Question Bank BSc Part-II

BY

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FOUNDER OF TIMEPASS EDUCATION

Physics (Hons.) Paper-III
Group-A

1. Give the theory and construction of name plate. How a name plate behaves like a convex lens ? **(12,2×10,08,5)**

2. Explain with theory the formation of spectra by a concave grating and Eagle's mounting ? **(12,9,7,5**

3. What are Rayleigh's criterian of the limit of resolution? Obtain an expression for resolving power of telescope. **(12,10,8,6**

4. Describe the production and detection of linearly,circularly,and elliptically polarized light. **(12,2×10,8,6**

5. What are cardinal points of thick lens? Discuss their use in the study of image formation by such a lens. **(12,2×10,8,6**

6. Discuss with neat diagram, the construction and working of He-Ne laser. Mention some applications of laser. **(12,2×10,9,8,6**

7. Distinguish between Freshnel's diffraction Fraunhoper's diffraction. Explain Freshnel's half period zone theory of laser. (13,12,10,7

8. Derive the expression for resolving power of microscope. (11,9,7,5

9. Give the principle and working of a Babinet compensator and and explain how elliptically polarized light is analyzed by it? (11,9,7,5

10. State and explain Fermat's Principle. Deduce lens formula from it. **(13,11,9,7**

11. **Describe ,with theory , the measurement of wavelength (or, circular fringes) of monochromatic light by using Michelson interferometer and also describe that how the instrument can be used to measure the wavelength of the monochromatic light (13,11,09,6**

12. What do you mean by stimulated emission and population inversion? Explain the production of Ruby laser and explain its properties. **(13,11,7,5**

13. Explain the Cornus spiral. Using it, explain the intensity distribution due to the diffraction at straight edge. (,9,7,5

14. What is meant by optical rotation ? Describe a half shaded polarismeter and explain how it can be used to find the specific rotation of optically active substance. (13,11

15. Give the theory of Fraunhoffer diffraction (due to single slit) by a equidistance slits of equal with . Disscuss the intensity distribution obtained due to diffraction. **(13,11,10,8,6**

16. Discuss the characteristic features of diffraction at a circular aperture. Describe the theory involved in it. **(2×10,8,6**

17. Give the theory of formation of fringes by a Lummer Gehrcke plate and obtain the expression for resolving power. (10

18. What is birefringence ? Explain double refraction, ordinary and extra ordinary rays. Give differences between positive crystal and negative crystal. (2013)

19. Write the notes :-

   i. Nicol prism **(12,10,08,06**

   ii. L.G. plate   **(12,10 ,08,05**

   iii. Polarimeter   (12 ,09,05

   iv. Echelon grating (12,09,06

   v. Diffraction at single narrow wire (11,07)

   vi. Diffraction at straight edge(13,05

   vii. Cornus spiral (11

   viii. Eagle Mounting (11

   ix. Half wave plate (13

   x. Quarter wave plate (11,09,06

   xi. Population inversion (10

   xii. Fabry –Perot interometer(10,07

   xiii. Resolving power of prism **(13,09,07,05**

   xiv. Resolving power of telescope (08

   xv. Zone plate (07

   xvi. Half period zone (13

   xvii. Newton's Ring (13

Group-B

1. Develop Maxwell's equation for an electromagnetic field. Discuss the physical significance of the equations.**(12,10,8,6**
2. Describe the theory of dispersion and explain anomalous dispersion. (12,10,08,06
3. Give the theory of reflection of electromagnetic wave from a metallic surface. Hence obtain the values of optical constants of metal.   **(12,10,8,6**
4. Describe the theory of (total) internal reflection of polarized light and mention its uses. **(13,11,09,07**

5. Determine the total cross-section for scattering of a plane monochromatic wave by charge carrying out small vibrations under elastic force. **(13,11,09,07,05**

6. Derive the equation for plane electromagnetic wave in free space using the Maxwell's field equation.**(13,11,09,07,05**

7. Describe a plane electromagnetic wave incident on a plane boundary between two non-conducting media. Specify the boundary conditions and hence derive Fresnel formulae for the reflected and transmitted intensities (2005).

