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

PAPER – I CHEMISTRY & PHYSICS

Version Code	A4	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 the items such as Name, Roll Number and Signature in the columns given above. Please also write Question Booklet Serial No. given at the top of this page against item 4 in the OMR Answer Sheet.
3. 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**.
4. **Negative Marking:** In order to discourage wild guessing, the score will be subjected 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.
5. 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.

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.

PLEASE ENSURE THAT THIS QUESTION BOOKLET CONTAINS 120 QUESTIONS SERIALLY NUMBERED FROM 1 TO 120. PRINTED PAGES : 32

1. Cheese is an example of

(A) solid sol (B) emulsion (C) gel

(D) foam (E) aerosol

2. 1.5 g of a non-volatile, non-electrolyte is dissolved in 50 g benzene ($K_b = 2.5$ K kg mol^{-1}). The elevation of the boiling point of the solution is 0.75 K. The molecular weight of the solute in g mol^{-1} is

(A) 200 (B) 50 (C) 75

(D) 100 (E) 150

3. Which one of the following binary liquid systems shows positive deviation from Raoult's law?

(A) Benzene-Toluene (B) Carbon disulphide-Acetone (C) Phenol-Aniline

(D) Chloroform-Acetone (E) Nitric acid-Water

4. When a gas is bubbled through water at 298 K, a very dilute solution of the gas is obtained. Henry's law constant for the gas at 298 K is 100 kbar. If the gas exerts a partial pressure of 1 bar, the number of millimoles of the gas dissolved in one litre of water is

(A) 0.555 (B) 5.55 (C) 0.0555

(D) 55.5 (E) 5.55×10^{-4}

Space for rough work

5. Calculate the work done (in Joules) when 0.2 mole of an ideal gas at 300 K expands isothermally and reversibly from an initial volume of 2.5 litres to the final volume of 25 litres

(A) 996 (B) 1148 (C) 11.48
(D) 897 (E) 114.8

6. Which one of the following coordination compounds is used to inhibit the growth of tumours?

(A) trans-platin (B) EDTA complex of calcium
(C) $[(Ph_3P)_3RhCl]$ (D) cis-platin (E) $[Ni(CO)_4]$

7. The IUPAC name of the complex $[Co(NH_3)_4(H_2O)Cl]Cl_2$ is

(A) aquatetramminechloridocobalt(III) chloride
(B) chloridoaquatetramminechloridocobalt(III) chloride
(C) chloridoaquatetramminechloridocobalt(II) chloride
(D) aquatetramminechloridocobalt(II) chloride
(E) tetrammineaquachloridocobalt(III) chloride

8. Which one of the following is the correct order of field strength of ligands in spectrochemical series?

(A) $I^- < Cl^- < F^- < H_2O < CN^-$ (B) $F^- < H_2O < I^- < CN^- < Cl^-$
(C) $CN^- < I^- < F^- < Cl^- < H_2O$ (D) $H_2O < F^- < CN^- < Cl^- < I^-$
(E) $Cl^- < I^- < H_2O < CN^- < F^-$

Space for rough work

9. Which one of the following transition metal ions shows magnetic moment of 5.92 BM?

(A) Mn^{2+} (B) Ti^{3+} (C) Cr^{3+}

(D) Cu^{2+} (E) Co^{2+}

10. Which one of the following transition elements does not exhibit variable oxidation state?

(A) Ni (B) Cu (C) Fe

(D) V (E) Sc

11. In the laboratory, manganese(II) salt is oxidized to permanganate ion in aqueous solution by

(A) Hydrogen peroxide (B) Conc. nitric acid (C) Peroxy disulphate

(D) Dichromate (E) Ozone

12. Which one of the following will decrease the pH of 50 ml of 0.01M hydrochloric acid?

(A) Addition of 50 ml of 0.01M HCl

(B) Addition of 50 ml of 0.002M HCl

(C) Addition of 150 ml of 0.002M HCl

(D) Addition of 5 ml of 1M HCl

(E) Addition of metallic zinc

13. Choose the reaction with negative ΔS value

(A) $2NaHCO_{3(s)} \rightarrow Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}$

(B) $Cl_{2(g)} \rightarrow 2Cl_{(g)}$

(C) $2SO_{2(g)} + O_{2(g)} \rightarrow 2SO_{3(g)}$

(D) $2KClO_{3(s)} \rightarrow 2KCl_{(s)} + 3O_{2(g)}$

(E) $H_2O_{(l)} \rightarrow H_2O_{(g)}$

Space for rough work

14. A chemical reaction is spontaneous at 298 K but non-spontaneous at 350 K. Which one of the following is true for the reaction?

