अधिव्याख्याता, रसायनशास्त्र चाळणी प[illegible]

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परीक्षा दि : ११/१२/२०११ प्रश्नपुस्तिका क्रमांक
BOOKLET No.

प्रश्नपुस्तिका

चाळणी परीक्षा
रसायनशास्त्र विषयक ज्ञान

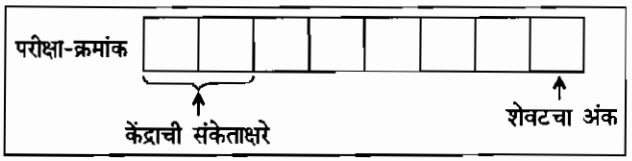
वेळ : $1\frac{1}{2}$ (दीड) तास

एकूण प्रश्न : 150
एकूण गुण : 150

सूचना

(1) सदर प्रश्नपुस्तिकेत **150** अनिवार्य प्रश्न आहेत. उमेदवारांनी प्रश्नांची उत्तरे लिहिण्यास सुरुवात करण्यापूर्वी या प्रश्नपुस्तिकेत सर्व प्रश्न आहेत किंवा नाहीत याची खात्री करून घ्यावी. असा तसेच अन्य काही दोष आढळल्यास ही प्रश्नपुस्तिका समवेक्षकांकडून लगेच बदलून घ्यावी.

(2) आपला परीक्षा-क्रमांक ह्या चौकोनांत **न विसरता बॉलपेनने** लिहावा.



(3) वर छापलेला प्रश्नपुस्तिका क्रमांक तुमच्या उत्तरपत्रिकेवर विशिष्ट जागी उत्तरपत्रिकेवरील सूचनेप्रमाणे **न विसरता नमूद करावा.**

(4) या प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाला 4 पर्यायी उत्तरे सुचविली असून त्यांना 1, 2, 3 आणि 4 असे क्रमांक दिलेले आहेत. त्या चार उत्तरांपैकी सर्वात योग्य उत्तराचा क्रमांक उत्तरपत्रिकेवरील सूचनेप्रमाणे तुमच्या उत्तरपत्रिकेवर नमूद करावा. अशा प्रकारे उत्तरपत्रिकेवर उत्तरक्रमांक नमूद करताना तो संबंधित प्रश्नक्रमांकासमोर छायांकित करून दर्शविला जाईल याची काळजी घ्यावी. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

(5) सर्व प्रश्नांना समान गुण आहेत. यास्तव सर्व प्रश्नांची उत्तरे द्यावीत. घाईमुळे चुका होणार नाहीत याची दक्षता घेऊनच शक्य तितक्या वेगाने प्रश्न सोडवावेत. क्रमाने प्रश्न सोडविणे श्रेयस्कर आहे पण **एखादा प्रश्न कठीण वाटल्यास त्यावर वेळ न घालविता पुढील प्रश्नाकडे वळावे.** अशा प्रकारे शेवटच्या प्रश्नापर्यंत पोहोचल्यानंतर वेळ शिल्लक राहिल्यास कठीण म्हणून वगळलेल्या प्रश्नांकडे परतणे सोईस्कर ठरेल.

(6) उत्तरपत्रिकेत एकदा नमूद केलेले उत्तर खोडता येणार नाही. नमूद केलेले उत्तर खोडून नव्याने उत्तर दिल्यास ते तपासले जाणार नाही.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच "उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची अचूक उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चार चुकीच्या उत्तरांसाठी एका प्रश्नाचे गुण वजा करण्यात येतील".**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

ताकीद

ह्या प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपेपर्यंत ही प्रश्नपुस्तिका आयोगाची मालमत्ता असून ती परीक्षाकक्षात उमेदवाराला परीक्षेसाठी वापरण्यास देण्यात येत आहे. ही वेळ संपेपर्यंत सदर प्रश्नपुस्तिकेची प्रत/प्रती, किंवा सदर प्रश्नपुस्तिकेतील काही आशय कोणत्याही स्वरूपात प्रत्यक्ष वा अप्रत्यक्षपणे कोणत्याही व्यक्तीस पुरविणे, तसेच प्रसिद्ध करणे हा गुन्हा असून अशी कृती करणाऱ्या व्यक्तीवर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचा अधिनियम-82" यातील तरतुदीनुसार तसेच प्रचलित कायद्याच्या तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

तसेच ह्या प्रश्नपत्रिकेसाठी विहित केलेली वेळ संपण्याआधी ही प्रश्नपुस्तिका अनधिकृतपणे बाळगणे हा सुद्धा गुन्हा असून तसे करणारी व्यक्ती आयोगाच्या कर्मचारीवृंदापैकी, तसेच परीक्षेच्या पर्यवेक्षकीयवृंदापैकी असली तरीही अशा व्यक्तीविरुद्ध उक्त अधिनियमानुसार कारवाई करण्यात येईल व दोषी व्यक्ती शिक्षेस पात्र होईल.

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

1. What does the relation $\Delta x \times \Delta p = \frac{h}{4\pi}$ represent ?

(1) De-Broglie equation (2) Heisenberg's uncertainty principle

(3) Schrodinger's wave equation (4) Pauli's exclusion principle

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2. The angular momentum quantum number is denoted by which letter ?

(1) n (2) s (3) m (4) l

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3. "No two electrons in an atom can have same set of four identical quantum numbers." It is the statement of

(1) Aufbau's principle (2) Hund's rule

(3) Pauli's exclusion principle (4) None of these

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4. The effective nuclear charge zeta is nearly equal to the nuclear charge for which orbital ?

(1) 1s orbital (2) Outermost orbital

(3) 2p orbital (4) Total nuclear charge of all orbitals

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5. Match the molecules and geometry according to valence shell electron pair repulsion theory for the following molecules :

Molecules	*Geometry*
i. NH_3	a. Linear
ii. ClF_3	b. V-shaped
iii. ICl_2^-	c. T-shaped
iv. H_2O	d. Trigonal bipyramidal
v. SF_4	e. Pyramidal

(1) i-d ii-c iii-b iv-e v-a (2) i-e ii-c iii-a iv-b v-d

(3) i-b ii-d iii-c iv-a v-e (4) i-c ii-e iii-d iv-a v-b

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6. The molecule among CCl_4, PCl_3, SF_4 and NH_3, which does ***not*** contain lone pair of electrons around the central atom is

(1) CCl_4 (2) PCl_3 (3) SF_4 (4) NH_3

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P.T.O.