8. Write the short notes on the following :-
   i. Pressure radiation (12,09,06
   ii. Polarization of electromagnetic waves (12,10,09
   iii. Double refraction in crystal **(13,12,09,06**
   iv. Poynting vector/theorem **(12,10,08,05**
   v. Maxwell's stress tensor (13,11
   vi. Properties of plane electromagnetic waves
   vii. Displacement current **(13,11,09,07,05**
   viii. Electromagnetic momentum **(13, 11,10,08**
   ix. Scattering of radiation by bound charge **(13,12,08,07,06**
   x. Electromagnetic stress energy tensor (07,05
   xi. Brewster's law and polarization of electromagnetic wave (07,05

PHYSICS (Hons.) Paper-IV

Instruction to solve the questions :

Answer six questions,

 A. *Selecting at least one question from group A,*
 B. *Selecting at least two questions from group B and*
 C. *Selecting at least two questions from group C*

Group-A

1. What are dia, para and ferro magnetism? Distinguish between them. Describe a method for determination of susceptibility of paramagnetic substance. (12,

2. Explain magnetic circuit, magneto-motive force and reluctance. Compare the magnetic circuit with electric circuit. (12,08,

3. Give an account of Wiess theory of ferromagnetism. **(13,11,09,07,05**

4. Discuss electric potential energy of a system of charge. Derive an expression for the energy stored in a electrostatic field and show that energy density U is given by: $U = \frac{1}{2}\epsilon_0 E^2 J/m^3$ **(13,11,09,07,05**

5. Set up Luplace equation in Cartesian co-ordinate and solve it. Apply it to obtain capacitance of parallel plate capacitor. (10,08,06

6. Describe the properties of paramagnetic substance. Give the Langevin's theory of paramagnetism and explain its merits and shortcomings. (06

Group-B

1. Describe with theory Andorson's bridge method for the determination of self inductance of a coil. **(12,10,08,06**

2. Discuss the theory and construction of a transformer. Explain its working with the help of phasor diagram. (12

3. What are Peltier and Thomson coefficients? Apply second law of thermodynamics to a thermocouple and show that $\pi = T \cdot \frac{dE}{dt}$ where the symbols have their usual meaning **(12,10,08,06**

4. A charged condenser is allowed to discharge through an inductance and a resistance in series. Discuss the nature of discharge. (12,08

5. Describe a moving coil ballistic galvanometer. What is meant by logarithmic decrement? How will you use such a galvanometer to measure the capacity of a capacitor? What are its uses?**(13,11,09,07,05**

6. Explain how a rotating magnetic field is produced? Describe how this principle is used in the construction of induction motor? **(13,11,09,07,05**

7. Discuss the concept of power factor in an A.C. circuit containing L-C-R. Explain its importance. **(13,11,09**

8. Describe with theory the shearing bridge and obtain its balanced condition. (11,09,07

9. What is a transformer? Describe its construction, working and theory with vector/phasor diagram. (10,08,06

10. Obtain an expression for the current in a circuit containing inductance, capacitance and resistance when a simple harmonic e.m.f is applied to it. Find the conditions (10
a) For the current to lag and
b) For the current to lead the e.m.f.

11. Define a mutual induction and coefficient of mutual induction. Describe a method for determining the self induction of a coil. **(13,09,07,05**

12. Discuss an alternating e.m.f. applied to a series containing a resistance, an inductance and a capacitance. Using complex variable, deduce the expression for the current in the circuit. Deduce the condition for electrical resonance.(07,05

13. Give the circuit diagram of modified Carey-Foster M/c bridge and find balance condition. Give vector diagram. (05

14. Write short notes on the following (in exam only 2) :

i. Wattmeter **(12,10,06**

ii. Induction motor (12

iii. Power in an A.C, circuit **(12,08,06**

iv. Carey Foster bridge (12,08

v. Mutual induction and coefficient of mutual induction (11

vi. De Sauyty's bridge (13,11,06

vii. Determination of self induction (11

viii. Series resonance circuit (13,11

ix. Single phase induction motor **(10,08,06**

x. Charging and discharging of condenser (10

xi. Thomson effect (10

xii. Seebeck effect (2013)

xiii. Dipole moment (2013)

