at the centre of an equilateral triangle, three corners being occupied by three hydrogens
(D) nitrogen at the junction of a T, three open ends being occupied by three hydrogens.

3. Find the molecule which is planar and polar. **[3]**
(A) $B_3N_3H_6$ (B) $F_2C = C = C = CF_2$
(C) BrF_2Cl (D) $F_2C = C = CF_2$

4. Find out the **incorrect** order of the dipole moment among the following pair of compound **[3]**
(A) $NH_3 > NF_3$ (B) p-dichloro benzene > o-dichloro benzene
(C) $CH_3Cl > CH_2Cl_2$ (D) $SiF_4 < SF_4$

5. **Statement-1** : Dipole moment of H_2O is more than that of OF_2. **[3]**
Statement-2 : In H_2O, the resultant bond dipole of O – H bond and the resultant lone pair moment are in opposite direction.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

6. **Statement-1** : Allene is a non polar molecule. **[3]**
Statement-2 : Allene is non planar molecule.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

More than may be correct

7. Which of the following statements is correct in the context of the allene molecule, C_3H_4? **[3]**
(A) The central carbon atom is sp hybridized
(B) The terminal carbon atoms are sp^2 hybridized
(C) The planes containing the CH_2 groups are mutually perpendicular to permit the formation of two separate π-bonds.
(D) C_3H_4 is a planar molecule

8. Structure of $Na_2[B_4O_5(OH)_4] \cdot 8H_2O$ contains **[3]**

(A) Two triangular and two tetrahedral units of boron

(B) Three triangular and one tetrahedral units of boron

(C) Five B–O–B linkages

(D) One peroxy linkage

9. **[10]**

Column-I	**Column-II**
(A) 2 lone pair	(P) XeF_5^-
(B) Zero dipole moment	(Q) NF_3
(C) Planar	(R) ICl_3
(D) All adjacent bond angles are equal	(S) XeF_4

10. Prove that dipole moment of C_6H_5Cl and m-$C_6H_4Cl_2$ are same. **[5]**

Q.1 Explain the structure of Boric acid in solid state.

Q.2 Boiling point of o-Nitrophenol is less than meta and para nitrophenol. Why?

Q.3 Maleic acid is more acidic than fumaric acid. Why?

Q.4 H – F is only liquid among halogen acid. Why?

Q.5 Ammonia is more easily liquefied than HCl, explain.

Q.6 Why ice floats on water?

Q.7 Water shows maximum density at 4°C. Why?

Q.8 HI is the strongest halogen acid, whereas H–F is the weakest. Why?

Q.9 Wood pieces are used to hold ice-cream. Why?

Q.10 KHF_2 is possible but not $KHBr_2$ or KHI_2. Why?

Q.11 O – Nitrophenol is less soluble in H_2O than p – Nitrophenol. Why?

Q.12 o-Hydroxy benzaldehyde is a liquid at room temperature while p-hydroxy benzaldehyde is a high melting solid.

Q.13 Glycerol is more viscous than ethanol. Explain.

Q.14 CH_4 and H_2O have nearly same molecular weight. Yet CH_4 has a boiling point 112 K and water 373 K. Explain.

Q.15 The experimental molecular weight of acetic acid in just double than theoretical molecular weight of acetic acid. Why?

Q.16 Although chlorine has same electronegativity as nitrogen but the former does not form effective H-bonding. Explain.

Q.17 Molar entropy change of vapourization of acetic acid is less than that of water. Explain

Q.18 Heat of vapourization of water is higher than HF, however strength of H-bond in HF is higher than water. Explain