Workshop-Inorganic Chemistry

s-Block Elements

Choose the correct alternative. Only One Choice is Correct. However, questions marked with '*' may have More than One correct option :

1. Which of the following is not known as alkaline earth metal ?

(A) Be **(B)** Ca **(C)** Ba **(D)** Ra

***2.** Which of the following is correct statement(s) for alkali metals ?

(A) Sodium and potassium are more abundant **(B)** Lithium, rubidium and caesium have lower abundance

(C) Francium is highly radioactive **(D)** Hydrogen is the simplest alkali metal

***3.** Identify correct statement(s) ?

(A) Magnesium and calcium are more abundant

(B) Strontium and barium have much lower abundances

(C) Beryllium is rare

(D) Radium is the rarest of all alkaline earth metals.

***4.** Which of the following Group 1 and Group 2 elements shows anomalous properties and in these properties they resemble the second element of the following group ?

(A) Li **(B)** Be **(C)** Na **(D)** Mg

***5.** Which of the following pairs(s) shows diagonal relationship ?

(A) Li – Mg **(B)** Be – Al **(C)** Li – Be **(D)** Fr – Ra

***6.** Which of the following ions are found in biological fluids and are responsible for maintenance of ion balance and nerve impulse conduction ?

(A) Na^+ **(B)** K^+ **(C)** Mg^{2+} **(D)** Ca^{2+}

***7.** Which of the following is(are) correct for group 1 metals ?

(A) All the alkali metals have one valence electron

(B) These are most electropositive metals

(C) They form monovalent M^+ ion

(D) They are never found in free state in nature

***8.** Identify correct statement(s).

(A) The alkali metal atoms have the largest sizes in a particular period of the periodic table

(B) The atomic and ionic radii of alkali metals increase on moving down the group

(C) The ionization enthalpies of the alkali metals are considerably low

(D) The ionization enthalpies of alkali metals decrease down the group from Li to Cs

***9.** Which of the following is(are) correct ?

(A) Hydration enthalpy of alkali metal ions is negative

(B) Hydration enthalpy of alkali metal ions decrease with increase in ionic sizes

(C) Lithium ion has maximum enthalpy of hydration

(D) Caesium ion has maximum enthalpy of hydration

10. Lithium salts are mostly hydrated because :

(A) High ionization enthalpy of lithium **(B)** High degree of hydration of lithium ion

(C) High covalent nature of lithium salts **(D)** Lithium ion form H-bond with water molecule

***11.** Which of the following is(are) correct ?

(A) Ionic size of $Li^+(g)$ is smaller than the ionic size of $Na^+(g)$

(B) Ionic size of $Li^+(aq)$ is greater than the ionic size of $Na^+(aq)$

(C) Ionic conductance of $LiCl(aq)$ is less than the ionic conductance of $NaCl(aq)$

(D) Ionic conductance of $LiCl(\ell)$ is more than the ionic conductance of $NaCl(\ell)$

***12.** Which of the following order of physical properties of alkali metals is(are) correct ?

(A) Melting point : $Li > Na > K > Rb > Cs$

(B) Boiling point : $Li > Na > K > Rb > Cs$

(C) Density : $Cs > Rb > Na > K > Li$

(D) $E°(M^+/M)$: $Na > K > Cs > Rb > Li$

***13.** Which of the following statements are correct ?

(A) The alkali metals do not react with dry air

(B) The alkali metals tarnish in dry air due to the formation of their oxides which in turn react with moisture to form hydroxides

(C) Alkali metals are normally stored in water

(D) Alkali metals are normally stored in kerosene oil

***14.** Which of the following statements are correct ?

(A) Lithium forms superoxide, sodium forms peroxide and the other alkali metals K, Rb & Cs form monoxide

(B) Lithium forms monoxide, sodium forms peroxide and the other alkali metals K, Rb & Cs form superoxides

(C) The superoxide O_2^- ion is stable only in the presence of small cations such as Li^+

(D) The superoxide O_2^- ion is stable only in the presence of large cations such as K^+, Rb^+ and Cs^+

***15.** Which of the following are correct ?

(A) In all the oxides of alkali metals (i.e. the monoxide, peroxide and superoxides) the oxidation state of the alkali metal is $+1$

(B) The oxidation state of the alkali metals in the monoxide is $+1$ whereas the same in the peroxide and superoxides is $+2$

(C) Li and Na react with nitrogen of air to form the nitrides Li_3N & Na_3N respectively

(D) Only Li reacts with the nitrogen of air to form Li_3N

16. The superoxide anion is :

(A) O_2^{2-} **(B)** O_2^- **(C)** O^{2-} **(D)** O^-

17. Which of the following statements are true ?

(A) The alkali metals react with water to form hydroxide and dioxygen

(B) The alkali metals react with water to form hydroxide and dihydrogen

(C) The alkali metals react with water to form only hydroxide

(D) The alkali metals react only with air and not with water and so are stored under water

***18.** Which of the following statements are true ?

(A) Lithium reacts most vigorously with water as compared to the rest of the alkali metals

(B) Lithium reacts least vigorously with water as compared to the rest of the alkali metals

(C) The metals K, Rb, Cs react explosively with water

(D) The alkali metals do not react with proton donors such as alcohol, gaseous ammonia and alkynes

***19.** The alkali metals react with dihydrogen to form hydrides :

$$2M + H_2 \longrightarrow 2MH$$

Which of the following statements about these metal hydrides are true ?

(A) They are covalent solids **(B)** They are ionic solids

(C) They have high melting points **(D)** They have low melting points

***20.** Consider the following information :

(i) The distortion of electron cloud of the anion by the cation is called polarisation.

(ii) The alkali metals react vigorously with halogens to form ionic halides M^+X^-

Which of the following statements are correct ?

(A) The lithium halides are somewhat covalent in nature due to the high polarisation capability of Li^+

(B) The lithium halides are purely ionic in nature due to the low polarisation capability of Li^+

(C) Since the electron cloud of large anions can be distorted easily, among lithium halides, LiI is the most covalent

(D) Since it is very difficult to distort the electron cloud of large anions, among the lithium halides, LiI is most ionic

***21.** The standard electrode potential $(E°)$ measures the reducing power and represents the overall change :

$$M(s) \longrightarrow M(g) \quad \text{(sublimation enthalpy)}$$

$$M(g) \longrightarrow M^+(g) + e^- \quad \text{(ionization enthalpy)}$$

$$M^+(g) + H_2O \longrightarrow M^+(aq) \quad \text{(hydration enthalpy)}$$

Which of the following statements are true ?

(A) Higher is the positive $E°$ value, greater is the reducing power

(B) Higher is the negative $E°$ value, greater is the reducing power

(C) With the small size of its ion, lithium has the smallest hydration enthalpy which accounts for its high positive $E°$ value and its low reducing power

(D) With the small size of its ion, lithium has the highest hydration enthalpy which accounts for its high negative $E°$ value and its high reducing power

22. The alkali metals dissolve in liquid ammonia giving solutions which are conducting in nature :

$$M + (x+y)NH_3 \longrightarrow \left[M(NH_3)_x\right]^+ + \left[e(NH_3)y\right]^-$$

Which of the following statements about the solution are true ?

(A) The solution is blue in colour due to the ammoniated electrons which absorb energy in the visible region of light.

(B) The solutions are paramagnetic and on standing, slowly liberate hydrogen resulting in the formation of amide.

(C) In concentrated solution, the blue colour changes to bronze colour and the solution becomes diamagnetic

(D) All of the above

***23.** Lithium metal :

(A) is used to make useful alloys **(B)** is used in thermonuclear plates

(C) is used to make electrochemical cells **(D)** is used in making statues

24. $PbEt_4$ and $PbMe_4$ are organolead compounds that were earlier used as antiknock additives to petrol.

An alkali metal, M was used to make an alloy M/Pb which was needed for the production of the above compounds. M is :

(A) Potassium **(B)** Sodium **(C)** Rubidium **(D)** Lithium

***25.** Which of the following statements are correct ?

(A) Liquid sodium metal is used as a coolant in fast breeder nuclear reactors

(B) Potassium has a vital role in biological systems

(C) Potassium chloride is used as a fertilizer

(D) Potassium chloride is used in the manufacture of soft soap

26. Which of the following alkali metals is used in devising photoelectric cells ?

(A) Sodium **(B)** Potassium **(C)** Caesium **(D)** Lithium

27. The general formulae of the oxides formed by the alkali metals are : M_2O, M_2O_2, MO_2. These oxides are respectively :

(A) oxide, peroxide, superoxide **(B)** superoxide, peroxide, oxide

(C) superoxide, oxide, peroxide **(D)** oxide, superoxide, peroxide

28. As the size of the alkali metal ions increases, the stability of the peroxides and the superoxides becomes more as compared to the oxides. This is due to :

(A) The stabilisation of larger cations by smaller anions through lattice energy effects.

(B) The stabilisation of smaller cations by larger anions through lattice energy effects.

(C) The stabilisation of larger cations by larger anions through lattice energy effects.

(D) None of the above

***29.** Which of the following statements regarding the oxides of alkali metals true ?

(A) The oxides and peroxide are yellow or orange in colour while the superoxides are colourless when pure.

(B) The oxides and peroxide are colourless when pure, but the superoxides are yellow or orange in colour.

(C) The superoxides are paramagnetic

(D) The superoxides are diamagnetic

***30.** Which of the following statements regarding the hydroxides of alkali metals true ?

(A) They are obtained by the reaction of metals or metal oxides with water

(B) They are all coloured,amorphous solids

(C) They are all white, crystalline solids

(D) They are the strongest of all bases and dissolve freely in water with the evolution of much heat on account of intense hydration.

31. The alkali metal halides, MX (X = F, Cl, Br, I)

(A) are all high melting, colourless crystalline solids

(B) can be prepared by the reaction of the appropriate oxide, hydroxide or carbonate with aqueous hydrohalic acid (HX).

(C) are soluble in water

(D) all of the above

***32.** The alkali metal halides have high negative enthalpies of formation. Which of the following statements are correct ?

(A) The $\Delta_f H°$ values for fluorides become less negative as we go down the group

(B) The $\Delta_f H°$ values for chlorides, bromides and iodides become more negative as we go down the group

(C) For a given metal, $\Delta_f H°$ always becomes more negative from fluoride to iodide

(D) For a given metal, $\Delta_f H°$ always becomes less negative from fluoride to iodide

33. The melting and boiling points of alkali metal halides always follow the trend ?

(A) fluoride > chloride > bromide > iodide **(B)** fluoride < chloride > bromide > iodide

(C) fluoride < chloride < bromide < iodide **(D)** fluoride > chloride < bromide < iodide

***34.** Which of the following statements are correct ?

(A) The low solubility of LiF in water is due to the small hydration enthalpy of its two ions.

(B) The low solubility of LiF in water is due to its high lattice enthalpy.

(C) The low solubility of CsI in water is due to its high lattice enthalpy.

(D) The low solubility of CsI in water is due to the small hydration enthalpy of its two ions.

***35.** Which of the following statements regarding oxo-acids true ?

(A) Oxo-acids are those in which the acidic proton is on a hydroxyl group with an oxo group attached to the adjacent atom.

(B) Oxo-acids are those in which the acidic proton is on a hydroxyl group with an oxo group attached to the same atom.

(C) Carbonic acid $\left(H_2CO_3\right)$ & sulphuric acid $\left(H_2SO_4\right)$ are both oxo-acids.

(D) Alkali metals form salts with all oxo-acids which are generally soluble in water and thermally stable.

***36.** Alkali metals react with carbonic acid to form carbonates $\left(M_2CO_3\right)$ and hydrogencarbonates $\left(MHCO_3\right)$.

Which of the following statements regarding them are correct ?

(A) They are highly stable to heat

(B) They decompose very quickly on heating

(C) As the electropositive character increases down the group, their stability increases

(D) Lithium carbonate is not so stable to heat as lithium being very small in size polarizes a large CO_3^{2-} ion leading to the formation of more stable Li_2O and CO_2

***37.** The anomalous behaviour of lithium is due to the :

(A) exceptionally large size of its atom and ion

(B) exceptionally small size of its atom and ion

(C) high polarising power (i.e. charge/ radius ratio)

(D) low polarising power (i.e. charge/ radius ratio)

38. Lithium compounds :

(A) have an increased covalent character and hence are soluble in organic solvents.

(B) have an increased ionic character and hence are soluble in organic solvents.

(C) have an increased covalent character and hence are insoluble in organic solvents.

(D) have an increased ionic character and hence are insoluble in organic solvent.

***39.** Which of the following statements are correct ?

(A) The m.p and b.p of Li is higher than the other alkali metals

(B) Li is least reactive but the strongest reducing agent

(C) LiCl is deliquescent and crystallises as a hydrate, $LiCl \cdot 2H_2O$ whereas other alkali metal chlorides do not form hydrates

(D) Lithium hydrogencarbonate is not obtained in the solid form while all other alkali metals form solid hydrogencarbonates

***40.** Which of the following statements are correct ?

(A) Like other alkali metals, lithium too forms ethynide on reaction with ethyne

(B) Lithium nitrate when heated gives lithium oxide Li_2O, whereas other alkali metal nitrates decompose to give the corresponding nitrite

(C) LiF and Li_2O are comparatively much more soluble in water than the corresponding compounds of other alkali metals

(D) LiF and Li_2O are comparatively much less soluble in water than the corresponding compounds of other alkali metals

41. The similarity between lithium and magnesium is particularly striking and arises because of their similar size. Which of the following statements is NOT correct ?

(A) Both are harder and lighter than other elements in the respective groups

(B) Both react slowly with water

(C) Their oxides and hydroxides are much more soluble and their hydroxides do not decompose on heating

(D) Both form a nitride Li_3N and Mg_3N_2 by direct combination with nitrogen

***42.** Which of the following statements are correct ?

(A) The oxides, Li_2O and MgO combine with excess oxygen to give superoxides

(B) The carbonates of Li and Mg decompose easily on heating to form the oxides and CO_2

(C) LiCl and $MgCl_2$ are insoluble in ethanol **(D)** Both LiCl and $MgCl_2$ are deliquescent

43. Solvay process is used for the preparation of :

(A) Sodium chloride **(B)** Sodium hydroxide

(C) Sodium carbonate **(D)** Sodium sulphate

***44.** Which of the following compounds are required for the Solvay process :

(A) NH_3 **(B)** CO_2 **(C)** H_2O **(D)** NaCl

45. In the Solvay process, NaCl reacts with X to form Y and Z.

$$NaCl + X \longrightarrow Y + Z$$

X, Y and Z are respectively :

(A) $NH_4Cl,\ (NH_4)_2CO_3,\ NaHCO_3$ **(B)** $NH_4HCO_3,\ NH_4Cl,\ NaHCO_3$

(C) $NaHCO_3,\ NH_4Cl,\ NH_4HCO_3$ **(D)** None of the above

46. In the Solvay process, NH_4Cl is obtained as a by product. In order to recover NH_3 from it, it is treated with :

(A) $CaCl_2$ **(B)** NaCl **(C)** $Ca(OH)_2$ **(D)** $MgCl_2$

***47.** Which of the following statements are correct ?

(A) Solvay process cannot be extended to the manufacture of potassium carbonate from potassium chloride

(B) Solvay process can be used for the manufacture of potassium carbonate from potassium chloride

(C) Potassium hydrogencarbonate is insoluble and so gets precipitated by the addition of ammonium hydrogencarbonate to a saturated solution of potassium chloride

(D) Potassium hydrogencarbonate is too soluble to be precipitated by the addition of ammonium hydrogencarbonate to a saturated solution of potassium chloride

***48.** Which of the following statements regarding sodium carbonate correct ?

(A) Sodium carbonate is a white crystalline solid which exists as a decahydrate, $Na_2CO_3 \cdot 10H_2O$

(B) It is readily soluble in water

(C) On heating, the decahydrate loses its water of crytallisation to form monohydrate

(D) Above 373 K, the monohydrate becomes completely anhydrous and changes to a white powder called SODA ASH

49. Another name for sodium carbonate is :

(A) Baking soda **(B)** Caustic soda **(C)** Washing soda **(D)** Common salt

50. The carbonate part of sodium carbonate gets hydrolysed by water to form :

(A) An acidic solution **(B)** An alkaline solution

(C) A neutral solution **(D)** None of the above

***51.** Which of the following are important uses of sodium carbonate ?

(A) Water softening, laundering and cleaning.

(B) Used in the manufacture of glass, soap, borax and caustic soda.

(C) Used in nuclear reactors.

(D) Used in paper, paints and textile industries.

***52.** In tropical countries like India, common salt is generally obtained by solar evaporation of sea water. Crude sodium chloride, generally obtained by crystallization of brine solution, contains which of the following compounds as impurities ?

(A) Sodium sulphate **(B)** Calcium sulphate

(C) Calcium chloride **(D)** Magnesium chloride

53. In crude sodium chloride, $CaCl_2$ & $MgCl_2$ are impurities because they are :

(A) deliquescent **(B)** efflorescent

(C) both (A) & (B) **(D)** None of the above

54. To obtain pure sodium chloride, the crude salt is dissolved in minimum amount of 'X' and filtered to remove any insoluble impurities. The solution is then saturated with a gas 'Y'. Crystals of pure sodium chloride separate out. X and Y are respectively :

(A) Xylene and ammonia **(B)** Xylene and hydrogen chloride
(C) Water and ammonia **(D)** Water and hydrogen chloride

***55.** Common salt (NaCl) is used for the preparation of which of the following compounds ?

(A) Na_2O_2 **(B)** NaOH **(C)** Na_2CO_3 **(D)** NO_2

56. Sodium hydroxide, NaOH is usually prepared commercially by :

(A) Evaporation of sea water **(B)** Electrolysis of sodium chloride in Castner-Kellner cell
(C) Solvay process **(D)** Saturating a solution of sodium carbonate with CO_2

***57.** Sodium hydroxide is generally prepared commercially by the electrolysis of sodium chloride in Castner-Kellner cell. Which of the statements about the above process is true ?

(A) A brine solution is electrolysed using a mercury cathode and a carbon anode.
(B) Sodium metal discharged at the cathode combines with mercury to form sodium amalgam.
(C) Chlorine gas is evolved at the anode.
(D) The amalgam is treated with water to give sodium hydroxide and hydrogen gas.

***58.** Which of the following statements are correct ?

(A) Sodium hydroxide is a white, translucent solid.
(B) Sodium hydroxide is readily soluble in water to give a strong alkaline solution.
(C) Crystals of NaOH are efflorescent.
(D) NaOH solution at the surface reacts with the CO_2 in the atmosphere to form Na_2CO_3.

***59.** Which of the following statements regarding the uses of sodium hydroxide true ?

(A) used in the manufacture of soap, paper, artificial silks and a number of chemicals.
(B) used in petroleum refining.
(C) used in the purification of bauxite.
(D) used in the textile industries for mercerising cotton fabrics.

60. Match the following compounds with their common names :

	Column I		Column II
(I)	$Na_2CO_3 \cdot 10H_2O$	**(p)**	Common salt
(II)	NaCl	**(q)**	Baking soda
(III)	NaOH	**(r)**	Washing soda
(IV)	$NaHCO_3$	**(s)**	Soda ash
(V)	Na_2CO_3	**(t)**	Caustic soda

	(I)	(II)	(III)	(IV)	(V)		(I)	(II)	(III)	(IV)	(V)
(A)	p	q	r	s	t	**(B)**	t	s	r	q	p
(C)	r	p	t	q	s	**(D)**	s	p	t	r	q

61. Sodium hydrogencarbonate is known as baking soda because it decomposes on heating to generate bubbles of a gas 'X'. This leaves holes in cakes & pastries and makes them light and fluffy X is :

(A) SO_2 **(B)** CO_2 **(C)** CO **(D)** SO_3

62. Sodium hydrogencarbonate, $NaHCO_3$ is made by :

(A) evaporation of sea-water **(B)** electrolysis of sodium chloride in Castner Kellner cell.

(C) Solvay process **(D)** Saturating a solution of sodium carbonate with CO_2.

63. Sodium hydrogencarbonate is used :

(A) as a mild antiseptic for skin infection **(B)** in baking powders

(C) in fire extinguishers **(D)** all of the above

***64.** Which of the following statements are true ?

(A) Na^+ ions are found primarily on the outside of cells in the blood plasma and in the interstitial fluids which surrounds the cells.

(B) The Na^+ ions participate in the transmission of never signals, in regulating the flow of water across cell membranes & in the transport of sugars and amino acids into cells.

(C) Sodium and potassium are absolutely identical quantitatively in their ability to penetrate cell membranes, in their transport mechanisms and in their efficiency to activate enzymes.

(D) K^+ ions are most abundant cations within cell fluids.

65. There is a very considerable variation in the concentration of sodium and potassium ions found on the opposite sides of cell membranes.
Which of the following are true ?

(A) The ionic gradient demonstrate that a discriminatory mechanism, called the sodium-potassium pump operates across the cell membrane.

