INDIAN ASSOCIATION OF PHYSICS TEACHERS
NATIONAL STANDARD EXAMINATION IN CHEMISTRY 2015 -16

Date of Examination: 22nd November, 2015

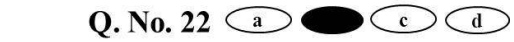
Time: 1230 to 1430 Hrs

Q. Paper Code: C 230

Write the question paper code mentioned above on YOUR answer sheet (in the space provided), otherwise your answer sheet will NOT be assessed.Note that the same Q. P. Code appears on each page of the question paper.

Instructions to Candidates –

1. Use of mobile phones, smartphones, ipads during examination is **STRICTLY PROHIBITED**.
2. In addition to this question paper, you are given answer sheet along with Candidate's copy.
3. On the answer sheet, make all the entries carefully in the space provided **ONLY** in **BLOCK CAPITALS** as well as by properly darkening the appropriate bubbles.
   Incomplete/ incorrect/carelessly filled information may disqualify your candidature.
4. On the answer sheet, use only **BLUE or BLACK BALL POINT PEN** for making entries and filling the bubbles.
5. Question paper has 80 multiple choice questions. Each question has four alternatives, out of which **only one** is correct. Choose the correct alternative and fill the appropriate bubble, as shown.



6. A correct answer carries 3 marks whereas 1 mark will be deducted for each wrong answer.
7. Any rough work should be done only in the space provided.
8. Periodic Table is provided at the end of the question paper.
9. Use of **non-programmable** calculator is allowed.
10. No candidate should leave the examination hall before the completion of the examination.
11. After submitting your answer paper, take away the Candidate's copy for your reference.

Please DO NOT make any mark other than filling the appropriate bubbles properly in the space provided on the answer sheet.

Answer sheets are evaluated using machine, hence CHANGE OF ENTRY IS NOT ALLOWED.

Scratching or overwriting may result in a wrong score.

DO NOT WRITE ON THE BACK SIDE OF THE ANSWER SHEET.

Instructions to Candidates (continued)–

Read the following instructions after submitting the answer sheet.

12. **Comments regarding this question paper, if any, may be sent by email only to iaptpune@gmail.com till 24th November, 2015.**
13. **The answers/solutions to this question paper will be available on our website – www.iapt.org.in by 2nd December, 2015.**
14. **CERTIFICATES and AWARDS –**

    Following certificates are awarded by the IAPT to students successful in NSEs

    (i)Certificates to "Centre Top 10%" students

    (ii)Merit Certificates to "Statewise Top 1%" students

    (iii)Merit Certificates and a book prize to "National Top 1%" students
15. Result sheets and the "Centre Top 10%" certificates will be dispatched to the Prof-in-charge of the centre by January, 2016.
16. List of students (with centre number and roll number only) having score above MAS will be displayed on our website (**www.iapt.org.in**) by **22nd December, 2015.** See the **Eligibility Clause** in the Student's brochure on our website.
17. Students eligible for the INO Examination on the basis of selection criteria mentioned in Student's brochure will be informed accordingly.
18. Gold medals will be awarded to TOP 35 students in the entire process.

NATIONAL STANDARD EXAMINATION IN CHEMISTRY 2015

(1) A bottle of H_3PO_4 solution contains 70% (w/w) acid. If the density of the solution is 1.54 g cm^{-3}, the volume of the H_3PO_4 solution required to prepare 1 L of I N solution is

(A) 90 mL (B) 45 mL

(C) 30 mL (D) 23 mL

(2) Wood or cattle dung ash is used for cleaning cooking utensils in many parts of India. The statement that is **not true** for this ash is:

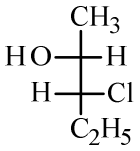
(A) it largely consists of metal oxides and silicates because non-metals are removed as gaseous compounds during burning of the wood/dung cakes.

(B) when added to water, it forms alkaline solution with pH~8 and above, which helps to remove oily substances from the utensils.

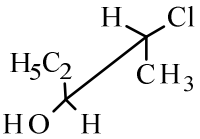
(C) several chemical components of ash remain undissolved as solids in water and these solids help in cleaning by providing scrubbing action.

(D) if left moist for a few hours in air, it slowly turns acidic because of oxidative decomposition

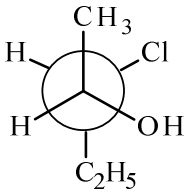
(3) The two projection formulae that represent a pair of enantiomers are



I



II



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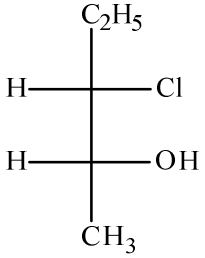


IV

(A) I and II (B) III and IV

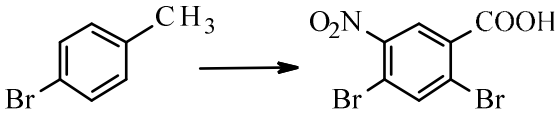
(C) I and III (D) II and IV

(4) When 1 L of 0.1 M sulphuric acid solution is allowed to react with 1 L of 0.1 M sodium hydroxide solution, the amount of sodium sulphate (anhydrous) that can be obtained from the solution formed and the concentration of H^+ in the solution respectively are

(A) 3.55 g, 0.1 M (B) 7.10 g, 0.025 M

(C) 3.55 g, 0.025 M (D) 7.10 g, 0.05 M

(5) The best sequence of reactions for the following conversion is



(A) (i) 1 mol $Br_2/FeBr_3$ (ii) $KMnO_4$, heat (iii) $HNO_3 + H_2SO_4$

(B) (i) $HNO_3 + H_2SO_4$ (ii) 1 mol $Br_2/FeBr_3$ (iii) $KMnO_4$, heat

(C) (i) $KMnO_4$, heat (ii) $HNO_3 + H_2SO_4$ (iii) 1 mol $Br_2/FeBr_3$

(D) (i) 1 mole $Br_2/FeBr_3$ (ii) $HNO_3 + H_2SO_4$ (iii) $KMnO_4$, heat

(6) If λ_0 and λ are the threshold wavelength and the wavelength of the incident light, respectively on a metal surface, the velocity of the photoelectron ejected from the metal surface is (m_e = mass of electron, h = Planck's constant, c = speed of light)

