31 Years NEET

CHAPTER-WISE SOLUTIONS with NCERT References

CHEMISTRY

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It give great pleasure to express our sincere thanks and gratitude to Dr. Ram Ratan Vishnoi for reviewing this book.

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Class XI

Class XII

Syllabus

Chemistry - XI

UNIT I: Some Basic Concepts of Chemistry

Details:-

- *General Introduction*: Important and scope of chemistry.
- Laws of chemical combination, *Dalton's atomic theory*: concept of elements, atoms and molecules.
- Atomic and molecular masses. Mole concept and molar mass; percentage composition and empirical and molecular formula; chemical reactions, stoichiometry and calculations based on stoichiometry.

UNIT II: Structure of Atom

Details:-

- Atomic number, isotopes and isobars. Concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbital, quantum numbers, shapes of *s*,*p* and *d* orbitals, rules for filling electrons in orbitals- Aufbau principle, Pauli exclusion principles and Hund's rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.

UNIT III: Classification of Elements and Periodicity in Properties

Details:-

- Modern periodic law and long form of periodic table, periodic trends in properties of elements- atomic radii, ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity, valence.

UNIT IV: Chemical Bonding and Molecular Structure

Details:-

- Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of molecules, VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only). Hydrogen bond.

UNIT V: States of Matter: Gases and Liquids

Details:-

- Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws of elucidating the concept of the molecule, Boyle's law, Charle's law, Gay Lussac's law, Avogadro's law, ideal behaviour of gases, empirical derivation of gas equation. Avogadro number, ideal gas equation. Kinetic energy and molecular speeds (elementary idea), deviation from ideal behaviour, liquefaction of gases, critical temperature.
- Liquid State- Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).

UNIT VI : Thermodynamics

Details:-

- First law of thermodynamics-internal energy and enthalpy, heat capacity and specific heat, measurement of ΔU and ΔH, Hess's law of constant heat summation, enthalpy of : bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution.
- Introduction of entropy as state function, Second law of thermodynamics, Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium and spontaneity.
- Third law of thermodynamics- Brief introduction.

UNIT VII: Equilibrium

Details:-

- Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of chemical equilibrium, equilibrium constant, factors affecting equilibrium- Le Chatelier's principle; ionic equilibrium- ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of polybasic acids, acid strength, concept of pH., Hydrolysis of salts (elementary idea)., buffer solutions, Henderson equation, solubility product, common ion effect (with illustrative examples).

UNIT VIII: Redox Reactions

Details:-

- Concept of oxidation and oxidation and reduction, redox reactions oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers.

UNIT IX: Hydrogen

Details:-

- Occurrence, isotopes, preparation, properties and uses of hydrogen; hydridesionic, covalent and interstitial; physical and chemical properties of water, heavy water; hydrogen peroxide-preparation, reactions, uses and structure;

UNIT X: s-Block Elements (Alkali and Alkaline earth metals)

Details:-

- *Group I and group 2 elements*:
- General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens; uses.
- Preparation and Properties of Some important Compounds:
- Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogencarbonate, biological importance of sodium and potassium.
- Industrial use of lime and limestone, biological importance of Mg and Ca.

UNIT XI: Some p-Block Elements

Details:-

- General Introduction to p-Block Elements.
- *Group 13 elements*: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boron, some important compounds: borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkalies.
- *General 14 element*s: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element. Carbon, allotropic forms, physical and chemical properties: uses of some important compounds: oxides.
- Important compounds of silicon and a few uses: silicon tetrachloride, silicones, silicates and zeolites, their uses.

UNIT XII: Organic Chemistry- Some Basic Principles and Techniques

Details:-

- General introduction, methods of purification qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds.
- Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation.
- Homolytic and heterolytic fission of a covalent bond: free radials, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions.

UNIT XIII: Hydrocarbons

Details:-

- *Alkanes*- Nomenclature, isomerism, conformations (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis.
- *Alkanes*-Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation: chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.
- *Alkynes*-Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of- hydrogen, halogens, hydrogen halides and water.
- *Aromatic hydrocarbons*- Introduction, IUPAC nomenclature; Benzene; resonance, aromaticity; chemical properties: mechanism of electrophilic substitution- Nitration sulphonation, halogenation, Friedel Craft's alkylation and acylation; directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.

UNIT XIV: Environmental Chemistry

Details:-

- *Environmental pollution*: Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants; acid rain ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming-pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

Chemistry - XII

UNIT I: Solid State

Details:-

- Classification of solids based on different binding forces; molecular, ionic covalent and metallic solids, amorphous and crystalline solids (elementary idea), unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties, Band theory of metals, conductors, semiconductors and insulators.

UNIT II: Solutions

Details:-

- Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties- relative lowering of vapour pressure, Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties abnormal molecular mass. Van Hoff factor.