(B) The sodium-potassium pump consumes more than one third of the ATP used by a resting animal.

(C) The sodium-potassium pump consumes about 15 kg ATP per 24 hours in a resting human.

(D) All of the above

66. Which of the following elements is an alkaline earth metal ?

(A) Magnesium **(B)** Calcium **(C)** Beryllium **(D)** Barium

67. The general electronic configuration of alkaline earth metals are represented as :

(A) [noble gas] ns^1 **(B)** [noble gas] ns^2

(C) [noble gas] $ns^2\ np^1$ **(D)** [noble gas] $ns^2\ np^2$

68. Match the following :

	Column I **Element**		**Column II** **Electronic Configuration**
(I)	Be	**(p)**	$[He]2s^2$
(II)	Mg	**(q)**	$[Kr]5s^2$
(III)	Ca	**(r)**	$[Ar]4s^2$
(IV)	Sr	**(s)**	$[Ne]3s^2$
(V)	Ba	**(t)**	$[Xe]6s^2$

	(I)	**(II)**	**(III)**	**(IV)**	**(V)**		**(I)**	**(II)**	**(III)**	**(IV)**	**(V)**
(A)	p	q	r	s	t	**(B)**	q	p	r	s	t
(C)	p	s	r	q	t	**(D)**	r	s	p	q	t

***69.** Which of the following statements are true regarding alkaline earth metals ?

(A) The atomic and ionic radii of the alkaline earth metals are smaller than those of the corresponding alkali metals in the same period.

(B) Within the group, the atomic and ionic radii increase with increase in atomic number.

(C) They have high ionisation enthalpies due to the fairly large size of the atoms.

(D) As we go down the group, the atomic size increases and the ionisation enthalpy decreases.

70. The first ionization enthalpies of the alkaline earth metals are higher than those of the corresponding Group I metals. The reason behind this is that :

(A) Their size is large as compared to the corresponding alkali metals.

(B) Their size is small as compared to the corresponding alkali metals.

(C) Their sizes are same as compared to the corresponding alkali metals.

(D) They are highly electropositive.

***71.** Which of the following statements are correct ?

(A) The second ionisation enthalpies of the alkaline earth metals are smaller than those of the corresponding alkali metals.

(B) The hydration enthalpies of the alkaline earth metal ions are larger than those of alkali metals ions.

(C) Unlike alkali metal ions, the hydration enthalpies of alkaline earth metal ions decrease with increase in ionic size down the group.

(D) The compounds of alkaline earth metals are more extensively hydrated than those of alkali metals.

***72.** Which of the following statements regarding the physical properties of alkali earth metals correct ?

(A) They are silvery white, lustrous and relatively soft but harder than the alkali metals.

(B) The melting and boiling points of these metals are higher than the corresponding alkali metals due to larger sizes.

(C) Because of low ionisation enthalpies, they are strongly electronegative.

(D) The electropositive character increases down the group from Be to Ba.

73. Match the element with the characteristic colour imparted by it to the flame.

	Column I		**Column II**
	Element		**Colour**
(I)	Calcium	**(p)**	Apple green
(II)	Strontium	**(q)**	Crimson
(III)	Barium	**(r)**	Brick red

	(I)	**(II)**	**(III)**
(A)	p	q	r
(C)	r	p	q

	(I)	**(II)**	**(III)**
(B)	r	q	p
(D)	q	p	r

74. Which of the following are true ?

(A)	Metallic radius	Be < Mg < Ca < Sr < Ba
(B)	Ionic radius	Be > Mg > Ca > Sr > Ba
(C)	Hydration Enthalpy	Be < Mg < Ca < Sr < Ba
(D)	Ionization Enthalpy	Be < Mg < Ca < Sr < Ba

***75.** Which of the following statements are true ?

(A) The alkaline earth metals are less reactive than the alkali metals.

(B) The alkaline earth metals are more reactive than the alkali metals.

(C) The reactively of the alkaline earth elements decreases on going down the group

(D) The reactively of the alkaline earth elements increases on going down the group

***76.** Which of the following metals react with oxygen and nitrogen present in air to form the respective oxides and nitrides?

(A) Be **(B)** Mg **(C)** Ca **(D)** Sr

***77.** Which of the following statements are correct ?

(A) All the alkaline earth metals combine with halogen at elevated temperature forming their halides.

(B) All the alkaline earth metals combine with hydrogen upon heating to form their hydrides.

(C) All the alkaline earth elements except beryllium combine with hydrogen upon heating to form their hydrides.

(D) All the alkaline earth metals except beryllium readily react with acids liberating dihydrogen.

78. Match the following.

Column I Compounds with their		**Column II** Best route of preparation	
(I)	BeF_2	**(p)**	Reaction of $BeCl_2$ with $LiALH_4$
(II)	$BeCl_2$	**(q)**	$BeO + C + Cl_2$
(III)	BeH_2	**(r)**	Thermal decomposition of $(NH_4)_2\,BeF_4$

	(I)	**(II)**	**(III)**		**(I)**	**(II)**	**(III)**
(A)	p	q	r	**(B)**	r	p	q
(C)	q	p	r	**(D)**	r	q	p

79. Which of the following statements is correct ?

(A) Unlike alkali metals, the alkaline earth metals are strong oxidising agents.

(B) Like alkali metals, the alkaline earth metals are strong reducing agents.

(C) Unlike alkali metals, the alkaline earth metals are strong reducing agents.

(D) Like alkali metals, the alkaline earth metals are strong oxidising agents.

80. Which of the following statements are true ?

(A) The reducing power of alkaline earth metals is less than those of the corresponding alkali metals.

(B) The reducing power of alkaline earth metals is more than those of the corresponding alkali metals.

(C) The reducing power of alkaline earth metals is equal to those of the corresponding alkali metals.

(D) The alkaline earth metals are oxidising agents.

***81.** Beryllium has less negative value of its reduction potential as compared to the rest of the alkaline earth metals. However its reducing nature is due to :

(A) Small hydration energy associated with the small size of Be^{2+} ion.

(B) Large hydration energy associated with the small size of Be^{2+} ion.

(C) Relatively large value of the atomization enthalpy of the metal.

(D) Relatively small value of the atomization enthalpy of the metal.

82. Which of the following statements of are correct ?

(A) Unlike alkali metals, the alkaline earth metals dissolve in liquid ammonia to give orange solutions forming ammoniated ions.

(B) Like alkali metals, the alkaline earth metals dissolve in liquid ammonia to give orange solutions forming ammoniated ions.

(C) Unlike alkali metals, the alkaline earth metals dissolve in liquid ammonia to give blue black solutions forming ammoniated ions.

(D) Like alkali metals, the alkaline earth metals dissolve in liquid ammonia to give blue black solutions forming ammoniated ions.

***83.** Beryllium is used in the :

(A) manufacture of Be-Al alloys which are used in air-craft construction.

(B) manufacture of Cu-Be alloys which are used in making high strength springs.

(C) making windows of x-ray tubes.

(D) making toothpaste.

***84.** Which of the following are true ?

(A) Mg-Al alloys being light in mass are used in air-craft construction.

(B) Mg (power and ribbon) is used in flash powders and bulbs, incendiary bombs and signals.

(C) A suspension of magnesium hydroxide in water (called milk of magnesia) is used as an antacid in medicine.

(D) Magnesium carbonate is are ingredient of toothpaste.

85. Which of the following are correct ?

(A) Ca is used in the extraction of metals from oxides which are difficult to reduce with C.

(B) Ca and Ba metals, owing to their reactivity with oxygen & nitrogen at elevated temperatures, have often been used to remove air from vacuum tubes.

(C) Radium salts are used in radiotherapy, for example, in the treatment of cancer.

(D) All of the above

86. The alkaline earth metals form compounds which are predominantly ionic but less ionic than the corresponding compounds of alkali metals. This is due to :

(A) Increased nuclear charge & greater size **(B)** Increased nuclear charge & smaller size

(C) Decreased nuclear charge & greater size **(D)** Decreased nuclear charge & smaller size

87. Which of the following statements are correct ?

(A) The oxides and other compounds of Be and Mg are more covalent than those formed by Ca, Sr, Ba.

(B) The oxides and other compounds of Be and Mg are less covalent than those formed by Ca, Sr, Ba.

(C) The covalent character of the oxides and other compounds of Be and Mg is equal to those formed by Ca, Sr, Ba.

(D) The oxides and other compounds of Be and Mg are purely ionic in nature & devoid of any covalent character.

88. The alkaline earth metals burn in oxygen to form :

(A) monoxide, MO **(B)** dioxide, MO_2 **(C)** monoxide, M_2O **(D)** trioxide, MO_3

89. Which of the following oxides does NOT have rock-salt structure ?

(A) CaO **(B)** MgO **(C)** BaO **(D)** BeO

***90.** Which of the following statements are correct ?

(A) BeO is essentially covalent in nature.

(B) The enthalpies of formation of the oxides of alkaline earth metals are quite high.

(C) The oxides of alkaline earth metals are unstable to heat.

(D) The oxides of alkaline earth metals are very stable to heat.

91. Which of the following oxide is amphoteric in nature ?

(A) BaO **(B)** CaO **(C)** SrO **(D)** BeO

92. Which of the following oxide is NOT basic in nature ?

(A) BaO **(B)** CaO **(C)** MgO **(D)** BeO

***93.** All the alkaline earth metal oxides react with water to form sparingly soluble hydroxides.

$$MO + H_2O \longrightarrow M(OH)_2$$

Which of the following statements regarding these hydroxides are true ?

(A) Their solubility, thermal stability and basic character decreases as we go down the group.

(B) Their solubility, thermal stability and basic character increases as we go down the group.

(C) They are more basic and more stable than the corresponding alkali metal hydroxides.

(D) They are less basic & less stable than the corresponding alkali metal hydroxides.

94. Beryllium hydroxide is amphoteric in nature. This means that it reacts with :

(A) only acids **(B)** only bases

(C) both acids & bases **(D)** None of the above

95. Halides of which of the following alkaline earth metals are essentially covalent in nature :

(A) Mg **(B)** Ba **(C)** Be **(D)** Ca

96. Beryllium halides are soluble in :

(A) Organic solvents **(B)** Water **(C)** Both A and B **(D)** None of the above

97. In the solid state, beryllium chloride has a structure X and in the vapour state, it tends to exist as Y. X and Y are respectively :

(A) Chain structure, chloro-bridged dimer **(B)** Chloro-bridged dimmer, chain structure

(C) Ring structure, chloro-bridged dimer **(D)** Chloro-bridged dimmer, ring structure

98. In the vapour phase, $BeCl_2$ tends to form a chloro-bridged dimer which dissociates into the linear monomer at high temperature of the order of :

(A) 500 K **(B)** 700 K **(C)** 900 K **(D)** 1200 K

99. As we go down the group, the tendency of the halides of the alkaline earth metals to form hydrates gradually :

(A) increases **(B)** decreases

(C) remains unchanged **(D)** they do not form hydrates

***100.** On heating the hydrated chlorides, bromides and iodides of which of the following alkaline earth metals, hydrolysis occurs instead of dehydration ?

(A) Ca **(B)** Mg **(C)** Be **(D)** Ba

101. Which of the following statements is correct ?

(A) The fluorides of the alkaline earth metals are relatively more soluble than the corresponding chlorides due to their low lattice energy.

(B) The fluorides of the alkaline earth metals are relatively more soluble than the corresponding chlorides due to their high lattice energy.

(C) The fluorides of the alkaline earth metals are relatively less soluble than the corresponding chlorides due to their low lattice energy.

(D) The fluorides of the alkaline earth metals are relatively less soluble than the corresponding chlorides due to their high lattice energy.

***102.** Carbonates of alkaline earth metals are insoluble in water and can be precipitated by the addition of a sodium or ammonium carbonate solution to a solution of a soluble salt of these metals. Which of the following statements regarding these carbonates correct ?

(A) Their solubility in water decreases as the atomic number of the metal ion increases.

(B) All of the them decompose on heating to give CO_2 and the oxide.

(C) $BeCO_3$ is unstable and can be kept only in the atmosphere of CO_2.

(D) Their thermal stability decreases with increasing cationic size.

103. The sulphates of the alkaline earth metals are all white solids and stable to heat. $BeSO_4$ and $MgSO_4$ are readily soluble in water and the solubility decreases from $CaSO_4$ to $BaSO_4$. The reason behind the solubility of $BeSO_4$ & $MgSO_4$ is :

(A) The hydration enthalpies of Be^{2+} and Mg^{2+} ions overcome the lattice enthalpy factor.

(B) The hydration enthalpies of Be^{2+} and Mg^{2+} ion cannot overcome the lattice factor.

(C) The hydration enthalpies of Be^{2+} and Mg^{2+} ions are extremely low.

(D) None of the above

104. The nitrates of the alkaline earth metals are made by dissolution of the carbonates in dilute HNO_3. Which of the following statements about these nitrates are correct ?

(A) The tendency to form hydrates increases with increase in size of the metal ion and decrease in hydration enthalpy.

(B) The tendency to form hydrates decreases with increase in size of the metal ion and decrease in hydration enthalpy.

(C) All of the alkaline metal nitrates decompose on heating to give the corresponding metal oxide, nitrogen dioxide and oxygen.

(D) All of the alkaline earth metal nitrates decompose on heating to give the corresponding metal oxide and nitrogen dioxide.

105. The solubility of alkaline earth metal hydroxides in water increases down the group. The reason behind it is that :

(A) The lattice enthalpy increases but the hydration enthalpy decreases as we go down the group.

(B) The lattice enthalpy decreases but the hydration enthalpy increases as we go down the group.

(C) The lattice enthalpy decreases much more hydration enthalpy as we go down the group.

(D) None of the above

106. Which of the following statements are correct regarding the solubility of the compounds of alkaline earth metals in H_2O?

(A) The solubility of the hydroxides decreases and that of the carbonates and sulphates increases as we go down the group.

(B) The solubility of the hydroxides, carbonates & sulphates increases as we go down the group.

(C) The solubility of the hydroxides, carbonates & sulphates decreases as we go down the group.

(D) The solubility of the hydroxides increases and that of the carbonates & sulphates decreases as we go down the group.

***107.** Which of the following observations regarding Be show that it exhibits anomalous behaviour as compared to the rest of the alkaline earth metals ?

(A) Due to its small size and high ionisation enthalpy, Be forms compounds that are largly covalent and can easily get hydrolysed.

(B) Be does not exhibits coordination number more than four.

(C) The oxide and hydroxide of Be are basic in nature.

(D) The oxide and hydroxide of Be are amphoteric in nature.

108. The ionic radius of Be^{2+} is estimated to be 31pm. The charge/radius ratio is nearly the same as that of Al^{3+} ion. Hence Be resembles Al in some ways. Some of the similarities are :

(A) Both are not readily attacked by acids because of the presence of an oxide film on the surface of the metal.

(B) The hydroxides of both the elements dissolve in excess of alkali to give, $[Be(OH)_4]^{2-}$ (beryllate ion) and $[Al(OH)_4]^-$ (aluminate ion) respectively.

(C) Be^{2+} & Al^{3+} ions have strong tendency to form complexes, BeF_4^{2-} & AlF_6^{3-}.

(D) All of the above

***109.** The chlorides of both Be and Al have Cl^- bridged chloride structure in vapour phase. Which of the following statements regarding these chlorides are correct ?

(A) They are insoluble in organic solvents and are strong Lewis acids.

(B) They are insoluble in organic solvents and are weak Lewis acids.

(C) They are soluble in organic solvents and are strong Lewis acids.

(D) They are used as Friedel Craft catalysts.

***110.** Which of the following are industrially important compounds of Calcium ?

(A) Quick lime **(B)** Slaked lime **(C)** Calcium carbonate **(D)** Plaster of Paris

111. Calcium oxide is prepared by :

(A) Heating gypsum to 393 K. **(B)** Passing carbondioxide through lime water.

(C) Heating limestone in a rotary kiln at 1070 – 1270 K. **(D)** None of the above

112. On exposure to atmosphere, CaO absorbs moisture and carbon dioxide to form X and Y respectively X and Y are :

(A) Calcium hydroxide and Calcium carbonate **(B)** Calcium carbonate and Calcium hydroxide

(C) Calcium sulphate and Calcium hydroxide **(D)** Calcium hydroxide and Calcium sulphate

113. Consider the following reactions.

$$CaO + SiO_2 \longrightarrow CaSiO_3$$

$$6CaO + P_4O_{10} \longrightarrow 2Ca_3(PO_4)_2$$

Which of the following statement is correct ?

(A) CaO, SiO_2 & P_4O_{10} are basic oxides.

(B) CaO, SiO_2 & P_4O_{10} are acidic oxides.

(C) CaO is an acidic oxide and SiO_2 & P_4O_{10} are basic oxides.

(D) CaO is a basic oxide and SiO_2 & P_4O_{10} are acidic oxides.

***114.** Which of the following are important uses of quick lime ?

(A) Primary material for manufacture of cement **(B)** Manufacture of Na_2CO_3 from caustic soda

(C) Purification of sugar **(D)** Manufacture of dye stuff

115. $Ca(OH)_2$ or Calcium hydroxide is also known as :

(A) Quick lime **(B)** Limestone **(C)** Plaster of Paris **(D)** Slaked lime

116. Milk of lime is a suspension of slaked lime in :

(A) Water **(B)** Alcohol **(C)** Acid **(D)** None of the above

117. When CO_2 is passed through lime water, it turns milky due to the formation of a compound X as a ppt. When excess of CO_2, the ppt. dissolves to form Y and the milkiness disappears. X and Y respectively :

(A) CaO and $Ca(HCO_3)_2$ **(B)** $CaCO_3$ and CaO

(C) $CaCO_3$ and $Ca(HCO_3)_2$ **(D)** $Ca(HCO_3)_2$ and CaO

118. Milk of lime reacts with chlorine to form hypochlorite, a constituent of :

(A) Washing soda **(B)** Baking powder **(C)** Bleaching powder **(D)** None of the above

***119.** Which of the following are uses of slaked lime ?

(A) used in the preparation of mortar. **(B)** used in white wash due to its disinfectant nature.

(C) used in glass making. **(D)** used in tanning industry & for the purification of sugar.

***120.** Calcium carbonate is prepared by :

(A) passing CO_2 through slaked lime. **(B)** addition of sodium carbonate to calcium chloride.

(C) heating gypsum to 393 K. **(D)** adding water to quick lime.

121. Which of the following statements regarding $CaCO_3$ is incorrect ?

(A) It is almost insoluble in water **(B)** When heated to 1200 K, it decomposes to evolve CO_2

(C) It reacts with dilute acid to liberate CO_2 **(D)** None of the above

***122.** Which of the following are important uses of calcium carbonate ?

(A) used as building material in the form of marble.

(B) used along with $MgCO_3$ as a flux in the extraction of metals such as iron.

(C) used as antacid.

(D) used as a mild abrasive in toothpaste.

123. Match the following.

	Column I Compound name		Column II Formula
(I)	Limestone	**(p)**	$CaCO_3$
(II)	Gypsum	**(q)**	$CaSO_4 \cdot \frac{1}{2}H_2O$
(III)	Dead burnt plaster	**(r)**	$CaSO_4 \cdot 2H_2O$
(III)	Plaster of Paris	**(r)**	$CaSO_4$

	(I)	(II)	(III)	(IV)		(I)	(II)	(III)	(IV)
(A)	p	r	s	q	**(B)**	q	p	s	r
(C)	p	r	q	s	**(D)**	s	q	r	p

***124.** Which of the following statements are correct ?

(A) Plaster of Paris is obtained when gypsum is heated to 393 K.

(B) Heating gypsum above 393 K causes the formation of anhydrous $CaSO_4$ which is known as dead burnt plaster.

(C) Plaster of Paris has a remarkable property of setting with water.

(D) Plaster of Paris is used in the building industry as well as plasters.

125. When clay and lime are strongly heated in a rotary kiln, they react to form a clinker. This clinker is mixed with 2–3% by weight of gypsum to form :

(A) Plaster of Paris **(B)** Quick lime **(C)** Caustic soda **(D)** Cement

126. The important ingredients present in Portland cement are :

(A) dicalcium silicate **(B)** tricalcium silicate

(C) tricalcium aluminate **(D)** All of the above

***127.** Cement is used in :

(A) Concrete **(B)** reinforced concrete

(C) plastering **(D)** construction of bridges, dams & buildings

128. When mixed with water, the setting of cement takes place to give a hard mass. This is due to the hydration of the molecules of the constituents & their rearrangement. Which of the following compounds is added to cement to slow down its setting so that it get sufficiently hard ?

(A) Plaster of Paris **(B)** Quick lime **(C)** Slaked lime **(D)** Gypsum

129. Chlorophyll is the main pigment for the absorption of light in plants. It contains X. X is also required as the cofactor for all enzymes that utilise ATP in phosphate transfer. X is :

(A) Sodium **(B)** Calcium **(C)** Potassium **(D)** Magnesium

***130.** The important functions of calcium in our bodies is :

(A) It is present in bones & teeth.