7. What is the bond order of carbon monoxide (CO) as per the molecular orbital configuration ?

(1) Four (2) Six (3) Three (4) Eight

8. As per Fajans' rules the formation of which bond in an ionic molecule is favoured when the cation has high positive charge, small size and $ns^2p^6d^{10}$ configuration while the anion has high negative charge and large size ?

(1) Valence bond (2) Covalent bond

(3) Ionic bond (4) Co-ordination bond

9. The magnitude of forces of attraction between the molecules of polar as well as non-polar substances is maximum in case of

(1) solids (2) liquids (3) gases (4) colloids

10. s-block elements consist of metals

(1) highly electro-positive elements (2) low electro-positive elements

(3) highly electro-negative elements (4) moderately electro-negative elements

11. Alkali metals have minimum effective nuclear charge and hence they have the

(1) smallest atomic radii

(2) smallest atomic radii in their respective periods

(3) largest atomic radii

(4) largest atomic radii in their respective periods

12. Diagonal relationship existing between a pair of s-block elements can be explained on the basis of

(1) atomic volume and density

(2) metallic and non-metallic character

(3) polarising power and electronegativity

(4) atomic and ionic radii

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13. The hydrides of the elements of which group are electron deficient and act as Lewis acid ?

(1) Gr. IA (2) Gr. IIIA (3) Gr. IVB (4) Gr. IB

14. Electron diffraction and X-ray measurements have shown that tetrasulphur tetranitride (S_4N_4) molecule has

(1) a tetrahedral structure

(2) an eight-membered cradle ring structure

(3) an eight-membered puckered ring structure

(4) a six-membered ring structure

15. Which halogen ***cannot*** form any interhalogen compound ?

(1) Iodine (2) Chlorine (3) Bromine (4) Fluorine

16. Perovskite is the mineral having structure

(1) $CaTiO_3$ (2) $FeTiO_3$ (3) $MgTiO_3$ (4) $MgAl_2O_4$

17. All of the following statements about the transition elements are true except that,

(1) all of the transition elements are metallic

(2) in aqueous solution many of their simple ions are coloured

(3) most of these elements show only one valence state

(4) most of these elements show pronounced catalytic activity

18. The purple colour of $[Ti(H_2O)_6]^{3+}$ ion is due to

(1) unpaired d-electron (2) transfer of an electron

(3) presence of water molecule (4) reflection of light

19. In $CoCl_3 . 6NH_3$, $CoCl_3 . 5NH_3$, $CoCl_3 . 4NH_3$ and $CoCl_3 . 3NH_3$ since the secondary valency of Co atom is six, each amine has

(1) trigonal planar geometry (2) tetrahedral geometry

(3) linear geometry (4) octahedral geometry

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20. The proper name of the compound $[Co(NH_3)_5Co_3]Cl$ is

(1) Pentaammine carbonato cobalt (III) chloride

(2) Carbonato pentaammine cobalt (III) chloride

(3) Chloro pentaammine cobalt (III) carbonate

(4) Pentaammine carbonato cobalt (II) chloride

21. For a d^6 system with an octahedral symmetry, the difference between CFSE for high spin and low spin configurations amounts to (Δ_0 and P have their usual meaning)

(1) $2\,\Delta_0 - 2P$ (2) $2\,\Delta_0 - 4P$ (3) $2{\cdot}6\,\Delta_0 - 2P$ (4) $2{\cdot}8\,\Delta_0 - P$

22. Silica readily dissolves in

(1) HF (2) HCl (3) HI (4) HNO_3

23. CFSE for a high spin octahedral system is zero. Its electronic distribution is

(1) $(t_{2g})^4\,(e_g)^0$ (2) $(t_{2g})^6\,(e_g)^3$ (3) $(t_{2g})^4\,(e_g)^2$ (4) $(t_{2g})^3\,(e_g)^2$

24. The CFSE for d^4 configuration for high spin complexes is

(1) $-0{\cdot}4\,\Delta_0$ (2) $-0{\cdot}6\,\Delta_0$ (3) $-0{\cdot}8\,\Delta_0$ (4) $-1{\cdot}2\,\Delta_0$

25. The most common oxidation state of lanthanides is

(1) +4 (2) +3 (3) +5 (4) +7

26. On alkylation of diborane, the product formed is

(1) hexaalkyl diborane (2) tetraalkyl diborane

(3) dialkyl diborane (4) None of these

27. Among the following lanthanides, the smallest size is that of

(1) Cerium (2) Dysprosium (3) Thulium (4) Ytterbium

28. The first actinide metal which resembles a lanthanide is

(1) Neptunium (2) Americium (3) Berkelium (4) Uranium

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29. The principal oxidation state of thorium is

(1) +4 (2) +3 (3) +2 (4) +5

30. $Fe(CO)_5$ has a geometry which is

(1) octahedral (2) trigonal bipyramidal

(3) square pyramidal (4) None of these

31. Unsaturated hydrocarbons can be separated from alkanes by the complex formed between this metal and the unsaturated hydrocarbon.