Group-C

1. What is Compton's effect? Give the theoretical exploitation of effect. **(12,08,06**
2. Describe Millikan oil drop method for the determination of charge of an electron. **(12,10,08,06**
3. What is the radioactivity? Discuss law of radioactivity and obtain relation between half life and decay constant. (12,09
4. Derive Bragg's law for diffraction of X-rays by a crystal and describe an experiment for determination of X-rays wavelength. **(12,10,08,06**
5. Describe with diagram and necessary theory Thomson's method for the determination of specific charge of an electron. **(13,11,07,05**
6. Describe the principle and working of G.M. (Geiger-Muller) counter. Mention its uses. **(13,11.09,07**
7. Describe the construction and working of a cyclotron. (13,11
8. Give the circuit diagram of R-C coupled amplifier and describe its frequency response for voltage again. (11,09,05
9. What are primary and secondary cosmic rays and how they are composed? How does the intensity of cosmic rays vary with altitude? (11,08,05
10. Describe the principle, construction and working of betatron with the help of neat diagram. (10
11. What is photoelectric effect? Discuss Einstein's explanation of this effect. (10
12. What do you mean by specific charge of an electron? How is it determine experimentally?(10
13. Describe and explain the construction and working of CRO. (07,05
14. State the law of radioactive disintegration and obtain the formula for disintegration of radioactive substance. Explain half life and mean life of a radioactive element and obtain their values. (06
15. Explain construction, theory and working of a solid state rectifier. (2013)
16. Write short notes on the following (in exam only 2) :
    i. Photoelectric effect (12,06
    ii. C.R.O (12,09
    iii. Isotopes (12,09,07
    iv. Origin of cosmic rays (12,09,07
    v. Compton effect (10
    vi. Artificial radioactivity (13,10,07,05
    vii. Nuclear fusion (10
    viii. Nuclear fission (08,05
    ix. Cascade theory of cosmic ray shower (10,06
    x. RC-coupled amplifier (09
    xi. Photovoltaic cell (13,08
    xii. Betatron (08
    xiii. Photo-inductive cell (07
    xiv. Cyclotron (06
    xv. Nuclear reactor (06
    xvi. GM counter (05
    xvii. Strucuture of nucleus (05
    xviii. Cosmic ray showers (13
    xix. Discovery of neutron (13

Chemistry (Subsidiary)

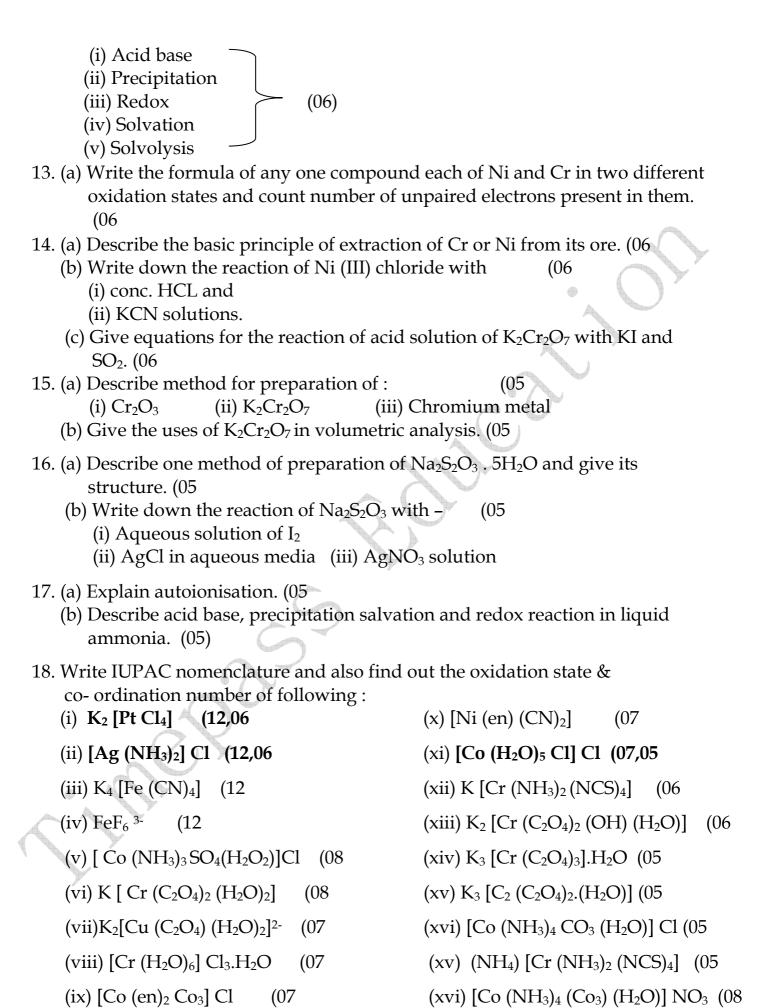*Answer five questions, selecting at least one from each group*

Group-A

1. (a) State phase rule and explain the terms used. (12,07
   (b) Draw phase diagram of Water system. (12,07
   (c) Explain the term ' triple point '. (12

2. (a) Define C_p and C_v thermodynamically and find the difference between the two for one mole of real gas. (12
   (b) state and explain 1st law of thermodynamics.(12,10,07

3. (a) Define that capacity at constant pressure and constant volume. (11
   (b) What is Hess' Law ? Explain. (11,07
   (c) State and explain second law of thermodynamics. (11

4. (a) Define auto catalyst, promoter with examples. (11,09
   (b) Discuss the concept of activation energy. (11,09
   (c) Discuss the Homogeneous and Heterogeneous catalysts with examples. (11,08

5. (a) Define molecularity (08) and order of reaction. Derive an expression for the rate constant of a first order reaction. (10,08
   (b) Give methods for the determination of order of reaction. (10,07
   (c) What is Arrhenius equation? Explain the significance of the terms involved In it. (10,05

6. (a) Derive an expression for the work done by n-mole of a gas under thermal and reversible condition. (10
   (b) What is Joul – Thomson effect. (10

7. (a) Show the half-life period of a first order reaction is independent of initial concentration. (09

8. (a) Define heat capacity at constant pressure and constant volume. (09
   (b) Prove that $C_p - C_v = R$ (09,07
   (c) Define enthalpy of neutralization. Why is it constant for theneutralization reaction between strong acid and strong base? (09

9. (a) How does rate constant of a chemical reaction vary with temperature? (08,07

10. (a) Explain the function of industrial catalyst, promoter and inhibitor in reaction rate. (08

11. (a) Discuss the Ostwald's dilution law and verify it. How it fails in case of Strong electrolytes?(08,05
    (b) Discuss entropy change for an ideal gas at constant pressure. (08

12. (a) What is Buffer solution? (07

13. (a) What is ionic product of water ? Why is it constant at constant
Temperature?(06
(b) Describe the theoretical method for the determination of pH of a salt of
strong acid and weak base. (06
(c) Calculate the pH of 10^{-4} M H_2SO_4 (log2 = 0.3013)   (06

14. (a) Define the lattice cell and unit cell. (06
(b) Classify the solid crystal on the basis of chemical bondings. (06
(c) The number of molecules in a unit cell of NaCl is 4, show it by calculation
From its crystal structures. (06

15. (a) Describe origin of charges in colloidal solution. How does it makes the
Colloidal solution stable? (06
(b) What is difference between emulsion and gel? Give one example of each
(06

16. (a) What is energy of activation of a chemical reaction? Show, how it varies
for exothermic and endothermic processes.(05
(b) Describe the application of EMF measurement.(05

17. (a) Define pH of solution. (05
(b) Giving suitable example, describe function of acid-base indicators. (05
(c) Explain hydrolysis and hydrolysis constant.(05

18. (a) Discuss the Hardy Suhulze Law. (05
(b) Explain coagulation of colloids. (05
(c) Describe crystal structure of AB type of ionic solid.(05

19. Write explanatory notes on the following :-

    i.   Kohlraucsh law (12,08
    ii. Arrhenius equation (12
    iii. Universal gas constant (12
    iv. Buffer solution (11,09
    v.   Ostwald dilution law (11
    vi. Hydrogen electrode (11
    vii. Phase, component and degree of freedom (11,09
    viii. Hydrolysis of salt (10
    ix. Triple point (10
    x.   Hess law (10
    xi. Reduced phase rule (09
    xii. Electrochemical cell and concentration cells (09
    xiii. Auto catalyst (08
    xiv. Common ion effect (08
    xv. Theory of indicater (08

Group – B

1. Transition metal show variable oxidadtion state, from coloured and paramagnetic compounds and behave as catalyst. Exemplify and explain the properties. (12

2. (a) Discuss Sidgwick-powell theory for complexes. (12
   (b) Explain the inner complexes and their application. (12
   (c) Illustrate Chelate effect. (12

3. (a) Explain Werner's co-ordination theory with reference to Cobalt Amine complexes . Or , describe Werner's concept of primary and secondary valency. (11,09,07,05
   (b) Differentiate inner orbital and outer orbital complexes with examples.(11
   (c) Calculate spin only magnetic moment for Mn^{2+} and Ni^{++} (11,09

4. (a) Define transition elements. Describe their characteristics. (10,06
   (b) Zinc is pseudo-transition element.Explain. (10
   (c) Count the number of unpaired electrons in Ni^{++} and Cr^{3+}. (10

5. (a) Write formula of one compound each of Iron and Copper in two Oxidation states. (10
   (b) Illustrate EAN rule with examples. (10,08
   (c) Explain valence bond theory for complex formation (or of M-L bonding) . (10,07

6. (a)Differentiate between double salt the coordination compound. (09,07,05

7. (a) What is transition element form complex compound ? (09
   (b) What is oxidation potential ? Discuss the oxidation potential diagram. (09
   (c) Define inner complex. Discuss its applications. (09

8. (a) Giving suitable examples, describe Sidwick concept of Effective Atomic Number (EAN) rule. (10, 08

   (b) Explain chelate,chelatingmolecule and inner complexes. (08,07
   (c) Describe the use of Dimethyglyoxime in gravimetric estimation of Ni(II). (08
9. (a) Describe valence bond theory to explain mode of bonding and structure of compounds. (08

10. (a) Describe the characteristics of compounds of 3d block element. (08

11. (a) Describe the characteristic properties of block element. (07

12. (a) What is autozonisation ? (06)
    (b)Describe any three of the following reactions in liquid NH_3 with one examled each :

(i) Acid base
(ii) Precipitation
(iii) Redox   (06)
(iv) Solvation
(v) Solvolysis

13. (a) Write the formula of any one compound each of Ni and Cr in two different oxidation states and count number of unpaired electrons present in them. (06

14. (a) Describe the basic principle of extraction of Cr or Ni from its ore. (06
    (b) Write down the reaction of Ni (III) chloride with   (06
        (i) conc. HCL and
        (ii) KCN solutions.
    (c) Give equations for the reaction of acid solution of $K_2Cr_2O_7$ with KI and SO_2. (06

15. (a) Describe method for preparation of :   (05
        (i) Cr_2O_3 (ii) $K_2Cr_2O_7$ (iii) Chromium metal
    (b) Give the uses of $K_2Cr_2O_7$ in volumetric analysis. (05

16. (a) Describe one method of preparation of $Na_2S_2O_3 . 5H_2O$ and give its structure. (05
    (b) Write down the reaction of $Na_2S_2O_3$ with –   (05
        (i) Aqueous solution of I_2
        (ii) AgCl in aqueous media   (iii) $AgNO_3$ solution

17. (a) Explain autoionisation. (05
    (b) Describe acid base, precipitation salvation and redox reaction in liquid ammonia. (05)

18. Write IUPAC nomenclature and also find out the oxidation state & co- ordination number of following :
    (i) **K$_2$ [Pt Cl$_4$]**   **(12,06**   (x) [Ni (en) (CN)$_2$]   (07

    (ii) **[Ag (NH$_3$)$_2$] Cl   (12,06**   (xi) **[Co (H$_2$O)$_5$ Cl] Cl (07,05**

    (iii) K$_4$ [Fe (CN)$_4$]   (12   (xii) K [Cr (NH$_3$)$_2$ (NCS)$_4$]   (06

    (iv) FeF$_6$ $^{3-}$ (12   (xiii) K$_2$ [Cr (C$_2$O$_4$)$_2$ (OH) (H$_2$O)]   (06

    (v) [Co (NH$_3$)$_3$ SO$_4$(H$_2$O$_2$)]Cl   (08   (xiv) K$_3$ [Cr (C$_2$O$_4$)$_3$].H$_2$O (05

    (vi) K [Cr (C$_2$O$_4$)$_2$ (H$_2$O)$_2$]   (08   (xv) K$_3$ [C$_2$ (C$_2$O$_4$)$_2$.(H$_2$O)] (05

    (vii)K$_2$[Cu (C$_2$O$_4$) (H$_2$O)$_2$]$^{2-}$ (07   (xvi) [Co (NH$_3$)$_4$ CO$_3$ (H$_2$O)] Cl (05

    (viii) [Cr (H$_2$O)$_6$] Cl$_3$.H$_2$O   (07   (xv) (NH$_4$) [Cr (NH$_3$)$_2$ (NCS)$_4$]   (05

    (ix) [Co (en)$_2$ Co$_3$] Cl   (07   (xvi) [Co (NH$_3$)$_4$ (Co$_3$) (H$_2$O)] NO$_3$ (08

15. write short notes or explain the followings :-
    i. Mass defect and (nuclear) binding energy   (12,11,08
    ii. Isotope, isobar and isotone   (12
    iii. Nuclear fusion (12,11,09,07
    iv. Nuclear fission   (10,08
    v. Separation of isotopes (11,06
    vi. $4n+2$ series (11,10
    vii. Nuclear stability (10,08
    viii. Artificial radioactivity   (09
    ix. Radioactive equilibrium   (09,07
    x. Nuclear isomerism   (09,07
    xi. Nuclear radioactive series (08
    xii. Effective Atomic rule (EAN rule) (07
    xiii. Sidwick Effective Atomic Number rule (06
    xiv. EDTA titration   (06
    xv. Activation analysis   (06
    xvi. Artificial radioactivity (06