(B) It plays important roles in neuromuscular function and interneuronal transmission.

(C) It is involved in cell membrane integrity.

(D) It plays a role in blood coagulation.

***131.** The calcium concentration in plasma is regulated at about $100\,mg\,L^{-1}$. It is maintained by the two hormones :

(A) calcitonin **(B)** cortisol **(C)** parathyroid **(D)** insulin

132. Which of the following statement is incorrect ?

(A) Bone is an inert, unchanging substance

(B) Bone is not an inert, unchanging substance

(C) Bone is continuously being solubilised and redeposited in man

(D) None of the above

p-Block Elements - I

Group - 13

1. In *p*- block elements, the electron enters the outermost:

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

2. The valence shell electronic configuration of p block elements (except He) is:

(A) $(n-1)s^2np^{1-6}$ **(B)** $ns^{0-2}np^{1-6}$ **(C)** ns^2np^{1-6} **(D)** ns^2np^{0-6}

3. The maximum oxidation state shown by a p-block element is equal to :

(A) Number of *p*-electrons in valence shell

(B) Number of *s*-electrons in valence shell

(C) Sum of the *s*- and *p*- electrons in valence shell

(D) Difference in the number of *s*- and *p*- electrons in valence shell

4. Which of the following statements is(are) correct regarding the boron, carbon and nitrogen families ?

I. The group oxidation state is the most stable state for the lighter elements in the group.

II. The oxidation state two units less than the group oxidation state becomes progressively less stable for the heavier elements

The correct choice is :

(A) Only I **(B)** Only II **(C)** I and II **(D)** Neither I nor II

5. In which block(s) of the periodic table do non-metals and metalloids exist ?

(A) *s* and *p* blocks **(B)** Only *p* block **(C)** *d* block **(D)** *f* and *p* blocks

***6.** Which of the following statements are correct ?

(A) The lightest element in each p-block in the most metallic in nature.

(B) The heaviest element in each p-block is the most metallic in nature

(C) Non-metals have higher ionisation enthalpies and higher electronegativities than metals

(D) Non-metals have lower ionisation enthalpies and lower electronegativities than metals

***7.** Which of the following statements are correct ?

(A) The second period elements of *p*- groups starting from boron are restricted to a maximum covalence of two

(B) The second period elements of *p*- groups starting from boron have vacant 2*d* orbitals and so can expand their covalence beyond four.

(C) The second period elements of *p*- groups starting from boron are restricted to a maximum covalence of four

(D) The third period elements of *p*-groups have vacant 3*d* orbits and so can expand their covalence beyond four

***8.** Which of the following statements are correct regarding *p*-block elements ?

(A) All the *p*-block elements form strong $p\pi - p\pi$ multiple bonds to themselves

(B) The first member of a group differs from the heavier member in its ability to form $p\pi - p\pi$ multiple bonds to itself

(C) The heavier elements form $d\pi - p\pi$ or $d\pi - d\pi$ bonds

(D) The first members of the group form $d\pi - p\pi$ or $d\pi - d\pi$ bonds

9. Boron is a fairly rare element and occurs mainly as the following compounds. Match the following compounds with their chemical formulae.

(P)	Orthoboric acid	**(i)**	$Na_2B_4O_7.4H_2O$
(Q)	Borax	**(ii)**	H_3BO_3
(R)	Kernite	**(iii)**	$Na_2B_4O_7.8H_2O$
		(iv)	H_3BO_4
		(v)	$Na_2B_4O_7.10H_2O$

	P	Q	R		P	Q	R
(A)	(ii)	(i)	(iii)	**(B)**	(ii)	(v)	(i)
(C)	(iv)	(v)	(iii)	**(D)**	(iv)	(i)	(v)

10. Which of the following is the most abundant metal and the third most abundant element in the earth's crust ?

(A) Boron **(B)** Aluminium **(C)** Lead **(D)** Bismuth

***11.** Boron exists in which of the following isotopic forms ?

(A) ^{10}B **(B)** ^{11}B **(C)** ^{9}B **(D)** ^{12}B

***12.** The important minerals of aluminum are:

(A) Bauxite **(B)** Buckminsterfullerene

(C) Cryolite **(D)** Borax

13. The outer shell electronic configuration of Group 13 elements is:

(A) ns^2np^2 **(B)** ns^2np^1 **(C)** ns^2np^3 **(D)** $(n-1)s^2np^3$

***14.** The outer electronic configuration of group 13 elements is ns^2np^1. Which of the following statements are correct regarding the electronic configuration of the group 13 elements ?

(A) Boron has noble gas core

(B) Gallium has noble gas plus 10 *d*-electrons core

(C) Indium and thallium have noble gas plus 14 *d*-electrons plus 10 *d*-electron cores

(D) Aluminium and gallium have noble has plus 10 *d*-electrons core

***15.** Which of the following statements are true ?

(A) The atomic radius of Ga is more than Al **(B)** the atomic radius of In is more than Ga

(C) The atomic radius of In is less than Ga **(D)** the atomic radius of Ga is less than Al

16. Which of the following is the correct order of ionic radius of group 13 elements ?

(A) $B^{3+} < Al^{3+} < Ga^{3+} > In^{3+} < Tl^{3+}$ **(B)** $B^{3+} < Al^{3+} > Ga^{3+} > In^{3+} < Tl^{3+}$

(C) $B^{3+} < Al^{3+} < Ga^{3+} < In^{3+} < Tl^{3+}$ **(D)** $B^{3+} < Al^{3+} > Ga^{3+} < In^{3+} < Tl^{3+}$

17. The atomic radius of Ga is less than that of Al. This is due to:

(A) high penetration power of *s*-orbital

(B) poor screening effect of the additional 10 d electrons present in Al

(C) high screening effect of the additional 10 d-electrons present in Al

(D) poor screening effect of the additional 10 d-electrons present in Ga

***18.** Which of the following statements regarding ionization enthalpy values of Group 13 elements correct ?

(A) It decreases from B to Al due to increase in size

(B) It increases from Al to Ga and also from In to Tl due to high screening effect of *d* and *f*-electrons

(C) The order of the first three ionisation enthalpies for each element is $\Delta_i H_1 < \Delta_i H_2 < \Delta_i H_3$

(D) Thallium has the highest ionisation enthalpy value in the group

***19.** Which of the following statements is(are) correct ?

(A) Boron is a hard metal having unusually high melting point.

(B) Apart from boron, all the elements of group 13 are soft metals with low melting point and high electrical conductivity

(C) The high boiling point of Ga makes it a useful material for measuring high temperatures

(D) The density of the elements decreases down the group from B to Tl

***20.** Which of the following statements is(are) correct ?

(A) Due to the small size of B, the sum of its first three ionisation enthalpies is very high.

(B) B forms B^{3+} ions fairly easily and so most of its compounds are ionic in nature

(C) As we move from B to Al the sum of the first three ionisation enthalpies of Al considerably decreases

(D) The relative stability of the +1 oxidation state progressively decreases for heavier elements: Al > Ga > In > Tl

***21.** The electron deficient molecules such as BF_3 have a tendency to accept a pair of electrons to achieve stable electronic configuration. Which of the following statements regarding them are true ?

(A) They behave as Lewis bases

(B) They behave as Lewis acids

(C) The tendency to accept electrons increases with increase in the size down the group

(D) The tendency to accept electrons decreases with increase in the size down the group

***22.** Group 13 elements such as amorphous boron and aluminium metal on heating in air form B_2O_3 and Al_2O_3. Which of the following statements regarding these oxides true ?

(A) B_2O_3 is basic in nature and reacts with acidic oxides forming metal borates

(B) B_2O_3 is acidic in nature and reacts with basic oxides forming metal borates

(C) Aluminum and gallium oxides are basic in nature.

(D) Indium and thallium oxides are basic in nature.

23. Which of the following statements is(are) incorrect ?

(A) Boron reacts vigorously with acids and alkalis at moderate temperature.

(B) Aluminium dissolves in conc HNO_3 and liberates H_2

(C) Aluminium reacts with aqueous alkali and liberates H_2

(D) Aluminium dissolves in conc HCl and liberates H_2

24. Aluminium reacts with aqueous NaOH to liberate H_2 gas and form a complex. The formula of this complex is:

(A) $Na[Al(OH)_4]$ **(B)** $Na[Al(OH)_3]$ **(C)** $Na_2[Al(OH)_4]$ **(D)** $Na_2[Al(OH)_3]$

25. Group 13 elements react with halogens to form :

(A) monohalides **(B)** dihalides **(C)** trihalides **(D)** tetrahalides

26. White fumes appear around the bottle of anhydrous aluminium chloride. These white fumes are that of :

(A) water vapour formed due to partial hydrolysis of aluminium chloride by atmospheric moisture

(B) vaporized aluminium chloride

(C) HCl gas formed due to partial hydrolysis of alumiuium chloride by atmospheric moisture.

(D) Al_2O_3 gas formed by reaction of aluminium chloride with oxygen present in air

27. The maximum covalence of boron is

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

28. Consider the following statements

I. Boron trihalides exist as dimers

II. Trihalides of all the Group 13 elements except boron exist as monomers.

III. In the dimerised trihalides of Group 13 elements, the metal completes its octet by accepting electrons from the halogens.

Which of the above are correct ?

(A) I and III **(B)** I, II and III **(C)** I and II **(D)** Only III

29. Boron is unable to form BF_6^{3-} ion. This is because :

(A) B cannot expand its octet due to non availability of s-orbitals

(B) B expands its octet due to availability of d- orbitals

(C) B expands its octet due to availability of f- orbitals

(D) B is unable to expand its octet due to non-availability of d-orbitals

30. Borax is a white crystalline solid of formula $Na_2B_4O_7.10H_2O$ it dissolves in water to give:

(A) a mildly acidic solution **(B)** an alkaline solution

(C) a neutral solution **(D)** acidic or alkaline solution depending on the concentration

31. On heating, borax first loses water molecules and swells up. On further heating, it turns into a transparent liquid which solidifies into glass like material known as borax bead. The correct equations for the above are :

(A) $Na_2B_4O_7 \cdot 10H_2O \xrightarrow{\Delta} Na_2B_4O_8 \xrightarrow{\Delta} NaBO_3 + B_2O_3$

(B) $Na_2B_4O_7 \cdot 10H_2O \xrightarrow{\Delta} Na_2B_4O_7 \xrightarrow{\Delta} NaBO_2 + B_2O_6$

(C) $Na_2B_4O_7 \cdot 10H_2O \xrightarrow{\Delta} Na_2B_4O_7 \xrightarrow{\Delta} NaBO_2 + B_2O_3$

(D) $Na_2B_4O_7 \cdot 10H_2O \xrightarrow{\Delta} Na_2B_4O_8 \xrightarrow{\Delta} NaBO_2 + B_2O_6$

32. The metaborates of many transition metals have characteristic colours and therefore borax bead test can be used to :identify them in the laboratory. When borax is heated in a Bunsen burner flame with Co on a loop of Pt wire,

(A) a green colored $Co(BO_3)_2$ bead is formed **(B)** a red colored $Co(BO_2)_2$ bead is formed

(C) a blue colored $Co(BO_2)_2$ bead is formed **(D)** a blue colored $Co(BO_3)_2$ bead is formed

33. Which of the following statements regarding orthoboric acid $\left(H_3BO_3\right)$ incorrect ?

(A) It is sparingly soluble in water but highly soluble in hot water

(B) It can be prepared by acidifying an aqueous solution of borax or by hydrolysis of most boron compounds (halides, hydrides etc.)

(C) It has a layer structure in which planar BO_3 units are joined by hydrogen bonds

(D) None of the above

34. Identify the correct statements

(A) Boric acid is a weak tribasic acid

(B) It acts as a protonic acid

(C) It acts as a Lewis acid by accepting electrons from a hydroxyl ion

(D) On heating orthoboric acid above 370K metaboric acid is obtained which on further heating yields boric acid B_2O_3

***35.** Diborane is prepared by

(A) treating boron trifluoride with NaOH in diethyl ether.

(B) treating boron trifluoride with $LiAlH_4$ in diethyl either

(C) oxidation of sodium borohydride with iodine

(D) reaction of BF_3 with sodium hydride.

36. Identify the incorrect statements:

(A) Diborane is highly resistant to fire and is used in fire proofing materials

(B) Diborane catches fire spontaneously upon exposure to air and burns in oxygen, releasing an enormous amount of energy

(C) Diborane undergoes cleavage reactions with Lewis bases to give borane adducts

(D) $B_3N_6H_6$ is also known as "inorganic benzene"

37. In diborane, the four terminal B-H bonds and the two bridge $\left(B-H-B\right)$ bonds are :

(A) Both two centre-two electron bonds

(B) Both three centre-two electron bonds

(C) Two centre two electron bonds and three centre-two electron bonds respectively.

(D) Three centre-two electron bonds and two centre-two electron bonds respectively.

38. Lithium and sodium tetrahydridoborates are prepared by:

(A) reaction of the metals with boron

(B) reaction of the metal hydrides with orthoboric acid

(C) reaction of metal hydrides with boron in diethyl ether.

(D) reaction of metal hydrides with diborane in diethyl ether

39. $LiBH_4$ and $NaBH_4$ are used in organic synthesis as:

(A) dehydrating agents **(B)** reducing agents **(C)** oxidizing agents **(D)** halogenating agents

***40.** Which of the following uses of boron are correct?

(A) Boron fibers are used in making bulletproof vest and light composite material for aircraft

(B) Boron-10 in the form of metal borides is used as control rods in the nuclear industry

(C) Borax and boric acid are used for making heat-resistant glasses, glass wool and fiberglass

(D) An aqueous solution of orthoboric acid is generally used as a mild antiseptic

Group - 14

41. Which of following is a radioactive isotope of carbon ?

I. ^{12}C **II.** ^{13}C **III.** ^{14}C

The correct choice is :

(A) Only II **(B)** I, II and III **(C)** Only III **(D)** II and III

42. Which of the following is the second most abundant element on the earths crust ?

(A) Aluminium **(B)** Silicon **(C)** Oxygen **(D)** Hydrogen

43. Which of the following are the most significant ores of tin and lead ?

(A) Galena and cinnabar respectively **(B)** Galena and cassiterite respectively

(C) Cinnabar and galena respectively **(D)** Cassiterite and galena respectively

44. Ultra pure form of Ge and Si are used to make:

(A) Aeroplane parts

(B) Transistors and semiconductor devices

(C) Scratch and stain resistant glazed coating of earthenwares

(D) Heat resistant glasses

45. The valence shell electronic configuration of Group 14 elements is :

(A) ns^2np^6 **(B)** ns^2np^1 **(C)** ns^2np^2 **(D)** ns^2np^3

46. There is a considerable increase in covalent radius from C the Si, thereafter from Si to Pb a small increase in radius is observed. This is due to :

(A) absence of completely filled *d* and *f* orbitals in heavier members

(B) presence of completely filled *s* and *p* orbitals in heavier members

(C) absence of completely filled *s* and *p* orbitals in heavier members

(D) presence of completely filled *d* and *f* orbitals in heavier members

47. Small decrease in $\Delta_i H$ from Si to Ge to Sn and slight increase in $\Delta_i H$ from Sn to Pb is the consequence of :

(A) poor shielding effect of intervening *d* and *f* orbitals and decrease in size of the atom

(B) strong shielding effect of intervening *d* and *f* orbitals and increase in size of the atom

(C) poor shielding effect of intervening *d* and *f* orbitals and increase in size of the atom

(D) strong shielding effect of intervening *d* and *f* orbitals and decrease in the size of the atom

***48.** Which elements amongst the following are nearly equally electronegative ?

(A) Carbon **(B)** Silicon **(C)** Germanium **(D)** Tin

49. The tendency of Group 14 elements to exhibit +2 oxidation state follows the following order :

(A) Ge < Sn > Pb **(B)** Ge < Sn < Pb **(C)** Ge > Sn > Pb **(D)** Ge > Sn < Pb

50. As we go down the group, the tendency of Group 14 elements to show +2 oxidation state increases due to :
(A) the participation of ns^2 electrons of valence shell in bonding
(B) the participation of *d*-electrons of penultimate shell in bonding
(C) the inability of ns^2 electrons of valence shell to participate in bonding
(D) the inability of *p*-electrons of valence shell to participate in bonding

51. Sn in +2 stable is :
(A) an oxidising agent **(B)** a reducing agent
(C) A or B depending on the substrate **(D)** Neither A nor B

52. Which of the following statements are true ?
(A) Pb compounds in +2 state are stable and in +4 state are strong reducing agent
(B) Pb compounds in +4 state are stable and in +2 state are strong oxidising agents
(C) Pb compounds in +2 stable are stable and in +4 state are strong oxidising agents
(D) Pb compounds in +4 state are stable and in +2 state are strong reducing agents

53. Tetravalent compounds of group 14 elements (e.g. CCl_4) are :
(A) electron donors **(B)** electron acceptors
(C) electron precise species **(D)** any of the above depending on the element

54. Halides of Group 14 elements (other than carbon) undergo hydrolysis and have tendency to form complexes by accepting electron pairs from donor species. This is because of the presence of :
(A) *s* orbitals **(B)** *p* orbitals **(C)** *d* orbitals **(D)** All of these

55. What are the main two types of oxides of Group 14 elements ?
(A) MO and MO_3 **(B)** MO and MO_2 **(C)** MO_2 and MO_3 **(D)** MO_2 and MO_4

56. Which of the following statements are true about oxides of Group 14 elements ?
I. Oxides in higher oxidation states of elements are generally more acidic than those in lower oxidations states
II. SnO_2 and PbO_2 are acidic whereas CO_2, SiO_2 and GeO_2 are amphoteric in nature
III. CO in neutral, GeO is distinctly acidic whereas SnO and PbO are amphoteric
The correct choice is :
(A) I and II **(B)** I, II and III **(C)** II and III **(D)** I and III

57. Tin decomposes steam to form :
(A) Tin (II) oxide and hydrogen gas **(B)** Tin (IV) oxide and hydrogen gas
(C) Tin (II) hydroxide **(D)** Tin (IV) hydroxide

58. Which of the following elements does not react directly with halogen under suitable condition to form halides ?
(A) Si **(B)** Ge **(C)** C **(D)** Sn

***59.** Which of the following tetrahalides are ionic in nature?
(A) PbF_4 **(B)** CCl_4 **(C)** $SnCl_4$ **(D)** SnF_4

***60.** Which of the following statements are correct?
(A) PbI_4 exists since Pb – I bond releases enough energy to unpair $6s^2$ electrons and excite one of them to higher orbital to have four unpaired electrons around lead atom.
(B) Heavier members of Group 14 tend to make halides of the formula MX_2.
(C) GeX_2 in more stable then GeX_4 whereas PbX_2 is less stable then PbX_4.
(D) Except CCl_4 other tetrachlorides are easily hydrolysed by water because the central atom can accommodate the lone pair of electrons from oxygen atom of water molecule in d-orbital.

61. Hydrolysis of $SiCl_4$ leads to the formation of :

(A) SiH_4 (silicon hydride) **(B)** $Si(OH)_4$ (silicic acid)

(C) SiO_2 (silicon dioxide) **(D)** SiO_3 (silicon trioxide)

62. $[SiF_6]^{2-}$ is known whereas $[SiCl_6]^{2-}$ is not. This is because :

(A) Six large chloride ions cannot be accommodated around Si^{4+} due to limitation of its size.

(B) Interaction between lone pair of Cl^- ion and Si^{4+} is not very strong.

(C) Both A and B **(D)** None of the above

***63.** Carbon differs from the rest of the members of its group due to :

(A) Its smaller size **(B)** Its higher electronegativity

(C) Its higher ionization enthalpy **(D)** Unavailability of d orbitals

64. Carbon has the unique ability to form $p\pi - p\pi$ multiple bonds with itself and with other atoms of small size and higher electronegativity .

On the other hand heavier elements do not form $p\pi - p\pi$ bonds because :

(A) Their atomic orbitals are too small and diffuse to have effective overlapping.

(B) Their atomic orbitals are too large and diffuse to have effective overlapping

(C) Can be A or B depending on the element

(D) None of the above.

65. Carbon atoms have the tendency to link with one another through covalent bonds to form chains and rings. This property is called:

(A) Resonance **(B)** Hybridization **(C)** Stereoisomerism **(D)** Catenation

66. The order of Group – 14 elements to exhibit catenation is :

(A) $C \ll Si > Ge \approx Sn$ **(B)** $C \gg Si < Ge \approx Sn$

(C) $C \gg Si > Ge \approx Sn$ **(D)** $C < Si \ll Ge \approx Sn$

***67.** Which of the following are allotropic forms of carbon?

(A) Graphite **(B)** Diamond **(C)** Zeolite **(D)** Fullerenes

68. In the crystalline allotrope of carbon, diamond, each carbon atom undergoes which of the following type of hybridization?