(1) Pt (2) Ag (3) Au (4) Zn

32. Which of the halide ions causes larger d orbital splittings ?

(1) Cl^- (2) I^- (3) Br^- (4) F^-

33. The infra-red absorption spectrum of $Fe_2(CO)_9$ indicates how many types of carbonyl groups in the complex ?

(1) 1 (2) 2 (3) 3 (4) Not clear

34. The temperature above which an antiferromagnetic complex shows paramagnetic behaviour is called

(1) Curie temperature (2) Neel temperature

(3) Critical temperature (4) Theta temperature

35. When an alkene molecule complexes with a metal, the alkene is susceptible to attack by

(1) Electrophiles (2) Nucleophiles

(3) Both (1) and (2) (4) None of these

36. The complex $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are respectively

(1) diamagnetic, paramagnetic (2) diamagnetic, diamagnetic

(3) paramagnetic, diamagnetic (4) paramagnetic, paramagnetic

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37. According to Curie's law, the paramagnetic susceptibility χ_M^{corr} is relat absolute temperature as

(1) $\chi_M^{corr} \propto T$ (2) $\chi_M^{corr} \propto \frac{1}{T}$

(3) does not depend on temperature (4) None of the above

38. The catalyst formed by the combination of $TiCl_4$ and $Al(C_2H_5)_3$ is called the

(1) Wilkinson's catalyst (2) Ziegler – Natta catalyst

(3) Lazier catalyst (4) Nishimura catalyst

39. A polynuclear metal carbonyl which does ***not*** contain a bridging carbonyl group is

(1) $Fe_2(CO)_9$ (2) $Co_4(CO)_{12}$

(3) $Co_2(CO)_8$ (4) All of the above

40. The splitting energy Δ_0 increases in the order

(1) $CrCl_6^{3-} < Cr(CN)_6^{3-} < Cr(NH_3)_6^{3+}$ (2) $CrCl_6^{3-} < Cr(NH_3)_6^{3+} < Cr(CN)_6^{3-}$

(3) $Cr(NH_3)_6^{3+} < Cr(CN)_6^{3-} < CrCl_6^{3-}$ (4) $Cr(NH_3)_6^{3+} < CrCl_6^{3-} < Cr(CN)_6^{3-}$

41. The condition that arises due to excessive intake of iron to toxic level is

(1) Hemochromatosis (2) Transferrins

(3) Ovotransferrins (4) Lactoferrin

42. The rate of hydrolysis of ATP by an active ion pump is directly related to

(1) concentration of Na^+ ions

(2) concentration of K^+ ions

(3) concentration of Mg^{+2} ions

(4) concentration of Na^+ and K^+ ions in presence of Mg^{+2}

43. The acid or base property of a substance is not inherent in the substance itself, is the limitation of

(1) Arrhenius concept (2) Bronsted – Lowry concept

(3) Protonic concept (4) Auto-ionisation concept

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44. According to Bronsted concept, the basicity of the anions derived from CH_4, NH_3, H_2 and HF is in the order of

(1) $F^- > OH^- > NH_2^- > CH_3^-$ (2) $CH_3^- > NH_2^- > F^- > OH^-$

(3) $F^- > OH^- > CH_3^- > NH_2^-$ (4) $CH_3^- > NH_2^- > OH^- > F^-$

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45. Which of the following are Lewis acids and Lewis bases ?

H^+, SO_3, phenol, H_2O, ROH

(1) Acids : – H^+, SO_3, phenol
Bases : – H_2O, ROH

(2) Acids : – H^+, SO_3, H_2O
Bases : – Phenol, ROH

(3) Acids : – H^+, ROH
Bases : – Phenol, H_2O, SO_3

(4) All are acids

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46. When acetic acid (CH_3COOH) is dissolved in liq. NH_3 (ammonia)

(1) it behaves as strong base

(2) it behaves as strong acid

(3) neutralisation reaction take place

(4) liq. NH_3 (ammonia) behaves as an acid

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47. When KNH_2 is mixed with liquor ammonia (NH_3) solution of silver nitrate ($AgNO_3$), the silver (Ag) precipitates as

(1) nitrate salt (2) imide salt (3) solid metal (4) amide salt

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48. The inorganic salts containing highly charged ions like oxides, hydroxides, sulphides are practically

(1) soluble in liq. SO_2 (2) soluble in liq. NH_3

(3) insoluble in liq. NH_3 and liq. SO_2 (4) soluble in both liq. SO_2 and liq. NH_3

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49. Non-ionising solvents have

(1) high dielectric constant and high dipole moment

(2) low dipole moment and high dielectric constant

(3) low dipole moment and low dielectric constant

(4) high polarity

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50. At constant temperature, the volume of a fixed mass of a gas is inversely prop to its pressure, is

(1) Charles' law (2) Einstein's law

(3) Boyle's law (4) Pressure-Temperature law

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51. The unit of 'a', the van der Waal's constant is

(1) atm lit mol^{-1} (2) atm lit^{-1} mol^{-1}

(3) atm lit^2 mol^{-2} (4) atm lit^{-1} mol^{-2}

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52. The inter-relationship between the average velocity ($\bar{v}$) and RMS velocity (μ) can be given as

(1) $\bar{v} = \mu \times 0{\cdot}9213$ (2) $\bar{v} = \mu \times 9{\cdot}213$

(3) $\mu = \bar{v} \times 0{\cdot}923$ (4) $\mu = \bar{v} \times 9{\cdot}213$

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53. The gases which have their critical temperature above or just below the ordinary atmospheric temperature are liquified by

(1) Linde's method (2) Faraday's method

(3) Claude's method (4) Maxwell's method

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54. Inter-molecular forces in liquids are essentially

(1) neutral (2) electrical (3) strong (4) magnetic

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55. The liquid crystals in which molecules are arranged in parallel to each other but they are free to slide or roll individually, are known as

(1) smectic liquid crystals (2) cholesteric liquid crystals

(3) nematic liquid crystals (4) crystalline liquid crystals

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56. In simple cubic lattice of NaCl, each particle is surrounded by

(1) eight other particles (2) four other particles

(3) six other particles (4) ten other particles

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57. The movement of sol particles under an applied electric field is called

(1) Electrofiltration (2) Electro-osmosis

(3) Electrokinetic phenomenon (4) Electrophoresis

58. An emulsion is a colloidal solution of a

(1) solid dispersed in liquid (2) liquid dispersed in another liquid

(3) liquid dispersed in solid (4) None of the above

59. The function of alum used for purification of water is to

(1) coagulate the colloidal particles (2) coagulate the sol particles

(3) emulsify the sol particles (4) emulsify the colloidal particles

60. The solution which does ***not*** show Tyndall effect is

(1) suspension (2) colloidal solution

(3) true solution (4) emulsion

61. The unit of specific reaction rate constant for zero order reaction is

(1) sec^{-1} (2) mol dm^{-3}

(3) mol dm^{-3} sec^{-1} (4) mol dm^{3} sec^{-1}

62. A graph of $\log \frac{\Delta}{(\Delta - x)}$ vs. t for a reaction is straight line graph with slope = – 0·00486. The value of K (specific rate constant) is

(1) – 0·00486 min^{-1} (2) – 0·001119 min^{-1}

(3) 0·001119 min^{-1} (4) 0·01119 min^{-1}

63. The half-time of a first-order reaction is 90 days. Starting with a unit concentration of a reactant, after 360 days, the amount of reactant remaining is

(1) $\frac{1}{16}$ (2) $\frac{1}{8}$ (3) $\frac{1}{4}$ (4) $\frac{1}{2}$

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64. In which of the following processes does the entropy decrease ?