(A) $\sqrt{\frac{2h(\lambda_0-\lambda)}{m_e}}$ (B) $\sqrt{\frac{2hc(\lambda_0-\lambda)}{m_e}}$

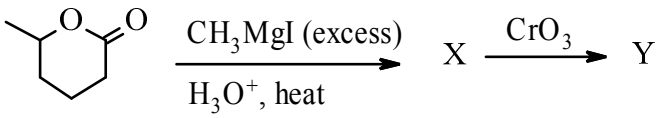
(C) $\sqrt{\frac{2hc}{m_e}\left(\frac{\lambda_0-\lambda}{\lambda\lambda_0}\right)}$ (D) $\sqrt{\frac{2h}{m_e}\left(\frac{1}{\lambda_0}-\frac{1}{\lambda}\right)}$

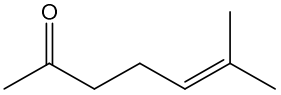
(7) A current of 5.0 A flows for 4.0 h through an electrolytic cell containing a molten salt of metal **M**. This results in deposition of 0.25 mol of the metal **M** at the cathode. The oxidation state of **M** in the molten salt is (1 Faraday = 96485 C mol^{-1})

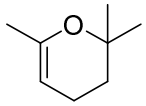
(A) +1 (B) +2

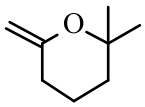
(C) +3 (D) +4

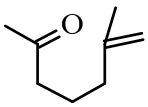
(8) The major product (Y) of the following reaction is -



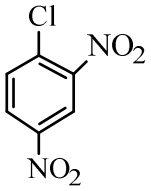
(A) 

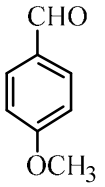
(B) 

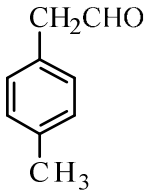
(C) 

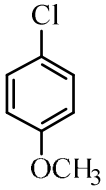
(D) 

(9) The compound that will **NOT** react with hot concentrated aqueous alkali at atmospheric pressure is

(A) 

(B) 

(C) 

(D) 

(10) The nature of $CsAuCl_3$ is (this compound contains Au in two oxidation states and there is no Au-Au bond)

(A) diamagnetic
(B) paramagnetic
(C) ferromagnetic
(D) antiferromagnetic

(11) The standard electrode potentials, E^0 of Fe^{3+}/Fe^{2+} and Fe^{2+}/Fe at 300 K are +0.77 V and –0.44 V, respectively. The E^0 of Fe^{3+}/Fe at the same temperature is

(A) 1.21 V
(B) 0.33 V
(C) –0.036 V
(D) 0.036 V

(12) The **incorrect** statement for lanthanides among the following statements is

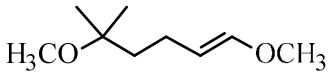
(A) 4f and 5d orbitals are so close in energy that it is very difficult to locate the exact position of electrons in lanthanides

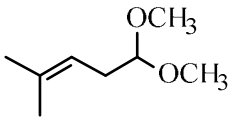
(B) most common stable oxidation state is +3

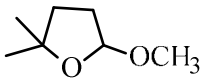
(C) tripositive lanthanide ions have characteristic color depending on nature of group with which they combine to form compounds

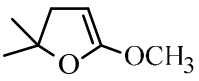
(D) some lanthanide ions absorb either in infrared or ultraviolet region of electromagnetic spectrum

(13) 4-Hydroxy-4-methylpentanal on heating with excess of methanol in the presence of an acid catalyst followed by dehydration of the product gives

(A) 

(B) 

(C) 

(D) 

(14) Ice crystallizes in a hexagonal lattice. At a certain low temperature, the lattice constants are a = 4.53 Å and c = 7.41 Å. The number of H_2O molecules contained in a unit cell (d ≈ 0.92 g cm^{-3} at the given temperature) is

(A) 4 (B) 8

(C) 12 (D) 24

(15) In the redox reaction

$$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$$

20 mL of 0.1 M $KMnO_4$ react quantitatively with

(A) 20 mL of 0.1 M oxalate (B) 40 mL of 0.1 M oxalate

(C) 50 mL of 0.25 M oxalate (D) 50 mL of 0.1 M oxalate

(16) The vapor pressure of benzene is 53.3 kPa at 60.6 °C, but it fall to 51.5 kPa when 19 g of a nonvolatile organic compound is dissolved in 500 g benzene. The molar mass of the nonvolatile compound is

(A) 82 (B) 85

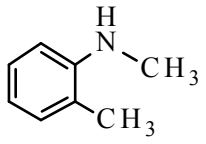
(C) 88 (D) 92

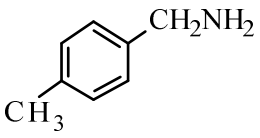
(17) Sodium metal dissolves in liquid ammonia and forms a deep blue solution. The color is due to absorption of light by

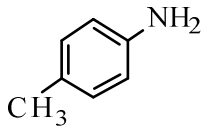
(A) sodium ions (B) ammoniated electrons

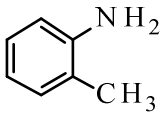
(C) free electrons (D) ammoniated sodium ions

(18) An organic base (X) reacts with nitrous acid at $0^{o}C$ to give a clear solution. Heating the solution with KCN and cuprous cyanide followed by continued heating with conc. HCl gives a crystalline solid. Heating this solid with alkaline potassium permanganate gives a compound which dehydrates on heating to a crystalline solid. 'X' is -

(A) 

(B) 

(C) 

(D) 

(19) The de Broglie wavelength of an object of mass 33 g moving with a velocity of 200 m s^{-1} is of the order of

(A) 10^{-31} m (B) 10^{-34} m

(C) 10^{-37} m (D) 10^{-41} m

(20) A person having osteoporosis is suffering from lead poisoning. Ethylene diamine tetra acetic acid (EDTA) is administered for this condition. The best form of EDTA to be used for such administration is -

(A) EDTA (B) tetrasodium salt

(C) disodium salt (D) calcium dihydrogen salt

(21) A water sample from a municipal water supply was found to have a pH = 7.0. On evaporating 2 L of this water, 2.016 g of white solid was left behind in the evaporation vessel, i.e., the total dissolved solid (TDS) content of this water was 1008 mg L^{-1}. However, addition of soap to a bucket of this water did not produce any visible scum. Based on these findings, one can conclude that

(A) there are no Ca^{2+} or Mg^{2+} ion in the water

(B) there are no CO_3^{2-} or HCO_3^- ion in the water

(C) concentration of any ion in the water is lower than 0.038 M

(D) water may be containing Na^+ ions in concentration > 0.04 M

(22) The best reaction sequence to convert 2-methyl-1-bromopropane into 4-methyl-2-bromopentane is

(A) (i) Mg in ether (ii) acetaldehyde (iii) H^+, H_2O iv) Δ v) HBr, H_2O_2

(B) (i) NaC≡CH in ether (ii) H_2, Lindlar catalyst (iii) HBr, no peroxide

(C) (i) alcoholic KOH (ii) CH_3COOOH (iii) H_2/Pt (iv) HBr, heat

(D) (i) NaC≡CH in ether (ii) H_3O^+ + $HgSO_4$ (iii) HBr, heat

(23) Metallic copper dissolves in

(A) dilute HCl (B) concentrated HCl

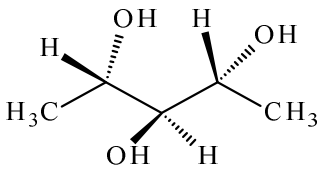
(C) aqueous KCN (D) pure ammonia

(24) A 50 mL solution of pH = 1 is mixed with a 50 mL solution of pH = 2. The pH of the mixture is

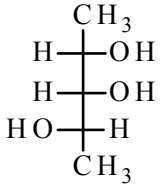
(A) 0.86 (B) 1.26

(C) 1.76 (D) 2.26

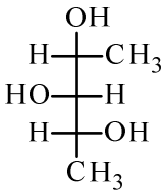
(25) The Fischer projection formula that represents the following compound is



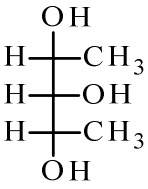
(A)



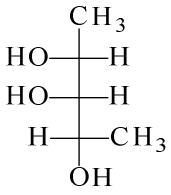
(B)



(C)



(D)



(26) Four statements for the following reaction are given below

$[CoCl_2(NH_3)_4]^+ + Cl^- \rightarrow [CoCl_3(NH_3)_3] + NH_3$

(I) only one isomer is produced if the reactant complex ion is a trans isomer

(II) three isomers are produced if the reactant complex ion is a cis isomer

(III) two isomers are produced if the reactant complex ion is a trans isomer

(IV) two isomers are produced if the reactant complex ion is cis isomer

The correct statements are

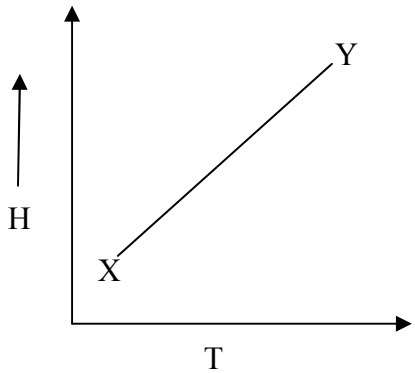
(A) I and II

(B) III and IV

(C) I and IV

(D) II and III

(27) The process in which an ideal gas undergoes change from X to Y as shown in the following diagram is



(A) isothermal compression
(B) adiabatic compression
(C) isothermal expansion
(D) adiabatic expansion

(28) With respect to halogens, four statements are given below

(I) The bond dissociation energies for halogens are in the order: $I_2 < F_2 < Br_2 < Cl_2$

(II) The only oxidation state is -1

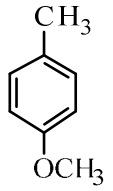
(III) The amount of energy required for the excitation of electrons to first excited state decreases progressively as we move from F to I

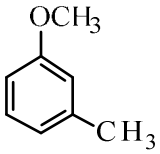
(IV) They form HX_2^- species in their aqueous solutions (X = halogen)

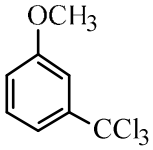
The correct statements are

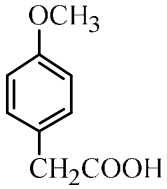
(A) I, II, IV
(B) I, III, IV
(C) II, III, IV
(D) I, III

(29) The order of reactivity of the following compounds in electrophilic monochlorination at the most favorable position is

(I) 

(II) 

(III) 

(IV) 

(A) I < II < IV < III
(B) III < IV < I < II
(C) IV < III < II < I
(D) III < II < IV < I

(30) The limiting molar conductivities of KCl, KNO_3 and $AgNO_3$ are 149.9, 145.0 and 133.4 S cm^2 mol^{-1}, respectively, at 25°C. The limiting molar conductivity of AgCl at the same temperature in S cm^2 mol^{-1} is

(A) 128.5
(B) 138.3
(C) 161.5
(D) 283.3

(31) Imagine that in any atom about 50% of the space is occupied by the atomic nucleus. If a silver foil is bombarded with α-particles, majority of the α-particles would

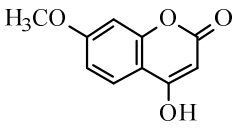
(A) be scattered

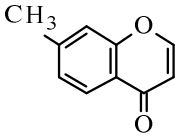
(B) be absorbed by the nuclei

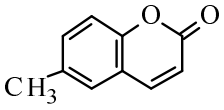
(C) pass through the foil undeflected

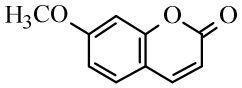
(D) get converted into photons

(32) An organic compound ("X") is a disubstituted benzene containing 77.8% carbon and 7.5% hydrogen. Heating an alkaline solution of "X" with chloroform gives a steam volatile compound "Y". Heating "Y" with acetic anhydride and sodium acetate gives a sweet smelling crystalline solid "Z". "Z" is

(A) 

(B) 

(C) 

(D) 

(33) The emf of a cell corresponding to the following reaction is 0.199 V at 298 K.

$Zn\ (s) + 2\ H^+\ (aq) \rightarrow Zn^{2+}\ (0.1\ M) + H_2\ (g)$ $\qquad (E^{O}_{Zn\,/\,Zn^{+2}} = 0.76V)$

The approximate pH of the solution at the electrode where hydrogen is being produced is (p_{H2} = 1 atm)

(A) 8 (B) 9

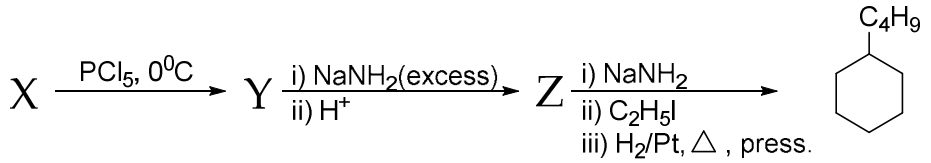
(C) 10 (D) 11

(34) The vapor pressure of two pure isomeric liquids **X** and **Y** are 200 torr and 100 torr respectively at a given temperature. Assuming a solution of these components to obey Raoult's law, the mole fraction of component **X** in vapor phase in equilibrium with the solution containing equal amounts of **X** and **Y,** at the same temperature**,** is

(A) 0.33 (B) 0.50

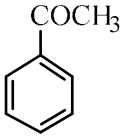
(C) 0.66 (D) 0.80

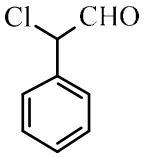
(35) n-Butylcyclohexane is formed through the following sequence of reactions.

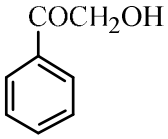


In the above scheme of reactions, "X" is -

(A) 

(B) 

(C) 

(D) 

(36) In a first order reaction, 75% of the reactant disappears in 1.386 h, the rate constant of the reaction is close to

(A) $7.2 \times 10^{-3}\ s^{-1}$ (B) $3.6 \times 10^{-3}\ s^{-1}$

(C) $1.8 \times 10^{-3}\ s^{-1}$ (D) $2.8 \times 10^{-4}\ s^{-1}$

(37) Four statements for Cr and Mn are given below.

(I) Cr^{2+} and Mn^{3+} have the same electronic configuration.

(II) Cr^{2+} is a reducing agent while Mn^{3+} is an oxidizing agent.

(III) Cr^{2+} is an oxidizing agent while Mn^{3+} is a reducing agent.

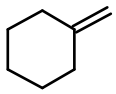
(IV) both Cr and Mn are oxidizing agents.

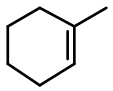
The correct statements are

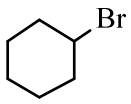
(A) I, III, IV (B) I, II

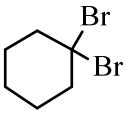
(C) I, II, IV (D) I, IV

(38) Four processes are indicated below:

(I)  (i) HBr/no peroxide (ii) alcoholic KOH, $\triangle$

(II)  (i) HI (ii) aqueous NaOH, $\triangle$

(III)  (i) Mg, ether (ii) CH_2O (iii) H^+, H_2O

(IV)  (i) aq KOH (ii) CH_3MgBr, ether (iii) H_3O^+

The processes that **do not** produce 1-methylcyclohexanol are

(A) II, IV (B) I, II

(C) III, IV (D) I, III

(39) The reaction that is **least feasible** is

(A) $Li_2CO_3 \rightarrow Li_2O + CO_2$

(B) $4Li + O_2 \rightarrow 2Li_2O$

(C) $6Li + N_2 \rightarrow 2Li_3N$

(D) $2C_6H_5C{\equiv}CH + 2Li \rightarrow 2C_6H_5C{\equiv}CLi + H_2$

(40) Glucose when dissolved in water leads to cooling of the solution. Suppose you take 250 mL water at room temperature in an open container (such as a bowl) made of thermally insulated material and dissolve a spoonful of glucose in it. If you are able to accurately measure the heat absorbed by this solution in reaching back to room temperature (assuming negligible changes in the composition and the amount of solution during this process), you will be measuring

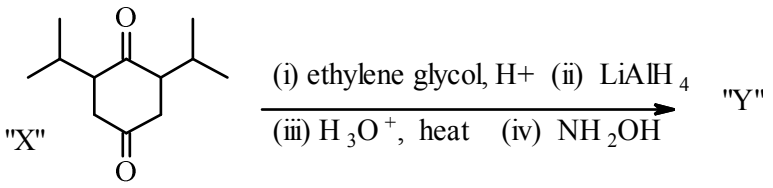
(A) the enthalpy of dissolution of the glucose in water

(B) the Gibbs free energy of dissolution of the glucose in water

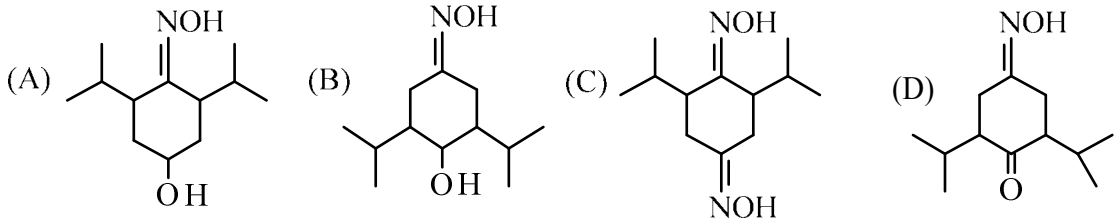
(C) the work done by the atmosphere on the system during the dissolution process

(D) the heat capacity of the solution

(41) Compound "X" undergoes the following sequence of reactions to form "Y".



Compound "Y" is -



(42) The complex that shows optical activity is

(A) *trans*-$[CoCl_2(en)_2]^+$ (B) *cis*-$[CoCl_2(en)_2]^+$

(C) *trans*-$[PtCl_2(NH_3)_2]$ (D) $[CoCl_2(NH_3)_2(en)]^+$

(43) 100 mL of 0.3 M acetic acid is shaken with 0.8 g wood charcoal. The final concentration of acetic acid in the solution after adsorption is 0.125 M. The mass of acetic acid adsorbed per gram of charcoal is

(A) 1.05 g (B) 0.0131 g

(C) 1.31 g (D) 0.131 g

(44) The reaction that **does not** produce nitrogen is

(A) heating $(NH_4)_2Cr_2O_7$ (B) NH_3 + excess of Cl_2

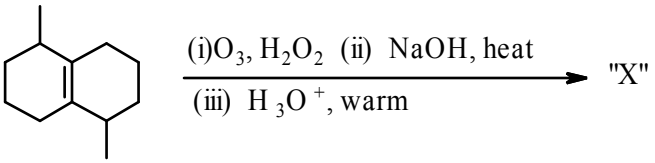
(C) heating of NaN_3 (D) heating of NH_4NO_3

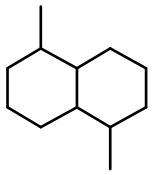
(45) The species having **highest** bond energy is

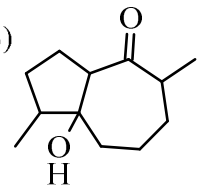
(A) O_2 (B) O_2^+

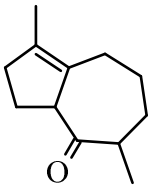
(C) O_2^- (D) O_2^{2-}

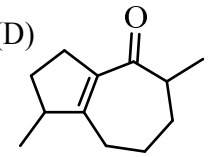
(46) The product ("X") of the following sequence of reactions is



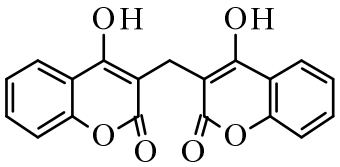
(A) 

(B) 

(C) 

(D) 

(47) Dicoumarol (X) is an anticoagulant. The number of possible monochloro substituted isomeric derivatives and the volume of hydrogen liberated at STP by the reaction of 0.5 mol of dicoumarol with sodium are respectively



(X)

(A) 5, 22.4 dm^3

(B) 5, 11.2 dm^3

(C) 6, 11.2 dm^3

(D) 4, 22.4 dm^3

(48) The structure of a molecule of $N(SiMe_3)_3$ is

(A) Pyramidal with angle close to 110^o

(B) T-shaped with angle 90^o

(C) Bent T-shaped with angle close to 89^o

(D) Trigonal planar with bond angle close to 120^o

(49) For an electron whose *x*-positional uncertainty is 1.0×10^{-10} m, the uncertainty in the *x*-component of the velocity in m s^{-1} will be of the order of

(A) 10^6

(B) 10^9

(C) 10^{12}

(D) 10^{15}

(50) The order of pπ-dπ interaction in the compounds containing bond between Si/P/S/Cl and oxygen is in the order

(A) P > Si > Cl > S (B) Si < P < S < Cl

(C) S < Cl < P < Si (D) Si > P > S > Cl

(51) The solubility products (K_{sp}) of three salts MX, MY_2 and MZ_3 are 1×10^{-8}, 4×10^{-9} and 27×10^{-8}, respectively. The correct order for solubilities of these salts is

(A) $MX > MY_2 > MZ_3$ (B) $MZ_3 > MY_2 > MX$

(C) $MZ_3 > MX > MY_2$ (D) $MY_2 > MX > MZ_3$

(52) Three isomeric compounds **M**, **N**, and **P** ($C_5H_{10}O$) give the following tests:

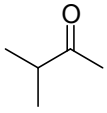
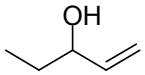
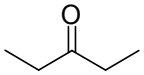
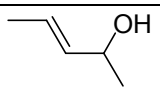
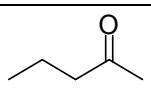
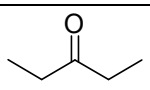
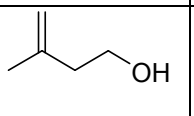
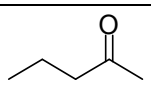
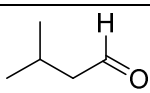
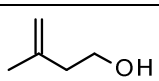
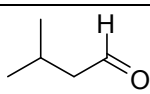
(i) **M** and **P** react with sodium bisulfite to form an adduct

(ii) **N** consumes 1 mol of bromine and also gives turbidity with conc. HCl/anhydrous $ZnCl_2$ after prolong heating

(iii) **M** reacts with excess of iodine in alkaline solution to give yellow crystalline compound with a characteristic smell.

(iv) p-Rosaniline treated with sulphur dioxide develops pink colour on shaking with **P**

The structures of M, N, and P, respectively are

	M	N	P
(A)			
(B)			
(C)			
(D)			

(53) The unbalanced equation for the reaction of P_4S_3 with nitrate in aqueous acidic medium is given below.

$P_4S_3 + NO_3^- \rightarrow H_3PO_4 + SO_4^{2-} + NO$

The number of mol of water required per mol of P_4S_3 is

(A) 18 (B) 8/3

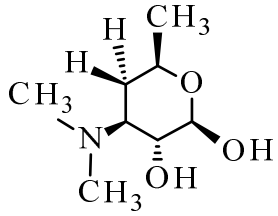
(C) 8 (D) 28

(54) Certain combinations of cations and anions lead to the formation of colored salts in solid state even though each of these ions with other counter ions may produce colorless salts. This phenomenon is due to temporary charge transfer between the two ions. Out of the following, the salt that can exhibit this behavior is

(A) $SnCl_2$ (B) $SnCl_4$

(C) $SnBr_2$ (D) SnI_4

(55) Desosamine has the following structure



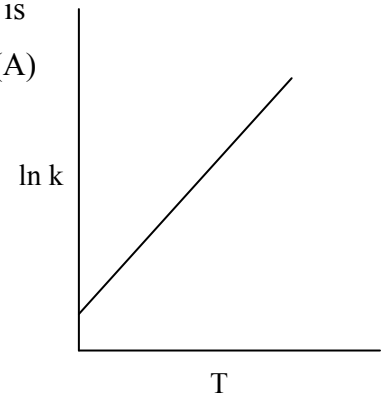
The number of functional groups which react with hydroiodic acid, the number of chiral centres, and the number of stereoisomers possible respectively are

(A) 4, 5, 8 (B) 3, 4, 16

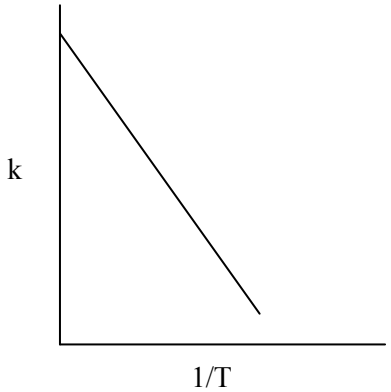
(C) 3, 4, 8 (D) 4, 4, 16

(56) If *k* is the rate constant of the reaction and *T* is the absolute temperature, the correct plot is

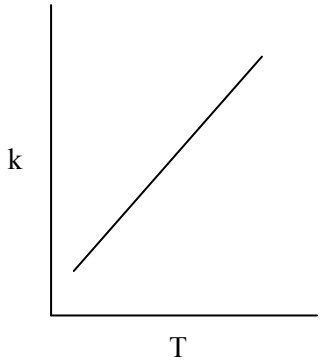
(A)



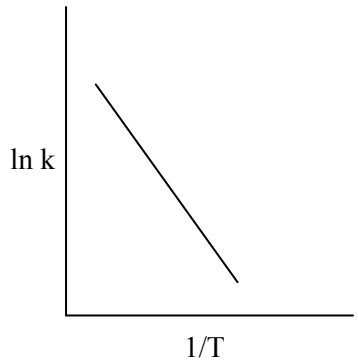
(B)



(C)



(D)



(57) 1,3-pentadiene and 1,4-pentadiene are compared with respect to their intrinsic stability and reaction with HI. The correct statement is

(A) 1,3-pentadiene is more stable and more reactive than 1,4-pentadiene

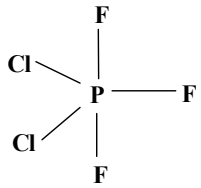
(B) 1,3-pentadiene is less stable and less reactive than 1,4-pentadiene

(C) 1,3-pentadiene is more stable but less reactive than 1,4-pentadiene

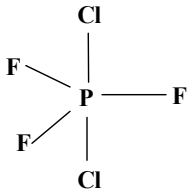
(D) 1,3-pentadiene is less stable but more reactive than 1,4-pentadiene

(58) From the given structures, the correct structure(s) of PF_3Cl_2 is/are

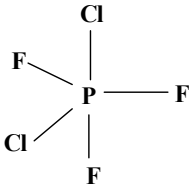
(I)



(II)



(III)



(A) only I

(B) only II

(C) only III

(D) I, II and III

(59) The ratio of the masses of methane and ethane in a gas mixture is 4:5. The ratio of number of their molecules in the mixture is

(A) 4:5

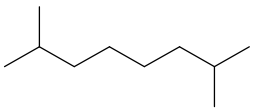
(B) 3:2

(C) 2:3

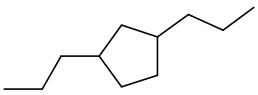
(D) 5:4

(60) The hydrocarbon that **cannot be** prepared effectively by Wurtz reaction is

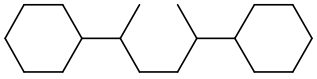
(A)



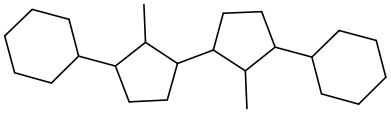
(B)



(C)



(D)



(61) Glacial acetic acid dissolves in

(I) liquid H_2S, as H_2S is a polar covalent compound

(II) liquid NH_3, as it can form hydrogen bond

(III) liquid $HClO_4$, as it can protonate acetic acid

The correct option is

(A) only I

(B) only II

(C) only III

(D) I, II and III

(62) The energy of an electron in the first Bohr orbit is −13.6 eV. The energy of Be^{3+} in the first excited state is

(A) – 30.6 eV

(B) – 40.8 eV

(C) – 54.4 eV

(D) + 40.8 eV

(63) Many protein-based biomaterials, such as waste hair and feathers, can absorb heavy metal ions from wastewater. It has been observed that metal uptake by these materials increases in alkaline condition. The enhanced uptake in alkaline conditions is due to

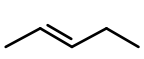
(A) generation of many ligand sites in the protein molecules due to removal of H^+

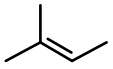
(B) availability of a high concentration of OH^- ions as ligands