Group –C

1. Distinguish between the following :
    (a) SN^1 and SN^2 mechanisms   (12,10,06
    (b) Homolytic and heterolytic fission   (12,10
    (c) Electrophile and nucleophile   (12,11
    (d) Carbocations and carboanions (11,10
    (e) E_1 and E_2 mechanisms (11

2. (a) What do understand by active methylene group? Give two examples of compounds having active methylene groups. (12,09,07
    (b) How diethylmalonate is prepared in laboratoery. (12,09,07
    (c) Describe three applications of diethylmalonate in synthesis. (12,09

3. (a) What are carbohydrates? How carbohydrates are classified? (12,10,08
    (b) Draw open chain structure of fructose and D-glucose. (12,05
    (c) How *(D)* glucose and *(D)* fructose are converted into one another. (12,10,05

4. How is ethylcetoacetate prepared in the laboratory? Describe four synthetic applications of ethylacetoacetate. (11

5. (a) Describe two methods of preparation of lactic acid. How does it react with HI? (10,08,06

(b) Discuss optical isomerism of lactic acid. (08,06

(c) Discuss two methods of preparation of tartaric acid. How does it react with HI.Discuss the optical activity of tartaric acid.   (10,09,05

6. (a) Describe relative stability of carbocation and free radical. (09

(b) Illustrate electrophile and nucleophile with examples. (09

7. (a) Discuss the isolation (from lemon juice), synthesis, and properties of citric acid. (09,07

(b) write down the reaction of citric acid
   (i) with HI (ii) with H_2SO_4 (iii) when heated alone.   (07

8. Give evidences on which clyclic structure of glucose is based. (08
   a) Give two methods of preparation of benzaldehyde. (08,06
   (b) How does benzaldehyde react with –
      (i) PCl_3 (ii)HCN (iii) $NH_2NHC_6H_5$ (08

9. (a) Describe Huckel rule of aromaticity. (07
   (b) Show that pyrrol and benzene have aromatic character. (07
   (c) Describe the mechanism of nitration reaction in benzene ring. (07

10. (a) Starting from benzene bring out the followiog conversion :   (07
      (i) Phenol
      (ii) Toluene
      (iii) m-nitraniline
   (b) Starting with benzaldehyde how would you prepare the following :
      (i) Benzaldoxime   (ii) Cinnamic acid   (06
      (iii) Benzil   (iv) Benzoine

11. (a) Explain directive influence of a substituent group in an aromatic ring.
   (b) Discuss, why Nitrobenzene is a deactivation group for electrophilic substitution reaction.
   (c) Describe the reduction of Nitrobenzene under neutral,acidic and basic Media.

12. (a) Giving suitable example, explain SN_1 & SN_2 reaction. (06
   (b) Discuss stability order of 1^0, 2^0 & 3^0 carbocations. (06
   (c) Write equation for preparation of acetylacetone from ethyl acetoacetate and acetyl chloride. (06

13. (a) What do you mean by diazotization reaction? (05
   (b) How is benzenediazonium chloride prepared in laboratory? (05
   (c) Starting from benzenediaxonium chloride, how would you prepare :
      (i) chlorobenzene   (iii) phenylhidrazine
      (ii) phenol   (05

14. Write notes on the following :-

I. Inductive effect. (11,

II. Optical activity of lactic acid. (11,

III. Conversion of fructose to glucose. (11,

IV. Halogenations of benzene. (11,

V. Hukckel rule of aromaticity. (09,

VI. Mechanism of Friedel Crafts alkylayion of benzene. (09,

VII. One method for the synthesis of citric acid. (09

VIII. Conversion of fructose into glucose. (09

IX. Directive influence of functional group (09

X. Formation of osazone. (08

XI. Killiani synthesis. (08

XII. Mutarotation (08

XIII. Keto-enol tautomerism (08,07,05

XIV. Carbocations (07

XV. Free radicals (07

XVI. Directive influence of $-NH_2$, $-OH$, $-NO_2$ in benzene. (07

XVII. Carbonium ion (05

XVIII. S N_1 & SN_2 reaction (05

XIX. Electrophiles and nucleophiles (05

XX. Reduction of nitrobenzene in different conditions. (05

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