	ΔG	ΔH	ΔS
(A)	–	–	+
(B)	+	+	+
(C)	–	+	–
(D)	+	–	+
(E)	–	–	–

15. The decomposition of ammonia on tungsten surface at 500 K follows zero order kinetics. The half-life period of this reaction is 45 minutes when the initial pressure is 4 bar. The half-life period (minutes) of the reaction when the initial pressure is 16 bar at the same temperature is

(A) 120 (B) 60 (C) 240
(D) 180 (E) 300

16. A current strength of 3.86 amp was passed through molten calcium oxide for 41 minutes and 40 seconds. The mass of calcium in grams deposited at the cathode is (Atomic mass of Ca is 40 g/mol, 1 F = 96500 C)

(A) 4 (B) 2 (C) 6
(D) 8 (E) 1

Space for rough work

17. The electrode potential $E_{(Zn^{2+}/Zn)}$ of a zinc electrode at 25°C with an aqueous solution of 0.1M $ZnSO_4$ is

($E^{\circ}_{(Zn^{2+}/Zn)} = -0.76$ V. Assume $\frac{2.303RT}{F} = 0.06$ at 298 K)

(A) +0.73 (B) −0.79 (C) −0.82

(D) −0.70 (E) +0.79

18. The electrical properties and their respective SI units are given below. Identify the wrongly matched pair

Electrical property		**SI unit**
(A) Specific conductance	-	Sm^{-1}
(B) Conductance	-	S
(C) Equivalent conductance	-	$Sm^2 g\ equiv^{-1}$
(D) Molar conductance	-	$Sm^2\ mol^{-1}$
(E) Cell constant	-	m

19. The electrolyte used in Leclanche cell is

(A) paste of KOH and ZnO

(B) 38 % solution of H_2SO_4

(C) Moist paste of NH_4Cl and $ZnCl_2$

(D) Moist sodium hydroxide

(E) Moist potassium hydroxide

Space for rough work

20. What is the volume of CO_2 liberated (in litres) at 1 atmosphere pressure and 0°C when 10 g of 100 % pure calcium carbonate is treated with excess dilute sulphuric acid? (Atomic mass Ca : 40, C : 12, O : 16)

(A) 0.224 (B) 2.24 (C) 22.4

(D) 224 (E) 11.2

21. Which one of the following is the lightest?

(A) 0.2 mole of hydrogen gas

(B) 6.023×10^{22} molecules of nitrogen

(C) 0.1 g of silver

(D) 0.1 mole of oxygen gas

(E) 1 g of water

22. One mole of propanone and one mole of formaldehyde are the products of ozonolysis of one mole of an alkene. The alkene may be

(A) 2-methylpropene (B) 2, 2-dimethyl-1-butene (C) propene

(D) 2-butene (E) 1-butene

23. Which one of the following is the correct statement?

(A) O_2 molecule has bond order 2 and is diamagnetic

(B) N_2 molecule has bond order 3 and is paramagnetic

(C) H_2 molecule has bond order zero and is diamagnetic

(D) C_2 molecule has bond order 2 and is diamagnetic

(E) He_2^+ ion has bond order zero and is diamagnetic

Space for rough work

24. Which set of quantum numbers are not possible?

	n	l	m	s
(A)	3	2	0	+½
(B)	2	2	1	+½
(C)	1	0	0	−½
(D)	3	2	−2	+½
(E)	2	1	1	−½

25. Intramolecular hydrogen bond exists in

(A) ortho nitrophenol (B) ethyl alcohol (C) water
(D) diethyl ether (E) para chlorophenol

26. The geometry of ammonium ion is

(A) trigonal planar (B) square planar (C) tetrahedral
(D) square pyramidal (E) octahedral

27. A mixture contains 64 g of dioxygen and 60 g of neon at a total pressure of 10 bar. The partial pressures in bar of dioxygen and neon are respectively
(Atomic masses O = 16, Ne = 20)