(1) Dissolution of NaCl in water

(2) Evaporation of water

(3) Conversion of CO_2 (g) into dry ice

(4) Spilling of food-grains on the ground

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65. The Gibbs – Helmholtz equation is

(1) $\Delta G = \Delta H + T\left[\frac{d(\Delta G)}{dT}\right]_P$ (2) $\left[\frac{d(\Delta G)}{dT}\right]_P = \frac{-\Delta H^0}{T^2}$

(3) $\left[\frac{d(\Delta G / T)}{d\left(\frac{1}{T}\right)}\right]_P = \Delta H^0$ (4) $\left[\frac{d(\Delta H / T)}{dT}\right]_P = \Delta G$

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66. The gas which does ***not*** show Joule – Thomson effect is

(1) CO_2 (2) H_2 (3) N_2 (4) NH_3

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67. The number of degrees of freedom for the following equilibrium reaction are

$CaCO_3$ (s) $\rightleftharpoons$ CaO (s) + CO_2 (g)

(1) zero (2) one (3) two (4) three

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68. In the phase diagram for water system, the number of curves representing monovariant system are

(1) one (2) two (3) three (4) four

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69. In the phase diagram of the CO_2 system, the fusion curve slopes away slightly from pressure axis. This is due to the fact that

(1) the molar volume of liquid CO_2 is larger than molar volume of solid CO_2

(2) the molar volume of liquid CO_2 is less than molar volume of solid CO_2

(3) the pressure is high

(4) this is due to the effect of sublimation curve

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70. The relation between K_p and K_c for the reaction

$N_2\,(g) + 3\,H_2\,(g) \rightleftharpoons 2\,NH_3\,(g)$ is

(1) $K_p = K_c$ (2) $K_p = K_c\,(RT)^2$

(3) $K_p = K_c\,(RT)^{-2}$ (4) $K_p = \dfrac{1}{K_c}$

---

71. At constant pressure, upon addition of He (g) at the equilibrium point in the reaction

$PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2\,(g)$

the degree of dissociation of

(1) PCl_5 will decrease (2) PCl_5 will increase

(3) PCl_3 will increase (4) Cl_2 will increase

---

72. Which of the following expressions is valid for a reversible process in a state of equilibrium ?

(1) $\Delta G = -\,RT\,ln\,K_p$ (2) $\Delta G = RT\,ln\,K_p$

(3) $\Delta G^0 = -\,RT\,ln\,K_p$ (4) $\Delta G^0 = RT\,ln\,K_p$

---

73. The disturbance in the equilibrium of NO and NO_2 results into

(1) acid rain (2) formation of smoke

(3) green house effect (4) photochemical smog

---

74. The type of cancer that is ***not*** caused due to expoure to ultraviolet radiations is

(1) Carcinoma (2) Squamous (3) Leukemia (4) Melanoma

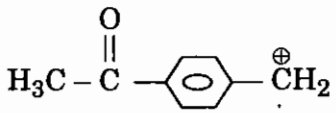
---

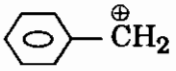
75. The gas that does ***not*** cause green house effect is

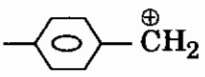
(1) CO_2 (2) CFC (3) N_2O (4) NO_2

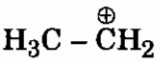
---

76. The relative stabilities of the carbocations a, b, c and d are in the order :

a. 

b. 

c. 

d. 

(1) d < b < c < a (2) b < d < c < a

(3) d < b < a < c (4) b < d < a < c

SPACE FOR ROUGH WORK

P.T.O.

77. The hybridisation of N atom in NH_3 is sp^3. The bond angle H – N – H is

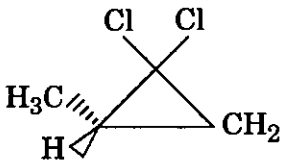
(1) 109·5° (2) 107·3° (3) 120° (4) 180°

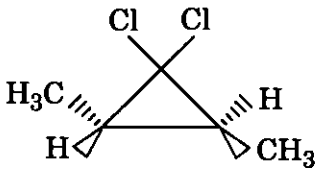
78. The boiling point of which of the following compounds is unusually higher as compared to the other three ?

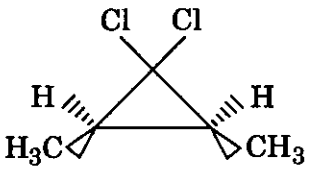
(1) Ethanol (2) Propane

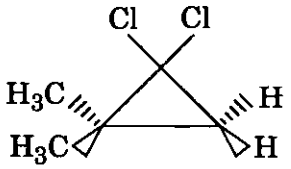
(3) Dimethyl ether (4) Ethyl Fluoride

79. The reaction of cis-2-butene with K-tert butoxide will yield the following cycloadduct.

(1) 

(2) 

(3) 

(4) 

80. Which of the statements given below about the reactive intermediate methylene are correct ?

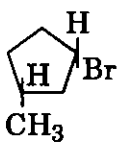
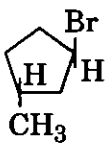
a. Methylene is formed by photolysis of diazomethane.

b. Methylene can exist in two forms, singlet and triplet.

c. Singlet methylene is more stable than triplet methylene.

d. When methylene is generated in presence of alkene, cyclopropanes are formed.