UNIT III: Electrochemistry

Details:-

- Redox reactions, conductance in electrolytic solutions, specific and molar conductivity variation of conductivity with concentration, kohlrausch's Law, electrolysis and Laws of electrolysis (elementary idea), dry cell- electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.

UNIT IV: Chemical Kinetics

Details:-

- Rate of a reaction (average and instantaneous), factors affecting rates of reaction; concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenious equation.

UNIT V: Surface Chemistry

Details:-

- *Adsorption*-physisorption and chemisorption; factors affecting adsorption of gases on solids, catalysis homogeneous and heterogeneous, activity and selectivity: enzyme catalysis; colloidal state: distinction between true solutions, colloids and suspensions; lyophillic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation; emulsions- types of emulsions.

UNIT VI: General Principles and Processes of Isolation of Elements

Details:-

- *Principles and methods of extraction*- concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron.

UNIT VII: p- Block Elements

Details:-

- *Group 15 elements*: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous- allotropic forms; compounds of phosphorous: preparation and properties of phosphine, halides (PCI3, PCI5) and oxoacids (elementary idea only).
- *Group 16 elements*: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxygen: preparation, properties and uses; classification of oxides; ozone. Sulphur – allotropic forms; compounds of sulphur: preparation, preparation, properties and uses of sulphur dioxide; sulphuric acid: industrial process of manufacture, properties and uses, oxoacids of sulphur (structures only).
- *Group 17 elements*: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens: preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds oxoacids of halogens (structures only).
- *Group 18 elements*: General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.

UNIT VIII: d and f Block Elements

Details:-

- General introduction, electronic configuration, characteristics of transition metals, general trends in properties of the first row transition metals- metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation. Preparation and properties of K2Cr2O7 and KMnO4.
- *Lanthanoids*- electronic configuration, oxidation states, chemical reactivity, and lanthanoid contraction and its consequences.
- *Actinoids*: Electronic configuration, oxidation states and comparison with lanthanoids.

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Details:-

- *Coordination compounds*: Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, isomerism (structural and stereo) bonding, Werner's theory VBT,CFT; importance of coordination compounds (in qualitative analysis, biological systems).

UNIT X: Haloalkanes and Haloarenes

Details:-

- *Haloalkanes*: Nomenclature, nature of C –X bond, physical and chemical properties, mechanism of substitution reactions. Optical rotation.
- *Haloarenes*: Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only).
- Uses and environment effects of – dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

UNIT XI: Alcohols, Phenols and Ethers

Details:-

- *Alcohols*: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses with special reference to methanol and ethanol.
- *Phenols*: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophillic substitution reactions, uses of phenols.
- *Ethers*: Nomenclature, methods of preparation, physical and chemical properties uses.

UNIT XII: Aldehydes, Ketones and Carboxylic Acids

Details:-

- *Aldehydes and Ketones*: Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties; and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.
- *Carboxylic Acids*: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

UNIT XIII: Organic Compounds Containing Nitrogen

Details:-

- *Amines*: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary secondary and tertiary amines.
- *Cyanides and Isocyanides*- will be mentioned at relevant places.
- *Diazonium salts*: Preparation, chemical reactions and importance in synthetic organic chemistry.

UNIT XIV: Biomolecules

Details:-

- *Carbohydrates*- Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D.L. configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance.
- *Proteins*- Elementary idea of – amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes.
- *Hormones*- Elementary idea (excluding structure).
- *Vitamins*- Classification and function.
- *Nucleic Acids*: DNA and RNA

UNIT XV: Polymers

Details:-

- *Classification*- Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polyesters, bakelite; rubber, Biodegradable and non-biodegradable polymers.

UNIT XVI: Chemistry in Everyday Life

Details:-

- Chemicals in medicines- analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.
- Chemicals in food- preservatives, artificial sweetening agents, **elementary idea of antioxidants**.
- Cleansing agents- soaps and detergents, cleansing action.

9 Hydrogen

1. Which of the following statements about hydrogen is incorrect? (2016 - I)

a. Dihydrogen does not act as a reducing agent.
b. Hydrogen has three isotopes of which tritium is the most common.
c. Hydrogen never acts as cation in ionic salts.
d. Hydronium ion, H_3O^+ exists freely in solution.

2. (A) $H_2O_2 + O_3 \rightarrow H_2O + 2O_2$

(B) $H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

Role of hydrogen peroxide in the above reactions is respectively: (2014)

a. Reducing in (A) and oxidizing in (B)
b. Reducing in (A) and (B)
c. Oxidizing in (A) and (B)
d. Oxidizing in (A) and reducing in (B)

3. The reaction of aqueous $KMnO_4$ with H_2O_2 in acidic conditions gives: (2014)

a. Mn^{2+} and O_2 b. Mn^{2+} and O_3
c. Mn^{4+} and MnO_2 d. Mn^{4+} and O_2

4. Which one of the following molecules contains no π bond? (2013)

a. CO_2 b. H_2O c. SO_2 d. NO_2

5. Some statements about heavy water are given below:

A. Heavy water is used as a moderator in nuclear reactors
B. Heavy water is more associated than ordinary water
C. Heavy water is more effective solvent than ordinary water

Which of the above statements are correct? (2010 Mains)

a. A and B b. A, B and C
c. B and C d. A and C

6. Which of the following alkaline earth metal sulphates has hydration enthalpy higher than the lattice enthalpy? (2010 Pre)

a. $SrSO_4$ b. $CaSO_4$
c. $BeSO_4$ d. $BaSO_4$

7. Which one of the following ionic species has the greatest proton affinity to form stable compound? (2007)

a. NH_2^- b. F^- c. I^- d. HS^-

8. The structure of H_2O_2 is: (1999)

a. Planar b. Non-planar
c. Spherical d. Linear

9. The volume strength of 1.5 N H_2O_2 solution is: (1996, 1997)

a. 8.8 b. 8.4 c. 4.8 d. 5.2

10. The O – O – H bond angle in H_2O_2 is: (1994)

a. 106^0 b. 109^028
c. 120^0 d. 97^0

11. Which of the following groups of ions makes the water hard? (1994)

a. Sodium and bicarbonate
b. Magnesium and chloride
c. Potassium and sulphate
d. Ammonium and chloride.

12. One would expect proton to have very large: (1993)

a. Charge b. Ionization potential
c. Hydration energy d. Radius

13. At its melting point ice is lighter than water because H_2O molecules are more closely packed in solid state: (1992)

a. H_2O molecules are more closely packed in solid state
b. Ice crystals have hollow hexagonal arrangement of H_2O molecules.
c. On melting of ice, the H_2O molecules shrinks in size
d. Ice forms mostly heavy water on first melting.

14. Hydrogen peroxide molecules are: (1991)

a. Monoatomic and form X_2^{2-} ions
b. Diatomic and form X^- ions
c. Diatomic and form HO_2^- ions
d. Monoatomic and form X^- ions.

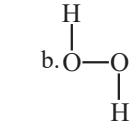
15. The ionization of hydrogen atom would give rise to: (1990)

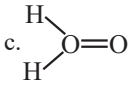
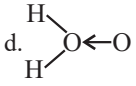
a. Hydride ion b. Hydronium ion
c. Proton d. Hydroxyl ion.

16. Which of the following metal evolves hydrogen on reacting with cold dilute HNO_3? (1989)

a. Mg b. A1
c. Fe d. Cu

17. Which of the following is the true structure of H_2O_2? (1989)

a. H—O—O—H b. 

c.  d. 

18. The reaction of H_2O_2 with H_2S is an example of ……reaction: (1988)

a. Addition b. Oxidation
c. Reduction d. Acidic

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
b	d	a	b	b	c	a	b	b	d	b	c	b	c	c	a	b

18
b

EXPLANATIONS

1. (b) ***NCERT (XI) Ch - 9, Pg. 227 & 279***

A. Hydrogen cannot act as a reducing agent everywhere Eg: $3H_2 + N_2 \rightarrow 2\ NH_3$

B. Hydrogen has 3 isotopes – tritium, protium & deuterium, where protium is its most abundant form.

2. (d) ***NCERT (XI) Ch - 9, Pg. 286***

H_2O_2 is a kind of compound which can work as both reducing & oxidizing agent. Here:

(A) $H_2O_2 + O_3 \rightarrow H_2O + 2O_2$

H_2O_2 acts as a oxidizing agent

(B) $H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

H_2O_2 acts as a reducing agent as oxidation state of changes from +1 to 0.

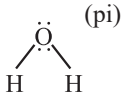
3. (a) ***NCERT (XI) Ch - 9, Pg. 286***

As $KMnO_4$ being strong oxidizing agent will reduce Mn^{2+} (+5) oxidation state to Mn (+2) & will oxidize H_2O_2 to water & O_2

$$2KMnO_4 + 5H_2O_2 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$$

4. (b) ***NCERT (XI) Ch - 9, Pg. 286***

H_2O molecule is formed of 2σ bond & does not contain any π bond.



5. (b) ***NCERT (XI) Ch - 9, Pg. 286***

Heavy water (D_2O) is used as a moderator in nuclear reactors to slow down neutrons & also as a coolant. Heavy water is more associated than ordinary water, having more boiling point than ordinary water, also being a better solvent it has more dielectric constant (K).

6. (c) ***NCERT (XI) Ch - 9, Pg. 102-103***

$BeSO_4$ is the correct option because when we move down the group, hydration energy decreases of the atom, the first member of the group have highest hydration energy, where as the lattice energy remains more or less same.

7. (a) ***NCERT (XI) Ch - 9, Pg. 277***

Proton affinity decreases when we move across the period from left to right due to increase in charge, within a group the proton affinity decreases from top to bottom, Nitrogen family > Oxygen family > Halogens

8. (b) H_2O_2 has half opened book like structure.

9. (b) Normality (N) = 1.5

We know that equivalent weight of H_2O_2 is 17 and strength of H_2O_2 = Normality × Equivalent weight

$= 1.5 \times 17 = 25.5$

Therefore, $2H_2O_2 \rightarrow 2H_2O + O_2$ ($2 \times 34 = 68$ g)

Since 68 grams of H_2O_2 produces 22.4 litres oxygen at NTP, therefore 25.5 grams of H_2O_2 will

produce $= \frac{22.4}{68} \times 25.5 = 8.4$ litre of oxygen.

Thus, volume strength of given H_2O_2 solution is 8.4.

10. (d) Bond angle of O – O – H in H_2O_2 is 97^0

11. (b) Hardness of water, due to the presence of chlorides and sulphates of Ca and Mg is called permanent hardness. Hence hard water will consist of Mg^{2+} and Cl^- ions.

12. (c) Proton (H^+) ion being very small in size would have very large hydration energy.

13. (b) When ice melts, its molecules move into the holes or open space and comes closer to each other than they were in solid state. Thus, ice has lower density than water and there is contraction in volume.

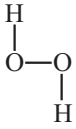
14. (c) H_2O_2 is diatomic and forms $H^+ + HO_2^-$ (hydroperoxide ion).

15. (c) It gives rise to proton.

$H\ (g) \rightarrow H^+ + e^-$ proton.

16. (a) Mg reacts with nitric acid to give $Mg(NO_3)_2$ and evolves H_2.

$$Mg + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2$$

17. (b)  is the true structure.

18. (b) It is an example of oxidation reaction.

$$H_2S + H_2O_2 \rightarrow 2H_2O + S$$

10 The s-Block Elements

1. Ionic mobility of which of the following alkali metal ions is lowest when aqueous solution of their salts are put under an electric field? (2017-Delhi)

a. Li^+ b. Na^+
c. K^+ d. Rb^+

2. In context with beryllium, which one of the following statements is incorrect? (2016 - II)

a. Its salts rarely hydrolyse
b. Its hydride is electron-deficient and polymeric
c. It is rendered passive by nitric acid
d. It forms Be_2C

3. The suspension of slaked lime in water is known as: (2016 - II)

a. Calcium carbonate
b. Aqueous solution of slaked lime
c. Lime water
d. Quick lime

4. Which of the following statements is false? (2016-I)

a. Ca^{2+} ions are not important in maintaining the regular beating of the heart
b. Mg^{2+} ions are important in the green parts of the plants
c. Mg^{2+} ions form a complex with ATP
d. Ca^{2+} ions are important in blood clotting

5. The product obtained as a result of reaction of nitrogen with CaC_2 is: (2016-I)

a. CaCN b. Ca_2CN
c. $Ca(CN)_2$ d. CaCN

6. The function of "Sodium pump" is a biological process operating in each and every cell of all animals. Which of the following biologically important ions is also a constituent of the pump? (2015)

a. Mg^{2+} b. K^+
c. Fe^{2+} d. Ca^{2+}

7. Solubility of the alkaline earth's metal sulphates in water decreases in the sequence: (2015)

a. Ca > Sr > Ba > Mg
b. Sr > Ca > Mg > Ba
c. Ba > Mg > Sr > Ca
d. Mg > Ca > Sr > Ba

8. 20.0 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 8.0 g magnesium oxide. What will be the percentage purity of magnesium carbonate in the sample? (2015 Re)

(Atomic weight of Mg = 24)

a. 96 b. 60
c. 84 d. 75

9. Which one of the alkali metals, forms only the normal oxide, M_2O on heating in air? (2012 Pre)

a. Na b. Rb
c. K d. Li

10. The ease of adsorption of the hydrated alkali metal ions on an ion-exchange resins follows the order: (2012 Pre)

a. $Li^+ < K^+ < Na^+ < Rb^+$
b. $Rb^+ < K^+ < Na^+ < Li^+$
c. $K^+ < Na^+ < Rb^+ < Li^+$
d. $Na^+ < Li^+ < K^+ < Rb^+$

11. Match list-I with list-II for the composition of substances and select the correct answer using the code given below the lists: (2011 Mains)

List – I (Substances)		List – II (Composition)	
(A)	Plaster of Paris	(i)	$CaSO_4.2H_2O$
(B)	Epsomite	(ii)	$CaSO_4.\frac{1}{2}H_2O$
(C)	Kieserite	(iii)	$MgSO_4.7H_2O$
(D)	Gypsum	(iv)	$MgSO_4.H_2O$
		(v)	$CaSO_4$

Code:

(A)	(B)	(C)	(D)
a. (i)	(ii)	(iii)	(iv)
b. (iv)	(iii)	(ii)	(i)
c. (iii)	(iv)	(i)	(ii)
d. (ii)	(iii)	(iv)	(i)

12. The compound A on heating gives a colourless gas and a residue that is dissolved in water to obtain B. Excess of CO_2 is bubbled through aqueous solution of B, C is formed which is recovered in the solid form. Solid C on gentle heating gives back A.

The compound is: (2010 Mains)

a. $CaCO_3$ b. Na_2CO_3
c. K_2CO_3 d. $CaSO_4.2H_2O$

13. Property of the alkaline earth metals that increase with their atomic number: (2010 Pre)

a. Electronegativity
b. Solubility of their hydroxides in water
c. Solubility of their sulphates in water
d. Ionization energy

14. Which of the following oxides is not expected to react with sodium hydroxide? (2009)

a. CaO b. SiO_2
c. BeO d. B_2O_3

15. Equimolar solutions of the following were prepared in water separately. Which one of the solutions will record the highest pH? (2008)

a. $MgCl_2$ b. $CaCl_2$
c. $SrCl_2$ d. $BaCl_2$

16. The alkali metals form salt-like hydrides by the direct synthesis at elevated temperature. The thermal stability of these hydrides decreases in which of the following orders? (2008)

a. NaH > LiH > KH > RbH > CsH
b. LiH > NaH > KH > RbH > CsH
c. CsH > RbH > KH > NaH > LiH
d. KH > NaH > LiH > CsH > RbH

17. In which of the following, the hydration energy is higher than the lattice energy? (2007)

a. $MgSO_4$ b. $RaSO_4$
c. $SrSO_4$ d. $BaSO_4$

18. The correct order of increasing thermal stability of K_2CO_3, $MgCO_3$, $CaCO_3$ and $BeCO_3$ is: (2007)

a. $BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3$
b. $MgCO_3 < BeCO_3 < CaCO_3 < K_2CO_3$
c. $K_2CO_3 < MgCO_3 < CaCO_3 < BeCO_3$
d. $BeCO_3 < MgCO_3 < K_2CO_3 < CaCO_3$

19. The correct order of the mobility of the alkali metal ions in aqueous solution is: (2006)

a. $Li^+ > Na^+ > K^+ > Rb^+$
b. $Na^+ > K^+ > Rb^+ > Li^+$
c. $K^+ > Rb^+ > Na^+ > Li^+$
d. $Rb^+ > K^+ > Na^+ > Li^+$

20. A solid compound 'X' on heating gives CO_2 gas and a residue. The residue mixed with water forms 'Y'. On passing an excess of CO_2 through 'Y' in water, a clear solution, 'Z', is obtained. On boiling 'Z' , compound 'X' is reformed. The compound 'X' is :- (2004)

a. $CaCO_3$ b. Na_2CO_3
c. K_2CO_3 d. $Ca(HCO_3)_2$

21. In which of the following processes, fused sodium hydroxide is electrolysed at 330° C temperature for extraction of sodium? (2000)

a. Castner's process b. Down's process
c. Cyanide process d. Both (b) and (c)

22. The first ionization potential (in eV) of Be and B, respectively are: (1998)

a. 8.29, 9.32 b. 9.32, 9.32
c. 8.29, 8.29 d. 9.32, 8.29

23. When a substance A reacts with water it produces a combustible gas B and a solution of substance C in water. When another substance D reacts with this solution of C, it also produces the same gas B on warming but D can produce gas B on reaction with dilute sulphuric acid at room temperature. 'A' imparts a deep golden yellow colour to a smokeless flame of bunsen burner. A, B, C and D respectively are: (1998)

a. Na, H_2, NaOH, Zn b. K, H_2, KOH, Al
c. CaH_2, $Ca(OH)_2$, Sn d. CaC_2, C_2H_2, $Ca(OH)_2$, Fe

24. Calcium is obtained by the: (1997)

a. Electrolysis of solution of calcium chloride in water
b. Electrolysis of molten anhydrous calcium chloride
c. Roasting of limestone
d. Reduction of calcium chloride with carbon.

25. Sodium is made by the electrolysis of a molten mixture of about 40% NaCl and 60% $CaCl_2$ because: (1995)

a. Ca^{2+} can reduce NaCl to Na
b. Ca^{++} can displace Na from NaCl
c. $CaCl_2$ helps in conduction of electricity
d. This mixture has a lower melting point than NaCl

26. The solubility in water of sulphate down the Be group is Be > Mg > Ca > Sr > Ba. This is due to: (1995)

a. Decreasing lattice energy
b. High heat of solvation for smaller ions Like Be^{2+}
c. Increase in melting points
d. Increasing molecular weights

27. Identify the correct statement. (1995)
a. Plaster of Paris can be obtained by hydration of gypsum
b. Plaster of Paris is obtained by partial oxidation of gypsum
c. Gypsum contains a lower percentage of calcium than Plaster of Paris
d. Gypsum is obtained by heating Plaster of Paris

28. Which of the following is known as fusion mixture? (1994)
a. Mixture of $Na_2CO_3 + NaHCO_3$
b. $Na_2CO_3.10H_2O$
c. Mixture of $K_2CO_3 + Na_2CO_3$
d. $NaHCO_3$

29. All the following substances react with water. The pair that gives the same gaseous product is: (1994)
a. K and KO_2 b. Na and Na_2O_2
c. Ca and CaH_2 d. Ba and BaO_2

30. Among the following oxides, the one which is most basic is: (1994)
a. ZnO b. MgO c. Al_2O_3 d. N_2O_5

31. Which of the following metal ions play an important role in muscle contraction? (1994)
a. K^+ b. Na^+ c. Mg^{2+} d.Ca^{2+}

32. Which of the following statement is false? (1994)
a. Strontium decomposes water readily than beryllium
b. Barium carbonate melts at a higher temperature than calcium carbonate
c. Barium hydroxide is more soluble in water than magnesium hydroxide
d. Beryllium hydroxide is more basic than barium hydroxide

33. Which one of the following has minimum value of cation/anion ratio? (1993)
a. NaCl b. KCl c. $MgCl_2$ d. CaF_2

34. Which of the following has largest size? (1993)
a. Na b. Na^+
c. Na^- d. Can't be predicted

35. Which compound will show the highest lattice energy? (1993)
a. RbF b. CsF c. NaF d. KF

36. Strongest bond is in between: (1993)
a. CsF b. NaCl
c. Both (a) and (b) d. None of the above

37. Electronic configuration of calcium atom may be written as: (1992)
a. [Ne] $4p^2$ b. [Ar] $4s^2$
c. [Ne] $4s^2$ d. [Ar] $4p^2$

38. Which one of the following substance is used in the laboratory for fast drying of neutral gases? (1992)
a. Phosphorus pentoxide
b. Active charcoal
c. Anhydrous calcium chloride
d. Na_3PO_4

39. Compared with the alkaline earth metals, the alkali metals exhibit: (1990)
a. Smaller ionic radii b. Highest boiling points
c. Greater hardness d. Lower ionization energies.

40. Washing soda has formula: (1990)
a. $Na_2CO_3.7H_2O$ b. $Na_2CO_3.10H_2O$
c. $Na_2CO_3.3H_2O$ d. Na_2CO_3

41. Which one of the following properties of alkali metals increases in magnitude as the atomic number rises? (1989)
a. Ionic radius b. Melting point
c. Electronegativity d. First ionization energy

42. Which of the following atoms will have the smallest size? (1989)
a. Mg b. Na c. Be d. Li

Answer Key

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
a	a	c	a	c	b	d	c	d	b	d	a	b	a	d	b	a
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
a	d	a	a	d	a	b	d	b	c	c	c	b	d	d	c	c
35	36	37	38	39	40	41	42									
c	a	b	a	d	b	a	c									

EXPLANATIONS

1. (a) ***NCERT (XI) Ch - 10, Pg. 296***

Li^+ being smallest, has maximum charge density

$\therefore$ Li^+ is most heavily hydrated among all alkali metal ions. Effective size of Li^+ in aqueous solution is therefore, largest.

$\therefore$ Moves slowest under electric field.

2. (a) ***NCERT (XI) Ch - 10, Pg. 299***

Beryllium is smallest among its group or have the highest hydration enthalpy, being the most covalent element of its group it is easily hydrolyzed.

3. (c) ***NCERT (XI) Ch - 10, Pg. 303***

$CaO + H_2O \rightarrow Ca(OH)_2$

Quick lime Lime Water

Suspension of slaked lime $[Ca(OH)_2]$ in water is known as Milk of Lime

4. (a) ***NCERT (XI) Ch - 10, Pg. 304***

Ca^{+2} $\rightarrow$ required to trigger the contraction of muscles and to maintain the regular beating of the heart.

5. (c) ***NCERT (XI) Ch - 10***

$CaC_2 + N_2 \rightarrow CaCN_2 + C$

$\downarrow$

Nitrolium

6. (b) ***NCERT (XI) Ch - 10, Pg. 298***

K^+ & Na^+ form the pump (channels), for diffusion of materials under ion concentration gradient.

7. (d) ***NCERT (XI) Ch - 10, Pg. 301***

Solubility of group II elements decrease down the group.

Order: Mg > Ca > Sr > Ba

8. (c) ***NCERT (XI) Ch - 10, Pg. 301***

$$MgCO_3 \rightarrow MgO + CO_2(g)$$

$$\text{Mw} \rightarrow \underset{\downarrow}{84\text{ g}} \qquad \underset{\downarrow}{40\text{ g}}$$

According to question

84 g $MgCO_3$ gives = 40 g MgO

1 g $MgCO_3$ gives = $\frac{40}{84}$

20 g $MgCO_3$ gives = $\frac{40}{84} \times 20$

= 9.52 g of MgO

But according to question

yield of MgO is = 8 g

% purity = $\frac{8}{9.52} \times 100 = 84\%$

9. (d) ***NCERT (XI) Ch - 10, Pg. 293***

Only Li reacts with O_2 to form a dioxide

$4\,Li + O_2 \rightarrow Li_2O$.

$2\,Na + O_2 \rightarrow Na_2O_2$ (Peroxide)

Rest all (K, Rb, Cs) forms superoxides. XO_2.

10. (b) Ease of adsorption of hydrated alkali metal ion decreases as the size of cation increases.

11. (d) ***NCERT (XI) Ch - 10, Pg. 304***

Plaster of Paris – $CaSO_4 . \frac{1}{2} H_2O$

Epsomite – $MgSO_4.7H_2O$

Kieserite – $MgSO_4.H_2O$

Gypsum (dead man's plaster) – $CaSO_4.2H_2O$.

12. (a) ***NCERT (XI) Ch - 10, Pg. 303***

$CaCO_3(A) \xrightarrow{\Delta} CO_2 + CaO$

$CaO + H_2O \rightarrow Ca(OH)_2$ (B)

$Ca(OH)_2$ (eq.) + $CO_2 \rightarrow \underset{(C)}{CaHCO_3} \xrightarrow{\Delta} \underset{(A)}{CaCO_3}$

So, compound A is $CaCO_3$, calcium carbonate.

13. (b) ***NCERT (XI) Ch - 10, Pg. 301***

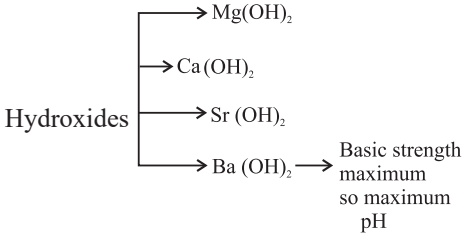
In alkaline earth metals, when we go down the group atomic number increases & their solubility of hydroxides in water also increases.

14. (a) ***NCERT (XI) Ch - 10, Pg. 301***

CaO will not react with NaOH because CaO is a stable compound, basic in nature & a base-base reaction is not feasible.

15. (d) ***NCERtT (XI) Ch - 10, Pg. 301***

Equimolar solution of chlorides when prepared with water form respective hydroxides.



Basic strength increase down the group.

16. (b) Increase with decreasing metal ion size

17. (a) ***NCERT (XI) Ch - 10, Pg. 301***

The solubility of sulphates of alkaline earth metals decreases as we move down the group from Be to Ba, because ionic size increases down the group. The lattice energy remains constant because sulphate ion (SO_4^{2-}) is so large that small change in cationic sizes do not make any difference. Thus the order for solubility of sulphates is:

$BeSO_4 > MgSO_4 > CaSO_4 > SrSO_4 > BaSO_4$

18. (a) ***NCERT (XI) Ch - 10, Pg. 301***

As the basicity of metal hydroxides increases down the group from Be to Ba, the thermal stability of their carbonates also increases in the same order. Further, group 1 compounds are more thermally stable than group 2 because their hydroxide are much more basic in nature than group 2 hydroxides therefore, the order of thermal stability becomes $BeCO_3 < MgCO_3 < CaCO_3 < K_2CO_3$

19. (d) As we go down the group dissociation enthalpy & hydration energy of elements decreases. Thus, Rb^+ will be the most mobile followed by $K^+ > Na^+ > Li^+$.

In group 1, Li^+ will have highest hydration enthalpy, most hydrated in aqueous solution & will thus be least mobile.

20. (a) $CaCO_3 \xrightarrow{\Delta} CaO + CO_2 \uparrow$

$CaO + H_2O \rightarrow Ca(OH)_2$(Y)

$Ca(OH)_2 + 2CO_2 + H_2O \rightarrow Ca(HCO_3)_2$ (Z)

$Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3(X) + CO_2 \uparrow + H_2O$

21. (a) In castner's process for production of sodium metal, sodium hydroxide (NaOH) is electrolysed at temperature 330° C.

22. (d) First ionisation potential of Be (completely filled orbitals) is greater than boron due to stable configuration

Be (z = 4) = $1s^2, 2s^2$

B(z = 5) = $1s^2, 2s^2, 2p^1$

Order of attraction of electrons towards nucleus 2s > 2p, so more amount of energy is required to remove the electrons with 2s orbitals in comparison to 2p orbitals. So ionisation potential of Be is 9.32 eV and B is 8.29 eV.

23. (a) Only Na gives golden colour to bunsen flame. So, A is Na

$2Na + 2H_2O \rightarrow 2NaOH + H_2 \uparrow$

'A' 'A' 'B'

$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2\uparrow$

'B'

$Zn + dil.\ H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$

'B'

Na, produced golden yellow colour with smokeless flame of bunsen burner. It can be explained on the basis of low ionisation potential of sodium & emission spectrum.

24. (b) Calcium is obtained by electrolysis of a fused mass consisting six parts calcium chloride and one part calcium fluoride at about 700°C.

$CaCl_2 \rightleftharpoons Ca^{2+} + 2Cl^-$

$2Cl^- \rightarrow Cl_2 + 2e^-$

$Ca^{2+} + 2e^- \rightarrow Ca$

25. (d) Sodium is obtained by electrolytic reduction of its chloride. Melting point of chloride of sodium is high, so in order to lower its melting point, calcium chloride is added to it.

26. (b) As we move down the group from $BeSO_4$ to $BaSO_4$, the enthalpy of hydration of the positive ion becomes smaller due to increase in ionic size. Salts of heavier metal ions are less soluble than those of lighter ions.

27. (c) Gypsum is $CaSO_4.\ H_2O$ and Plaster is $(CaSO_4)_2.2H_2O$. Therefore gypsum contains a lower percentage of calcium than Plaster of Paris.

28. (c) K_2CO_3 and Na_2CO_3 mixture is called as fusion mixture.

29. (c) The pair which gives the same gaseous product is Ca and CaH_2.

Reaction : $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

$CaH_2 + 2H_2O \rightarrow Ca(OH)_2 + 2H_2$

Whereas, K gives H_2 while KO_2 gives O_2 and H_2O_2.

$2K + 2H_2O \rightarrow 2KOH + H_2$

$2KO_2 + 2H_2O \rightarrow 2KOH + O_2 + H_2O_2$

Similarly, Na gives H_2. While Na_2O_2 gives H_2O_2.

$2Na + 2H_2O \rightarrow 2NaOH + H_2$

$Na_2O_2 + 2H_2O \rightarrow 2NaOH + H_2O_2$

Likewise Ba gives H_2 while BaO_2 gives H_2O_2.

$Ba + 2H_2O \rightarrow Ba(OH)_2 + H_2$

$BaO_2 + 2H_2O \rightarrow Ba(OH)_2 + H_2O_2$

30. (b) Al_2O_3 and ZnO are amphoteric. N_2O_5 is strongly acidic.

31. (d) Calcium is an essential element for the contraction of muscles. In the presence of calcium ions and energy from ATP, actin and myosin (contractile proteins) interact forming actinmyosin which causes contraction of muscles.

32. (d) Beryllium hydroxide although amphoteric, is however less basic than barium hydroxide.

33. (c) The order of ionic size for given ions will be: $K^+ > Ca^{2+} > Mg^{2+}$ and that of $Cl^- > F^-$. Therefore Mg^{2+}/Cl^- has minimum value of cation/anion ratio.

34. (c) The cations are always smaller than the neutral atom and anions are always larger in size than the neutral atom.

$Na^- > Na > Na^+$

35. (c) With the same anion, smaller the size of the cation, higher is the lattice energy. Therefore, NaF will show the highest lattice energy among the given compounds.

36. (a) According to Fajan rules, ionic character increases with increase in size of the cation (Cs > Rb > K > Na) and with decrease in size of the anion (F > Cl > Br > I). Thus, CsF has higher ionic character than NaCl and hence bond in CsF is stronger than in NaCl.

37. (b) $_{20}Ca \rightarrow 1s^2, 2s^22p^6, 3s^23p^6, 4s^2$

$_{18}Ar \rightarrow 1s^2, 2s^22p^6, 3s^23p^6$

hence $_{20}Ca \rightarrow [Ar]4s^2$

38. (a) P_2O_5 absorbs moisture much readily than anhydrous $CaCl_2$.

39. (d) The alkali metals are larger in size and have smaller nuclear charge thus they have low ionization energy in comparison to alkaline earth metals.

40. (b) $Na_2CO_3.10H_2O$ is washing soda.

41. (a) In a group, ionic radius increases with increase in atomic number whereas the melting point decreases down in a group due to weakening of metallic bond. Similarly, electronegativity and the ionization energy also decreases down the group.

42. (c) The atomic size decreases within a period from left to right, therefore Li > Be and Na > Mg. The size increases in a group from top to bottom. Hence, the size of Na is greater than Li. Overall order can be given as

Na > Mg > Li > Be

Thus, Be has smallest size.