(A) 4 and 6 (B) 6 and 4 (C) 5 and 5
(D) 8 and 2 (E) 2 and 8

28. Choose the incorrect statement in the following

(A) Surface tension is the force acting per unit length perpendicular to the line drawn on the surface of the liquid
(B) Surface tension of a liquid increases with increase of temperature
(C) The SI unit of surface tension is Jm^{-2}
(D) Viscosity is a measure of resistance for the flow of liquid
(E) Viscosity of a liquid decreases with increase of temperature

Space for rough work

29. The empty space in body centred cubic lattice is

(A) 68 % (B) 52.4 % (C) 47.6 %

(D) 32 % (E) 74 %

30. 2-Bromopentane is treated with alcoholic KOH solution. The major product formed in this reaction and the type of reaction respectively are

(A) pent-2-ene, β -elimination

(B) pent-1-ene, β -elimination

(C) 2-pentanol, nucleophilic substitution

(D) pent-1-ene, nucleophilic substitution

(E) pent-2-ene, nucleophilic substitution

31. The element with positive electron gain enthalpy is

(A) hydrogen (B) sodium (C) oxygen

(D) fluorine (E) neon

32. Syngas is a mixture of

(A) $CO_2 + H_2$ (B) $CO + H_2$ (C) $CO + CO_2$

(D) $CO + N_2$ (E) $CO + O_2$

33. The strength of H_2O_2 (in g/litre) in 11.2 volume solution of H_2O_2 is

(A) 17 (B) 51 (C) 34

(D) 85 (E) 68

Space for rough work

34. Which one of the following is not a sulphide ore?

(A) Magnetite (B) Iron pyrites (C) Copper glance

(D) Sphalerite (E) Galena

35. The *p*-block element that forms predominantly basic oxide is

(A) N (B) P (C) As

(D) Sb (E) Bi

36. Germanium of very high purity is obtained by

(A) liquation (B) vapor phase refining (C) distillation

(D) zone refining (E) electrolytic refining

37. The correct formula of plaster of Paris is

(A) $CaSO_4.2H_2O$ (B) $CaSO_4.H_2O$ (C) $Ca_2SiO_4.2H_2O$

(D) $Ca_3SiO_5.H_2O$ (E) $CaSO_4.\frac{1}{2}H_2O$

38. The product/s formed when diborane is hydrolysed is/are

(A) B_2O_3 and H_3BO_3 (B) B_2O_3 only (C) H_3BO_3 and H_2

(D) H_3BO_3 only (E) B_2O_3 and H_2

Space for rough work

39. The pK_a of an acid HA is 4.77 and pK_b of a base BOH is 4.75. The pH of 0.1M aqueous solution of the salt AB is

(A) 7.02 (B) 7.01 (C) 6.99

(D) 7.00 (E) 6.98

40. In the equilibrium $2A \rightleftharpoons B + C$ the equilibrium concentrations of A, B and C at 300 K are 3×10^{-4}M, 1×10^{-4}M and 4.5×10^{-4}M respectively. The value of K_C for the above equilibrium at 300 K is

(A) 0.5 (B) 0.05 (C) 5.0

(D) 1.5 (E) 0.2

41. The element that does not show catenation among the following *p*-block elements is

(A) carbon (B) silicon (C) germanium

(D) lead (E) tin

42. Choose the equilibrium that is not influenced by pressure

(A) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

(B) $CO_{(g)} + 3H_{2(g)} \rightleftharpoons CH_{4(g)} + H_2O_{(g)}$

(C) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$

(D) $2HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$

(E) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

Space for rough work

43. The most acidic hydrogen atoms are present in

(A) ethane (B) ethene (C) cyclohexane

(D) benzene (E) ethyne

44. Among the three conformations of ethane, the order of stability follows the sequence

(A) eclipsed > gauche > staggered

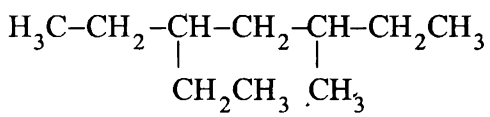
(B) eclipsed > staggered > gauche

(C) staggered > gauche > eclipsed

(D) gauche > staggered > eclipsed

(E) gauche > eclipsed > staggered

45. The correct IUPAC name of the following compound



is

(A) 3-ethyl-5-methylheptane

(B) 5-ethyl-3-methylheptane

(C) 3, 5-diethylhexane

(D) 1, 1-diethyl-3-methylpentane

(E) 1, 3-diethyl-1-methylpentane

46. Aniline is separated from aniline-water mixture by

(A) crystallisation (B) steam distillation (C) solvent extraction

(D) sublimation (E) differential extraction

Space for rough work

47. Only *sp* and sp^2 hybrid orbitals are involved in the formation of

(A) $CH_3-CH=CH_2$ (B) CH_3-CH_3 (C) $CH_3-C\equiv CH$

(D) $CH_2=C=CH_2$ (E) $CH_3-C\equiv C-CH_3$

48. Choose the incorrect statement in the following

(A) BeO is almost insoluble but $BeSO_4$ is soluble in water

(B) BaO is soluble but $BaSO_4$ is insoluble in water

(C) LiI is more soluble than KI in ethanol

(D) Both Li and Mg form solid hydrogen carbonates

(E) Both LiCl and $MgCl_2$ are deliquescent

49. Which one of the following is an antihistamine?

(A) Ipronlazid (B) Salvarsan (C) Zantac

(D) Chloramphenicol (E) Terpineol

50. Which one of the following is not used as a filler in laundry soaps?

(A) Sodium silicate (B) Glycerol (C) Sodium rosinate

(D) Borax (E) Sodium carbonate

51. The pH of normal rain water is

(A) 6.5 (B) 7.5 (C) 5.6

(D) 3.5 (E) 4.6

Space for rough work

52. The glycosidic linkage involved in linking the glucose units in amylose part of starch is

(A) $C_1 - C_4$ β linkage (B) $C_1 - C_6$ α linkage (C) $C_1 - C_5$ α linkage

(D) $C_1 - C_6$ β linkage (E) $C_1 - C_4$ α linkage

53. Anaemia is caused by the deficiency of vitamin

(A) B_6 (B) B_1 (C) B_2

(D) B_{12} (E) C

54. When (−)-2-methylbutan-1-ol is heated with concentrated hydrochloric acid, (+) 1-chloro-2-methylbutane is obtained. The reaction is an example of

(A) retention (B) inversion (C) racemisation

(D) resolution (E) mutarotation

55. An acidic amino acid among the following is

(A) glycine (B) valine (C) proline

(D) leucine (E) alanine

56. Which one of the following is not a primary amine?

(A) tert-Butylamine (B) Ethylamine (C) sec-Butylamine

(D) iso-Butylamine (E) Dimethylamine

Space for rough work

57. Meta directing and deactivating group in aromatic electrophilic substitution is

(A) $-CH_3$ (B) $-OH$ (C) $-NO_2$

(D) $-Cl$ (E) $-OCH_3$

58. Photochemical halogenation of alkane is an example of

(A) electrophilic substitution (B) electrophilic addition

(C) nucleophilic substitution (D) nucleophilic addition

(E) free radical substitution

59. The organic halogen compound used as refrigerant in refrigerators and air-conditioners is

(A) DDT (B) Freon (C) BHC

(D) BFC (E) CCl_4

60. Which one of the following is the correct order of acidic strength?

(A) $CF_3COOH > CHCl_2COOH > HCOOH > C_6H_5CH_2COOH > CH_3COOH$

(B) $CH_3COOH > HCOOH > CF_3COOH > CHCl_2COOH > C_6H_5CH_2COOH$

(C) $HCOOH > C_6H_5CH_2COOH > CF_3COOH > CHCl_2COOH > CH_3COOH$

(D) $CF_3COOH > CH_3COOH > HCOOH > CHCl_2COOH > C_6H_5CH_2COOH$

(E) $C_6H_5CH_2COOH > HCOOH > CHCl_2COOH > CF_3COOH > CH_3COOH$

Space for rough work

61. Primary, secondary and tertiary alcohols can be distinguished by

(A) Borsche's test (B) Lucas test (C) Hinsberg's test

(D) Tollen's test (E) Fehling's test

62. The catalyst used in the Wacker process of oxidation of ethyne to ethanal is

(A) $PdCl_2$ (B) V_2O_5 (C) Nickel complexes

(D) $TiCl_4$ and $Al(CH_3)_3$ (E) Fe

63. Which one of the following alkyl halides has the lowest boiling point?

(A) n-Butyl chloride (B) iso-Butyl chloride (C) sec-Butyl chloride

(D) n-Pentyl chloride (E) tert-Butyl chloride

64. Which one of the following reagents is used to reduce an aldehyde to primary alcohol?

(A) N_2H_4 / KOH (B) Zn/Hg and Conc. HCl (C) $LiAlH_4$

(D) Alkaline $CuSO_4$ containing Rochelle salt (E) Ag_2O/OH^-

65. Secondary amines could be prepared by

(A) reduction of nitriles (B) Hofmann bromoamide reaction

(C) reduction of amides (D) reduction of isonitriles

(E) reduction of nitro compounds

Space for rough work

66. A sample of 0.5 g of an organic compound was treated according to Kjeldahl's method. The ammonia evolved was absorbed in 50 ml of 0.5M H_2SO_4. The remaining acid after neutralization by ammonia consumed 80 ml of 0.5M NaOH. The percentage of nitrogen in the organic compound is

(A) 14 (B) 28 (C) 42

(D) 56 (E) 70

67. The weakest base among the following is

(A) phenylmethanamine (B) N-methylmethanamine

(C) ethanamine (D) methanamine

(E) benzenamine

68. For the reaction $A + B \rightarrow C + 2D$, experimental results were collected for three trials and the data obtained are given below.

Trial	[A],M	[B],M	Initial Rate, Ms^{-1}
1	0.40	0.20	5.5×10^{-4}
2	0.80	0.20	5.5×10^{-4}
3	0.40	0.40	2.2×10^{-3}

The correct rate law of the reaction is

(A) rate = k $[A]^0 [B]^2$ (B) rate = k $[A][B]^2$ (C) rate = k [A][B]

(D) rate = k $[A][B]^0$ (E) rate = k $[A]^0$ [B]

Space for rough work

69. In a first order reaction the concentration of the reactant is reduced to $\frac{1}{8}$ of the initial concentration in 75 minutes at 298 K. What is the half-life period of the reaction in minutes?

(A) 50 (B) 15 (C) 45
(D) 25 (E) 30

70. In the Arrhenius plot of ln k vs $\frac{1}{T}$, a linear plot is obtained with a slope of -2×10^4 K. The energy of activation of the reaction (in kJ mole^{-1}) is

(R value is 8.3 J K^{-1}mol^{-1})

(A) 83 (B) 166 (C) 249
(D) 332 (E) 830

71. Glucose on oxidation with bromine water gives

(A) gluconic acid (B) tartaric acid (C) saccharic acid
(D) mesoxalic acid (E) tartronic acid

72. In the adsorption of a gas on solid, Freundlich isotherm is obeyed. The slope of the plot is zero. Then the extent of adsorption is

(A) directly proportional to the pressure of the gas
(B) inversely proportional to the pressure of the gas
(C) directly proportional to the square root of the pressure of the gas
(D) inversely proportional to the square root of the pressure of the gas
(E) independent of the pressure of the gas

Space for rough work

73. Biot-Savart law can be expressed alternatively as

(A) Coulomb's law (B) Ampere's circuital law (C) Ohm's law

(D) Gauss' law (E) Kirchhoff's law

74. If the susceptibility of dia, para and ferro magnetic materials are χ_d, χ_p, χ_f respectively, then

(A) $\chi_d < \chi_p < \chi_f$ (B) $\chi_d < \chi_f < \chi_d$ (C) $\chi_f < \chi_d < \chi_p$

(D) $\chi_f < \chi_p < \chi_d$ (E) $\chi_p < \chi_d < \chi_f$

75. If the number of turns in a moving coil galvanometer of current sensitivity C and voltage sensitivity V is doubled, then

(A) C remains unchanged and V is doubled

(B) both C and V are halved

(C) both C and V are doubled

(D) C is doubled and V remains unchanged

(E) both C and V remain unchanged

76. The rate of change of current of 10 A s^{-1} in a coil produces an emf of 5 V. Then the self-inductance of the coil in henry is

(A) 0.5 (B) 0.25 (C) 1

(D) 1.25 (E) 2

Space for rough work

77. The magnetic flux (in weber) linked with a coil of resistance 10 Ω is varying with respect to time t as $\phi = 4t^2 + 2t + 1$. Then the current in the coil at time $t = 1$ second is