(1) a, b and d (2) a, b and c (3) c and d (4) a, c and d

81. The compounds  and  are a pair of

(1) enantiomers (2) diastereomers

(3) conformational isomers (4) constitutional isomers

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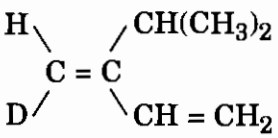
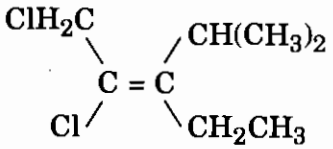
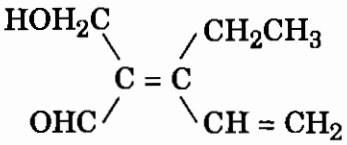
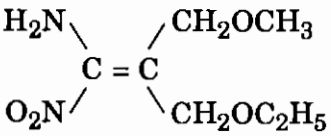
82. Which of the following isomers may be labelled as an E isomer ?

(1) 

(2) 

(3) 

(4) 

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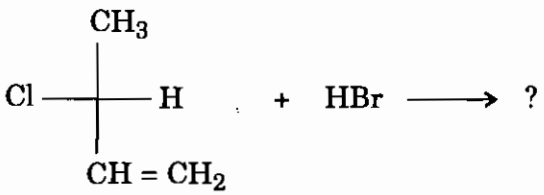
83. The product of the following reaction is



(1) 1-bromo-3-chlorobutane

(2) threo-2-bromo-3-chlorobutane

(3) erythro-2-bromo-3-chlorobutane

(4) A mixture of threo-2-bromo-3-chlorobutane + erythro-2-bromo-3-chlorobutane

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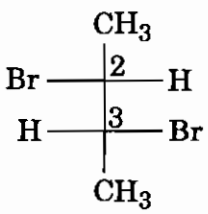
84. The absolute configuration of the asymmetric centres in the given molecule is



(1) 2R, 3R (2) 2R, 3S (3) 2S, 3R (4) 2S, 3S

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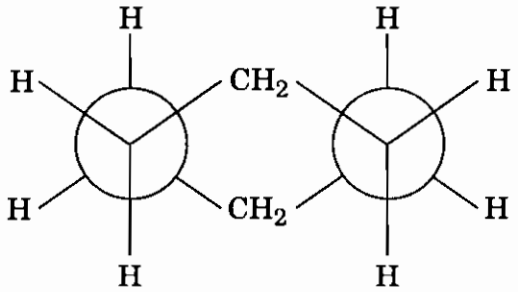
85. The conformation of cyclohexane in Newman style projection is that of



(1) Boat form (2) Chair form

(3) Twist Boat form (4) Half Chair form

---

86. Match the following :

Organic compounds		*λ_{max} (nm) values of absorption (uv-vis)*
a.	Benzene	i. 270
b.	Nitrobenzene	ii. 261
c.	p-dinitrobenzene	iii. 254

(1) a-i b-ii c-iii (2) a-ii b-iii c-i

(3) a-iii b-ii c-i (4) a-iii b-i c-ii

---

87. The IR spectrum of an organic compound shows absorption bands at 3050 cm^{-1}, 2740 cm^{-1}, 1700 cm^{-1}, 1600 cm^{-1} and 1460 cm^{-1}. The compound would most likely be

(1) Phenol (2) Benzaldehyde

(3) Benzophenone (4) Acetophenone

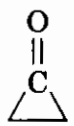
---

88. A compound with molecular formula $C_9H_{10}O$ gives a strong absorption band at 1680 cm^{-1} and signals in the NMR spectrum as follows :

a triplet at 1·2 δ (3H); a quartet at 3·0 δ (2H) and a multiplet at 7·4 – 8·0 δ (5H).

The given compound is

(1) $C_6H_5CH_2CH_2CHO$ (2) $C_6H_5 - CH_2 - \overset{\overset{O}{\|}}{C} - CH_3$

(3) $C_6H_5 - \overset{\overset{O}{\|}}{C} - CH_2 - CH_3$ (4) $C_6H_5 -$ 

SPACE FOR ROUGH WORK

89. On what basis will you distinguish between cis and trans alkenes using ^{1}H-NM spectroscopy ?

(1) Coupling constants (2) Splitting pattern

(3) Chemical shifts (4) All of the above

---

90. From the pure rotation spectrum of HF molecule, information can be obtained about

(1) force constant (2) the internuclear distance

(3) hydrogen bonding (4) bond strength

---

91. 2-pheny-1-propanol can be obtained from 2-phenyl propene by

(1) reaction with ozone followed by hydrolysis

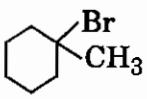
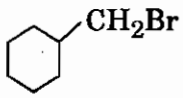
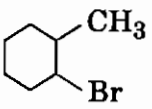
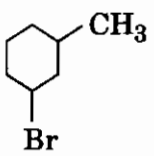
(2) hydroboration followed by oxidation with H_2O_2

(3) oxymercuration followed by reduction

(4) reaction with $KMnO_4$ under alkaline conditions

---

92. Which of the following alkyl halides will give methylene cyclohexane in good yield by an E_2-elimination ?

(1)  (2)  (3)  (4) 

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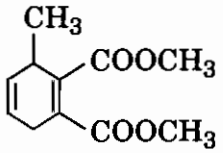
93. The products obtained on treatment of 2-methyl-2-butene with ozone followed by aqueous H_2O_2 would be

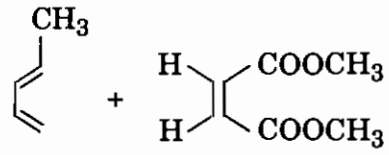
(1) Acetone + Acetone (2) Acetone + Acetaldehyde

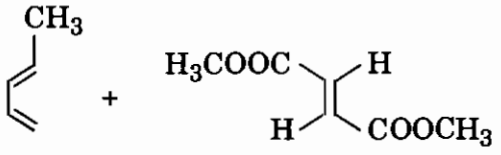
(3) Acetone + Acetic acid (4) Acetone + Formaldehyde

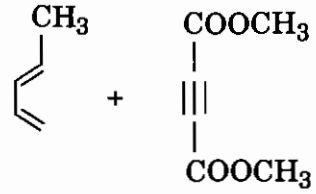
SPACE FOR ROUGH WORK

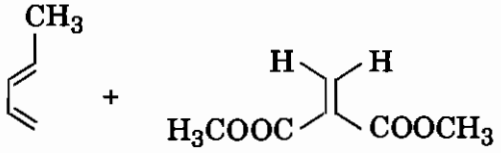
P.T.O.