(A) sp^2 **(B)** sp^3 **(C)** sp **(D)** dsp^2

69. Why does diamond have high melting point despite being covalent?

(A) It has a 2-D network involving weak C – C bonds

(B) It has a 3-D network involving strong C – C bonds

(C) It has a 3-D network involving weak C – C bonds

(D) It has a 2-D network involving strong C – C bonds

70. Which of the following substance is the hardest in the world?

(A) Graphite **(B)** Buckminster fullerene

(C) Diamond **(D)** Silicates

***71.** Which of the following statements regarding graphite is(are) incorrect ?

(A) It has layer structure and the layers are held by covalent bonds.

(B) Each layer is composed of planar hexagonal rings on carbon atoms

(C) Each carbon atom in the hexagonal ring undergoes sp^3 hybridisation

(D) The valence electrons not involved in the sigma bonding are delocalized over the whole sheet due to which graphite is a good conductor of electricity.

72. Fullerenes are made by :

(A) heating of diamond in an electric arc in the presence of inert gases

(B) passing steam over red hot coal

(C) heating of graphite in an electric arc in the presence of inert gases

(D) heating wood at high temperature in the absence of air.

73. Among the following allotropes of carbon which is the most purest form of carbon ?

(A) diamond **(B)** graphite **(C)** fullerenes **(D)** coke

74. Which of the following represents Buckminster fullerene ?

(A) C_{350} **(B)** C_{70} **(C)** C_{60} **(D)** C_{65}

75. The number of six-membered rings and five – membered rings present in Buckminster fullerene are respectively :

(A) 12 and 20 **(B)** 20 and 12 **(C)** 18 and 12 **(D)** 26 and 12

***76.** Which of the following statements regarding Buckminster fullerene true ?

(A) A six membered ring is fused only with a five membered ring but a five membered ring is fused with a six or a five membered ring.

(B) The carbon atoms are sp^2 hybridized .

(C) The electron on each carbon atom which is not involved in sigma bonds remains delocalised in molecular orbitals which in turn gives aromatic character to the molecule.

(D) It is a ball shaped molecule with 60 vertices each of which is occupied by one carbon atom.

77. The thermodynamically most stable allotrope of carbon is :

(A) graphite **(B)** diamond **(C)** fullerene **(D)** coke

78. Match the following forms of carbon with the process by which they are obtained

	Column I		**Column II**
(P)	Carbon black	**1**	Heating wood at high temperature in the absence of air
(Q)	Charcoal	**2**	Burning hydrocarbons in limited supply of air
(R)	Coke	**3**	Heating coal at high temperatures in the absence of air

Code :

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

79. Match the following forms of carbon with their uses :

	Column I		Column II
(P)	Graphite	**1**	Making crucibles which are inert to dilute acids and alkalies.
(Q)	Activated charcoal	**2**	Used as a fuel and also as a reducing agent in metallurgy
(R)	Carbon black	**3**	Used in adsorbing poisonous gases as well as in air conditioning systems to control odour.
(S)	Coke	**4**	Used as black pigment in black ink and as filler in automobile tyres.

Code :

	P	Q	R	S		P	Q	R	S
(A)	1	2	3	4	**(B)**	2	4	1	3
(C)	3	1	2	4	**(D)**	1	3	4	2

80. On a small scale, pure CO is prepared by :

(A) dehydration of acetic acid with conc. H_2SO_4 at 373 K.

(B) dehydration of acetic acid with NaOH at 373 K.

(C) dehydration of formic acid with conc. H_2SO_4 at 373 K.

(D) dehydration of formic acid with NaOH at 373 K.

***81.** Which of the following statements regarding water gas is(are) true?

(A) It is also known as producer gas. **(B)** It is an industrial fuel.

(C) It is also known as synthesis gas . **(D)** It causes green house effect.

82. Water gas is prepared by :

(A) passing air over hot coke **(B)** passing steam over hot coke

(C) oxidation of C in limited supply of oxygen **(D)** All of the above

***83.** Water gas or synthesis gas is a mixture of which of the following gases ?

(A) CO_2 **(B)** H_2O (steam) **(C)** CO **(D)** H_2

***84.** Producer gas is :

(A) prepared by passing air over hot coke

(B) an important industrial fuel

(C) obtained by passing air over heated limestone

(D) a mixture of CO, N_2 and H_2

***85.** Which of the following statements about carbon monoxide correct ?

(A) It is highly water soluble

(B) It is a very powerful reducing agent

(C) It reduces all the metal oxides including those of the alkali and alkaline earth metals

(D) It acts as a donor molecule and reacts with certain metals when heated to form metal carbonyls

86. CO is used in the extraction of many metals from their oxide ores due to its

(A) oxidising property **(B)** reducing property

(C) ability to form metal carbonyls **(D)** B and C

87. The number of sigma and pi bonds between carbon and oxygen in CO are respectively :
(A) 2 and 1 **(B)** 1 and 2 **(C)** 1 and 1 **(D)** 2 and 0

88. CO acts as a donor and reacts with certain metals when heated to form metal carbonyls. This is due to :
(A) presence of lone pair on oxygen **(B)** presence of lone pair on carbon
(C) the electron deficiency of carbon **(D)** the electron deficiency of oxygen

89. The highly poisonous nature of CO arises because :
(A) of its ability to form a complex with haemoglobin which is about 20 times less stable than the oxygen haemoglobin complex.
(B) of its ability to effect the functioning of the voluntary muscles.
(C) of its ability to form a complex with haemoglobin which is about 300 times more stable than the oxygen – haemoglobin complex.
(D) of its ability to trigger heart attacks.

***90.** CO_2 is obtained by :
(A) direct oxidation of C in limited supply of oxygen or air.
(B) Complete combustion of carbon and carbon containing fuels in excess of air.
(C) Heating limestone
(D) Photosynthesis.

91. In the laboratory, CO_2 is prepared by :
(A) dehydration of oxalic acid with conc. H_2SO_4 **(B)** action of dil HCl with $CaCO_3$
(C) treatment of zinc with dil H_2SO_4 **(D)** reaction of alkali metals with oxygen

***92.** Which of the following statements regarding CO_2 true ?
(A) It is a colourless gas with a pungent odour
(B) It is very highly soluble in water which makes it of immense biochemical and geo-chemical importance.
(C) In solid form it is known as dry ice
(D) It is not poisonous.

***93.** With water, CO_2 forms carbonic acid Which of the following statements regarding carbonic acid are true?
(A) It's formula is H_3CO_3 **(B)** It is a tribasic acid
(C) It is a dibasic acid **(D)** It combines with alkalies to form metal carbonates

94. The H_2CO_3 / HCO_3^- buffer system helps to maintain pH of blood between:
(A) 6.42 to 6.91 **(B)** 5.90 to 6.31 **(C)** 7.26 to 7.42 **(D)** 8.27 to 9.59

***95.** Which of the following statements are correct ?
(A) Green plants convert atmospheric CO_2 into carbohydrates such as glucose by a process called transpiration.
(B) Increase in the CO_2 content of the atmosphere leads to green house effect.
(C) Dry ice is used as a refrigerant for ice cream and frozen food.
(D) Since CO_2 is light and supports combustion, it is used as fire extinguisher.

96. Which of the following gases is used in the manufacture of urea ?
(A) SO_2 **(B)** CO **(C)** SO_3 **(D)** CO_2

97. In CO_2 molecule, C atom undergoes which type of hybridization ?
(A) sp^2 **(B)** sp **(C)** sp^3 **(D)** dsp^2

98. Which of the following molecules have no dipole moment ?
(A) H_2O **(B)** CO_2 **(C)** CO **(D)** Both A and B

99. Silicon dioxide (SiO_2) is commonly known as :
(A) Silicone **(B)** Silicate **(C)** Silica **(D)** Zeolite

***100.** Which of the following are crystalline form of SiO_2?
(A) Quartz **(B)** Cristobalite **(C)** Tridymite **(D)** Kieselghur

101. Which of the following statements are correct ?
(A) Silica is an ionic, three dimensional network solid.
(B) Each Si atom is covalently bonded in a tetrahedral manner to four oxygen atoms
(C) The entire silica crystal may be considered as a giant molecule in which six membered rings are formed with alternate Si and O atoms.
(D) All of the above

***102.** Which of the following statements regarding silica correct ?
(A) It is almost non-reactive because of very high Si – O bond enthalpy.
(B) It is highly reactive because of low Si – O bond enthalpy.
(C) It reacts with halogens, H_2, most acids and metals at room temperature.
(D) It resists the attack by halogens, H_2, most acids and metals even at elevated temperatures

103. What happens on addition of NaOH to silica ?
(A) Na_2SiO_4 is formed **(B)** Na_2SiO_3 is formed
(C) Na_2SiO_2 is formed **(D)** No reaction occurs.

104. What is obtained on treatment of SiO_2 with HF?
(A) SiF_2 **(B)** SiF_3 **(C)** SiF **(D)** SiF_4

***105.** Quartz is used :
(A) as a piezoelectric material **(B)** as a pyroelectric material
(C) to develop extremely accurate clocks **(D)** in mobile radio communications

106. Which of the following statements regarding silica gel correct?
I. It is used as a drying agent
II. It is used as a support for chromatographic materials and catalysts.
(A) Only I **(B)** Only II **(C)** I and II **(D)** Neither I nor II

107. X is an amorphous form of silica used in filtration plants. X is:
(A) quartz **(B)** cristobalite **(C)** tridymite **(D)** Kieselghur

***108.** Silicones :
(A) are a group of organosilicon polymers.
(B) have (R_3SiO) as repeating unit
(C) are made from alkyl or aryl substituted chlorides.
(D) are water repelling in nature

109. $2CH_3Cl + Si \xrightarrow[570K]{X} Y \xrightarrow[-2HCl]{+2H_2O} (CH_3)_2Si(OH)_2$ X and Y are respectively :

(A) Cu and CH_3SiCl_3 **(B)** Fe and CH_3SiCl_3

(C) Cu and $(CH_3)_2SiCl_2$ **(D)** Fe and $(CH_3)_2SiCl_2$

***110** Silicones :

(A) have high thermal stability **(B)** have high dielectric strength

(C) are resistant to oxidation and chemicals **(D)** are hydrophilic in nature.

111. Feldspar, zeolites, mica and asbestos are types of

(A) Silica **(B)** silicones **(C)** silicates **(D)** fullerenes

***112.** Which of the following statements regarding silicates is(are) true ?

(A) The basic structural unit of silicates is SiO_4^{3-}

(B) When silicate units are linked together, they form chain, ring, sheet or three – dimensional structures.

(C) Negative charge on silicate structure is neutralized by positively charged metal ions

(D) Since silicates are biocompatible, they are used in surgical plants.

***113.** Which of the following are man-made silicates?

(A) glass **(B)** marble **(C)** cement **(D)** nylon

114. If aluminium atoms replace few silicon atoms in 3-D network of SiO_2, the overall structure:

I. is known as aluminosilicate II. acquires a positive charge

Which of the above is(are) correct

(A) Only I **(B)** Only II **(C)** I and II **(D)** None

115. Which of the following is used to convert alcohols directly into gasoline ?

(A) Quartz **(B)** Feldspar **(C)** Asbestos **(D)** ZSM-5

***116.** Zeolites are used :

(A) as catalyst in petrochemical industries

(B) as ion exchangers in softening of 'hard' water

(C) for cracking of hydrocarbons and isomerization

(D) as drying agent.

p-Block Elements - II

Group - 15

***1.** On the earth, nitrogen occurs as :

(A) molecular nitrogen in the atmosphere **(B)** Chile saltpetre

(C) Indian saltpetre **(D)** proteins in plants and animals

2. The formula of a phosphorus containing mineral, fluorapatite is :

(A) $Ca_9(PO_4)_6.CaF_6$ **(B)** $Ca_9(PO_4)_4.CaF_2$ **(C)** $Ca_9(PO_4)_6.CaF_2$ **(D)** $Ca_9(PO_4)_4.CaF_6$

3. Arsenic, antimony and bismuth are mainly found as :

(A) Carbonate minerals **(B)** Free metals

(C) Sulphide minerals **(D)** Oxide minerals

4. The valence shell electronic configuration of Group 15 elements is :

(A) ns^2np^2 **(B)** $(n-1)s^2np^3$ **(C)** $(n-1)s^2np^2$ **(D)** ns^2np^3

5. The electronic configuration of Sb is :

(A) $[Xe]4f^{14}5d^{10}6s^26p^3$ **(B)** $[Kr]4d^{10}5s^25p^3$

(C) $[Ar]3d^{10}4s^24p^3$ **(D)** $[Xe]4d^{10}5s^25p^3$

6 The order of the first ionization enthalpy of the Group 15 elements is :

(A) N < P >> As > Sb > Bi **(B)** N > P > As > Sb > Bi

(C) N < P < As < Sb < Bi **(D)** N > P > As < Sb < Bi

7. The order of increasing melting points of Group 15 elements is :

(A) N > P > As > Sb > Bi **(B)** N < P > As > Sb > Bi

(C) N < P < As > Sb > Bi **(D)** N < P < As < Sb < Bi

8. There is considerable increase in covalent radius from N to P. However, from As to Bi only a small increase in covalent radius is observed. This is due to the presence of :

(A) vacant d and/or f orbitals in heavier members.

(B) fully filled s and/or p orbitals in heavier members.

(C) vacant s and/or p orbitals in heavier members.

(D) fully filled d and/or f orbitals in heavier members.

***9.** The ionization enthalpy of group 15 elements is much greater than group 14 elements in the corresponding periods. This is because of :

(A) extra stability of half – filled p orbitals

(B) extra stability of half – filled d orbitals

(C) less stability of half – filled p orbitals

(D) smaller size of Group 15 elements as compared to Group 14 elements.

10. The order of electronegativity of Group 15 elements is :

(A) N > P > As < Sb < Bi **(B)** N > P > As > Sb ≈ Bi

(C) N > P > As > Sb >> Bi **(D)** N > P > As > Sb < Bi

11. Which of the following statements regarding Group 15 elements are NOT true ?

(I) N and P are non-metals, As and Sb are metalloids and Bi is a metal

(II) The boiling points decrease from top to bottom in the group.

(III) The melting point decreases upto arsenic and then increases upto bismuth.

(IV) Except nitrogen, all the elements show allotropy.

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

***12.** Which of the following are commonly exhibited oxidation states of Group 15 elements?

(A) +3 **(B)** –3 **(C)** + 5 **(D)** –5

***13.** Which of the following statements are true regarding Group 15?

(A) The tendency to exhibit –3 oxidation state increases down the group

(B) The tendency to exihibit –3 oxidation state decreases down the group

(C) The stability of +5 oxidation state increases down the group

(D) The stability of +5 oxidation state decreases down the group

14. As we go down the group (Group 15), the stability of +5 oxidation state decreases and that of +3 state increases due to:

(A) decrease in electronegativity **(B)** increase in atomic size

(C) inert pair effect **(D)** All of the above

***15.** Which of the following statements are true?

(A) All oxidation states of nitrogen from +1 to +4 tend to disproportionate in acid solution.

(B) All intermediate states of phosphorus disproportionate into +5 and –3 both in alkali and acid.

(C) +3 oxidation state in case of arsenic, antimony and bismuth is extremely susceptible to disproportionation.

(D) All of the Group 15 elements have vacant d orbitals in the outermost shell which can be used to expand their covalencies beyond 4.

***16.** Nitrogen differs from the rest of the members of group 15 due to :

(A) its small size **(B)** low ionization enthalpy

(C) high electronegativity **(D)** Non-availability of d orbitals

***17.** Which of the following statements are NOT true ?

(A) Nitrogen forms $p\pi - p\pi$ multiple bonds with itself and with other elements having small size and high electronegativity.

(B) All the Group 15 elements form $p\pi - p\pi$ bond with themselves.

(C) Nitrogen exists as a diatomic molecule with a triple bond between the two atoms

(D) Phosphorus, arsenic and antimony form double bonds as p = p, As = As, Sb = Sb while bismuth forms metallic bonds in elemental state.

18. The catenation tendency is weaker in nitrogen as compared to phosphorus. This is because :

(A) the N – N single bond is weaker than P = P single bond because of low interelectronic repulsion of the non-bonding electrons owing to the small bond length

(B) the N – N single bond is stronger than P – P single bond because of high interelectronic repulsion of the non-bonding electrons owing to the small bond length.

(C) the N – N single bond is weaker than P – P single bond because of high interelectronic repulsion of the non-bonding electrons owing to the small bond length.

(D) the N – N single bond is weaker than P – P single bond because of low interelectronic repulsion of the non-bonding electrons owing to large bond length.

19. All the elements of Group 15 form hydrides of the type : (E = N, P, As, Sb or Bi)
(A) EH_2 **(B)** EH_3 **(C)** EH_4 **(D)** EH_6

20. The melting points and boiling points of the hydrides of Group 15 of the type EH_3 follow the order :
(A) $NH_3 < PH_3 < AsH_3 < SbH_3$ **(B)** $NH_3 < PH_3 > AsH_3 > SbH_3$
(C) $NH_3 > PH_3 < AsH_3 < SbH_3$ **(D)** $NH_3 > PH_3 > AsH_3 > SbH_3$

21. The formation of which of the following hydrides (from their constituents in elemental forms) is exothermic in nature?
(A) NH_3 **(B)** PH_3 **(C)** AsH_3 **(D)** SbH_3

22. The stability of hydrides (EH_3) of Group 15 elements follows which of the following order :
(A) $NH_3 < PH_3 < AsH_3 < SbH_3$ **(B)** $NH_3 > PH_3 > AsH_3 > SbH_3$
(C) $NH_3 < PH_3 > AsH_3 > SbH_3$ **(D)** $NH_3 > PH_3 < AsH_3 < SbH_3$

23. The reducing character of the hydrides of group 15 elements follows which of the following order :
(A) $NH_3 < PH_3 < AsH_3 < SbH_3$ **(B)** $NH_3 > PH_3 > AsH_3 > SbH_3$
(C) $NH_3 < PH_3 > AsH_3 > SbH_3$ **(D)** $NH_3 > PH_3 < AsH_3 < SbH_3$

24. The basicity of the hydrides of group 15 elements follows the order :
(A) $NH_3 > PH_3 > AsH_3 < SbH_3 < BiH_3$ **(B)** $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$
(C) $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$ **(D)** $NH_3 < PH_3 > AsH_3 > SbH_3 < BiH_3$

***25.** All the elements of Group 15 form which of the following types of oxides ?
(A) E_2O_3 **(B)** EO **(C)** E_2O_5 **(D)** EO_3

26. Which of the following statements are true regarding the oxides of Group 15 elements?
I The oxide in the higher oxidation state is less acidic than that in the lower oxidation state
II The acidic character of the oxides increases down the group.
(A) Only I **(B)** Only II **(C)** Both I and II **(D)** neither I nor II

27. The oxides of arsenic and antimony of the type E_2O_3 are:
(A) acidic **(B)** basic **(C)** neutral **(D)** amphoteric

28. Nitrogen does not form pentahalides because :
(A) it is highly electronegative
(B) of high stability of half filled p-orbital in its valence shell
(C) of non-availability of d-orbitals in its valence shell
(D) All of the above

29. Which of the following statements regarding the halides of Group 15 elements is true ?
(A) Trihalides are more covalent than pentahalides
(B) All the trihalides except those of nitrogen are stable
(C) Group – 15 elements form three types of halides monohalides, trihalides and pentahalides
(D) None of the above

30. Which is the only nitrogen trihalide known to be stable ?
(A) NF_3 **(B)** NBr_3 **(C)** NCl_3 **(D)** NI_3

31. PH_3 has lower boiling point than NH_3 because.:

(A) Phosphorus atom is larger than nitrogen atom

(B) P-H bond is longer than N-H bond

(C) NH_3 molecules are associated through hydrogen bonding whereas PH_3 molecules are not

(D) All of the above

***32.** Which of the following statements are not true ?

(A) Trihalides of Group 15 elements are predominantly ionic in nature

(B) Group 15 elements react with metals to form their binary compounds exhibiting – 3 oxidation state

(C) Nitrogen does not form pentahalides nor does it exhibit +5 oxidation state

(D) BiH_3 is the weakest reducing agent amongst all the hydrides of Group 15 elements

***33.** Dinitrogen is produced by:

(A) liquefaction and fractional distillation of air.

(B) treating an aqueous solution of ammonium chloride with sodium nitrite

(C) thermal decomposition of ammonium dichromate

(D) thermal decomposition of sodium or barium azide.

***34.** Dinitrogen :

(A) is colourless **(B)** is odourless **(C)** has a mild, sweet taste **(D)** is non – toxic

***35.** Which of the following are stable isotopes of nitrogen atom ?

(A) ^{13}N **(B)** ^{14}N **(C)** ^{15}N **(D)** ^{16}N

***36.** Which of the following statements regarding nitrogen are not true ?

(A) It is highly soluble in water

(B) It has low freezing and boiling points

(C) It is highly reactive at room temperature because of low bond enthalpy of $N \equiv N$ bond.