(A) 0.5 A (B) 2 A (C) 1.5 A

(D) 1 A (E) 2.5 A

78. If ϕ is the phase difference between the instantaneous values of voltage V and current I in an AC circuit, then the average power loss over a complete cycle is

(A) VI $\sin\phi$ (B) VI $\cos\phi$ (C) VI

(D) $\frac{VI}{2}$ (E) $\frac{VI\cos\phi}{2}$

79. A plane electromagnetic wave travels in free space along X-direction. If the value of $\vec{B}$ (in tesla) at a particular point in space and time is $1.2\times10^{-8}\hat{k}$. The value of $\vec{E}$ (in Vm^{-1}) at that point is

(A) $1.2\hat{j}$ (B) $3.6\hat{k}$ (C) $1.2\hat{k}$

(D) $3.6\hat{j}$ (E) $0.4\hat{i}$

80. The least distance of distinct vision of a person is 75 cm. The focal length of the reading spectacles for such a person should be

(A) 37.5 cm (B) 40 cm (C) 25 cm

(D) 50 cm (E) 47.5 cm

Space for rough work

81. In Young's double slit experiment with slit separation d, a monochromatic light of wavelength λ is used. The angular separation of the fringes is

(A) $\frac{d}{\lambda}$ (B) $\frac{\lambda}{d}$ (C) $\frac{2\lambda}{d}$

(D) $\frac{\lambda}{2d}$ (E) $\frac{\lambda}{4d}$

82. Unpolarized light is incident on a plane sheet of water surface. The angle of incidence for which the reflected and refracted rays are perpendicular to each other is (μ of water = $\frac{4}{3}$)

(A) $\sin^{-1}\left(\frac{4}{3}\right)$ (B) $\tan^{-1}\left(\frac{3}{4}\right)$ (C) $\tan^{-1}\left(\frac{4}{3}\right)$

(D) $\sin^{-1}\left(\frac{1}{3}\right)$ (E) $\tan^{-1}\left(\frac{1}{3}\right)$

83. The de Broglie wavelength associated with an electron accelerated by a potential of 64 V is

(A) 1.227 nm (B) 0.613 nm (C) 0.302 nm

(D) 0.153 nm (E) 2.454 nm

84. The fraction of the radioactive sample that will remain undecayed after 4 half-life periods is

(A) $\frac{1}{2}$ (B) $\frac{3}{4}$ (C) $\frac{15}{16}$

(D) $\frac{1}{4}$ (E) $\frac{1}{16}$

Space for rough work

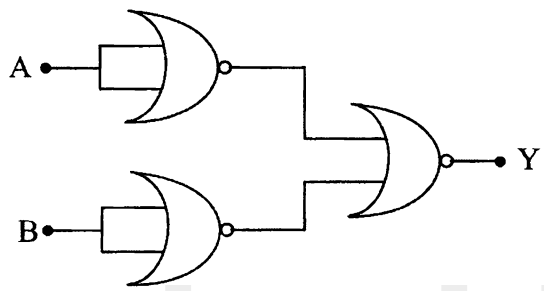
85. Four atoms of hydrogen combine to form an $_{2}^{4}He$ atom with a release of energy of

(A) 26.7 MeV (B) 216 MeV (C) 3.27 MeV
(D) 1 MeV (E) 7.68 MeV

86. The device used for detecting optical signal is

(A) zener diode (B) photodiode (C) LED
(D) junction diode (E) optical fiber

87.



The logical operation carried out by the above circuit is

(A) OR (B) NOT (C) AND
(D) NOR (E) NAND

88. In CE transistor amplifier if the base current is increased by 20 μA, the collector current changes from 4 mA to 5 mA. The current amplification factor of the transistor is

(A) 200 (B) 50 (C) 125
(D) 250 (E) 100

Space for rough work

89. An example of point to point mode of communication is
(A) FM radio
(B) standard FM radio
(C) television
(D) internet
(E) telephony

90. A signal of peak voltage 5 V at 10 kHz is modulated using a carrier wave of peak voltage 10 V at 2 MHz. The side band frequencies are
(A) 2010 kHz, 1990 kHz
(B) 2000 kHz, 1990 kHz
(C) 2010 kHz, 2000 kHz
(D) 2100 kHz, 1900 kHz
(E) 2200 kHz, 1800 kHz

91. The range of frequency bands used for television VHF service is
(A) 540 - 1600 kHz (B) 88 - 108 MHz (C) 3.7 - 4.2 GHz
(D) 54 - 72 MHz (E) 174 - 216 MHz

Space for rough work

92. The dimensions for gravitational constant G is

(A) $M^{-1}L^{2}T^{-2}$ (B) $M^{\circ}L^{\circ}T^{\circ}$ (C) MT^{-2}

(D) $ML^{2}T^{-2}$ (E) $M^{-1}L^{3}T^{-2}$

93. The graph between displacement and time for a particle moving with uniform acceleration is a

(A) straight line with a positive slope

(B) parabola

(C) ellipse

(D) straight line parallel to time axis

(E) straight line perpendicular to time axis

94. The slope of the tangent drawn on position-time graph at any instant is equal to the instantaneous

(A) acceleration (B) force (C) velocity

(D) momentum (E) impulse

95. The horizontal range of a projectile is maximum when the angle of projection is

(A) 0° (B) 30° (C) 45°

(D) 60° (E) 90°

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96. If the velocity (in ms^{-1}) of a particle is given by $4.0\,\hat{i} + 5.0\,t\,\hat{j}$, then the magnitude of its acceleration (in ms^{-2}) is

(A) 4 (B) – 5 (C) 0

(D) – 4 (E) 5

97. Identify the correct statement

(A) Static friction depends on the area of contact

(B) Kinetic friction depends on the area of contact

(C) Coefficient of kinetic friction does not depend on the surfaces in contact

(D) Coefficient of static friction does not depend on the surfaces in contact

(E) Coefficient of kinetic friction is less than the coefficient of static friction

98. A batsman hits back a ball of mass 0.15 kg straight in the direction of the bowler without changing its initial speed of $10\ ms^{-1}$. If the ball moves linearly, then the impulse imparted on it (in Ns) is

(A) 3.0 (B) 2.0 (C) 1.5

(D) 1.9 (E) 0

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99. If K_i and K_f are the initial and final values of kinetic energy of a body respectively, then the work done by the net force on the body is equal to

(A) $\frac{K_f K_i}{K_f - K_i}$ (B) $K_f + K_i$ (C) $\frac{K_f + K_i}{2}$

(D) $\frac{K_f K_i}{K_f + K_i}$ (E) $K_f - K_i$

100. When two spheres of equal masses undergo glancing elastic collision with one of them at rest, after collision they will move

(A) opposite to one another (B) in the same direction (C) together

(D) at right angle to each other (E) randomly

101. A particle of mass *m* describes uniform circular motion in a horizontal plane. The quantity that is conserved is

(A) linear velocity (B) linear momentum (C) angular momentum

(D) linear acceleration (E) angular displacement

102. The centre of mass of three bodies each of mass 1 kg located at the points (0, 0), (3, 0) and (0, 4) in the XY plane is

(A) $\left(\frac{4}{3}, 1\right)$ (B) $\left(\frac{1}{3}, \frac{2}{3}\right)$ (C) $\left(\frac{1}{2}, \frac{1}{2}\right)$

(D) $\left(1, \frac{4}{3}\right)$ (E) $\left(\frac{1}{4}, \frac{3}{4}\right)$

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103. In planetary motion, the angular momentum conservation leads to the law of

(A) orbits (B) areas (C) periods

(D) conservation of kinetic energy

(E) conservation of linear momentum

104. The ratio between the values of acceleration due to gravity at a height 1 km above and at a depth of 1 km below the earth's surface is (radius of earth is R)

(A) $\frac{R-2}{R-1}$ (B) $\frac{R}{R-1}$ (C) $\frac{R-2}{R}$

(D) 1 (E) $\frac{2R}{R-1}$

105. Identify the false statement

(A) Young's modulus of rubber is greater than that of steel

(B) The stretching of a coil is determined by shear modulus

(C) Elastomers do not obey Hooke's law

(D) Stress is a vector quantity

(E) Metals have larger values of Young's modulus than alloys

106. The force acting on a window of area 50 cm × 50 cm of a submarine at a depth of 2000 m in an ocean, interior of which is maintained at sea level atmospheric pressure is (Density of sea water $10^3 kgm^{-3}$, $g = 10\ ms^{-2}$)