94. The cycloadduct  is obtained in the Diels – Alder reaction of

(1) 

(2) 

(3) 

(4) 

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95. The product obtained when cyclohexene is brominated using N-bromosuccinimide is/are

(1) cis-1,2-dibromo cyclohexane

(2) trans-1,2-dibromo cyclohexane

(3) cis-1,2-dibromo cyclohexane + trans-1,2-dibromo cyclohexane

(4) 3-bromo cyclohexene

---

96. According to Huckel's rule, the ring is said to be aromatic if it contains

(1) 4, 8, 12 etc. electrons (2) 2, 6, 10, 14 etc. electrons

(3) 1, 3, 5, 7 etc. electrons (4) 5, 8, 12 etc. electrons

---

97. In electrophilic substitution, reaction of aromatic rings, if an electrophile is a positive ion, it gives

(1) carbocation (2) carboanion

(3) π-complexes (4) None of the above

---

98. When aromatic rings are reduced by Na in liq. NH_3 in presence of alcohol, 1,4 addition of hydrogen takes place and non-conjugated cyclohexadienes are produced. This reaction is called

(1) Michael reaction (2) Knoevenagel reaction

(3) Birch reduction (4) Friedel – Crafts reaction

SPACE FOR ROUGH WORK

99. When glycols are treated with acids, they can be rearranged to give

(1) acetic acid (2) alcohols

(3) aldehydes or ketones (4) tetra-substituted glycols

100. To obtain a good yield of aldehyde or ketone under mild conditions from 1,2 glycol, its oxidative cleavage is carried out with

(1) $K_2Cr_2O_7$ (2) $KMnO_4$ (3) ZnO (4) HIO_4

101. The reaction in which phenolic esters can be rearranged by heating with Friedel – Crafts catalyst to o- and p- acylphenols is known as

(1) Claisen rearrangement (2) Fries rearrangement

(3) Cleavage (4) Gabriel rearrangement

102. In the self redox reaction of a compound having no α-hydrogen atom, in which one molecule of an aldehyde is oxidised to carboxylic acid and other is reduced to alcohol is known as

(1) Cannizzaro's reaction (2) Baeyer – Villiger reaction

(3) Wittig and Mannich reaction (4) Houben – Hoesch reaction

103. The reduction of aldehydes to primary alcohol and ketones to secondary alcohol can be carried out in presence of reducing agent such as

(1) alkaline $KMnO_4$ (2) PCl_4

(3) $LiAlH_4$ (4) trimethyl aluminium

104. $R-\underset{\underset{O}{\|}}{C}-R' \xrightarrow[HCl]{Zn-Hg} R-CH_2-R'$

The above reaction is known as

(1) Wolff – Kishner reduction reaction (2) Skraup synthesis

(3) Gatterman synthesis (4) Clemmensen reduction reaction

105. α, β-unsaturated aldehydes can be oxidized to carboxylic acid without disturbing the double bond by using oxidizing agent such as

(1) MgO (2) ZnO

(3) sodium chlorite (4) alkaline $KMnO_4$

106. The atom which gets halogenated in the process of halogenation of carboxylic acid with PCl_3 is

(1) para-hydrogen (2) ortho-hydrogen

(3) meta-hydrogen (4) α-hydrogen

SPACE FOR ROUGH WORK

P.T.O.

107. Which of the following carboxylic acids can be esterified most readily ?

(1) CH_3COOH (2) $(CH_3)_2CHCOOH$

(3) $(CH_3)_3CCOOH$ (4) $\begin{matrix} CH_3 \\ CH_3 \end{matrix}\rangle CHCH_2COOH$

108. When a mixture of absolute alcohol and glacial acetic acid is heated in presence of conc. H_2SO_4, the product that distills out is

(1) acetoacetic ester (2) ethyl acetate

(3) ethyl acetoacetate (4) methyl acetoacetate

109. Decarboxylation of carboxylate ion of carboxylic acid follows the mechanism

(1) S_{E_1} (2) S_{E_2} (3) S_{N_1} (4) S_{E_1} or S_{E_2}

110. In Gabriel synthesis, for the conversion of halide (RX) to primary amines, the halide is first treated with

(1) guanidine (2) $(PhS)_2NLi$

(3) potassium phthalimide (4) alkyl bromides

111. When primary aromatic amines are treated with nitrous acid, it forms

(1) Diazonium salt (2) Heterocyclic amines

(3) Nitro amines (4) Amide

112. Phase transfer catalysts are salts in which one of the ions (usually the cation) has

(1) polar substituent groups (2) methyl group

(3) non-polar substituent groups (4) sulphonated benzene ring

113. When aryhydrazones are treated with a catalyst such as $ZnCl_2$, an indole is formed with the elimination of

(1) H_2O (2) CH_4 (3) CH_3OH (4) NH_3

114. Quinolines are commonly synthesized by a method known as the Skraup synthesis, in which aniline is treated with glycerol under

(1) high pressure (2) alkaline conditions

(3) normal temperature (4) acidic conditions

SPACE FOR ROUGH WORK

115. The reaction in which amide can be cyclized with phosphorus oxychloride is know

(1) Baeyer – Villiger reaction (2) Bischler – Napieralski synthesis

(3) Mannich reaction (4) None of the above

---

116. Ethyl acetate undergoes a condensation reaction when treated with sodium ethoxide to give

(1) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-OC_2H_5$ (2) $H_5C_2O-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-OC_2H_5$

(3) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$ (4) $H_3C-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-COOH$