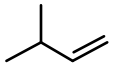
(C) increased cross-linkages in the protein chains by formation of amide bonds

(D) increase in solubility of the proteins

(64) Compound "X" reacts with diborane followed by alkaline hydrogen peroxide to form compound "Y". "Y" on reaction with a mixture of sodium bromide in sulphuric acid followed by bromobenzene and sodium in ether gives n-pentylbenzene. Compound "X" is

(A) 

(B) 

(C) 

(D) 

(65) When any solution passes through a cation exchange resin that is in acidic form, H^+ ion of the resin is replaced by cations of the solution. A solution containing 0.319 g of an

isomer with molecular formula $CrCl_3.6H_2O$ is passed through a cation exchange resin in acidic form. The eluted solution requires 19 cm^3 of 0.125 N NaOH. The isomer is

(A) triaquatrichloro chromium(III) chloride trihydrate

(B) hexaaqua chromium(III) chloride

(C) pentaaquamonochloro chromium(III) chloride monohydrate

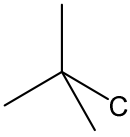
(D) tetraaquadichloro chromium(III) chloride dihydrate

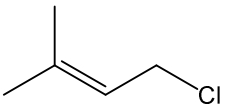
(66) In an experiment, it was found that for a gas at constant temperature, PV = C. The value of C depends on

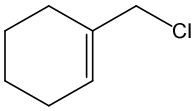
(A) atmospheric pressure (B) quantity of gas

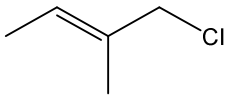
(C) molecular weight of gas (D) volume of chamber

(67) The compound that undergoes solvolysis in aq. ethanol most easily is

(A) 

(B) 

(C) 

(D) 

(68) Silver nitrate solution when added to a colorless aqueous solution **E** forms a white precipitate which dissolves in excess of **E**. If the white precipitate is heated with water, it turns black and the supernatant solution gives a white precipitate with acidified barium nitrate solution. Therefore, **E** is

(A) Na_2S (B) $Na_2S_2O_3$

(C) Na_2SO_3 (D) Na_2SO_4

(69) The metal **M** crystallizes in a body centered lattice with cell edge 400 pm. The atomic radius of **M** is

(A) 200 pm (B) 100 pm

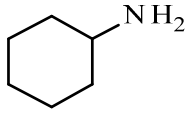
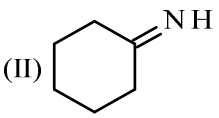
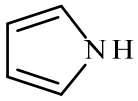
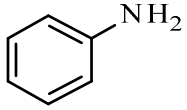
(C) 173 pm (D) 141 pm

(70) The reaction that **does not** proceed in forward direction is

(A) $BeF_2 + HgI_2 \rightarrow BeI_2 + HgF_2$ (B) $LiI + CsF \rightarrow LiF + CsI$

(C) $CuI_2 + 2CuF \rightarrow CuF_2 + 2CuI$ (D) $CaS + H_2O \rightarrow CaO + H_2S$

(71) The order of basicity of the following compounds is

(I)  (II)  (III)  (IV) 

(A) I > II > IV > III (B) IV > II > I > II

(C) III > II > I > IV (D) I > II > III > IV

(72) The appropriate sequence of reactions for obtaining 2-phenylbutanoic acid from benzene is

(A) (i) 1-chlorobutane/$AlCl_3$ (ii) limited Cl_2, light (iii) aq NaCN (iv) H^+, H_2O, heat

(B) (i) 2-chlorobutane/$AlCl_3$ (ii) $K_2Cr_2O_7/H_2SO_4$

(C) (i) propanoyl chloride/$AlCl_3$ (ii) Zn-Hg/HCl (iii) limited Cl_2, light (iv) aq. NaCN (v) H^+, H_2O, heat

(D) (i) butanoyl chloride/$AlCl_3$ (ii) $NaBH_4$ (iii) CuCN (iv) H^+, H_2O, heat

(73) The quantity that **does not** change for a sample of a gas in a sealed rigid container when it is cooled from 120^oC to 90^oC at constant volume is

(A) average energy of the molecule (B) pressure of the gas

(C) density of the gas (D) average speed of the molecules

(74) An ideal gas taken in an insulated chamber is released into interstellar space. The statement that is nearly true for this process is

(A) $Q = 0, W \neq 0$ (B) $W = 0, Q \neq 0$

(C) $\Delta U = 0, Q \neq 0$ (D) $Q = W = \Delta U = 0$

(75) 4-amino-3-methylbutanoic acid is treated with thionyl chloride followed by ammonia to obtain compound "X". "X" on reaction with bromine in an alkaline medium gave

compound "Y". For estimation, "Y" was titrated with perchloric acid. The volume of 0.1 M perchloric acid needed to react with 0.22 g of "Y" is

(A) 50 mL (B) 80 mL

(C) 120 mL (D) 200 mL

(76) For $[FeF_6]^{3-}$ and $[CoF_6]^{3-}$, the statement that is correct is

(A) both are colored

(B) both are colorless

(C) $[FeF_6]^{3-}$ is colored and $[CoF_6]^{3-}$ is colorless

(D) $[FeF_6]^{3-}$ is colorless and $[CoF_6]^{3-}$ is colored

(77) Cotton fibers consist of cellulose polymers with neighboring polymers chains held together by hydrogen bonds between –OH groups in the glucose units. Due to these hydrogen bonds

(A) cotton is insoluble in water

(B) cotton can easily absorb ghee and oils and therefore are used to make wicks in traditional lamps

(C) it is easier to iron cotton clothes when they are slightly wet or by applying steam to the clothes

(D) cotton clothes have a high wear and tear than other fibers

(78) For the following reaction, formation of the product is favored by

$A_2(g) + 4B_2(g) \ll 2AB_4(g), \ \Delta H < 0$

(A) low temperature and high pressure (B) high temperature and low pressure

(C) low temperature and low pressure (D) high temperature and high pressure

(79) Imagine a hypothetical situation in which capacity of any molecular orbital is 3 instead of 2 and the combination rules for the formation of molecular orbitals remain the same. The number of delocalized pi-electrons stipulated by the modified Huckel's rule of aromaticity is (n= integer, including zero)

(A) (3n+2) (B) (4n+3)

(C) (2n+3) (D) (6n+3)

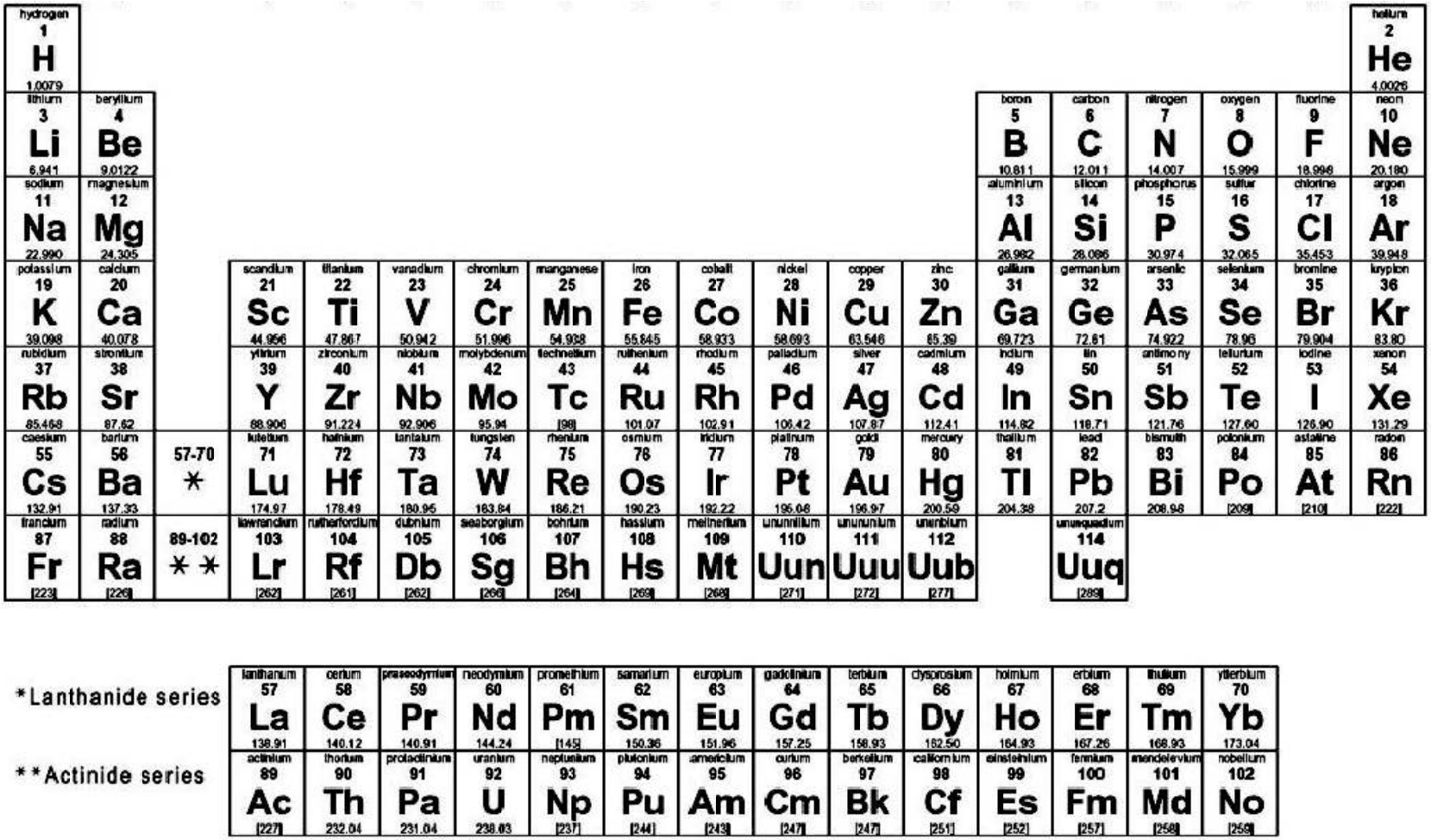
(80) One mole crystal of a metal halide of the type MX with molecular weight 119 g having face centered cubic structure with unit cell length 6.58 Å was recrystallized. The density of the recrystallized crystal was found to be 2.44 g cm^{-3}. The type of defect introduced during the recrystalization is

(A) additional M^+ and X^- ions at interstitial sites

(B) Schottky defect

(C) F-centre

(D) Frenkel defect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helium 2 He 4.0026
lithium 3 Li 6.941
beryllium 4 Be 9.0122
boron 5 B 10.811
carbon 6 C 12.011
nitrogen 7 N 14.007
oxygen 8 O 15.999
fluorine 9 F 18.998
neon 10 Ne 20.180
sodium 11 Na 22.990
magnesium 12 Mg 24.305
aluminium 13 Al 26.982
silicon 14 Si 28.086
phosphorus 15 P 30.974
sulfur 16 S 32.065
chlorine 17 Cl 35.453
argon 18 Ar 39.948
potassium 19 K 39.098
calcium 20 Ca 40.078
scandium 21 Sc 44.956
titanium 22 Ti 47.867
vanadium 23 V 50.942
chromium 24 Cr 51.996
manganese 25 Mn 54.938
iron 26 Fe 55.845
cobalt 27 Co 58.933
nickel 28 Ni 58.693
copper 29 Cu 63.546
zinc 30 Zn 65.39
gallium 31 Ga 69.723
germanium 32 Ge 72.61
arsenic 33 As 74.922
selenium 34 Se 78.96
bromine 35 Br 79.904
krypton 36 Kr 83.80
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tellurium 52 Te 127.60
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