

WARNING : Any malpractice or any attempt to commit any kind of malpractice in the Examination will **DISQUALIFY THE CANDIDATE**.

PAPER – I CHEMISTRY & PHYSICS – 2014

Version Code	A3	Question Booklet Serial Number :	
Time : 150 Minutes	Number of Questions : 120	Maximum Marks : 480	
Name of Candidate			
Roll Number			
Signature of Candidate			

INSTRUCTIONS TO THE CANDIDATE

1. Please ensure that the **VERSION CODE** shown at the top of this Question Booklet is the same as that shown in the OMR Answer Sheet issued to you. If you have received a Question Booklet with a different **VERSION CODE**, please get it replaced with a Question Booklet with the same **VERSION CODE** as that of the OMR Answer Sheet from the invigilator. **THIS IS VERY IMPORTANT.**
2. Please fill in the items such as name, signature and roll number of the candidate in the columns given above. Please also write the Question Booklet Sl. No. given at the top of this page against item 5 in the OMR Answer Sheet.
3. Please read the instructions given in the OMR Answer Sheet for marking answers. Candidates are advised to strictly follow the instructions contained in the OMR Answer Sheet.
4. This Question Booklet contains 120 questions. For each question, five answers are suggested and given against (A), (B), (C), (D) and (E) of which, only one will be the **Most Appropriate Answer**. Mark the bubble containing the letter corresponding to the 'Most Appropriate Answer' in the OMR Answer Sheet, by using either **Blue or Black ball-point pen only**.
5. **Negative Marking:** In order to discourage wild guessing, the score will be subject to penalization formula based on the number of right answers actually marked and the number of wrong answers marked. Each correct answer will be awarded **FOUR** marks. One mark will be deducted for each incorrect answer. More than one answer marked against a question will be deemed as incorrect answer and will be negatively marked.

IMMEDIATELY AFTER OPENING THIS QUESTION BOOKLET, THE CANDIDATE SHOULD VERIFY WHETHER THE QUESTION BOOKLET ISSUED CONTAINS ALL THE 120 QUESTIONS IN SERIAL ORDER. IF NOT, REQUEST FOR REPLACEMENT.

DO NOT OPEN THE SEAL UNTIL THE INVIGILATOR ASKS YOU TO DO SO.

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PLEASE ENSURE THAT THIS BOOKLET CONTAINS 120 QUESTIONS
SERIALLY NUMBERED FROM 1 TO 120.

(Printed Pages : 32)

1. When ammonium chloride is added to ammonium hydroxide solution, the dissociation of ammonium hydroxide is suppressed due to
 - (A) hydrolysis
 - (B) oxidation
 - (C) reduction
 - (D) increase in dielectric constant
 - (E) common ion effect

2. The pK_a of a weak acid HA and pK_b of a weak base BOH are 4.60 and 4.80 respectively. The pH of 0.1M solution of the salt, BA, formed from the acid HA and base BOH is
 - (A) 7.10
 - (B) 9.40
 - (C) 6.90
 - (D) 0.20
 - (E) 4.80

3. In which one of the following equilibria will the point of equilibrium shift to left when the pressure of the system is increased?
 - (A) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$
 - (B) $2NH_3(g) \rightleftharpoons N_2(g) + 3H_2(g)$
 - (C) $C(s) + O_2(g) \rightleftharpoons CO_2(g)$
 - (D) $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$
 - (E) $2H_2(g) + O_2(g) \rightleftharpoons H_2O(l)$

Space for rough work

4. The experimental and calculated elevation in boiling points of an electrolyte AB in its aqueous solution at a given concentration are 0.81 K and 0.54 K respectively. The percentage ionization of the electrolyte at this concentration is
- (A) 20 (B) 40 (C) 50 (D) 60 (E) 80
5. Which one of the following binary liquid mixtures exhibits negative deviation from Raoult's law?
- (A) *n*-hexane-*n*-heptane (B) Chloroform-acetone
(C) Carbondisulphide-acetone (D) Bromoethane-chloroethene
(E) Benzene-toluene
6. An electrolyte (AB) is 100 % ionized in 10 % aqueous solution. What is the osmotic pressure (L-atm.) of a 10 % solution of the electrolyte at 300 K if molecular weight of AB is 200 g mol^{-1} ?
- ($R=0.082 \text{ L atm K}^{-1} \text{ mol}^{-1}$)
- (A) 200 (B) 100 (C) 246 (D) 24.6 (E) 2.46
7. In the electrolysis of aqueous solution of copper sulphate using copper strips as anode and cathode, the anode reaction is
- (A) $\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$ (B) $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$
(C) $2\text{HO}^{-} \rightarrow \text{H}_2 + \frac{1}{2}\text{O}_2 + 2\text{e}^{-}$ (D) $\text{SO}_4^{2-} \rightarrow \text{SO}_4 + 2\text{e}^{-}$
(E) $2\text{HSO}_4^{-} \rightarrow \text{H}_2\text{S}_2\text{O}_8 + 2\text{e}^{-}$