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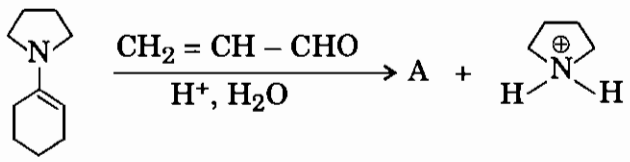
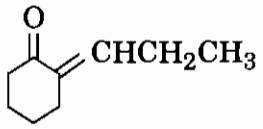
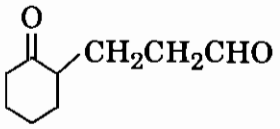
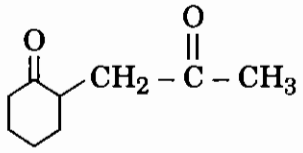
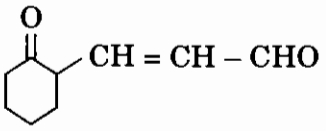
117. Product (A) obtained in the following reaction is



(1) 

(2) 

(3) 

(4) 

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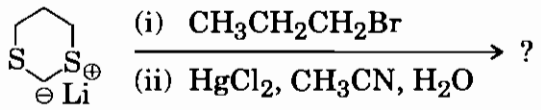
118. Complete the following reaction :



(1) $CH_3CH_2CH_2CHO$ (2) $CH_3CH_2CH_2CH_2OH$

(3) $CH_3CH_2CH_2COOH$ (4) $CH_3CH_2CH_2CN$

SPACE FOR ROUGH WORK

P.T.O.

119. When glucose is first treated with excess CH_3I and then subjected to acid hyd... the sole – OH group present on the hydrolysed product is present on which C ato...

(1) C-2 (2) C-3 (3) C-4 (4) C-5

120. Starch is a polymer of

(1) α-D glucose (2) β-D glucose

(3) α-D glucose + β-D glucose (4) α-D fructose

121. Match the following :

Disaccharides		*Constituent Monosaccharides*
a.	Maltose	i. glucopyranose + galactopyranose
b.	Sucrose	ii. glucopyranose + glucopyranose
c.	Lactose	iii. glucopyranose + fructopyranose

(1) a-ii b-iii c-i (2) a-i b-ii c-iii

(3) a-ii b-i c-iii (4) a-iii b-i c-ii

122. The conversion of α and β glucopyranose into an equilibrium mixture of both is termed as

(1) inversion (2) racemisation

(3) mutarotation (4) anomerisation

123. The tertiary structure of protein describes

(1) the sequence of amino acids in the chain

(2) location of all disulphide bridges

(3) regular conformations assumed by segments of protein backbone

(4) the three-dimensional structure of entire polypeptide

124. When two amino acids are heated to form dipeptide, four dipeptides are obtained. To avoid this, in classical peptide synthesis, amino group of one amino acid is protected using A, while the acid group of the same amino acid is activated using reagent B. The reagents A and B are

(1) A — tBOC, B — DCC (2) A — DCC, B — $SOCl_2$

(3) A — DCC, B — tBOC (4) A — tBOC, B — $SOCl_2$

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125. A four amino acids containing polypeptide Val-Phe-Gly-Ala is labelled with 1-fluoro-2,4-dinitro benzene by carrying out a nucleophilic aromatic substitution reaction and subjected to hydrolysis. The products obtained are

Dinitrophenyl Val + Phe + Gly + Ala

The C-terminal and N-terminal amino acids are

(1) Ala; Val (2) Val; Ala (3) Phe; Val (4) Gly; Ala

---

126. Nucleic acids are composed of long strands of nucleotide subunits linked to each other by phosphodiester bonds linking :

(1) 3′-OH group of one nucleotide to 4′-OH group of another nucleotide

(2) 3′-OH group of one nucleotide to 5′-OH group of another nucleotide

(3) 2′-OH group of one nucleotide to 4′-OH group of another nucleotide

(4) 2′-OH group of one nucleotide to 5′-OH group of another nucleotide

---

127. Which of the following desirable properties may not be achieved by the use of Ziegler-Natta catalyst ?

(1) Resistance to cracking

(2) Control over configuration of double bonds in the polymer

(3) Cross-linking of polymers

(4) Conducting polymer

---

128. The vinyl monomers which bear electron withdrawing groups are most susceptible to _____ polymerisation.

(1) Cationic (2) Anionic

(3) Free radical (4) Condensation

---

129. _____ are macromolecules usually formed by the reaction of a diol with isocyanate and contains the functional group $-O-\overset{\overset{O}{\|}}{C}-NH$.

(1) Polyamides (2) Polyurethanes

(3) Polyanilides (4) Polyisocyanates

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130. Match the following :

	Synthetic Dye		*Preparation from*
a.	Malachite Green	i.	Phthalic anhydride + resorcinol (Friedel – Crafts)
b.	Crystal Violet	ii.	Benzaldehyde + dimethyl aniline (condensation)
c.	Fluorescein	iii.	Formaldehyde + dimethyl aniline (condensation)

(1) a-ii b-i c-iii (2) a-i b-iii c-ii

(3) a-iii b-ii c-i (4) a-ii b-iii c-i

---

131. The principal synthesis of _____ involves oxidation of anthraquinone-2-sulphonic acid with sodium nitrate in concentrated NaOH solution.

(1) Indigo (2) Alizarin

(3) Methyl orange (4) Phenolphthalein

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132. Consider the following statements about explanation of colour of organic compounds on the basis of Valence Bond theory. Which of these is ***not*** true ?

(1) Resonance among charged structures reduces energies of both ground and excited states.

(2) Charged structures contribute less to excited state than to the ground state.

(3) The larger the number of electrons involved in resonance, the smaller is the energy difference between ground state and excited state.

(4) The more extended the conjugation in a molecule and greater the contribution of charged structure, longer is the wavelength of the photon required to excite the molecules.

---

133. In general, all _____ reactions are atom economical.

(1) Substitution (2) Elimination

(3) Addition (4) Hydrolysis

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134. Which of the following ***cannot*** be termed as a green solvent ?