(D) At higher temperatures, it directly combines with some metals to form predominantly covalent nitrides and with non-metals to form predominantly ionic nitrides.

***37.** Ammonia is formed by the combination of nitrogen and hydrogen during Haber's process. Which of the following statements regarding Haber's process are true ?

(A) Temperature of approximately 700 K is required.

(B) Pressure of 200 atm is required

(C) It is an endothermic process.

(D) Iron oxide is used as a catalyst along with small quantities of K_2O and Al_2O_3 in order to increase the rate of attainment of equilibrium.

***38.** Which of the following statements are correct ?

(A) Dinitrogen combines with dioxygen only at very low temperature to form nitric oxide, NO.

(B) Dinitrogen is used in iron and steel industry as an inert diluent for reactive chemicals.

(C) Liquid dinitrogen is used as a refrigerant to preserve biological matters, food items and in cryosurgery.

(D) Dinitrogen is used in the manufacture of ammonia and other industrial chemicals containing nitrogen.

39. The formula of sodium azide is :

(A) Na_3N **(B)** Na_2N_3 **(C)** Na_3N_2 **(D)** NaN_3

***40.** On a small scale, ammonia is obtained by decomposition of ammonium salts on treatment with

(A) caustic soda **(B)** acetic acid **(C)** formaldehyde **(D)** lime

***41.** Which of the following statements regarding ammonia are not correct ?

(A) It is a colourles gas **(B)** It has the smell of rotten eggs

(C) Its shape is tetrahedral **(D)** Its solubility in water is very low

42. The melting point and boiling point of ammonia is more than what is expected on the basis of its molecular mass. This is due to :

(A) vander waals interaction between the molecules.

(B) dipole – induced dipole interaction between the molecules

(C) hydrogen bonding between the molecules

(D) ion – dipole interaction between the molecules.

43. An aqueous solution of ammonia has a pH value :

(A) 2 – 3 **(B)** 7 **(C)** 5 – 6 **(D)** > 7

44. On adding ammonium hydroxide to an aqueous solution of zinc sulphate, a white precipitate, X is obtained. X is :

(A) $(NH_4)_2\,SO_4$ **(B)** NH_4SO_4 **(C)** ZnO **(D)** $Zn(OH)_2$

45. On adding ammonium hydroxide to an aqueous solution of ferric chloride, a brown precipitate Y is obtained. Y is:

(A) $FeO.xH_2O$ **(B)** $Fe_2O_3.xH_2O$ **(C)** $Fe(OH)_3$ **(D)** $Fe(OH)_2$

46. Which of the following statements are correct?

(A) The absence of lone pair of electrons on nitrogen atom of NH_3 makes it a Lewis acid.

(B) Since the octet of nitrogen atom of NH_3 is not complete, it acts like a Lewis acid.

(C) The presence of half filled p-orbital on nitrogen atom of NH_3 makes it a Lewis base.

(D) The presence of lone pair of electrons on the nitrogen atom of NH_3 makes it a Lewis base.

47. NH_3 donates the lone pair of electrons on nitrogen atom and forms linkage with metal ions which results in the formation of complex compounds. On adding ammonia to a solution containing cupric ions, a complex is formed. The formula and colour of this complex is :

(A) $[Cu(NH_3)_4]^+$, blue **(B)** $[Cu(NH_3)_6]^{2+}$, blue

(C) $[Cu(NH_3)_4]^{2+}$, blue **(D)** $[Cu(NH_3)_4]^{2+}$, green

48. $Ag^+(aq) + Cl^-(aq) \longrightarrow \underset{\text{White ppt}}{AgCl(s)}$

$\underset{\text{white ppt}}{AgCl(s)} + 2NH_3(aq) \longrightarrow X$

The formula and colour of X is :

(A) $[Ag(NH_3)_4]Cl$, colourless **(B)** $[Ag(NH_3)_2]Cl$, colourless

(C) $[Ag(NH_3)_4]Cl$, white **(D)** $[Ag(NH_3)_2]Cl$, white

***49.** Ammonia is used to produce various nitrogenous fertilizers such as :

(A) ammonium nitrate **(B)** urea

(C) ammonium phosphate **(D)** ammonium sulphate

50. Match the following methods of preparation of nitrogen oxides with the nitrogen oxide obtained in each case :

Column-I (method of preparation)		**Column-II** (Nitrogen oxide)	
(P)	$NH_4NO_3 \xrightarrow{\Delta}$	**1**	NO
(Q)	$Pb(NO_3)_2 \xrightarrow{673}$	**2**	NO_2
(R)	$HNO_3 + P_4O_{10} \longrightarrow$	**3**	N_2O
(S)	$NaNO_2 + FeSO_4 + H_2SO_4 \longrightarrow$	**4**	N_2O_3
		5	N_2O_5

Codes :

	P	**Q**	**R**	**S**		**P**	**Q**	**R**	**S**
(A)	2	3	4	1	**(B)**	3	2	4	1
(C)	1	3	4	5	**(D)**	3	2	5	1

51. $NO + N_2O_4 \xrightarrow{250K} X$

The formula of X is :

(A) N_2O_5 **(B)** N_2O_4 **(C)** N_2O_3 **(D)** NO_2

***52** Which of the following oxides of nitrogen are neutral ?

(A) NO **(B)** N_2O_3 **(C)** N_2O_5 **(D)** N_2O

53. Which of the following oxide of nitrogen is an acidic blue solid?

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

54. $2NO_2 \underset{b}{\overset{a}{\rightleftharpoons}} N_2O_4$

a and b are respectively.

(A) heat and cool **(B)** cool and cool **(C)** heat and heat **(D)** cool and heat

***55.** In which of the following oxides of nitrogen, is the oxidation state of nitrogen +4?

(A) N_2O_5 **(B)** N_2O_3 **(C)** NO_2 **(D)** N_2O_4

56. Which of the following oxides of nitrogen have a linear shape ?

I. N_2O II. N_2O_3 III. NO_2

(A) Only I **(B)** I, II and III **(C)** Only III **(D)** I and III

57. Which of the following nitrogen oxide dimerises ?

(A) NO **(B)** N_2O **(C)** NO_2 **(D)** Both A and C

58. The covalence of nitrogen in N_2O_5 is :

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

59. The formula of hyponitrous acid is :

(A) $H_2N_4O_2$ **(B)** $H_4N_2O_2$ **(C)** $H_2N_2O_2$ **(D)** $H_2N_2O_4$

60. On heating KNO_3 or $NaNO_3$ and conc H_2SO_4, which of the following acids are obtained ?
(A) HNO_2 **(B)** HNO_3 **(C)** $H_2N_2O_2$ **(D)** H_2N_4

61. On a large scale, nitric acid is prepared by :
(A) Contact process **(B)** Haber's Process
(C) Aluminothermic process **(D)** Ostwald's Process

62. During the Ostwald process, nitric oxide is prepared by :
(A) direct combination of nitrogen and oxygen
(B) catalytic oxidation of NH_3 by atmospheric oxygen
(C) catalytic oxidation of aluminium nitride by atmospheric oxygen
(D) reduction of NO_2

63. The aqueous HNO_3 obtained by Ostwald's process can be concentrated to 98% by :
(A) distillation **(B)** dehydration with conc H_2SO_4
(C) A or B **(D)** None of the above

64. Conc HNO_3 is a :
(A) mild reducing agent **(B)** strong reducing agent
(C) strong oxidizing agent **(D)** strong dehydrating agent

65. Which of the following nitrogen oxides are evolved on reaction of copper with dilute and conc HNO_3 respectively?
(A) NO_2 and NO **(B)** N_2O_5 and NO_2 **(C)** NO and NO_2 **(D)** N_2O_5 and NO

66. Which of the following nitrogen oxides are evolved on reaction of zinc with dilute HNO_3 and with conc HNO_3 respectively?
(A) N_2O and NO **(B)** NO and NO_2 **(C)** N_2O and NO_2 **(D)** NO and N_2O

67. Metals such as chromium and aluminium :
(A) react with conc HNO_3 vigorously **(B)** react with dil HNO_3 vigorously
(C) do not dissolve in conc HNO_3 **(D)** evolve hydrogen gas on addition of dil HNO_3

68. On adding conc HNO_3 to iodine, carbon, sulphur and phosphorus, the compounds obtained are respectively:
(A) HI, CO_2, H_2SO_3, H_3PO_3 **(B)** HIO_2, CO, H_2SO_4, H_3PO_4
(C) HIO_3, CO, H_2SO_3, H_3PO_4 **(D)** HIO_3, CO_2, H_2SO_4, H_3PO_4

69. The Brown Ring test for nitrates depends on the ability of Fe^{2+} to :
(A) reduce nitrates to nitrogen dioxide **(B)** reduce nitrates to nitrous oxide
(C) reduce nitrates to nitric oxide **(D)** reduce nitrates to nitrites

70. The Brown Ring test is carried out by adding a dilute solution of X to an aqueous solution containing Y ions and then adding conc H_2SO_4 carefully along the sides of the test tube. X and Y are respectively.
(A) $Fe_2(SO_4)_3$ and nitrate ion **(B)** $Fe_2(SO_4)_3$ and nitrite ion
(C) $FeSO_4$ and nitrate ion **(D)** $FeSO_4$ and nitrite ion

71. The brown coloured ring formed during the Brown Ring test for nitrates is due to the formation of :
(A) $[Fe(H_2O)_5(NO)]^{3+}$ **(B)** $[Fe(H_2O)_5(NO)]^{2+}$
(C) $[Fe(H_2O)_4(NO)]^{3+}$ **(D)** $[Fe(H_2O)_5(NO)_2]^{2+}$

***72.** Nitric acid is used in the manufacture of :

(A) ammonium nitrate **(B)** ammonia

(C) nitroglycerin **(D)** trinitrotoluene

***73.** Nitric acid is used :

(A) in the manufacture of nitrates for use in explosive and pyrotechnics

(B) in the pickling of stainless steel

(C) in etching of metals

(D) as an oxidizer in rocket fuels.

***74.** The important allotropic forms of phosphorus are :

(A) Black **(B)** White **(C)** Red **(D)** Green

***75.** White phosphorus :

(A) is non-poisonous

(B) insoluble in water as well as in CS_2

(C) shows chemiluminescence

(D) is less stable than other allotropes of phosphorus and readily catches fire when exposed to air.

76. White phosphorus dissolves in boiling NaOH solution in an inert atmosphere.

$$P_4 + NaOH + H_2O \longrightarrow X + Y$$

X and Y are

(A) PH_3 and Na_3PO_3 **(B)** H_3PO_4 and Na_3PO_2

(C) PH_3 and NaH_2PO_2 **(D)** PH_3 and Na_3PO_4

77. Which of the following allotropes of phosphorus consist of discrete tetrahedral P_4 molecules?

(A) White **(B)** Red **(C)** Black **(D)** A and B

78. White phosphorus is more reactive than the other allotropes of phosphorus because :

(A) it can be sublimed in air

(B) it cannot be oxidized in air.

(C) it consists of P_4 tetrahedra linked together in a polymeric form.

(D) of angular strain in the discrete P_4 tetrahedra where the angles are only 60°.

79. Red phosphorus in obtained by :

(A) cooling white phosphorus at $-573K$ in an inert atmosphere for several days.

(B) exposing white phosphorus to air

(C) heating black phosphorus at 573 K in an inert atmosphere for several days.

(D) heating white phosphorus at 573 K in an inert atmosphere for several days.

***80.** Red phosphorus :

(A) possesses an iron grey lustre **(B)** is non poisonous

(C) is insoluble in water but soluble in carbon disulphide.

(D) shows chemiluminescence

81. What is obtained on heating red phosphorus in a sealed tube at 803 K?

(A) White phosphorus **(B)** α -Black phosphorus

(C) β -Black phosphorus **(D)** Phosphorous pentoxide

82. β -black phosphorus is obtained by heating X at 473 K under high pressure X is:

(A) Red phosphorus **(B)** White phosphorus
(C) α -black phosphorus **(D)** Phosphorous pentoxide

***83.** α -black phosphorus :

(A) cannot be sublimed **(B)** has opaque monoclinic or rhombohedral crystals
(C) is a waxy translucent solid **(D)** does not oxidise in air

***84.** Phosphine is prepared by reaction of calcium phosphide with

(A) water **(B)** conc. HNO_3 **(C)** dil HCl **(D)** NaOH solution

85. In laboratory phosphine is prepared by heating X with conc NaOH solution in an inert atmosphere of CO_2 . X is :

(A) Red phosphorus **(B)** β -black phosphorus
(C) α -black phosphorus **(D)** White phosphorus

86. When pure phosphine is non inflammable but becomes inflammable owing to the presence of P_2H_4 or P_4 vapours. To purify it from the impurities phosphine is absorbed in X to form Y which is then treated with Z to give off phosphine X,Y and Z are respectively. :

(A) KOH, PH_3OH, KI **(B)** HI, PH_4I, KOH
(C) H_2SO_4, H_3PO_4, KI **(D)** CaI_2, Ca_3P_2, KOH

87. Match the following compounds with their properties.

	Column-I		**Column-II**
(P)	PH_3	**1**	Colourless oily liquid
(Q)	PCl_3	**2**	Colourless gas with rotten fish smell
(R)	PCl_5	**3**	Yellowish white powder.

Codes :

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

88. X is a highly poisonous compound. It explodes in contact with traces of oxidizing agents such as HNO_3, Cl_2 and Br_2 vapours. It is slightly soluble in water and a solution of X in water decomposes in the presence of light giving its constituents in their elemental forms. X is:

(A) PCl_3 **(B)** PH_3 **(C)** PCl_5 **(D)** H_3PO_2

89. $CuSO_4 + PH_3 \longrightarrow$ Products . The products are :

(A) Cu, H_3PO_2, SO_2 **(B)** Cu, H_2SO_4, P_4 **(C)** $Cu(PO_4)_2$, H_2SO_4 **(D)** Cu_3P_2, H_2SO_4

90. When phosphine is adsorbed in $HgCl_2$ solution, X is obtained. X is :

(A) Pure mercury **(B)** mercurous phosphide
(C) mercuric phosphide **(D)** mercuric phosphate

91. Phosphine is

(A) amphoteric **(B)** acidic **(C)** neutral **(D)** basic

92. Identify the product(s) in the following reaction : $PH_3 + HBr \longrightarrow$

(A) H_2 and PBr_3 **(B)** H_2 and PBr_5 **(C)** PH_4Br **(D)** H_2, PBr_3, PBr_5

93. Which property of phosphine enables its use in Holme's signals ?

(A) Its non-inflammability **(B)** Its toxicity

(C) Its spontaneous combustion **(D)** Its basicity

***94.** Phosphorus forms which of the following types of halides ?

(A) PX_2 **(B)** PX_3 **(C)** PX_4 **(D)** PX_5

***95.** PCl_3 can be prepared by :

(A) passing dry chlorine over heated white phosphorus

(B) adding HCl to phosphine

(C) reaction of calcium phosphide with dil HCl

(D) action of thionyl chloride with white phosphorus.

96. PCl_3 hydrolyses in the presence of moisture to give :

(A) H_3PO_4 and HCl **(B)** H_3PO_2 and HCl **(C)** H_3PO_3 and HCl **(D)** $H_4P_2O_5$ and HCl

97. In PCl_3, the hybridization of phosphorus atom is :

(A) sp **(B)** sp^2 **(C)** sp^3 **(D)** dsp^2

98. PCl_3 reacts with acetic acid and ethanol to form acetyl chloride and ethyl chloride respectively along with the formation of an acid. That acid is :

(A) Hypophosphorous acid **(B)** Pyrophosphorous acid

(C) Orthophosphorous acid **(D)** Orthophosphoric acid

99. The shape of PCl_3 is :

(A) tetrahedral **(B)** pyramidal

(C) trigonal planar **(D)** B or C depending on the temperature

100. On hydrolysis of PCl_5, X is formed which gets converted to Y.

$$PCl_5 + H_2O \longrightarrow X + HCl$$

$$X + H_2O \longrightarrow Y + HCl$$

X and Y are respectively :

(A) $POCl_3$ and H_3PO_3 **(B)** $(HPO_3)_3$ and H_3PO_3

(C) $(HPO_3)_3$ and H_3PO_4 **(D)** $POCl_3$ and H_3PO_4

101. In liquid and gaseous states, the shape of PCl_5 is:

(A) square pyramidal **(B)** Pentagonal

(C) Trigonal bipyramidal **(D)** Octahedral

***102.** Which of the following statements regarding the P-Cl bonds present in PCl_5 correct?

(A) The three equatorial bonds are longer than the two axial bonds

(B) The two axial bonds are longer than the three equatorial bonds

(C) The axial bond pairs suffer more repulsion than the equatorial bond pairs

(D) The equatorial bond pairs suffer more repulsion than the axial bond pairs

103. In the solid state PCl_5 exists as :

(A) a covalent solid having discrete trigonal bipyramidal PCl_5 units.

(B) an ionic solid, $[PCl_3]^{2+}[PCl_7]^{2-}$ where $[PCl_3]^{2+}$ is trigonal planar and $[PCl_7]^{2-}$ is pentagonal bipyramidal.

(C) an ionic solid, $[PCl_4]^{+}[PCl_6]^{-}$ where $[PCl_4]^{+}$ is tetrahedral and $[PCl_6]^{-}$ is octahedral.

(D) an ionic solid $[PCl_4]^{+}[PCl_6]^{-}$ where $[PCl_4]^{+}$ is square planar and $[PCl_6]^{-}$ is octahedral.

104. Match the following compounds with their molecular formulae :

Column-I (Name)		**Column-II (Formula)**	
(P)	Hypophosphorous acid	**1**	$H_4P_2O_6$
(Q)	Pyrophosphorous acid	**2**	$H_4P_2O_5$
(R)	Hypophosphoric	**3**	H_3PO_2
(S)	Pyrophosphoric	**4**	$H_4P_2O_7$

Codes :

	P	**Q**	**R**	**S**		**P**	**Q**	**R**	**S**
(A)	2	1	3	4	**(B)**	3	2	1	4
(C)	1	2	3	4	**(D)**	1	2	4	3

105. In which of the following oxo-acids, is the oxidation state of phosphorus +4?

(A) Pyrophosphorous acid **(B)** Phyrophosphoric aicd

(C) Metaphosphoric acid **(D)** Hypophosphoric acid

106. Match the following oxoacids of phosphorus with the methods of their preparation.

Column-I (Name)		**Column-II (Preparation)**	
(P)	Hypophosphorous acid	**1**	$PCl_5 + H_3PO_3$
(Q)	Hypophosphoric acid	**2**	Red P_4+ alkali
(R)	Orthophosphorous acid	**3**	$P_4O_{10} + H_2O$
(S)	Orthophosphoric aicd	**4**	White P_4 + alkali
(T)	Pyrophosphorous acid	**5**	$P_2O_3 + H_2O$

Codes :

	P	**Q**	**R**	**S**	**T**		**P**	**Q**	**R**	**S**	**T**
(A)	2	4	3	5	1	**(B)**	1	4	2	3	5
(C)	2	4	5	3	1	**(D)**	4	2	5	3	1

107. Which of the following oxo-acids tend to disproportionate to higher and lower oxidation states on heating ?

(A) H_3PO_4 **(B)** H_3PO_2 **(C)** H_3PO_3 **(D)** $H_4P_2O_6$

***108.** Which of the following oxo-acids have reducing properties ?

(A) H_3PO_4 **(B)** H_3PO_3 **(C)** H_3PO_2 **(D)** $H_4P_2O_7$

109. The basicity of H_3PO_2, H_3PO_3 and H_3PO_4 are respectively:

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

Group - 16

110. The elements known as 'Chalcogens' belong to Group :

(A) 15 **(B)** 16 **(C)** 17 **(D)** 18

111. Match the following :

Column-I		Column-II	
(P)	Gypsum	**1**	$BaSO_4$
(Q)	Espom salt	**2**	$CaSO_4.2H_2O$
(R)	Baryte	**3**	ZnS
(S)	Galena	**4**	$MgSO_4.7H_2O$
		5	PbS

Codes :

	P	Q	R	S		P	Q	R	S
(A)	4	1	2	3	**(B)**	4	2	1	3
(C)	2	4	1	3	**(D)**	2	4	1	5

***112.** Which of the following organic materials contain sulphur ?

(A) Eggs **(B)** Onion **(C)** Mustard **(D)** Garlic

113. Match the following :

Column-I (Element)		**Column-II** (Electronic configuration)	
(P)	S	**1**	$[Kr]4d^{10}5s^25p^4$
(Q)	Se	**2**	$[Ne]3s^23p^4$
(R)	Po	**3**	$[Xe]4f^{14}5d^{10}6s^26p^4$
(S)	Te	**4**	$[Ar]3d^{10}4s^24p^4$

Codes :

	P	Q	R	S		P	Q	R	S
(A)	3	1	4	2	**(B)**	2	4	3	1
(C)	2	1	4	3	**(D)**	1	2	3	4

114. In Group 16 elements the stability of –2 oxidation state follows the order :

(A) O < S < Se < Te < Po **(B)** O > S < Se < Te < Po

(C) O > S > Se > Te > Po **(D)** O > S > Se > Te < Po

115. In which of the following compounds does oxygen show an oxidation state of +2?

(A) H_2O **(B)** OF_2 **(C)** SO_2 **(D)** Cl_2O

116. Which of the following statements regarding Group 16 elements are true ?

(I) S, Se and Te usually show +4 oxidation state in their compounds with oxygen and +6 oxidation state in their compounds with fluorine.