(A) 10^6 N (B) 5×10^5 N (C) 25×10^6 N

(D) 25×10^5 N (E) 5×10^6 N

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107. The rise in the water level in a capillary tube of radius 0.07 cm when dipped vertically in a beaker containing water of surface tension 0.07 Nm^{-1} is ($g = 10\ ms^{-2}$)

(A) 2 cm (B) 4 cm (C) 1.5 cm

(D) 3 cm (E) 2.5 cm

108. A one litre flask contains certain quantity of mercury. If the volume of air inside the flask remains the same at all temperatures then the volume of mercury in the flask is (volume expansion coefficient of mercury is 20 times that of flask)

(A) 100 cc (B) 50 cc (C) 200 cc

(D) 150 cc (E) 500 cc

109. The total internal energy of one mole of rigid diatomic gas is

(A) $\frac{3}{2}RT$ (B) $\frac{7}{2}RT$ (C) $\frac{5}{2}RT$

(D) $\frac{9}{2}RT$ (E) $\frac{1}{2}RT$

110. Pick out the correct match from the following

Process		**Feature**
(A) Isothermal	-	Pressure constant
(B) Isobaric	-	Volume constant
(C) Isochoric	-	$\Delta Q = 0$
(D) Adiabatic	-	Temperature constant
(E) Cyclic	-	$\Delta U = 0$

Space for rough work

111. The length of the simple pendulum which ticks seconds is

(A) 2 m (B) 1.5 m (C) 1 m

(D) 3 m (E) 0.5 m

112. The simple harmonic vibrations of two particles are $y_1 = 5 \sin(100t)$ and $y_2 = 4 \cos\left(100t + \frac{\pi}{4}\right)$. The phase difference between them is

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$ (C) π

(D) $\frac{3\pi}{4}$ (E) $\frac{\pi}{3}$

113. A travelling harmonic wave on a string is described by $y = 7.5 \sin(0.005x + 12t)$ in metre. Its time period in second is

(A) $\frac{\pi}{12}$ (B) $\frac{\pi}{6}$ (C) $\frac{\pi}{3}$

(D) $\frac{\pi}{2}$ (E) π

Space for rough work

114. A train moving at a speed v_s towards a stationary observer on a platform emits sound of frequency f and velocity v. Then the apparent frequency heard by him is

(A) $f\left(1+\frac{v}{v_s}\right)$ (B) $f\left(1-\frac{v_s}{v}\right)$ (C) $f\left(1+\frac{v_s}{v}\right)$

(D) $f\left(1-\frac{v}{v_s}\right)$ (E) $f\left(\frac{v}{v+v_s}\right)$

115. If a linear isotropic dielectric is placed in an electric field of strength E, then the polarization P is

(A) independent of E

(B) inversely proportional to E

(C) directly proportional to $\sqrt{E}$

(D) inversely proportional to $\sqrt{E}$

(E) directly proportional to E

116. The electric field due to an infinitely long straight uniformly charged wire at a distance r is directly proportional to

(A) r (B) r^2 (C) $\frac{1}{r}$

(D) $\frac{1}{r^2}$ (E) $\frac{1}{\sqrt{r}}$

Space for rough work

117. In a parallel plate capacitor, if the intervening medium of permittivity ε between the plates is replaced by another medium of permittivity $\frac{\varepsilon}{2}$, then its capacitance is

(A) halved (B) doubled (C) unchanged
(D) quadruped (E) tripled

118. Ohm's law is valid if

(A) V is directly proportional to I^3
(B) the relation between V and I depends on the sign of V for the same absolute value of V
(C) the relation between V and I is non-unique
(D) V is directly proportional to I^2
(E) V depends on I linearly

119. The percentage error in measuring resistance with a metre bridge can be minimized by adjusting the balancing point close to

(A) 0 cm (B) 20 cm (C) 50 cm
(D) 80 cm (E) 100 cm

120. The resistance and tolerance of a yellow, violet, red colour coded resistor respectively are

(A) 47 kΩ, 10 % (B) 4.7 kΩ, 10 % (C) 47 kΩ, 20 %
(D) 4.7 kΩ, 20 % (E) 47 kΩ, 5 %

Space for rough work

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