Space for rough work

8. 0.001 mole of strong electrolyte $\text{Zn}(\text{OH})_2$ is present in 200 mL of an aqueous solution. The pH of this solution is
(A) 2 (B) 4 (C) 12 (D) 10 (E) 7
9. If the standard potential for Daniel cell is 1.1 V, then the potential of the cell when $[\text{Zn}^{2+}] = 1.0\text{M}$ and $[\text{Cu}^{2+}] = 0.1\text{M}$ at 298 K is $(\frac{2.303RT}{F})$ value at 298 K = 0.06 V
(A) 1.1295 V (B) 0.100 V (C) 1.07 V (D) 0.76 V (E) 1.1 V
10. The $t_{1/2}$ for a zero order reaction at the initial concentration of $6 \times 10^{-3}\text{M}$ is one minute at 27°C . The rate constant at 27°C in $\text{mol dm}^{-3}\text{s}^{-1}$ is
(A) 3×10^{-4} (B) 6×10^{-4} (C) 5×10^{-5} (D) 5×10^{-4} (E) 3×10^{-5}
11. The inversion of cane sugar is first order in [sugar] and proceeds with half-life of 600 minutes at $\text{pH} = 4$ for a given concentration of sugar. However, if $\text{pH} = 5$, the half-life changes to 60 minutes. The rate law expression for the sugar inversion can be written as
(A) $\text{rate} = k[\text{sugar}]^1[\text{H}^+]^2$ (B) $\text{rate} = k[\text{sugar}]^1[\text{H}^+]^1$
(C) $\text{rate} = k[\text{sugar}]^1[\text{H}^+]^4$ (D) $\text{rate} = k[\text{sugar}]^1[\text{H}^+]^0$
(E) $\text{rate} = k[\text{sugar}]^1[\text{H}^+]^5$
12. In an attempt to compare the half-lives of two radioactive elements A and B, a scientist set aside 400 g of each. After 3 months, the scientist found 25 g of A and 200 g of B. Which one of the following statements is true?
(A) Half-life of B is twice that of A
(B) Half-life of B is four times that of A
(C) Half-life of A is twice that of B
(D) Half-life of A is four times that of B
(E) Half-life of B is eight times that of A

Space for rough work

13. When molten magnesium oxide was electrolysed for a certain period, 150 mg of Mg was deposited on the cathode. The volume of oxygen gas in cm^3 at STP conditions liberated at the anode during the same period is (Atomic mass of Mg = 24 gmol^{-1})
- (A) 140 (B) 280 (C) 70 (D) 120 (E) 240
14. Which one of the following is not explained by adsorption?
- (A) When acetic acid solution is shaken with charcoal, the concentration of the acid decreases
- (B) The white precipitate of $\text{Mg}(\text{OH})_2$ attains blue colour when precipitated in the presence of magneson reagent
- (C) The air becomes dry in the presence of silica gel
- (D) An aqueous solution of NaOH attains pink colour with a drop of phenolphthalein
- (E) When animal charcoal is shaken with coloured methylene blue solution, the solution turns colourless
15. The hybridization of central metal ion in $\text{K}_2[\text{Ni}(\text{CN})_4]$ and $\text{K}_2[\text{NiCl}_4]$ are respectively
- (A) dsp^2, sp^3 (B) sp^3, sp^3 (C) dsp^2, dsp^2
- (D) $sp^3, sp^3 d^2$ (E) $sp^3 d^2, d^2 sp^3$
16. Which of the following compounds show optical isomerism?
- (i) $\text{cis}[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ (ii) $\text{trans}[\text{Co}(\text{en})_2\text{Cl}_2]^+$
- (iii) $\text{cis}[\text{Co}(\text{en})_2\text{Cl}_2]^+$ (iv) $[\text{Co}(\text{en})_3]^{3+}$
- Choose the correct answer codes given below
- (A) i and ii (B) ii and iii (C) iii and iv
- (D) i, iii and iv (E) i, ii, iii and iv

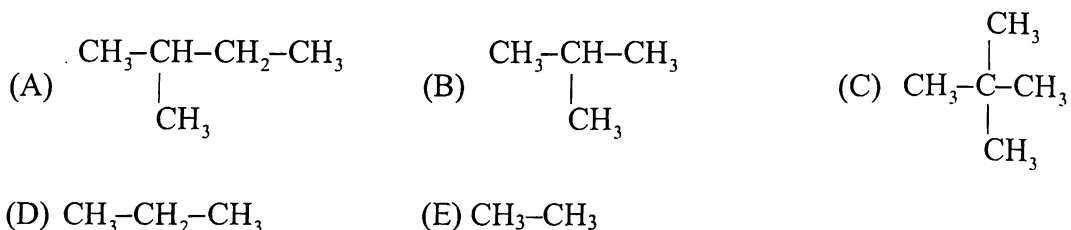
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17. Camphor can be purified by
(A) distillation (B) vacuum distillation (C) sublimation
(D) steam distillation (E) fractional crystallization
18. Tropolone is an example of
(A) benzenoid aromatic compound (B) non-benzenoid aromatic compound
(C) alicyclic compound (D) acyclic compound
(E) heterocyclic aromatic compound
19. Both sp^2 and sp^3 hybrid orbitals are involved in the formation of
(A) $\text{CH}_2=\text{CH}-\text{C}\equiv\text{C}-\text{H}$ (B) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_3$
(C) $\text{CH}_2=\text{CH}-\text{C}\equiv\text{N}$ (D) $\text{CH}_2=\text{CH}_2$
(E) $\text{CH}_2=\text{CH}-\text{CO}-\text{CH}_3$
20. Arrange the following molecules in the correct order of decreasing C–C bond length:
 C_2H_6 , C_2H_4 , C_2H_2 , C_6H_6
(A) $\text{C}_2\text{H}_6 > \text{C}_6\text{H}_6 > \text{C}_2\text{H}_4 > \text{C}_2\text{H}_2$
(B) $\text{C}_2\text{H}_6 > \text{C}_2\text{H}_4 > \text{C}_6\text{H}_6 > \text{C}_2\text{H}_2$
(C) $\text{C}_2\text{H}_4 > \text{C}_2\text{H}_2 > \text{C}_2\text{H}_6 > \text{C}_6\text{H}_6$
(D) $\text{C}_2\text{H}_2 > \text{C}_6\text{H}_6 > \text{C}_2\text{H}_4 > \text{C}_2\text{H}_6$
(E) $\text{C}_6\text{H}_6 > \text{C}_2\text{H}_4 > \text{C}_2\text{H}_6 > \text{C}_2\text{H}_2$
21. Williamson's synthesis of preparing dimethyl ether is a/an
(A) electrophilic substitution (B) $\text{S}_{\text{N}}1$ reaction
(C) electrophilic addition (D) $\text{S}_{\text{N}}2$ reaction
(E) free radical substitution

Space for rough work

22. The effect that makes 2,3-dimethyl-2-butene more stable than 2-butene is
 (A) resonance (B) hyperconjugation (C) electromeric effect
 (D) inductive effect (E) steric effect

23. In which of the following compounds only primary carbon atoms are present?

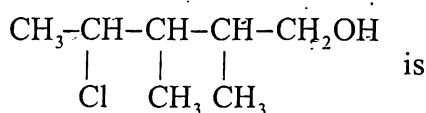


24. The organic compound with two asymmetric carbon atoms is
 (A) 3,4-dimethylheptane (B) 3-methyl-1-pentene
 (C) 2-chloropentane (D) 5-ethyl-2,3-dimethylheptane
 (E) 3-chlorohexane

25. Geometrical isomerism is not possible in
 (A) 2,4-hexadiene (B) benzaldoxime (C) but-2-ene
 (D) 1,2-dichloroethene (E) benzophenone oxime

Space for rough work

26. The correct IUPAC name of the organic compound



- (A) 4-chloro-2,3-dimethylpentan-1-ol
 (B) 2-chloro-3,4-dimethylpentan-5-ol
 (C) 2,3-dimethyl-4-chloropentan-1-ol
 (D) 2-chloro-3,4-dimethyl *n*-pentyl alcohol
 (E) 2,3-dimethyl-4-chloro *n*-pentyl alcohol
27. Carbylamine test is not answered by
 (A) $\text{C}_6\text{H}_5\text{NH}_2$ (B) $(\text{CH}_3)_3\text{C}-\text{CH}_2-\text{NH}_2$ (C) $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$
 (D) $(\text{CH}_3)_3\text{N}$ (E) CH_3NH_2
28. Which of the following represents Wurtz-Fittig reaction?
 (A) $\text{C}_6\text{H}_5\text{I} + 2\text{Na} + \text{CH}_3\text{I} \rightarrow \text{C}_6\text{H}_5\text{CH}_3 + 2\text{NaI}$
 (B) $2\text{C}_6\text{H}_5\text{I} + 2\text{Na} \rightarrow \text{C}_6\text{H}_5\text{C}_6\text{H}_5 + 2\text{NaI}$
 (C) $2\text{CH}_3\text{CH}_2\text{I} + 2\text{Na} \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 + 2\text{NaI}$
 (D) $\text{C}_2\text{H}_5\text{ONa} + \text{C}_2\text{H}_5\text{I} \rightarrow \text{C}_2\text{H}_5-\text{O}-\text{C}_2\text{H}_5 + \text{NaI}$
 (E) $\text{CH}_3\text{Br} + \text{AgF} \rightarrow \text{CH}_3\text{F} + \text{AgBr}$
29. Which of the following organic halogen compounds undergoes hydrolysis with aqueous NaOH predominantly by $\text{S}_{\text{N}}1$ mechanism?
 (A) ethyl iodide (B) methyl chloride (C) isopropyl chloride
 (D) chlorobenzene (E) benzyl chloride

Space for rough work

30. The major product formed when 2-bromo-2-methyl butane is refluxed with ethanolic KOH is
- (A) 2-methylbut-2-ene (B) 2-methylbutan-1-ol
(C) 3-methylbutan-2-ol (D) 2-methylbutan-2-ol
(E) 2-methylbut-1-ene
31. In which of the following reactions new carbon-carbon bond is not formed?
- (A) Cannizzaro reaction (B) Wurtz reaction
(C) Aldol condensation (D) Friedel-Craft reaction
(E) Kolbe's reaction
32. Which one of the following phenols has the highest pK_a value?
- (A) *o*-Nitrophenol (B) Phenol (C) *m*-Nitrophenol
(D) Picric acid (E) *p*-Cresol
33. The reagent that is used to distinguish between secondary amine and tertiary amine is
- (A) *p*-toluenesulphonyl chloride (B) Lucas reagent
(C) CHCl_3 and alc.KOH (D) Borsche's reagent
(E) Bromine water

Space for rough work

37. Which one of the following is an example for biodegradable polyester?
(A) PHBV (B) PET (C) Nylon 6
(D) Bakelite (E) Glyptal
38. Which one of the following is an essential amino acid?
(A) Methionine (B) Tyrosine (C) Proline
(D) Glycine (E) Alanine
39. The one letter code for the amino acid tryptophan is
(A) G (B) V (C) W (D) H (E) A
40. Cheilosis and digestive disorders are due to the deficiency of
(A) Vitamin A (B) Thiamine (C) Riboflavin
(D) Ascorbic acid (E) Pyridoxine
41. Which one of the following is a bacteriostatic drug?
(A) Aminoglycosides (B) Penicillin-G (C) Ofloxacin
(D) Ampicillin (E) Tetracycline
42. Freon-12 is manufactured from tetrachloromethane by
(A) Haloform reaction (B) Reimer-Tiemann reaction
(C) Wurtz reaction (D) Swartz reaction
(E) Gattermann reaction

Space for rough work

43. The ratio of de Broglie wavelengths of a deuterium atom to that of an α particle, when the velocity of the former is five times greater than that of the latter, is
(A) 4 (B) 0.2 (C) 2 (D) 0.4 (E) 5
44. The maximum number of electrons which can be held by sub shell with azimuthal quantum number ' l ' in an atom is given by
(A) $(2l + 1)$ (B) $(2l + 2)$ (C) $2(2l + 1)$ (D) $2(2l + 2)$ (E) $2l$
45. Which one of the following data has only four significant figures?
(A) 6.023×10^{23} (B) 285 cm (C) 0.0025 L (D) 0.200 g
(E) 1.0×10^5 m
46. The uncertainty in the velocity of a particle of mass 6.626×10^{-31} kg is 1×10^6 ms $^{-1}$. What is the uncertainty in its position (in nm)? ($h = 6.626 \times 10^{-34}$ Js)
(A) $(1/2\pi)$ (B) $(2.5/\pi)$ (C) $(4/\pi)$ (D) $(1/4\pi)$ (E) $(5/\pi)$
47. The bond orders for O_2^+ and C_2 respectively are
(A) 2.5, 2 (B) 3, 2 (C) 2, 2.5 (D) 2, 3 (E) 3, 3

Space for rough work

48. The percentage of s-character in the hybridised orbitals of B in BF_3 is
(A) 25 (B) 50 (C) 75 (D) 33.3 (E) 21.5
49. Which one of the following has the lowest dipole moment?
(A) CH_3F (B) CH_3Cl (C) CH_3I (D) CHCl_3 (E) CH_3Br
50. The number of bond pair and lone pair of electrons respectively in NH_3 molecule are
(A) 4 and 0 (B) 3 and 0 (C) 3 and 1 (D) 2 and 2 (E) 5 and 0
51. The partial pressure of nitrogen in air is 0.76 atm. and its Henry's law constant is 7.6×10^4 atm at 300 K. What is the mole fraction of N_2 in the solution obtained when air is bubbled through water at 300 K?
(A) 1×10^{-4} (B) 2×10^{-4} (C) 1×10^{-5} (D) 2×10^{-5} (E) 1×10^{-6}
52. The type of attractive forces that operate between gaseous HCl and chlorine molecule is
(A) dipole-dipole forces (B) London forces
(C) induced dipole-induced dipole (D) dipole-induced dipole forces
(E) electrostatic forces

Space for rough work

53. Which one of the following statements is incorrect?
- (A) Glass is an extremely viscous liquid
 - (B) Viscosity co-efficient of a liquid decreases with increase in temperature
 - (C) Laminar flow represents regular gradation of velocity in passing from one layer to another in liquids
 - (D) Liquids rise in capillary due to surface tension
 - (E) Gases can be liquefied at any temperature by applying sufficient pressure
54. The number of tetrahedral and octahedral voids in a ccp array of 100 atoms are respectively
- (A) 200 and 100
 - (B) 100 and 200
 - (C) 200 and 200
 - (D) 100 and 100
 - (E) 50 and 50
55. Which of the following pairs contain metalloid elements in the periodic table?
- (A) Na and K
 - (B) F and Cl
 - (C) Ca and Mg
 - (D) As and Si
 - (E) Cu and Ag
56. The atom/ion that has the highest number of unpaired electrons is
- (A) Na^+
 - (B) F
 - (C) N
 - (D) O^{2-}
 - (E) B

Space for rough work

57. The inorganic compound obtained by the auto-oxidation of 2-alkylanthraquinol is
(A) H_2O (B) H_2O_2 (C) H_2 (D) O_2 (E) H_2SO_4
58. The least stable carbonate of alkali metals is
(A) Cs_2CO_3 (B) Na_2CO_3 (C) K_2CO_3 (D) Rb_2CO_3 (E) Li_2CO_3
59. Sphalerite is concentrated by
(A) gravity separation (B) froth floatation
(C) magnetic separation (D) hydraulic washing
(E) leaching
60. The following set of reactions are used in refining zirconium.
$$\text{Zr (impure)} + 2\text{I}_2 \xrightarrow{523\text{K}} \text{ZrI}_4 \xrightarrow{1800\text{K}} \text{Zr (pure)} + 2\text{I}_2$$

This method is known as
(A) Distillation (B) Liquation (C) Hall-Heroult method
(D) Van Arkel method (E) Mond's process
61. Which one of the following is used as a piezoelectric material?
(A) Silicones (B) Graphite (C) Silica gel (D) Kieselghur (E) Quartz

Space for rough work

62. The gaseous product formed when HOCl reacts with H_2O_2 in acidic medium is
(A) H_2 (B) Cl_2 (C) O_2 (D) $HClO_2$ (E) $HClO_3$
63. Three centre two electron bond is present in
(A) NH_3 (B) B_2H_6 (C) BCl_3 (D) $AlCl_3$ (E) BF_3
64. Which one of the following is used for the production of UF_6 in the enrichment of U^{235} ?
(A) ClF_3 (B) KF (C) KHF_2 (D) HF (E) PF_3
65. Zeigler-Natta catalyst is
(A) $ZnCl_2$ (B) $Et_3Al + TiCl_4$ (C) $Cu / ZnO-Cr_2O_3$
(D) Pt (E) V_2O_5

Space for rough work

66. Among the 3d series of transition metals the one that has positive M^{2+}/M standard electrode potential is
(A) Cr (B) Mn (C) Zn (D) Ni (E) Cu
67. Which one of the following transition metal ions is colourless in aqueous solution?
(A) Ti^{4+} (B) V^{4+} (C) Mn^{2+} (D) Fe^{3+} (E) Ni^{2+}
68. The magnetic moment of Ni^{2+} ion (At. No. of Ni. is 28) in BM unit is
(A) 1.73 (B) 4.81 (C) 5.96 (D) 2.84 (E) 3.86
69. The enthalpy of formation of $CH_4(g)$, $H_2O(l)$ and $CO_2(g)$ are respectively $-74.8 \text{ kJ mol}^{-1}$, $-285.8 \text{ kJ mol}^{-1}$ and $-393.5 \text{ kJ mol}^{-1}$. Then, the standard enthalpy of combustion of $CH_4(g)$ is
(A) $+890.3 \text{ kJ mol}^{-1}$ (B) $-604.5 \text{ kJ mol}^{-1}$
(C) $-754.1 \text{ kJ mol}^{-1}$ (D) $+604.5 \text{ kJ mol}^{-1}$
(E) $-890.3 \text{ kJ mol}^{-1}$

Space for rough work

70. In the following reaction, $4\text{NO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{N}_2\text{O}_5(\text{g})$; $\Delta H = -110 \text{ kJ}$;
if $\text{N}_2\text{O}_5(\text{s})$ is formed instead of $\text{N}_2\text{O}_5(\text{g})$ in the reaction, the enthalpy change (in kJ) would
be (enthalpy of sublimation of $\text{N}_2\text{O}_5(\text{s})$ is $+53 \text{ kJ mol}^{-1}$)
(A) -216 (B) -162 (C) $+108$ (D) $+216$ (E) $+162$
71. For the reaction $2\text{A}_3 \rightleftharpoons 3\text{A}_2$ the equilibrium constant and the ΔG° values at a certain
temperature are respectively 1×10^{30} and $-172.4 \text{ kJ mol}^{-1}$. The equilibrium temperature in
 $^\circ\text{C}$ is about ($2.303 \text{ R} = 19.15 \text{ JK}^{-1} \text{ mol}^{-1}$)
(A) 300 (B) 27 (C) 273 (D) 298 (E) 270
72. The equilibrium constant (K_C) for the reaction
 $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}(\text{g})$
at 800 K is 0.0625. What is the K_C value for the following reaction at 800 K?
 $\text{NO}(\text{g}) \rightleftharpoons \frac{1}{2}\text{N}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$
(A) 0.4 (B) 0.375 (C) 4 (D) 40 (E) 0.20

Space for rough work

73. A toroid having 200 turns carries a current of 1 A. The average radius of the toroid is 10 cm. The magnetic field at any point in the open space inside the toroid is
- (A) 4×10^{-3} T (B) zero (C) 0.5×10^{-3} T
(D) 3×10^{-3} T (E) 2×10^{-3} T
74. Transformer is used to
- (A) convert ac to dc voltage
(B) convert dc to ac voltage
(C) obtain desired dc power
(D) obtain desired ac voltage and current
(E) obtain desired dc voltage and current
75. If an LCR series circuit is connected to an ac source, then at resonance the voltage across
- (A) R is zero
(B) R equals the applied voltage
(C) C is zero
(D) L equals the applied voltage
(E) L is zero
76. A dynamo converts
- (A) mechanical energy into thermal energy
(B) electrical energy into thermal energy
(C) thermal energy into electrical energy
(D) mechanical energy into electrical energy
(E) electrical energy into mechanical energy

Space for rough work

77. The electromagnetic waves detected using a thermopile and used in physical therapy are
- (A) gamma radiations
 - (B) X-rays
 - (C) ultra-violet radiations
 - (D) infra-red radiations
 - (E) micro-wave radiations
78. Two lenses of power 15 and -3 dioptre are placed in contact. The focal length of the combination is
- (A) 10 cm (B) 15 cm (C) 12 cm (D) 18 cm (E) 8.33 cm
79. The speed of light in an isotropic medium depends on
- (A) the nature of the source
 - (B) its wavelength
 - (C) its direction of propagation
 - (D) its intensity
 - (E) the motion of the source relative to the medium
80. Astigmatism is corrected using
- (A) cylindrical lens
 - (B) plano-convex lens
 - (C) plano-concave lens
 - (D) convex lens
 - (E) concave lens

Space for rough work

81. If the wavelength of incident light falling on a photosensitive material decreases, then
- (A) photoelectric current increases
 - (B) stopping potential decreases
 - (C) stopping potential remains constant
 - (D) photoelectric current decreases
 - (E) stopping potential increases
82. After 300 days, the activity of a radioactive sample is 5000 dps (disintegrations per sec). The activity becomes 2500 dps after another 150 days. The initial activity of the sample in dps is
- (A) 20,000 (B) 10,000 (C) 7,000 (D) 25,000 (E) 15,000
83. The control rods used in a nuclear reactor can be made up of
- (A) Graphite (B) Cadmium (C) Uranium (D) Barium (E) Lead
84. The fusion reaction in the sun is a multi-step process in which the
- (A) helium is burned into deuterons
 - (B) helium is burned into hydrogen
 - (C) deuteron is burned into hydrogen
 - (D) hydrogen is burned into helium
 - (E) helium is burned into neutrons

Space for rough work

85. Identify the wrong statement
- (A) In conductors, the valence and conduction bands overlap
 - (B) Substances with energy gap of the order of 10 eV are insulators
 - (C) The resistivity of semiconductors is lower than metals
 - (D) The conductivity of metals is high
 - (E) The resistivity of a semiconductor is lower than that of an insulator
86. Identify the wrong statement with reference to a solar cell
- (A) It is a p-n junction diode with no external bias
 - (B) It uses materials of high optical absorption
 - (C) It uses materials with band gap of 5 eV
 - (D) It converts light energy into electrical energy
 - (E) It uses materials such as GaAs, Si
87. The minimum number of NAND gates used to construct an OR gate is
- (A) 4 (B) 6 (C) 5 (D) 3 (E) 2
88. An AM radio station operating at 630 kHz is permitted to broadcast audio frequencies up to 6 kHz. The band pass filter in its modulation circuit can retain the frequencies
- (A) 636 kHz, 630 kHz (B) 12 kHz, 6 kHz
(C) 1260 kHz, 6 kHz (D) 1260 kHz, 630 kHz
(E) 6 kHz, 630 kHz
89. A transducer, in communication system is a device that
- (A) is a part of the antenna
 - (B) is a combination of a receiver and a transmitter
 - (C) converts audio signals into video signals
 - (D) detects the incoming signal
 - (E) converts physical variable into corresponding variations in the electrical signal

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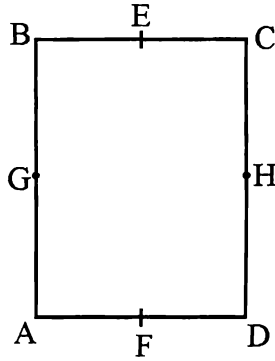
90. The dimensions of mobility of charge carriers are
(A) $M^{-2}T^2A$ (B) $M^{-1}T^2A$ (C) $M^{-2}T^3A$
(D) $M^{-1}T^3A$ (E) $M^{-1}T^2A^{-1}$
91. The acceleration of a moving body is found from the
(A) area under velocity – time graph
(B) area under displacement – time graph
(C) slope of distance – time graph
(D) slope of velocity – time graph
(E) area under acceleration – time graph
92. A ball thrown vertically upwards after reaching a maximum height h , returns to the starting point after a time of 10 s. Its displacement is
(A) h (B) $2h$ (C) $10h$ (D) $20h$ (E) zero
93. If the angles of projection of a projectile with same initial velocity exceed or fall short of 45° by equal amounts α , then the ratio of horizontal ranges is
(A) 1 : 2 (B) 1 : 3 (C) 1 : 4 (D) 1 : 1 (E) $1 : \sqrt{2}$
94. If the length of seconds' hand of a clock is 10 cm, the speed of its tip (in cm s^{-1}) is nearly
(A) 2 (B) 0.5 (C) 1.5 (D) 3 (E) 1

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95. The retarding acceleration of 7.35 m s^{-2} due to frictional force stops the car of mass 400 kg travelling in a road. The coefficient of friction between the tyre of the car and the road is
(A) 0.55 (B) 0.75 (C) 0.70 (D) 0.65 (E) 0.80
96. A hammer weighing 3 kg strikes the head of a nail with a speed of 2 m s^{-1} drives it by 1 cm into the wall. The impulse imparted to the wall is
(A) 6 Ns (B) 3 Ns (C) 2 Ns (D) 12 Ns (E) 18 Ns
97. If two persons A and B take 2 seconds and 4 seconds respectively to lift an object to the same height h , then the ratio of their powers is
(A) $1 : 2$ (B) $1 : 1$ (C) $2 : 1$ (D) $1 : 3$ (E) $3 : 1$
98. If a machine gun fires n bullets per second each with kinetic energy K , then the power of the machine gun is
(A) nK^2 (B) $\frac{K}{n}$ (C) n^2K (D) nK (E) $\frac{n}{K}$

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99. The moment of inertia of the rectangular plate ABCD, ($AB = 2 BC$) is minimum along the axis



- (A) GH (B) EF (C) BC (D) AC (E) AB
100. The position of centre of mass of a system of particles does not depend upon the
- (A) mass of particles
 (B) symmetry of the body
 (C) position of the particles
 (D) relative distance between the particles
 (E) nature of particles
101. The relation between escape velocity (V_e) from the surface of the earth and the orbital velocity (V_o) is
- (A) $\sqrt{2}V_e = V_o$
 (B) $V_e = \sqrt{2}V_o$
 (C) $V_e = 2V_o$
 (D) $4V_e = 3V_o$
 (E) $V_e = \sqrt{3}V_o$

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102. The time period of an earth's satellite revolving at a height of 35,800 km is
- (A) 24 hours (B) 100 minutes (C) 12 hours
(D) 48 hours (E) 52 hours
103. A solid ball of volume V experiences a viscous force F when falling with a speed v in a liquid. If another ball of volume $8V$ with the same velocity v is allowed to fall in the same liquid, it experiences a force
- (A) F (B) $16F$ (C) $4F$ (D) $8F$ (E) $2F$
104. For most of the materials, Young's modulus (Y) and rigidity modulus (G) are related as
- (A) $G = 3Y$ (B) $G = \frac{Y}{3}$ (C) $G = \frac{3}{2}Y$
(D) $G = \frac{Y}{8}$ (E) $10G = 3Y$
105. The pressure on an object of bulk modulus B undergoing hydraulic compression due to a stress exerted by surrounding fluid having volume strain $\left(\frac{\Delta V}{V}\right)$ is
- (A) $B^2\left(\frac{\Delta V}{V}\right)$ (B) $B\left(\frac{\Delta V}{V}\right)^2$ (C) $\frac{1}{B}\left(\frac{\Delta V}{V}\right)$
(D) $\frac{1}{B^2}\left(\frac{\Delta V}{V}\right)$ (E) $B\left(\frac{\Delta V}{V}\right)$

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106. If d is the average diameter of the molecule, then the mean free path of the molecules between two successive collisions is proportional to
- (A) d (B) d^2 (C) $\frac{1}{d}$ (D) $\frac{1}{d^2}$ (E) $\frac{1}{d^3}$
107. Which one of the following is a wrong statement in kinetic theory of gases?
- (A) The gas molecules are in random motion
(B) The gas molecules are perfect elastic spheres
(C) The volume occupied by the molecules of a gas is negligible
(D) The force of attraction between the molecules is negligible
(E) The collision between molecules are inelastic
108. The change in internal energy of a thermodynamical system which has absorbed 2 kcal of heat and done 400 J of work is (1 cal = 4.2 J)
- (A) 2 kJ (B) 8 kJ (C) 3.5 kJ (D) 5.5 kJ (E) 4.2 kJ
109. When the displacement of a particle executing simple harmonic motion is half its amplitude, the ratio of its kinetic energy to potential energy is
- (A) 1 : 3 (B) 2 : 1 (C) 3 : 1 (D) 1 : 2 (E) 2 : 3

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110. A body oscillates with SHM according to the equation (in SI units), $x = 5 \cos\left(2\pi t + \frac{\pi}{4}\right)$.

Its instantaneous displacement at $t = 1$ second is

- (A) $\frac{\sqrt{2}}{5}$ m (B) $\frac{1}{\sqrt{3}}$ m (C) $\frac{1}{\sqrt{2}}$ m (D) $\frac{1}{2}$ m (E) $\frac{5}{\sqrt{2}}$ m

111. Identify the correct statement

- (A) Transverse wave can propagate in gases.
(B) Transverse wave consists of compressions and rarefactions.
(C) Longitudinal wave can propagate in solids, liquids and gases.
(D) In a longitudinal wave, particles of the medium vibrate perpendicular to the direction of propagation.
(E) In a longitudinal wave, the higher density corresponds to rarefactions.

112. The speed of sound in air

- (A) decreases with temperature
(B) increases with pressure
(C) increases with humidity
(D) decreases with pressure
(E) increases with density

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113. The bulk modulus of a spherical object is B . If it is subjected to uniform pressure p , the fractional decrease in radius is

- (A) $\frac{p}{B}$ (B) $\frac{p}{3B}$ (C) $\frac{3p}{B}$ (D) $\frac{B}{3p}$ (E) $\frac{3B}{p}$

114. An electric dipole of dipole moment \vec{p} is placed in a uniform external electric field \vec{E} . Then the

- (A) torque experienced by the dipole is $\vec{E} \times \vec{p}$
(B) torque is zero if \vec{p} is perpendicular to \vec{E}
(C) torque is maximum if \vec{p} is perpendicular to \vec{E}
(D) potential energy is maximum if \vec{p} is parallel to \vec{E}
(E) potential energy is maximum if \vec{p} is perpendicular to \vec{E}

115. Electric field at a point of distance r from a uniformly charged wire of infinite length having linear charge density λ is directly proportional to

- (A) r^{-1} (B) r (C) r^2 (D) r^{-2} (E) \sqrt{r}

116. When 4 ampere current flows for 2 minutes in an electroplating experiment, m gram of silver is deposited. Then the amount (in gram) of silver deposited by 6 ampere current flowing for 40 seconds is

- (A) $4m$ (B) $\frac{m}{2}$ (C) $2m$ (D) $\frac{m}{4}$ (E) $\frac{3m}{4}$

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117. A uniform wire of resistance $9\ \Omega$ is joined end-to-end to form a circle. Then the resistance of the circular wire between any two diametrically opposite points is
- (A) $6\ \Omega$ (B) $3\ \Omega$ (C) $\frac{9}{4}\ \Omega$ (D) $\frac{3}{2}\ \Omega$ (E) $1\ \Omega$
118. The temperature coefficient of resistance of an alloy used for making resistors is
- (A) small and positive
(B) small and negative
(C) large and positive
(D) large and negative
(E) zero
119. The deflection in a moving coil galvanometer is
- (A) directly proportional to the torsional constant of the spring
(B) independent of the torsional constant of the spring
(C) inversely proportional to the area of the coil
(D) inversely proportional to the current flowing through it
(E) directly proportional to the number of turns in the coil
120. When a magnetic field is applied on a stationary electron, it
- (A) remains stationary
(B) spins about its own axis
(C) moves in the direction of the field
(D) moves perpendicular to the direction of the field
(E) moves opposite to the direction of the field

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