(II) The stability of +6 oxidation state increases and that of +4 oxidation state decreases as we go down the group

(III) Bonding in +4 and +6 oxidation states is primarily ionic.

(A) Only II **(B)** I and III **(C)** Only I **(D)** I, II and III

117. Consider the following statement : "Strong hydrogen bonding is present in H_2O but not in H_2S"

(A) The above statement is false

(B) The above statement is true and this effect is due to the small size and low electronegativity of oxygen.

(C) The above statement is true and this effect is due to the large size and high electronegativity of oxygen.

(D) The above statement is true and this effect is due to the small size and high electronegativity of oxygen.

***118.** Which of the following statements regarding the hydrides of the type H_2E of Group 16 elements are true ?

(A) As we go down the group, the acidic character of the hydrides increases due to increase in bond (H-E) dissociation enthalpy.

(B) The thermal stability of the hydrides decreases from H_2O to H_2Po

(C) All hydrides except water possess reducing property.

(D) The reducing character decreases from H_2S to H_2Te.

***119.** Which of the following statements are NOT correct regarding the oxides of Group – 16 elements ?

(A) The reducing property of dioxide increases from SO_2 to TeO_2.

(B) SO_2 is oxidizing while TeO_2 is a reducing agent

(C) Both the types of oxides EO_2 and EO_3 are basic in nature.

(D) O_3 and SO_2 are gases whereas SeO_2 is a solid.

120. The stability of the halides of Group 16 elements follows the order :

(A) Fluorides < Chlorides < Bromides < Iodides

(B) Fluorides > Chlorides > Bromides < Iodides

(C) Fluorides > Chlorides < Bromides < Iodides

(D) Fluorides > Chlorides > Bromides > Iodides

121. Which is the most stable hexahalide of Group – 16 elements ?

(A) hexafluoride **(B)** hexachloride **(C)** hexabromide **(D)** hexaiodide

122. Which of the following statements regarding hexafluorides of Group 16 elements true ?

(A) They have octahedral structure

(B) They are gaseous in nature

(C) SF_6 is exceptionally stable due to steric reasons.

(D) All of the above

123. SF_4, SeF_4, TeF_4 have which of the following type of hybridization?

(A) sp^3 **(B)** sp^3d **(C)** dsp^2 **(D)** sp^3d^2

124. The dihalides of Group 16 elements have which of the following hybridization ?

(A) sp^2 **(B)** sp **(C)** sp^3 **(D)** dsp^2

125. Many monohalides of group 16 elements such as S_2F_2, S_2Cl_2, S_2Br_2, Se_2Cl_2, Se_2Br_2 are dimeric in nature. Consider the following reaction of Se_2Cl_2

$$Se_2Cl_2 \longrightarrow \text{Products .}$$

The products are :

(A) $SeCl_2$, Se **(B)** $SeCl_6$, Se **(C)** $SeCl_4$, Se **(D)** Se, Cl_2

***126.** By which of the following ways can O_2 be prepared in the laboratory?

(A) By heating oxygen containing salts such as chlorates, nitrates and permanganates.

(B) By thermal decomposition of the oxides of metals low in the electrochemical series and higher oxides of some metals.

(C) By decomposition of hydrogen peroxide by catalysts such as finely divided metals and manganesc dioxide.

(D) By addition of conc H_2SO_4 to copper.

***127.** Which of the following are stable isotopes of oxygen?

(A) ^{15}O **(B)** ^{16}O **(C)** ^{17}O **(D)** ^{18}O

***128.** Molecular oxygen is:

(A) paramagnetic **(B)** diamagnetic

(C) has odd number of electrons **(D)** has even number of electrons

129. To initiate the combination reaction of oxygen with other elements, some external heating is required. This is because:

(A) The reaction is often strongly exothermic

(B) The reaction is always endothermic

(C) The bond dissociation enthalpy of oxygen – oxygen double bond is very low.

(D) The bond dissociation enthalpy of oxygen – oxygen double bond is high.

130. Which of the following metals does not react with oxygen directly ?

(A) Zn **(B)** Pt **(C)** Ca **(D)** Fe

***131.** Which of the following oxides are not acidic in nature?

(A) SO_2 **(B)** CaO **(C)** V_2O_5 **(D)** BaO

***132.** Which of the following oxides are amphoteric in nature ?

(A) ZnO **(B)** Al_2O_3 **(C)** CaO **(D)** SO_2

***133.** Which of the following oxides are neutral ?

(A) N_2O **(B)** CO **(C)** NO **(D)** NO_2

134. Ozone is made by :

(A) heating SO_3 in a closed container

(B) reaction of SO_2 with O_2

(C) passing SO_2 through water

(D) passing a slow dry stream of oxygen through a silent electrical discharge.

***135.** Which of the following statements regarding ozone are NOT true ?

(A) Formation of ozone is an exothermic process

(B) Even in small concentrations, ozone is highly poisonous

(C) If the concentration of ozone rises above about 100 parts per million, breathing becomes uncomfortable resulting in headache & nausea.

(D) Ozone is exceptionally stable thermo dynamically with respect to oxygen.

136. The conversion of ozone into oxygen results in :

(A) absorption of heat and decrease in entropy due to which ΔG has a large positive value.

(B) liberation of heat and increase in entropy due to which ΔG has a small negative value.

(C) absorption of heat and decrease in entropy due to which ΔG has a small negative value.

(D) liberation of heat and increase in entropy due to which ΔG has a large negative value.

137. O_3 is a :

(A) weak reducing agent **(B)** powerful reducing agent

(C) weak dehydrating agent **(D)** powerful oxidizing agent

138. $PbS + O_3 \longrightarrow$ Products

The products are :

(A) $PbO + SO_2$ **(B)** $PbSO_4 + O_2$ **(C)** $Pb + SO_2 + O_2$ **(D)** $PbO + SO_3$

139. Which of the following is a quantitative method for estimating O_3 gas ?

(A) Reaction of O_3 with excess KI solution buffered with a borate buffer and subsequent titration of the liberated I_2 against a standard solution of potassium hydroxide.

(B) Passing a slow dry stream of oxygen through a silent electrical discharge.

(C) Reaction of O_3 with excess of KI solution buffered with a borate buffer and subsequent titration of the liberated I_2 against a standard solution of sodium thiosulphate

(D) Passing ozone through solid lead sulphide.

***140.** Which of the following are responsible for the slow depletion of the ozone layer in the upper atmosphere ?

(A) Emission of nitrogen oxides from the exhaust systems of supersonic jet aeroplanes.

(B) Use of freons in aerosol sprays and as refrigerants.

(C) Large scale deforestation and increase in the amount of green house gases.

(D) Radiations from nuclear wastes.

***141.** Which of the following statements regarding ozone are true ?

(A) It is a linear molecule

(B) It is used as a germicide, disinfectant and for sterlising water.

(C) It is used for bleaching oils, ivory, flour, starch etc.

(D) It is used in the manufacture of $KMnO_4$.

***142.** Which of the following statements are correct ?

(A) Rhombic sulphur is prepared by melting monoclinic sulphur in a dish and cooling till crust is formed.

(B) Rhombic sulphur is yellow in colour whereas monoclinic sulphur is colourless.

(C) Rhombic sulphur is insoluble in CS_2 whereas monoclinic sulphur dissolves readily in CS_2.

(D) Rhombic sulphur is also called α -sulphur and monoclinic sulphur is called β -sulphur.

143. Which of the following statements is(are) correct?

I Rhombic sulphur has S_8 molecules in which the ring is puckered and has a crown shape.

II Monoclinic sulphur has S_6 molecules having chair shaped rings.

III α -sulphur is stable above 369 K and β -sulphur is stable below 369 K.

(A) Only I **(B)** Only III **(C)** I, II and III **(D)** I and II

***144.** SO_2 is obtained by :

(A) burning of S in air **(B)** treating a sulphite with strong base

(C) treating a sulphite with dil H_2SO_4 **(D)** roasting of sulphide ores.

145. When SO_2 is dissolved in water, a solution of X is formed. X is :

(A) H_2SO_3 **(B)** H_2SO_4 **(C)** $H_2S_2O_8$ **(D)** $H_2S_2O_7$

146. $NaOH + SO_2 \longrightarrow X + H_2O$; $X + H_2O + SO_2 \longrightarrow Y$

X and Y are respectively :

(A) $NaHSO_3$, Na_2SO_3 **(B)** $NaHSO_4$, Na_2SO_4

(C) Na_2SO_3, $NaHSO_3$ **(D)** Na_2SO_4, $NaHSO_4$

147. SO_2 reacts with chlorine in the presence of charcoal (as catalyst) to give sulphuryl chloride. The formula of sulphuryl chloride is:

(A) $SOCl_2$ **(B)** SO_2Cl_2 **(C)** SO_2Cl_3 **(D)** $SOCl_3$

148. SO_2 is oxidized to SO_3 in the presence of which of the following compounds as catalyst?

(A) MnO_2 **(B)** V_2O_5 **(C)** SiO_2 **(D)** MgO

149. When moist, SO_2 behaves as :

(A) an oxidizing agent **(B)** a dehydrating agent

(C) a reducing agent **(D)** a dehydrohalogenating agent

***150.** Which of the following reactions is used as a test for detection of SO_2 gas ?

(A) passing SO_2 through NaOH solution **(B)** passing SO_2 through distilled water

(C) passing SO_2 through lime water **(D)** passing SO_2 through acidified $KMnO_4$ solution

151. Which of the following statements is(are) correct?

I SO_2 is a linear molecule

II SO_2 is used in refining petroleum and sugar

III SO_2 is used in bleaching wool and silk and also as a disinfectant.

(A) Only I **(B)** I, II, III **(D)** II and III **(D)** I and III

152. Match the following :

	Column-I (Name)		**Column-II Formula)**
(P)	Sulphurous acid	**1**	$H_2S_2O_8$
(Q)	Sulphuric acid	**2**	$H_2S_2O_7$
(R)	Peroxdisulphuric acid	**3**	H_2SO_3
(S)	Pyrosulphuric acid	**4**	H_2SO_4

Codes :

	P	**Q**	**R**	**S**		**P**	**Q**	**R**	**S**
(A)	3	4	2	1	**(B)**	4	3	2	1
(C)	1	4	2	3	**(D)**	3	4	1	2

153. Sulphuric acid is manufactured by :

(A) Haber's Process **(B)** McMurry reaction

(C) Etard Reaction **(D)** Contact Process

154. Oleum is:

(A) $H_2S_2O_8$ **(B)** $H_2S_2O_7$ **(B)** $H_2S_2O_5$ **(D)** $H_2S_3O_7$

***155.** Which of the following statements are correct regarding the following reaction ?

$$2SO_2 + O_2 \longrightarrow 2SO_3$$

(A) V_2O_5 is used as the catalyst **(B)** The reaction is irreversible

(C) The reaction is endothermic **(D)** Forward reaction leads to decrease in volume

***156.** Which of the following characteristics are correct regarding H_2SO_4?

(A) low volatility **(B)** strong acidic character

(C) strong affinity for water **(D)** ability to act as a reducing agent

157. H_2SO_4 ionises in two steps :

$$H_2SO_4(aq) + H_2O(\ell) \longrightarrow H_3O^+(aq) + HSO_4^-(aq) \qquad K_{a_1}$$

$$HSO_4^-(aq) + H_2O(\ell) \longrightarrow H_3O^+(aq) + SO_4^{2-}(aq) \qquad K_{a_1}$$

(A) $K_{a_1} = K_{a_2}$ **(B)** $K_{a_1} >> K_{a_2}$ **(C)** $K_{a_1} << K_{a_2}$

(D) Any of the above depending on the concentration of acid

***158.** Which of the following statements are correct?

(A) Because of its high volatility, H_2SO_4 can be used to manufacture less volatile acids from their corresponding salts.

(B) Many wet gases can be dried by passing them through conc H_2SO_4, provided the gases do not react with the acid.

(C) H_2SO_4 removes water from organic compounds and chars carbohydrates

(D) The order of strength of oxidizing agent is $H_2SO_4 < H_3PO_4 < HNO_3$

Group - 17

159. Which of the following elements is a radioactive halogen ?

(A) Francium **(B)** Radium **(C)** Actinium **(D)** Astatine

160. Match the following :

Column-I (Name)		**Column-II Formula)**	
(P)	Fluorspar	**1**	$Ca_3(PO_4)_2.CaF_2$
(Q)	Cryolite	**2**	Na_3AlF_6
(R)	Fluoroapatite	**3**	CaF_2
(S)	Carnalite	**4**	Na_2AlF_5
		5	$KCl.MgCl_2.6H_2O$

Codes :

	P	**Q**	**R**	**S**		**P**	**Q**	**R**	**S**
(A)	3	4	1	5	**(B)**	1	4	3	5
(C)	2	4	3	1	**(D)**	3	2	1	5

161. The correct order of electron gain enthalpy of the halogens is ;
(A) F > Cl > Br > I **(B)** F < Cl > Br > I **(C)** F < Cl < Br < I **(D)** F > Cl < Br < I

162. Which of the following statements is(are) true ?
I The noble gases have the smallest atomic radii in their respective periods.
II Halogens have maximum electron gain enthalpy in the corresponding periods
III The negative electron gain enthalpy of chlorine is more than that of fluorine.
(A) I and II **(B)** Only II **(C)** II and III **(D)** I, II and III

163. The most electronegative element in the periodic table is :
(A) Iodine **(B)** Fluorine **(C)** Oxygen **(D)** Francium

***164.** Which of the following statements are correct ?
(A) Halogens have maximum negative electron gain enthalpy in their respective period due to their small size and low effective nuclear charge.
(B) F_2, Cl_2 and Br_2 are gases whereas I_2 is a solid
(C) F_2 has yellow, Cl_2, greenish yellow, Br_2, red and I_2, violet colour
(D) The halogens are coloured due to absorption of radiations in visible region which result in the excitation of outer electrons to higher energy levels.

***165.** Br_2 and I_2 are only sparingly soluble in water but are soluble in which of the following solvents ?
(A) $CHCl_3$ **(B)** CCl_4 **(C)** CS_2 **(D)** Hydrocarbons

166. Which of the following is the correct order of the bond dissociation enthalpy (X – X) of the elements of Group-17?
(A) F – F < Cl – Cl < Br – Br < I – I **(B)** F – F < C l – Cl > Br – Br > I – I
(C) F – F > Cl – Cl > Br – Br > I – I **(D)** F – F > Cl – Cl < Br – Br < I – I

167. The bond dissociation enthalpy of F – F bond is less than that of Cl – Cl bond because ;
(A) of higher electronegativity of fluorine atom
(B) of higher ionization enthalpy of fluorine atom
(C) the electron gain enthalpy of fluorine is less negative as compared to chlorine
(D) of relatively large electron – electron repulsion among the lone pairs in F_2 molecule where they are much closer to catch other than in the case of Cl_2

***168.** Why is fluorine a stronger oxidizing agent than chlorine ?
(A) high positive ionization enthalpy of fluorine
(B) low enthalpy of dissociation of F – F bond
(C) high hydration enthalpy of $F^{\ominus}$
(D) less negative electron gain enthalpy of fluorine as compared to chlorine.

***169.** All halogens exhibit –1 oxidation state. However, which of the following halogens exhibit oxidation states +1, +3, + 5 and +7 also?
(A) Fluorine **(B)** Chlorine **(C)** Bromine **(D)** Iodine

170. The higher oxidation states (+1, +3, +5 and +7) of chlorine, bromine and iodine are realized when they are in combination with :
(A) Group 14 elements **(B)** s-block elements
(C) small and highly electronegative fluorine and oxygen atoms **(D)** Both A and C

171. In their oxides and oxoacids, chlorine and bromine exhibit the oxidation state :
(A) +1, –1, **(B)** +3, –1 **(C)** +4, +6 **(D)** + 1, +3

172. When can't fluorine exhibit +3, +5 or +7 oxidation states ?
(A) low enthalpy of dissociation of F – F bond **(B)** high hydration enthalpy of $F^{\ominus}$
(C) absence of d orbitals in its valence shell **(D)** presence of p-orbitals in its valence shell.

*__173.__ Which of the following statements are not correct?
(A) Halogens are extremely unreactive
(B) The halogens react with only metals and not with non - metals
(C) The reactivity of the halogens increases down the group.
(D) The ready acceptance of an electron is the reason for the strong oxidizing nature of halogens.

174. Which halogen is most stongly oxidizing and oxidises other halide ions in solution and even in the solid phase ?
(A) Chlorine **(B)** Fluorine **(C)** Bromine **(D)** Iodine

175. What is the correct order of the oxidising ability of the halogens ?
(A) $Cl_2 > F_2 > Br_2 > I_2$ **(B)** $F_2 > Br_2 > Cl_2 > I_2$
(C) $F_2 > Cl_2 > I_2 > Br_2$ **(D)** $F_2 > Cl_2 > Br_2 > I_2$

***176.** Which of the following statements are correct ?
(A) Cl_2 and Br_2 oxidise water to O_2 whereas F_2 reacts with water to form hydrofluoric acid.
(B) F_2 and Cl_2 oxidise water to O_2 whereas Br_2 reacts with water to form hydrobromic acid.
(C) F_2 oxidises water to O_2 whereas Br_2 and Cl_2 react with water to form the corresponding hydrohalic and hypohalous acids.
(D) I^- can be oxidized by oxygen in acidic medium.

***177.** Which of the following properties of fluorine have higher values than expected from the trend set by other halogens ?
(A) electronegativity **(B)** electron gain enthalpy
(C) ionization enthalpy **(D)** electrode potential

***178.** Fluorine is anomalous in many properties. This is due to its :
(A) small size **(B)** highest electronegativity
(C) high F – F bond dissociation energy **(D)** non availability of d orbitals in valence shell

179. Most of the reactions of fluorine are :
(A) endothermic due to strong bond formed by it with other elements
(B) exothermic due to weak bond formed by it with other elements.
(C) endothermic due to weak bond formed by it with other elements
(D) exothermic due to strong bond formed by it with other elements

180. Which of the following halogens forms only one oxoacid?
(A) Fluorine **(B)** Chlorine **(C)** Bromine **(D)** Iodine

181. Which of the following is a liquid at 10°C?
(A) HCl **(B)** HBr **(C)** HF **(D)** HI

182. Which of the following represents the correct order of affinity of the halogens towards hydrogen ?
(A) fluorine < chlorine < bromine < iodine **(B)** fluorine < chlorine > bromine > iodine
(C) fluorine > chlorine < bromine > iodine **(D)** fluorine > chlorine > bromine > iodine

183. Hydrogen halides dissolve in water to form hydrohalic acids. The acidic strength of these acids varies in the order :

(A) HF > HCl > HBr > HI **(B)** HF < HCl > HBr > HI

(C) HF < HCl < HBr < HI **(D)** HF < HCl < HBr > HI

184. Match the following :

	Column-I		Column-II
(P)	Order of melting point	**1**	HF > HCl > HBr > HI
(Q)	Order of boiling point	**2**	HCl < HBr < HF < HI
(R)	Order of bond dissociation enthalpy	**3**	HCl < HBr < HI < HF
(S)	Order of bond length	**4**	HF < HCl < HBr < HI

Codes :

	P	Q	R	S		P	Q	R	S
(A)	1	3	4	2	**(B)**	3	2	4	1
(C)	3	1	2	4	**(D)**	2	3	1	4

185. Oxygen fluorides are strong :

(A) reducing agents **(B)** fluorinating agents

(C) dehydrating agents **(D)** None of the above

186. How is plutonium removed from spent nuclear fuel ?

(A) It is reduced by O_2F_2 to PuF_6 and then removed in this form

(B) It is oxidized by O_2F_2 to PuF_2 and then removed in this form

(C) It is oxidized by O_2F_2 to PuF_6 and then removed in this form.

(D) It cannot be removed.

187. What is the correct order of stability of oxides formed by halogens ?

(A) I < Cl < Br **(B)** I < Br < Cl **(C)** I > Cl > Br **(D)** I > Br > Cl

188. Which of the following is used as a bleaching agent for paper pulp and textiles and in water treatment ?

(A) I_2O_5 **(B)** ClO_2 **(C)** Cl_2O **(D)** Br_2O

189. Which of the following is used in the estimation of CO?

(A) BrO_3 **(B)** Cl_2O_6 **(C)** I_2O_5 **(D)** Cl_2O_7

190. Halogens react with metals to form metal halides. The ionic character of the halides follows the order:
(M is a monovalent metal)

(A) MF < MCl < MBr < MI **(B)** MF < MI < MBr < MCl

(C) MI < MCl < MBr < MF **(D)** MI < MBr < MCl < MF

191. Which of the following statements are correct ?

I If a metal exhibits more than one oxidation state, the halides of that metal in higher oxidation state will be more ionic than the ones in lower oxidation stable.

II The higher oxides of halogen tend to be less stable than the lower ones.

(A) Only I **(B)** Only II **(C)** Both I and II **(D)** Neither I nor II

192. Halogens combine amongst themselves to form a number of compounds known as inter-halogens. Which of the following statements regarding inter-halogens correct?

I They are of the type : XX', XX'_3, XX'_5, XX'_7

II X is a large size halogen and X' is smaller size halogen.

(A) Only I **(B)** Only II **(C)** Both I and II **(D)** None of the above

***193.** Chlorine can be prepared by :

(A) heating MnO_2 with conc. HCl

(B) heating MnO_2 with a mixture of NaCl and H_2SO_4

(C) heating MnO_2 with a mixture of NaCl and NaOH

(D) electrolysis of brine

194. The Deacon's Process is used in the manufacture of :

(A) Chlorine **(B)** hydrogen chloride

(C) Hypochlorous acid **(D)** Inter-halogen compounds

195. In the Deacon's Process, HCl gas is oxidized by atmospheric oxygen in the presence of which of the following compounds as catalyst ?

(A) $FeCl_3$ **(B)** MnO_2 **(C)** $CuCl_2$ **(D)** Ni

***196.** Which of the following statements regarding chlorine are correct ?

(A) It is a greenish – yellow gas **(B)** It has a fruity odour

(C) It is soluble in water **(D)** It has great affinity for hydrogen

197. $S_8 + Cl_2 \longrightarrow X$

X is :

(A) SCl_2 **(B)** S_2Cl_3 **(C)** SCl_4 **(D)** S_2Cl_2

198. $\underset{\text{(excess)}}{NH_3} + Cl_2 \longrightarrow$ Products

The products are :

(A) NCl_3 and HCl **(B)** NH_4Cl and HCl **(C)** NH_4Cl and N_2 **(D)** N_2 and HCl

199. $NH_3 + \underset{\text{(excess)}}{Cl_2} \longrightarrow$ Products

The products are :

(A) NCl_3 and HCl **(B)** NH_4Cl and HCl **(C)** NH_4Cl and N_2 **(D)** N_2 and HCl

200. Consider the following reactions :

$$\underset{\text{(cold and dilute)}}{NaOH} + Cl_2 \longrightarrow X + NaCl + H_2O$$

$$\underset{\text{(hot and conc.)}}{NaOH} + Cl_2 \longrightarrow Y + NaCl + H_2O$$

X and Y are respectively :

(A) NaOCl and $NaClO_4$ **(B)** $NaClO_3$ and NaOCl

(C) $NaClO_3$ and $NaClO_4$ **(D)** NaOCl and $NaClO_3$

201. Chlorine reacts with dry slaked lime to give :

(A) washing powder **(B)** baking powder

(C) bleaching powder **(D)** Plaster of Paris

***202.** Which of the following statements are correct ?

(A) Chlorine reacts with saturated hydrocarbons to give addition products

(B) Chlorine reacts with unsaturated hydrocarbons to give substitution products

(C) Chlorine water on standing loses its yellow colour due to the formation of HCl and HOCl

(D) Hypochlorous acid (HOCl) gives nascent oxygen which is responsible for oxidizing and bleaching properties of chlorine.

***203.** Which of the following statements are correct ?

(A) Chlorine oxidizes Fe^{2+} to Fe^{3+}, SO_3^{2-} to SO_4^{2-}, SO_2 to SO_4^{2-}, I_2 to IO_3^-

(B) The bleaching action of chlorine is temporary

(C) Chlorine is used in the extraction of gold and platinum

(D) Chlorine is used in the manufacture of DDT and refrigerants.

204. Chlorine is used in the manufacture of the following poisonous gases. Match the names with the formulae:

Column-I		Column-II	
(P)	Phosgene	**1**	$Cl\,CH_2\,CH_2S\,CH_2CH_2Cl$
(Q)	Mustard gas	**2**	$COCl_2$
(R)	Tear gas	**3**	CCl_3NO_2
		4	CCl_3NO_3

Codes :

	P	Q	R		P	Q	R
(A)	4	2	1	**(B)**	3	2	1
(C)	2	1	4	**(D)**	2	1	3

205. What is obtained on heating NaCl with Conc H_2SO_4?

(A) NaOH, H_2, SO_2, Cl_2 **(B)** Na_2SO_4, HCl

(C) Na_2SO_4, SO_2, Cl_2 **(D)** NaH, SO_2, Cl_2

206. Aqua regia is used for dissolving noble metals such as gold and platinum. Aqua regia is a mixture of :

(A) conc HCl and conc HNO_3 in the ratio 1 : 3 respectively

(B) conc HCl and dil HNO_3 in the ratio 1 : 3 respectively.

(C) conc HCl and conc HNO_3 in the ratio 3 : 1 respectively.

(D) conc HCl and dil HNO_3 in the ratio 3 : 1 respectively.

***207.** Which of the following statements are correct?

(A) HCl decomposes salts of strong acids

(B) HCl decomposes salts of weak acids

(C) HCl reacts with finely powdered iron to form $FeCl_3$.

(D) HCl reacts with finely powdered iron to form $FeCl_2$

208. Fluorine forms only one oxo-acid. Its formula is :

(A) HOFO **(B)** $HOFO_2$ **(C)** HOF **(D)** $HOFO_3$

209. Match the following :

	Column-I		Column-II
(P)	Hypochlorous acid	**1**	$HOClO_3$
(Q)	Chlorous acid	**2**	HOCl
(R)	Chloric acid	**3**	$HOClO_2$
(S)	Perchloric acid	**4**	HOClO

Codes :

	P	Q	R	S		P	Q	R	S
(A)	4	2	3	1	**(B)**	4	2	1	3
(C)	2	4	1	3	**(D)**	2	4	3	1

***210.** When two different halogens react with each other, interhalogen compounds are formed. Which of the following statements regarding them are correct?

(A) They can be assigned general compositions as XX', XX'_3, $XX'_5 XX'_7$

(B) X is halogen of smaller size and X' of larger size

(C) X is more electropositive than X'

(D) As the ratio between radii of X and X' decreases, the number of atoms per molecule increases.

211. The shapes of IF_5 and IF_3 are respectively :

(A) square pyramidal and tetrahedral **(B)** square pyramidal and lrnt T – shaped

(C) trigonal bipyramidal and tetrahedral **(D)** trigonal bipyramidal and lrnt T-shaped

***212.** Which of the following statements regarding inter-halogen compounds are correct ?

(A) All of them except IF_7 are covalent.

(B) All of them are diamagnetic in nature

(C) All are volatile solids or liquids at room temperature except ClF which is a gas.

(D) They can be prepared by direct combination or by the action of halogen on lower inter-halogen compounds.

213. Consider the following statements :

I Inter-halogen compounds are less reactive than halogens (except fluorine)

II $X - X'$ bond in inter-halogens is stronger than X – X bond in halogens except F – F bond.

(A) Both are correct and II is the correct explanation for I **(B)** Only I is correct

(C) Only II is correct **(D)** Both are incorrect

214. The inter halogen compounds undergo hydrolysis to give halide ion derived from the smaller halogen and an anion derived from the large halogen. Match these anions with the inter halogen compound from which they are derived.

	Column-I		Column-II
(P)	Hypohalite	**1**	XX'_5
(Q)	Halite	**2**	XX'_7
(R)	Halate	**3**	XX'
(S)	Perhalate	**4**	XX'_3

Codes :

	P	Q	R	S		P	Q	R	S
(A)	1	2	3	4	**(B)**	3	4	1	2
(C)	4	3	1	2	**(D)**	2	1	4	3

215. Which of the following statements regarding interhalogen compounds is(are) correct?

(A) They are used as non aqueous solvents

(B) They are very useful fluorinating agents

(C) ClF_3 and BrF_3 are used for the production of UF_6 in the enrichment of ^{325}U

(D) All of the above.

Group - 18

216. Which of the following noble gases does not occur in the atmosphere?

(A) Krypton **(B)** Xenon **(C)** Radon **(D)** Neon

217. The atmospheric abundance of noble gases in dry air is ~1%. Which of the following noble gases is the major constituent ?

(A) Helium **(B)** Krypton **(C)** Xenon **(D)** Argon

218. Which is the main commercial source of helium ?

(A) Ocean water **(B)** Atmosphere **(C)** Natural Gas **(D)** Volcanic lava

***219.** Which of the following are the rarest elements of Group – 18?

(A) Helium **(B)** Krypton **(C)** Radon **(D)** Xenon

***220.** Which of the following statements regarding Group 18 elements are correct?

(A) They are chemically unreactive

(B) He, Ne, ar and Kr are gases whereas Xe and Rn are solids

(C) They have general electronic configuration ns^2np^6 except Helium which has $1s^2$.

(D) They have very high ionization enthalpy and it increases as we go down the group.

***221.** Which of the following noble gases are not radioactive ?

(A) Neon **(B)** Argon **(C)** Krypton **(D)** Xenon

222. The electronic configuration of Xenon is :

(A) $[Ar]3d^{10}4s^24p^6$ **(B)** $[Kr]4f^{14}5d^{10}6s^26p^6$

(C) $[Kr]4d^{10}5s^25p^6$ **(D)** $[Ar]4d^{10}5s^25p^6$

***223.** Which of the following statements regarding group 18 elements are correct ?

(A) They have large positive values of electron gain enthalpy

(B) They are sparingly soluble in water

(C) They have low melting but high boiling points.

(D) The only type of inter-atomic interaction in these elements is weak dispersion force

224. Which of the following elements has the lowest boiling point of any known substance ?

(A) Helium **(B)** Krypton **(C)** Neon **(D)** Radon

225. Which of the following noble gas has an unusual property of diffusing through most commonly used laboratory material such as rubber, glass or plastic?

(A) Helium **(B)** Krypton **(C)** Neon **(D)** Radon

***226** The inertness of the noble gases to chemical reactivity is attributed to which of the following reasons ?

(A) The noble gases except helium ($1s^2$) have completely filled ns^2np^6 electronic configuration in their valence shell.

(B) They have low ionization enthalpy and high negative electron gain enthalpy.

(C) They have high ionization enthalpy and highly positive electron gain enthalpy.

(D) They have very small size

***227.** Which of the following fluorides are formed by xenon ?

(A) XeF **(B)** XeF_2 **(C)** XeF_4 **(D)** XeF_6

228. Match the following

Column-I		Column-II	
(P)	$Xe(g) + \underset{\text{excess}}{F_2(g)} \xrightarrow{673,1bar}$	**1**	$XeF_4(s)$
(Q)	$Xe(g) + F_2(g) \xrightarrow{873K,7bar}$ (1 : 5 ratio)	**2**	$XeF_6(s)$
(R)	$Xe(g) + F_2(g) \xrightarrow{573K,\ 60-70\ bar}$ (1 : 20 ratio)	**3**	$XeF_2(s)$

Codes :

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

229. The structures of XeF_2, XeF_4 and XeF_6 are respectively:

(A) bent, square planar and distorted octahedral

(B) bent, tetrahedral and pentagonal pyramidal

(C) linear, square planar and distorted octahedral

(D) linear, tetrahedral and distorted octahedral

230. Complete hydrolysis of XeF_4 and XeF_6 with water gives :

(A) $XeOF_4$ **(B)** XeO_4 **(C)** XeO_3 **(D)** XeO_2F_2

231 Which of the following statements are NOT true ?

(A) XeF_2, XeF_4 and XeF_6 are powerful fluorinating agents.

(B) XeF_2, XeF_4 and XeF_6 are readily hydrolysed by even traces of water.

(C) Xenon fluorides react with fluoride ion acceptors to form cationic species and fluoride ion donors to form fluoroanions.

(D) None of the above

232. The structures of XeO_3 and $XeOF_4$ are respectively.

(A) trigonal planar and trigonal bipyramidal **(B)** tetrahedral and trigonal bipyramidal

(C) tetrahedral and square pyramidal **(D)** pyramidal and square pyramidal

***233.** Helium is a non-inflammable and light gas. It is used :

(A) in filling balloons for meterological observations **(B)** in gas – cooled nuclear reactors

(C) as a cryogenic agent (in liquid form) **(D)** as a diluent for oxygen in diving apparatus

234. Which of the following gases is used to provide an inert atmosphere in higher temperature metallurgical process ?

(A) Helium **(B)** Xenon **(C)** Argon **(D)** Krypton

***235.** Partial hydrolysis of XeF_6 gives :

(A) $XeOF_2$ **(B)** XeO_2F_2 **(C)** $XeOF_4$ **(D)** XeO_2F_4

d & f -Block Elements

1. Which of the following statement is true ?

(A) Transition metal and many of their compounds show paramagnetic behaviour.

(B) The enthalpy of atomisation of the transition metal are high.

(C) Transition metal and their compounds act as good catalyst.

(D) All the above

2. General electronic configuration of d-block element is :

(A) $ns^2np^2nd^{1-10}$ **(B)** $(n-1)d^{0-10}ns^2$ **(C)** $(n-1)d^{1-10}ns^2$ **(D)** $nd^{1-10}ns^2$

3. Consider the following statements :

I. Melting point of Mn is maximum in 3d series because of maximum number of unpaired electron.

II. Greater the number of valence electron, stronger is the resulting bonding.

III. Metals with high enthalpy of atomisation tends to be noble in their reaction.

IV. Metal of first transition series have greater enthalpy of atomisation than metal of third and second transition series.

Among above statements, correct statements are :

(A) I, II, III **(B)** II and III **(C)** II, III, IV **(D)** All of the above

4. Comment on the stability of CrO_3 and WO_3 :

(A) CrO_3 is more stable than WO_3 **(B)** WO_3 is more stable than CrO_3

(C) Both CrO_3 and WO_3 are equally stable **(D)** Both are unstable

5. Bonding in $Fe(CO)_5$ has :

(A) σ character **(B)** π character **(C)** Both (A) & (B) **(D)** None of these

6. The correct statement about transition element is :

(A) Scandium exhibits variable oxidation state.

(B) Lower oxidation state is favoured by heaviar members of group.

(C) Some transition elements like Ni, Fe, Cr may show zero oxidation state in same of their compound

(D) All of the above

7. $E^{\circ}\left(M^{2+}/M\right)$ of copper is positive. It is because of :

(A) High hydration energy **(B)** Low hydration energy

(C) d^9 electronic configuration of Cu is less stable **(D)** None of these

8. Ti^{2+} and CrO_4^{2-} are respectively :

(A) Reducing agent and oxidizing agent **(B)** Oxidizing agent and reducing agent

(C) Both are oxidizing agent **(D)** Both are reducing agent

9. Ability of fluorine to stabilise highest oxidation state is due to :

(A) High lattice energy **(B)** High bond enthalpy

(C) High electronegativity **(D)** All of the above

10. Which of the following is correct order of oxidising power :

(A) $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$ **(B)** $VO_2^+ < MnO_4^- < Cr_2O_7^{2-}$

(C) $MnO_4^- < Cr_2O_7^{2-} < VO_2^+$ **(D)** $MnO_4^- < VO_2^+ < Cr_2O_7^{2-}$

11. Transition metal should be more reactive than hydrogen on basis of electrode potential. But most of them do not give hydrogen on reaction with dilute acid because :

(A) An oxide layer is formed on their surface **(B)** Hydration energy is low

(C) Electronegitivity is low **(D)** None of these

12. $E^{\circ}_{Mn^{3+}/Mn^{2+}} = x$; $E^{\circ}_{Cr^{3+}/Cr^{2+}} = y$:

(A) $x > y$ **(B)** $x < y$ **(C)** $x = y$ **(D)** Can't be predicted

13. $M^{2+} + H^+ \longrightarrow M^{3+} + H_2$. Metal (M) can be :

(A) Cr **(B)** Mn **(C)** Co **(D)** Insufficient data

14. Magnetic moment of transition metal ion is $\sqrt{15}$. Therefore number of unpaired electron present in it is :

(A) 0 **(B)** 1 **(C)** 2 **(D)** 3

15. Consider following statement.

I. Ferromagnetism is an extreme form of paramagnetism.

II. Paramagnetism is an extreme form of ferromagnetism.

III. Both spin and orbital angular momentum give rise to paramagnetism.

IV. Contribution of orbital angular momentum is maximum for first transition series.

Correct statements are :

(A) I, III & IV **(B)** II, III & IV **(C)** II and III **(D)** I and III

***16.** Transition metal show colour because :

(A) They are paramagnetic **(B)** Charge transfer

(C) d-d transition **(D)** They emit light

17. Which one of the following characteristics of transition metals is associated with catalytic properties.

(A) Paramagnetic behaviour **(B)** Variable oxidation state

(C) High enthalpy of atomisation **(D)** Low hydration

18. Which of the following is true for interstial compounds ?

(A) Interstial compounds have high melting point, Higher than those of pure metal

(B) They are very soft

(C) They are very reactive

(D) All above are correct

19. In the dichromate ion $\left(Cr_2O_7\right)^{2-}$,

(A) 4 Cr-O bonds are equivalent **(B)** 6 Cr-O bonds are equivalent

(C) All Cr-O bonds are equivalent **(D)** 4 Cr-O bonds are not equivalent

20. Which of the following oxide of chromium is Amphoteric in nature ?

(A) CrO_3 **(B)** CrO **(C)** Cr_2O_3 **(D)** Cr

21. $Cr_2O_7^{2-} \underset{Y}{\overset{X}{\rightleftharpoons}} 2CrO_4^{2-}$, X and Y are respectively :

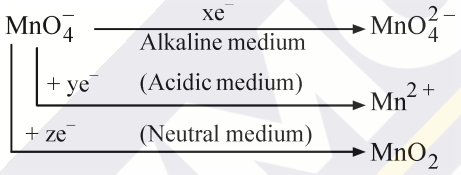
(A) H^+ and OH^- **(B)** OH^- and H^+ **(C)** OH^- and H_2O **(D)** H_2O and OH^-

22. MnO_4^- and MnO_4^{2-} are respectively :

(A) Green and purple **(B)** Purple and green

(C) Brown and purple **(D)** Purple and brown

23.



x, y and z are respectively :

(A) 1, 2, 3 **(B)** 1, 5, 3 **(C)** 1, 3, 5 **(D)** 5, 3, 1

24. The product of oxidation of I^- with MnO_4^- in alkaline and acidic medium is respectively :

(A) I_2 and IO_3^- **(B)** IO_3^- and I_2 **(C)** Both I_2 **(D)** Both IO_3^-

25. Permanganate titration in presence of HCl are unsatisfactory because :

(A) It will form complex **(B)** HCl is reduced

(C) HCl is oxidized to chlorine **(D)** All above are true

26. When MnO_2 is fused with KOH, a coloured compound is formed, the product and its colour is :

(A) K_2MnO_4, green **(B)** $KMnO_4$, purple

(C) K_2MnO_4, purple **(D)** $KMnO_4$, green

27. Which of the following statement is not true about potassium permanganate :

(A) It is green in colour **(B)** It is Iso-structural to $KClO_4$

(C) It decomposes on heating **(D)** It is good oxidising agent

28. $FeCr_2O_4 + Na_2CO_3 + O_2 \longrightarrow X + Fe_2O_3 + CO_2$

$X + H^+ \longrightarrow Y + Na^+ + H_2O$

$Y + 2KCl \longrightarrow K_2Cr_2O_7 + 2NaCl$

Colours of X and Y are respectively :

(A) Yellow and orange **(B)** Orange and yellow

(C) Both yellow **(D)** Both orange

29. Correct statement is :

(A) Cu^{2+} is more stable than Cu^+ in aqueous solutions

(B) Cu^{2+} is less stable than Cu^+ in aqueous solutions

(C) Both Cu^+ and Cu^{2+} are equally stable in aqueous stable

(D) Both are unstable

30. Which of the following is well known to exhibit $+4$ oxidation state.

(A) Eu **(B)** Ce **(C)** Yb **(D)** La

31. The outer electronic configuration of cerium (Ce), atomic number is :

(A) $5d^2 6s^2$ **(B)** $4f^1 5d^1 6s^2$ **(C)** $4f^2 6s^2$ **(D)** $4f^3$

32. In context of Lanthanides, which of the following statement is correct ?

(A) There is a gradual increase in the atomic radii of the members with increasing atomic number

(B) Because of similar properties, the separation of Lanthanide is not easy.

(C) They forms acidic oxides and hydroxides

(D) They are hard metals

33. Lanthanide contraction is due to :

(A) Shielding of one 4f electron by another is very large

(B) Imperfect shielding of one electron by another in same sub shell.

(C) Poor shielding of 5f electrons

(D) Because of strong inter-atomic interaction

34. Most stable oxidation stable of lanthanide is :

(A) $+2$ **(B)** $+3$ **(C)** $+4$ **(D)** $+6$

35. Eu^{2+} and Ce^{4+} are respectively good :

(A) Reducing agent and oxidizing agent **(B)** Oxidizing agent and Reducing agent

(C) Both reducing agent **(D)** Both oxidizing agent

36. Correct order of increasing ionic Radii is :

(A) $La^{3+} < Ce^{3+} < Eu^{3+} < Gd^{3+} < Lu^{3+}$ **(B)** $Lu^{3+} < Gd^{3+} < Eu^{3+} < Ce^{3+} < La^{3+}$

(C) $Lu^{3+} < Eu^{3+} < Ce^{3+} < Gd^{3+} < La^{3+}$ **(D)** $Lu^{3+} < Eu^{3+} < Gd^{3+} < Ce^{3+} < La^{3+}$

37. Which of the following statement is not true :

I. Lu^{3+} is paramagnetic **II.** Absorption bonds shown by Lanthanoid are broad

III. All Ln^{3+} ions show colour

Incorrect statements are :

(A) I, II and III **(B)** I and II **(C)** II and III **(D)** Only II

38. Which of the following statement is true about Actinoids.

(A) It shows variable oxidation state

(B) Ionic radii of M^{3+} ions decreases irregularly across series.

(C) Actinoid contraction is lesser from element to element than Lanthanoid contraction

(D) All of the above

39. Ionization enthalpy of Actinoids are generally lower than that of Lanthanoids. It is because of :

(A) Less peneration of 5f orbital **(B)** High shielding effect of 5f orbital

(C) High penetration of 5f orbital **(D)** Both (B) and (C)

40. Which of the following is used in Ziegler-Natta Catalysis :

(A) Ti **(B)** Zn **(C)** Fe **(D)** Sn

41. In the wacker's process, Catalyst used is :

(A) $PdCl_2$ **(B)** $ZnCl_2$ **(C)** $TiCl_4$ **(D)** V_2O_5

42. Larger number of oxidation states are exhibited by Actinoides than by Lanthanoides, the main reason being.

(A) 4f orbital is more diffused than 5f orbital

(B) More energy difference between 5f and 6d orbital

(C) Less energy difference between 5f and 6d orbital

(D) Actinoid are smaller in size

Co-Ordination Compounds

1. For the complex $[CoCl(NH_3)_5]^{2+}$, secondary valency of Co is :

(A) 6 **(B)** 2 **(C)** 3 **(D)** 1

2. Consider the following statements :

According to Werner's theory

1. Secondary valencies are Ionisable **2.** Primary valencies are satisfied by negative ions

3. Secondary valuencies have directional properties

of these statements

(A) 1, 2, 3 are correct **(B)** 2 and 3 are correct

(C) 1 and 3 are correct **(D)** 1 and 2 are correct

3. Which of the following is the most likely structure of $CoCl_3.6NH_3$, if 1/3 of total chlorine of the compound is precipitated as AgCl on adding excess silver Nitrate Solution to its aqueous solution.

(A) $[Co(NH_3)_6]Cl_3$ **(B)** $[Co(NH_3)_5Cl]Cl_2\ (NH_3)$

(C) $[Co(NH_3)_4Cl_2]Cl(NH_3)_2$ **(D)** $[Co(NH_3)_3Cl_3](NH_3)_3$

4. The number of donor sites in $C_2O_4^{2-}$, $[EDTA]^{4-}$ and Cl^- are respectively

(A) 4, 4, 1 **(B)** 2, 6, 1 **(C)** 2, 6, 3 **(D)** 4, 6, 1

5. Which of following is Ambidentate ligand ?

1. NO_2^- **2.** $C_2O_4^{2-}$ **3.** SCN^-

(A) 1 and 3 **(B)** 2 and 3 **(C)** Only 3 **(D)** All

6. Co-ordination Number of complex $[Fe(C_2O_4)_3]^{3-}$ is :

(A) 3 **(B)** 6 **(C)** 4 **(D)** -3

7. Which of following statement is true for co-ordination Number ?

(A) It is determined by sigma bond formed by ligand with central atom.

(B) It is determined by pi bond formed by ligand with central atom

(C) It is determined by both sigma and pi bond formed by ligand with central atom

(D) Co-ordination no. do not depend on sigma and pi bond

8. Oxidation Number of metal in complex $[Cu(CN)_4]^{3-}$ is :

(A) 3 **(B)** 1 **(C)** 4 **(D)** -3

9. For a give metal M^{3+} co-ordination number is six, then for which set of ligand, complex will be more stable.

(A) $6H_2O$ **(B)** $EDTA^{4-}$ **(C)** $6F^-$ **(D)** $2NH_3$ and $2C_2O_4^{2-}$

10. IUPAC naming of $[Ag(NH_3)_2][Ag(CN)_2]$ is :

(A) diammine silver (ii) dicyano silver (ii) **(B)** diammine silver (i) dicyanoargentate (i)

(C) diammine silver (ii) dicyano argentite **(D)** diammine silver (i) dicyano silver (i)

11. IUPAC naming of $Hg[Co(SCN)_4]$

(A) Mercury tetrathiocyanato cobalt (ii) **(B)** Mercury tetrathiocyanato cobaltate (ii)
(C) Mercury tetrathiocyanato coblet (iii) **(D)** Mercury tetrathiocyanato cobaltate (iii)

12. Correct structure of dichloridobis (ethane - 1, 2 - diamine) cobalt (iii) is :

(A) $[CoCl_2(en)_2]$ **(B)** $[CoCl_2en]^-$ **(C)** $[CoCl_2(en)_2]^+$ **(D)** $[CoCl_2(en)_2]^-$

13. Which of the following can show face-mer isomerism?

(A) $[Co(NH_3)_3(NO_2)_3]$ **(B)** $[Co(en)_3]$
(C) $[CoCl_2(en)_2]$ **(D)** $[CoCl_2(NH_3)_4]$

14. For the complex ion dichloro bis (ethylene diamine) cobalt (III), select the correct statement.

(A) It has three isomers, two of them are optically active and one is optically inactive
(B) It has three isomers, all of them are optically Active.
(C) It has three isomers, all of them are optically inactive
(D) It has only two isomers, both are optically inactive.

15. Which of following is likely to show optical Activity :

(A) $[Co(en)_3]^{3+}$ **(B)** trans $[Co(en)_2Cl_2]$
(C) cis $[Fe(NH_3)_2Cl_4]$ **(D)** None of these

16. Identify type of isomerism exhibited by complex $[Co(NH_3)_5NO_2](NO_3)_2$

(A) Geometrical **(B)** Linkage **(C)** Ionisation **(D)** All of these

17. Which of the following statement is true ?

(A) Geometrical isomerism is shown by homoleptic complexes only.
(B) Square planar complexes of type Mabcd shows geometrical isomers.
(C) $[ZnCl_2(NH_3)_2]$ exhibit cis-trans isomers.
(D) All of these

18. Which of the following is outer-orbital complex ?

(A) $[Co(NH_3)_6]^{3+}$ **(B)** $[CoF_6]^{3-}$ **(C)** $[Co(H_2O)_6]^{3+}$ **(D)** $[Co(C_2O_4)_3]^{-3}$

19. Number of unpaired electron and magnetic behaviour of $[Ni(CO)_4]$ is :

(A) 0 and diamagnetic **(B)** 2 and diamagnetic
(C) 0 and paramagnetic **(D)** 2 and paramagnetic

20. Among $[NiCl_4]^{2-}$,$[Ni(CN)_4]^{2-}$ and$[Ni(CO)_4]$

(A) $[Ni(CO)_4]$ and$[NiCl_4]^{2-}$ are paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic

(B) $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CN)_4]^{2-}$ and $[Ni(CO)_4$ are diamagnetic

(C) $[Ni(CO)_4$ is diamagnetic while $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic

(D) All are diamagnetic

21. Assign the hybridization, shape and Magnetic moment of $[MnBr_4]^{2-}$

(A) sp^3, tetrahedral, 1.73 **(B)** sp^3, tetrahedral, 5.9
(C) dsp^2, square planar, 1.73 **(D)** dsp^2, square planar, 5.9

22. Number of unpaired electrons in $[CoF_6]^{3-}$ and $[Co(NH_3)_6]^{3+}$ are respectively.

(A) 4 and 0 **(B)** 0 and 4 **(C)** 3 and 1 **(D)** 1 and 3

23. For correct information about the structure adopted by metal complex, the Valence Bond Theory often requires the measurement of :

(A) Molar conductance **(B)** Optical Activity
(C) Magnetic Moment **(D)** All of these

24. Magnitude of crystal field splitting depends on

(A) Charge on metal ion **(B)** Type of ligand
(C) Whether the metal belong to first, second or Third transition series.
(D) All of these

25. Which of the following is correct order of energy of d orbital's for $[Mn(H_2O)_6]^{2+}$

(A) $dxy = dyz = dzx < dx^2 - y^2 = dz^2$ **(B)** $dz^2 = dx^2 - y^2 < dxy = dyz = dz^2$
(C) $dxy < dyz = dxz < dx^2 < dx^2 - y^2$ **(D)** $dxz = dyz < dxy < dx^2 < dx^2 - y^2$

26. Which of the following relationship is true :

(A) $\Delta t = \frac{8}{9}\Delta_0$ **(B)** $\Delta t = \frac{4}{9}\Delta_0$ **(C)** $\Delta_0 = \frac{8}{9}\Delta t$ **(D)** $\Delta_0 = \frac{4}{9}\Delta t$

27. In which of the following co-ordination entities, Magnitude of Δ_0 is maximum

(A) $[Co(CN)_6]^{3-}$ **(B)** $[Co(C_2O_4)_3]^{3-}$ **(C)** $[Co(H_2O)_6]^{3+}$ **(D)** $[Co(NH_3)_6]^{3+}$

28. For complex $[Ml_6]^{3+}$ where M is metal ion with d^7 configuration and L is neutral monodentate ligand. If $\Delta_0 = 17000cm^{-1}$ and P = 14,000. Then electronic configuration of complex will be :

(A) $t_2g^3eg^1$ **(B)** $t_2g^4eg^0$ **(C)** $t_2g^4eg^3$ **(D)** $t_2g^6eg^1$

29. An ion Ni^{2+} form complex $[Ni(H_2O)_4en]^{2+}$, $[Ni(H_2O)_2(en)_2]^{2+}$ and $[Ni(en)_3]^{2+}$. The colour of complexes are respectively :

(A) Pale Blue, Blue and Violet **(B)** Blue, pale – blue and violet
(C) Violet, Blue and Pale – blue **(D)** Violet, Pale – blue and blue.

30. Colour of anhydrous $CuSO_4$ and $CuSO_4 . 5H_2O$ are respectively.

(A) Blue and white **(B)** white and Blue **(C)** Both blue **(D)** Both white

31. Which of following is colourless ?

(A) $[Ti(H_2O)_6]^{3+}$ **(B)** $[Cu(H_2O)_4]^{2+}$ **(C)** $[Mn(H_2O)_6]^{2+}$ **(D)** $[TiF_6]^{2-}$

32. What will be correct order for wavelength of Absorption in visible light for following :

(A) $[Ni(NO_2)_6]^{4-} < [Ni(NH_3)_6]^{2+} < [Ni(H_2O)_6]^{2+}$

(B) $[Ni(H_2O)_6]^{2+} < [Ni(NH_3)_6]^{2+} < [Ni(NO_2)_6]^{4-}$

(C) $[Ni(NH_3)_6]^{2+} < [Ni(H_2O)_6]^{2+} < [Ni(NO_2)_6]^{2+}$

(D) $[Ni(H_2O)_6]^{2+} < [Ni(NO_2)_6]^{2+} < Ni(NH_3)_6]^{2+}$

33. Among following ligand, the correct order of increasing field strength is :

(A) $CO < NH_3 < en < CN^-$ **(B)** $CN^- < NH_3 < CO < en$

(C) $NH_3 < en < CN^- < CO$ **(D)** $en < CN^- < NH_3 < CO$

34. Shape of $[Ni(CO)_4]$, $[Fe(CO)_5]$ and $[Cr(CO)_6]$ are respectively.

(A) Tetrahedral, Trigonal bipyramidal and octahedral

(B) Square planar, Trigonal bipyramidal and octahedral

(C) Square planar, octahedral and Octahedral

(D) Tetrahedral, Octahedral and Octahedral

35. Which of the following statement are correct ?

(A) In $[Ni(CO)_4]$, the oxidation state of Ni is zero

(B) In metal carbonyls, dc-o increases compared to that in CO molecule

(C) Carbonyl ligand can be bridging as well as terminal **(D)** All of these

36. For a Reaction of type $M + 4L \rightleftharpoons ML_4$, four stability constant are as follows.

$M + L \rightleftharpoons ML$ K_1 ; $ML + L \rightleftharpoons ML_2$ K_2

$ML_2 + L \rightleftharpoons ML_3$ K_3 ; $ML_3 + L \rightleftharpoons ML_4$ K_4

Choose incorrect statements

(A) Stepwise stability constant are in order $K_1 > K_2 > K_3 > K_4$

(B) Overall stability constant is represented as β i.e $\beta = K_1 \times K_2 \times K_3 \times K_4$

(C) Larger the stability constant, lesser the proportion of ML_4 that exist in solution

(D) Dissociation constant of co-ordination compound is defined as reciprocal of formation constant.

37. Which of the following complex show synergic Bonding.

(A) $[Ni(CO)_4]$ **(B)** $[Mn(H_2O)_6]^{2+}$ **(C)** $NiCl_4^{2-}$ **(D)** $Ti(H_2O)_6]^{2+}$

38. Stability of co-ordination compound is Related to

(A) Enthalpy **(B)** Gibbs free energy **(C)** Entropy **(D)** All of these

39. Bonding in metal carbonyl process

(A) sigma character **(B)** pi character **(C)** Both a and b **(D)** either a or b

40. Wilkinson catalyst is :

(A) $[Rh(PPh_3)_2Cl_2]$ **(B)** $[Rh(PPh_3)_3Cl]$ **(C)** $[RhCl_3(PPh_3)]$ **(D)** $[Rh(PPh_3)_3Cl_3]$

41. Co-ordination compounds have great importance in biological system. In this context which of the following statement is correct.

(A) Chlorophyll, the pigment responsible for chlorophyll contain calcium

(B) Haemoglobin is Red pigment of Blood and acts as oxygen carries in co-ordination compound of iron.

(C) Cyanocobalamine is Vitamin B_{12} and contain Mg.

(D) Carbonic Anhydrase is an enzyme

42. Metal co-ordinate with Anti cancer/Anti tumor Species, cis-platin is

(A) Pt **(B)** Zn **(C)** Mg **(D)** Fe

43. EDTA is used in

(A) Estimation of Hardness of water

(B) Treatment of lead poisoning

(C) Instrumental method of Analysis of co-ordination compounds

(D) All of these

44. The IUPAC naming of $[Co(NH_3)_5NO_2]Cl_2$ is :

(A) Nitrito-N-pentaammine cobalt (III) chloride

(B) Nitrito – N – pentaammine coblet (II) chloride

(C) pentaanmine nitrito – N cobalt (II) chloride

(D) Pentaammine nitrito – N cobalt (III) chloride

45. Correct order of Magnetic Moment is

(A) $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$ **(B)** $[MnCl_4]^{2-} > [Fe(CN)_6]^{4-} > [CoCl_4]^{2-}$

(C) $[Fe(CN)_6]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$ **(D)** $[Fe(CN)_6]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$

Answer to Workshop - Inorganic Chemistry | Class XI

s-BLOCK ELEMENTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	ABC	ABCD	AB	AB	ABCD	ABCD	ABCD	ABC	B	ABCD	ABCD	BD	BD	AD
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
B	B	BC	BC	AC	BD	D	ABC	B	ABC	C	A	C	BC	ACD
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
D	ABD	A	BD	BCD	ACD	BC	A	ABCD	BD	C	BD	C	ABCD	B
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
C	AD	ABCD	C	B	ABD	ABCD	A	D	ABC	B	ABCD	ABD	ABCD	C
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
B	D	D	ABD	D	C	B	C	ABD	B	ABD	AD	B	A	AD
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
ABCD	AC	D	B	A	BC	D	BC	ABCD	D	B	A	A	D	ABD
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**
D	D	BD	C	C	A	A	D	B	BC	D	ABC	A	BC	C
106	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
D	ABD	D	CD	ABCD	C	A	D	ABCD	D	A	C	C	ABCD	AB
121	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**			
D	ABCD	A	ABCD	D	D	ABCD	D	D	ABCD	AC	A			

p-BLOCK ELEMENTS - I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	C	C	A	B	BC	CD	BC	B	B	B	AC	B	AB	BD
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
D	D	AC	BC	AC	BD	BD	AB	A	C	C	A	D	D	B
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
C	C	D	C	BCD	AD	C	D	B	AB	C	B	D	B	C
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
D	C	BC	B	C	B	C	C	C	B	D	B	C	AD	BD
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
B	C	ABCD	B	D	C	ABD	B	B	C	AC	C	C	C	B

76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
BCD	A	B	D	C	BC	B	CD	AB	BD	B	B	B	C	BC
91	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**
B	CD	CD	C	BC	D	B	B	C	ABC	B	AD	B	D	ACD
106	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**				
C	D	ACD	C	ABC	C	BC	A	A	D	ABC				

Answer to Workshop - Inorganic Chemistry | Class XII

p-BLOCK ELEMENTS - II

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ABCD	C	C	D	B	B	C	D	AD	B	C	ABC	BD	C	AB
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
ACD	BD	C	B	C	A	B	A	B	ABC	D	D	C	B	A
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
C	AC	ABCD	ABD	BC	ACD	ABD	BCD	D	AD	BCD	C	D	D	B
46	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
D	C	B	ABCD	D	C	AD	B	D	CD	A	D	D	C	B
61	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
D	B	B	C	C	C	C	D	C	C	B	ACD	ABCD	ABC	CD
76	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
C	A	D	D	AB	B	B	BD	AC	D	B	C	B	D	C
91	**92**	**92**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**
D	C	C	BD	AD	C	C	C	B	D	C	BC	C	B	D
106	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
D	C	BC	B	B	D	BCD	B	C	B	C	D	BC	ABC	D
121	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**	**135**
A	D	B	C	C	ABC	BCD	AD	D	B	BD	AB	ABC	D	ABD
136	**137**	**138**	**139**	**140**	**141**	**142**	**143**	**144**	**145**	**146**	**147**	**148**	**149**	**150**
D	D	B	C	AB	BCD	BD	A	ACD	A	C	B	B	C	CD
151	**152**	**153**	**154**	**155**	**156**	**157**	**158**	**159**	**160**	**161**	**162**	**163**	**164**	**165**
C	D	D	B	AD	ABC	B	BC	D	D	B	C	B	CD	ABCD
166	**167**	**168**	**169**	**170**	**171**	**172**	**173**	**174**	**175**	**176**	**177**	**178**	**179**	**180**
B	D	BC	BCD	C	C	C	ABC	B	D	CD	ACD	ABD	D	A
181	**182**	**183**	**184**	**185**	**186**	**187**	**188**	**189**	**190**	**191**	**192**	**193**	**194**	**195**
C	D	C	D	B	C	C	B	C	D	D	C	ABD	A	C

196	197	198	199	200	201	202	203	204	205	206	207	208	209	210
ACD	D	C	A	D	C	CD	ACD	D	B	C	BD	C	D	AC
211	**212**	**213**	**214**	**215**	**216**	**217**	**218**	**219**	**220**	**221**	**222**	**223**	**224**	**225**
B	BCD	D	B	D	C	D	C	CD	AC	ABCD	C	ABD	A	A
226	**227**	**228**	**229**	**230**	**231**	**232**	**233**	**234**	**235**					
AC	BCD	C	C	C	D	D	ABCD	C	BC					

d & f - BLOCK ELEMENTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	C	B	B	C	C	B	A	D	A	A	A	A	D	D
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
BC	B	A	B	C	B	B	B	B	C	A	A	A	A	B
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**			
B	B	B	B	A	B	A	A	A	A	A	C			

CO-ORDINATION CHEMISTRY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	B	C	B	A	B	A	B	B	B	D	C	A	A	A
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
B	B	B	A	B	B	A	C	D	A	B	A	B	A	B
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
D	A	C	A	D	C	A	D	C	B	B	A	D	D	A