(1) Supercritical CO_2 (2) Water

(3) Carbon tetrachloride (4) Ionic solvent

---

135. Which of the following is a green reagent to carry out selective methylation of active methylene compound ?

(1) Dimethyl sulphate (2) Dimethyl carbonate

(3) Diazomethane (4) Methyl chloride

---

136. 'An electrolyte in solution need not necessarily be completely dissociated into ions; instead it may be only partially dissociated to yield ions in equilibrium with unionized molecules of the substance', is put forth by

(1) Kohlrausch's theory (2) Debye – Huckel theory

(3) Arrhenius theory (4) Nernst theory

---

137. The conductance behaviour of strong electrolytes has been given by the Debye-Huckel-Onsager equation and it is given as

(1) $\lambda_o = \lambda_c - (A + B\,\lambda_o)\sqrt{c}$ (2) $\lambda_c = \lambda_o - (A + B\,\lambda_o)\sqrt{c}$

(3) $\lambda_c = \dfrac{\lambda_o - (A + B)\lambda_o}{\sqrt{c}}$ (4) $\lambda_c = \lambda_o - (A + B)\,\lambda_o\sqrt{c}$

---

138. Ostwald's dilution law can be used to determine

(1) conductance of weak acid

(2) dissociation constant of strong acid

(3) molar conductivity at infinite dilution for a weak acid

(4) molar conductivity at infinite dilution for a weak base

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139. The unique ions which show high velocity under a potential drop of one volt per centimeter are

(1) H^+ and OH^- (2) K^+ and Cl^-

(3) K^+ and NO_3^- (4) NH_4^+ and NO_3^-

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140. The electrode which is constructed by dipping metal electrode into its own ion is known as

(1) metal-insolule salt electrode (2) redox-electrode

(3) metal-metal ion electrode (4) None of the above

---

141. When solar cell is exposed to sunlight, the energy from sunlight excites electrons

(1) from n-type silicon to the holes of the p-type silicon

(2) from p-type silicon to the holes of the n-type silicon

(3) and the electrons transfer to p-type silicon through external circuits

(4) and the electrons transfer from n-type silicon to external circuit

---

142. At 25°C, the pH of the solution can be calculated by measuring E_{cell} of the cell so constructed by using saturated calomel electrode and quinhydrone electrode. The equation employed for the purpose is

(1) $pH = \frac{0{\cdot}4581 - E_{cell}}{0{\cdot}052}$ (2) $pH = \frac{E_{cell} - 0{\cdot}04581}{0{\cdot}0591}$

(3) $pH = \frac{0{\cdot}4581 - E_{cell}}{0{\cdot}0591}$ (4) $pH = \frac{0{\cdot}0591 - E_{cell}}{0{\cdot}4581}$

---

143. In cathodic protection of metal from corrosion, the current is leaked to the ground from any conductor and the current is known as

(1) cathodic current (2) over-voltage

(3) sacrificial current (4) stray current

---

144. The total energy operator is called as

(1) Hermitian operator (2) Hamiltonian operator

(3) Linear operator (4) Addition of operator

---

145. For a sound wave, as per the postulates of quantum mechanics, the wave function is a function of

(1) Temperature (2) Magnetic moment

(3) Time (4) Energy

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146. In Schrodinger's wave equation, the symbol ψ represents

(1) wavelength of the spherical wave

(2) amplitude of the spherical wave

(3) frequency of the spherical wave

(4) None of the above

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147. It is only the absorbed light radiations that are effective in producing a chemical reaction is the

(1) Beer's law (2) Einstein's law

(3) Grothus – Draper law (4) Bunsen – Roscoe's law

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148. Which process stops as soon as the incident radiation is cut off ?

(1) Fluorescence (2) Phosphorescence

(3) Chemiluminescence (4) None of the above

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149. Photosensitizer is a substance which can

(1) take part in the chemical reaction

(2) only absorbs the radiant energy

(3) only transfers the radiant energy

(4) absorbs and transfers radiant energy

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150. In a Jablonski diagram depicting various photophysical processes, the non-radiative processes of intersystem crossing, internal conversion and vibrational relaxation are indicated by the

(1) Horizontal lines (2) Vertical lines

(3) Wavy lines (4) Diagonal lines

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सूचना - (पृष्ठ 1 वरुन पुढे....)

(8) प्रश्नपुस्तिकेमध्ये विहित केलेल्या विशिष्ट जागीच कच्चे काम (रफ वर्क) करावे. प्रश्नपुस्तिकेव्यतिरिक्त उत्तरपत्रिकेवर वा इतर कागदावर कच्चे काम केल्यास ते कॉपी करण्याच्या उद्देशाने केले आहे, असे मानले जाईल व त्यानुसार उमेदवारावर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचे अधिनियम-82" यातील तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

(9) सदर प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपल्यानंतर उमेदवाराला ही प्रश्नपुस्तिका स्वतः बरोबर परीक्षाकक्षाबाहेर घेऊन जाण्यास परवानगी आहे. **मात्र परीक्षा कक्षाबाहेर जाण्यापूर्वी उमेदवाराने आपल्या उत्तरपत्रिकेचा भाग-1 समवेक्षकाकडे न विसरता परत करणे आवश्यक आहे.**

नमुना प्रश्न

Pick out the correct word to fill in the blank :

Q. No. 201. I congratulate you _____ your grand success.

(1) for (2) at (3) on (4) about

ह्या प्रश्नाचे योग्य उत्तर "(3) on" असे आहे. त्यामुळे या प्रश्नाचे उत्तर "(3)" होईल. यास्तव **खालीलप्रमाणे** प्र.क्र. **201** समोरील उत्तर-क्रमांक "③" हे वर्तुळ पूर्णपणे छायांकित करून दाखविणे आवश्यक आहे.

प्रश्न क्र. **201.** ① ② ● ④

अशा पद्धतीने प्रस्तुत प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाचा तुमचा उत्तरक्रमांक हा तुम्हाला स्वतंत्ररीत्या पुरविलेल्या उत्तरपत्रिकेवरील त्या त्या प्रश्नक्रमांकासमोरील संबंधित वर्तुळ पूर्णपणे छायांकित करून दाखवावा. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK