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	**A1**	**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 4 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 from the total score 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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1. 4 g of a hydrated crystal of formula $A.xH_2O$ has 0.8 g of water. If the molar mass of the anhydrous crystal (A) is 144 g mol^{-1}, x value is

   (A) 4   (B) 1   (C) 2   (D) 3   (E) 5

2. Two fast moving particles X and Y are associated with de Broglie wavelengths 1 nm and 4 nm respectively. If mass of X is nine times the mass of Y, the ratio of kinetic energies of X and Y would be

   (A) 3 : 1   (B) 9 : 1   (C) 5 : 12   (D) 16 : 9   (E) 14 : 9

3 20.0 kg of $H_2(g)$ and 32 kg of $O_2(g)$ are reacted to produce $H_2O(l)$. The amount of $H_2O(l)$ formed after completion of reaction is

   (A) 62 kg   (B) 38 kg   (C) 42 kg   (D) 72 kg   (E) 36 kg

4 The wavelength (in cm) of second line in the Lyman series of hydrogen atomic spectrum is (Rydberg constant = R cm^{-1})

   (A) $\left(\dfrac{8R}{9}\right)$ (B) $\left(\dfrac{9}{8R}\right)$ (C) $\left(\dfrac{4}{3R}\right)$ (D) $\left(\dfrac{3R}{4}\right)$ (E) $\left(\dfrac{16}{3R}\right)$

5. The number of lone pair and bond pair of electrons on the sulphur atom in sulphur dioxide molecule are respectively

   (A) 1 and 3   (B) 4 and 1   (C) 3 and 1   (D) 1 and 4   (E) 2 and 3

Space for rough work

6. The shape of stannous chloride molecule is

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

7. Which one of the following molecules is expected to have zero dipole moment?

   (A) H_2O (B) CO_2 (C) SO_2 (D) CaF_2 (E) LiF

8. The type of hybridization in xenon atom and the number of lone pairs present on xenon atom in xenon hexafluoride molecule are respectively

   (A) sp^3d^3 , one
   (B) sp^3d^2 , two
   (C) sp^3d^3 , two
   (D) sp^3d^2 , zero
   (E) sp^3d^3 , zero

9. At a certain temperature equal masses of a gaseous hydrocarbon and carbon dioxide in a closed vessel exert the same partial pressure. The hydrocarbon is

   (A) ethane   (B) butane   (C) ethene   (D) propane   (E) ethyne

10. 500 mL of air at 760 mm pressure were compressed to 200 mL. If the temperature remains constant, what will be the pressure after compression?

   (A) 1800 mm   (B) 1900 mm   (C) 2000 mm   (D) 1500 mm   (E) 1600 mm

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Space for rough work

11. Which one of the following statements is correct?

   For a liquid, with increase in temperature

   (A) the volume decreases   (B) the density increases
   (C) vapour pressure decreases   (D) viscosity increases
   (E) surface tension decreases

12. The percentage of *s*-character of the hybrid orbitals of carbon in graphite and diamond are respectively

   (A) 33, 25   (B) 50, 50   (C) 67, 25   (D) 33, 67   (E) 25, 75

13. The volume strength of a 3% w/v H_2O_2 sample is

   (A) 20   (B) 15   (C) 25   (D) 10   (E) 30

14. The electronegativities of four atoms labeled as D, E, F and G are as follows. D = 3.8, E = 3.3, F = 2.8 and G = 1.3. If the atoms form the molecules DE, DG, EG and DF, the order of arrangement of these molecules in the increasing order of covalent bond character is

   (A) DG < EG < DF < DE   (B) DF < DG < DE < EG
   (C) DG < DF < EG < DE   (D) DE < EG < DG < DF
   (E) EG < DF < DE < DG

15. The sum of the number of neutrons and protons in all the three isotopes of hydrogen is

   (A) 6   (B) 5   (C) 4   (D) 3   (E) 2

Space for rough work

16. The temperature (°C) at which Fe_2O_3 is finally reduced to Fe in the blast furnace is

    (A) 993   (B) 797   (C) 897   (D) 1597   (E) 1897

17. The polymeric hydride is

    (A) CaH_2 (B) NaH   (C) BaH_2 (D) MgH_2 (E) SrH_2

18. Choose the amphoteric compound in the following

    (A) NaOH   (B) $Ca(OH)_2$ (C) LiOH   (D) CsOH   (E) $Be(OH)_2$

19. The hybridized state of boron in diborane molecule is

    (A) dsp^2 (B) sp^2 (C) sp^3 (D) sp (E) sp^2d

20. In which one of the following oxides of nitrogen, one nitrogen atom is not directly linked to oxygen?

    (A) NO   (B) N_2O_4 (C) N_2O (D) N_2O_3 (E) N_2O_5

21. The raw materials used in the manufacture of cement are

    (A) Lime stone, gypsum
    (B) Lime stone, calcite
    (C) Lime stone, alumina
    (D) Lime stone, clay
    (E) Gypsum, alumina

Space for rough work

22. The group 13 element that is liquid during summer and used for measuring high temperature is

(A) Boron   (B) Aluminum   (C) Gallium   (D) Indium   (E) Thallium

23. An alloy of transition metal containing a non transition metal as a constituent is

(A) invar   (B) bronze   (C) chrome steel
(D) stainless steel   (E) nichrome

24. In the following salts the lowest value of magnetic moment is observed in

(A) $MnSO_4 \cdot 4H_2O$ (B) $CuSO_4 \cdot 5H_2O$ (C) $FeSO_4 \cdot 6H_2O$
(D) $ZnSO_4 \cdot 7H_2O$ (E) $NiSO_4 \cdot 6H_2O$

25. The colour of the following ions V^{2+}, V^{3+}, V^{4+}, Fe^{2+}, Fe^{3+} are respectively

(A) green, violet, blue, green, yellow
(B) yellow, green, violet, green, blue
(C) violet, green, yellow, green, blue
(D) yellow, green, blue, green, violet
(E) violet, green, blue, green, yellow

26. Which of the following is not a characteristic of interstitial compounds of transition elements?

(A) The formulae of these compounds do not correspond to any normal oxidation state
(B) They have melting points higher than those of pure elements
(C) They are very hard and some compounds approach diamond in hardness
(D) They are insulators in contrast to the transition metals
(E) They are chemically inert

Space for rough work

27. The enthalpy change for the reaction $\frac{1}{2} X_2(g) + \frac{3}{2} Y_2(g) \rightarrow XY_3(g)$ is -50 kJ mol^{-1}. If the bond enthalpies of X–X, and X–Y are respectively 380 and 150 kJ mol^{-1} the bond enthalpy of Y–Y in kJ mol^{-1} is

(A) 35   (B) 210   (C) 280   (D) 70   (E) 140

28. Consider the following spontaneous reaction
$$2C_8H_{18}(g) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(g)$$
The sign of ΔH, ΔS, ΔG would be respectively

(A) +, –, +   (B) –, +, –   (C) +, +, –   (D) –, –, –   (E) +, +, +

29. One mole of solid iron was vaporized in an oven at its boiling point of 3443 K and enthalpy of vaporization of iron is 344.3 kJ mol^{-1}. The value of entropy vaporization (in J mol^{-1}) of iron is

(A) 100   (B) 10   (C) – 100   (D) 110   (E) – 10

30. The K_p value for the equilibrium $2A_2(g) + B_2(g) \rightleftharpoons 2A_2B(g)$ is 4×10^4 atm^{-1} at 27°C. The K_p value for the equilibrium $A_2B(g) \rightleftharpoons A_2(g) + \frac{1}{2}B_2(g)$ at 27°C is

(A) 1×10^{-5} (B) 2.5×10^{-5} (C) 1×10^{-3} (D) 5×10^{-5} (E) 5×10^{-3}

31. Five gaseous homogeneous equilibrium reactions are given below. Choose the reaction in which both increase in pressure and increase in temperature favour the formation of products.
(A) $2A + B \rightleftharpoons C+D$; $\Delta H = -78$ kJ mol^{-1}
(B) $2M + 3N \rightleftharpoons P + 2Q$; $\Delta H = +105$ kJ mol^{-1}
(C) $W + X \rightleftharpoons 2Y + 3Z$; $\Delta H = +92$ kJ mol^{-1}
(D) $S + T \rightleftharpoons E + F$; $\Delta H = -80$ kJ mol^{-1}
(E) $H + G \rightleftharpoons 2K + L$; $\Delta H = -95$ kJ mol^{-1}

Space for rough work

32. In the decomposition reaction $AB_5(g) \rightleftharpoons AB_3(g) + B_2(g)$, at equilibrium in a 10 litre closed vessel at 227°C, 2 moles of AB_3, 5 moles of B_2 and 4 moles of AB_5 are present. The equilibrium contant K_C for the formation of $AB_5(g)$ is

    (A) 0.25   (B) 4.0   (C) 0.04   (D) 2.5   (E) 40

33. Calculate the pH of a solution obtained by diluting 1 mL of 0.10M weak monoacidic base to 100 mL at constant temperature if K_b of the base is 1×10^{-5} ?

    (A) 8   (B) 9   (C) 10   (D) 11   (E) 12

34. Which one of the following binary mixtures forms an azeotrope with minimum boiling point type?

    (A) acetone-ethanol   (B) H_2O-HNO_3 (C) benzene-toluene
    (D) n-hexane-n-heptane   (E) acetone-chloroform

35. A solution is prepared by dissolving 10 g NaOH in 1250 mL of a solvent of density 0.8 mL/g. The molality of the solution in mol kg^{-1} is

    (A) 0.25   (B) 0.2   (C) 0.008   (D) 0.0064   (E) 0.5

36. Which observation(s) reflect(s) colligative properties?

    (i) a 0.5 m NaBr solution has a higher vapour pressure than a 0.5 m $BaCl_2$ solution at the same temperature
    (ii) pure water freezes at a higher temperature than pure methanol
    (iii) a 0.1 m NaOH solution freezes at a lower temperature than pure water

    Choose the correct answer from the codes given below

    (A) (i), (ii) and (iii)   (B) (i) and (ii)   (C) (ii) and (iii)
    (D) (i) and (iii)   (E) (iii) only

Space for rough work

37. The ion of least limiting molar conductivity among the following is

(A) SO_4^{2-} (B) H^+ (C) Ca^{2+} (D) HO^- (E) CH_3COO^-

38. The reduction potential (in volt) of a hydrogen electrode set up with a 2×10^{-2} M aqueous solution of a weak mono basic acid ($K_a = 5 \times 10^{-5}$) at one atmosphere and 25°C is

(A) $+ 0.09$ (B) $+ 0.18$ (C) $- 0.09$ (D) $- 0.18$ (E) $+ 0.24$

39. Prevention of corrosion of iron by zinc coating is called

(A) electrolysis   (B) photoelectrolysis   (C) cathodic protection
(D) galvanization   (E) amalgamation

40. When the initial concentration of the reactant in a reaction is doubled the half-life period of the reaction gets halved. The order of the reaction is

(A) $\frac{1}{2}$ (B) 0   (C) 1   (D) 3   (E) 2

41. Which one of the following reactions is a true first order reaction?

(A) Alkaline hydrolysis of ethyl acetate
(B) Acid catalyst hydrolysis of ethyl acetate
(C) Decomposition of N_2O
(D) Decomposition of gaseous ammonia on a hot platinum surface
(E) Oxidation of I^- by H_2O_2 to I_2 in alkaline medium

Space for rough work

42. The rate of reaction is doubled for every 10°C rise in temperature. The increase in reaction rate as a result of temperature rise from 10°C to 100 °C is

   (A) 112   (B) 512   (C) 400   (D) 614   (E) 680

43. The separation of colloidal particles from particles of molecular dimensions is known as

   (A) sedimentation   (B) dispersion   (C) pyrolysis
   (D) peptisation   (E) dialysis

44. According to Freundlich adsorption isotherm, the amount of gas adsorbed at very high pressure
   (A) reaches a constant limiting value
   (B) goes on increasing with pressure
   (C) goes on decreasing with pressure
   (D) increases first and decreases later with pressure
   (E) decreases first and increases later with pressure

45. The magnetic moment of $[NiCl_4]^{-2}$ is expected to be

   (A) 2.88 BM   (B) 1.44 BM   (C) 5.25 BM   (D) 4.91 BM   (E) zero

46. Among the following coordination compounds / ions

   (i) $[Fe(CN)_6]^{3-}$, (ii) $[Pt(NH_3)_2Cl_2]$, (iii) $[Co(NH_3)_6]^{3+}$, (iv) $[Cr(H_2O)_6]Cl_3$

   which species exhibit geometrical isomerism?

   (A) (ii) only   (B) (i) and (ii)   (C) (ii) and (iv)
   (D) (i) and (iii)   (E) (i), (ii) and (iii)

Space for rough work

.47. Which one among the following is not correct?

(A) Alumina can be used as adsorbent
(B) Glycerol is purified by steam distillation
(C) Water trapped in the chromatographic filter paper acts as stationary phase
(D) In TLC the thickness of the adsorbent layer is about 0.2 mm thickness
(E) In TLC amino acids may be identified by using a spray of ninhydrin solution

48. When 1.4 g of a nitrogen containing organic compound is heated with CuO in an atmosphere of CO_2 224 mL of free N_2 gas is liberated at STP. The percentage of nitrogen in the compound is

(A) 10 (B) 14 (C) 25 (D) 30 (E) 20

49. Which one of the following has the least boiling point?

(A) 2, 2-dimethylpropane (B) *n*-butane (C) 2-methylpropane
(D) *n*-pentane (E) 2-methylbutane

50. The correct increasing order of acidity of the following alkynes

(1) $CH_3-C\equiv C-CH_3$ (2) $CH_3-C\equiv CH$ (3) $CH\equiv CH$

(A) $1 < 2 < 3$ (B) $2 < 3 < 1$ (C) $3 < 2 < 1$ (D) $1 < 3 < 2$ (E) $2 < 1 \leqslant 3$

51. Hyperconjugation is more pronounced in

(A) 2-methylpropene (B) but-2-ene
(C) 2,3-dimethylbut-2-ene (D) 2-methylbut-2-ene
(E) 2-methylbut-1-ene

Space for rough work

52. Which of the following compounds are optically active?

   (i) 3-hydroxypentane   (ii) 2-aminopropanoic acid
   (iii) 2-chlorobutane   (iv) 2-methylbutane

Choose your answer from the codes given below

(A) (i), (ii), (iii)   (B) (ii), (iii), (iv)   (C) (i), (iv)
(D) (ii), (iii)   (E) (i), (ii), (iv)

53. The total number of acyclic chain isomers possible for an alkane with molecular formula C_6H_{14} are

(A) 4   (B) 5   (C) 6   (D) 3   (E) 7

54. Which one of the following is not superimposable on its mirror image?

(A) Ethanol   (B) 1-Butanol   (C) trans-2-Butene
(D) 2-Propanol   (E) 2-Butanol

55. An aqueous solution containing an organic compound has a specific rotation of +9°. When a small amount of NaOH is added its specific rotation changes to zero. This process is called

(A) retention   (B) racemisation   (C) resolution
(D) inversion   (E) isomerisation

56. Which one of the following halides shows high reactivity towards S_N1 reaction?

(A) 3-Bromopropene   (B) Bromoethene   (C) Bromobenzene
(D) 1-Bromopropane   (E) 1-Bromo-2,2-dimethylpropane

Space for rough work

57. Which one of the following on hydrolysis produces a ketone ?

(A) Isobutylidene chloride
(B) Secondarybutylidene chloride
(C) Benzylidene chloride
(D) Ethylidene chloride
(E) *n*-Butylidene chloride

58. The organic compound used as feedstock in the synthesis of chlorofluorocarbons is

(A) CH_2Cl_2 (B) $CHCl_3$ (C) CH_3Cl (D) CCl_4 (E) CHI_3

59. When chlorobenzene is reacted with acetyl chloride in the presence of anhydrous $AlCl_3$, the major product formed is

(A) 2-chloroacetophenone
(B) 3-chloroacetophenone
(C) 4-chloroacetophenone
(D) 1,4-dichlorobenzene
(E) 1-chloro-4-methylbenzene

60. Which one of the following reaction provides a primary alcohol?

(A) Hydration of alkyne.
(B) Oxymercuration of alkene
(C) Oxidative hydroboration of alkene
(D) Reaction of Grignard reagent with acetaldehyde
(E) Reduction of a ketone

61. Which one of the following reagents enables the purification of benzaldehydes?

(A) HCN (B) CH_3MgBr (C) NH_2OH (D) $NaHSO_3$ (E) NH_3

Space for rough work

62. When 2-methoxypropane is heated with HI, in the mole ratio 1 : 1, the major products formed are

(A) methanol and 2-iodopropane
(B) methyl iodide and 2-propanol
(C) methyl iodide and 2-iodopropane
(D) methanol and 2-propanol
(E) methane and propane

63. The IUPAC name of diethyl isopropyl amine is

(A) N,N-diethylpropan-2-amine
(B) N,N-diethylpropan-1-amine
(C) N,N-diethylisopropylamine
(D) N,N-diethylaminopropane
(E) N-isopropyl-N-ethylethanamine

64. Which one of the following amine reacts with chloroform and alkali to give an isocyanide?

(A) Dimethylamine   (B) Triethylamine   (C) Diethylamine
(D) Ethylmethylamine   (E) Ethylamine

65. Which one of the following statements is not correct?

(A) pK_b of aniline is greater than that of methyl amine
(B) Aniline does not undergo Friedel–Crafts reaction
(C) Dimethyl amine is capable of forming intermolecular hydrogen bonding
(D) NH_3 is a stronger base than ethanamine
(E) Aniline reacts with ethanoic anhydride to give N-phenyl ethanamide

66. Which of the following gives reddish brown precipitate on heating with a solution of $CuSO_4$ and alkaline sodium potassium tartarate?

(A) Ethanol   (B) Ethanal   (C) Propanone
(D) Ethanoic acid   (E) Diethyl ether

Space for rough work

67. A network polymer among the following is

(A) teflon (B) polythene (C) bakelite
(D) PVC (E) nylon 66

68. The monomer(s) used in the preparation of Orlon, a substitute for wool is/are

(A) caprolactam (B) tetrafluoroethene
(C) styrene and 1,3-butadiene (D) acrylonitrile
(E) adipic acid and hexamethylenediamine

69. The polymer used in the manufacture of lacquers is

(A) bakelite (B) glyptal (C) PVC (D) PHBV (E) polystyrene

70. Number of chiral carbon atoms in glucose and fructose are

(A) 4 in each
(B) 3 in each
(C) 4 in glucose and 3 in fructose
(D) 3 in glucose and 4 in fructose
(E) 5 in each

71. Which one of the following is not a neurologically active drug?

(A) Veronal (B) Bithionol (C) Equanil
(D) Nardil (E) Chlordiazepoxide

72. Novestrol is an

(A) antibiotic (B) analgesic (C) antacid
(D) antihistamine (E) antifertility drug

Space for rough work

73. The dimensional formula for rate of doing work is

(A) ML^2T^{-3} (B) $ML^{-3}T^2$

(C) $M^2L^2T^2$ (D) MLT^{-2}

(E) $M^3L^3T^3$

74. The density of glass is 2.8 gram/cc in CGS system. The value of density in SI unit is

(A) 2.8×10^{-3} (B) 2.8×10^{-2}

(C) 2.8×10^2 (D) 2.8×10^6

(E) 2.8×10^3

75. A packet is dropped from a flight ascending with a velocity at height of 10 km. If the packet takes 100 s to reach the ground, then the velocity of the flight is (Take $g = 10$ ms^{-2})

(A) 100 ms^{-1} (B) 300 ms^{-1}

(C) 200 ms^{-1} (D) 400 ms^{-1}

(E) 250 ms^{-1}

Space for rough work

76. To get a resultant displacement of 10 m, two displacement vectors, one of magnitude 6 m and another of magnitude 8 m should be combined

    (A) parallel to each other
    (B) anti-parallel to each other
    (C) at an angle of 60°
    (D) at an angle of 30°
    (E) perpendicular to each other

77. The angle between the linear momentum and angular momentum of a particle in circular motion is

    (A) 180°   (B) 0°   (C) 90°   (D) 270°   (E) 45°

78. A 60 kg person is weighed by a balance as 54 kg in a lift which is accelerated downwards. The acceleration of the lift is

    (A) 1.26 ms^{-2} (B) 1.76 ms^{-2} (C) 1.98 ms^{-2}
    (D) 3.26 ms^{-2} (E) 0.98 ms^{-2}

79. The heart is pumping blood at x kg per unit time, with a constant velocity v. The force required is

    (A) xv (B) $v\dfrac{dx}{dt}$ (C) $x\dfrac{dv}{dt}$

    (D) $\dfrac{x}{v}$ (E) zero

Space for rough work

80 A block of 200 g mass is dropped from a height of 2 m on to a spring and compress the spring to a distance of 50 cm. The force constant of the spring is

(A) 20 Nm^{-1}
(B) 10 Nm^{-1}
(C) 30 Nm^{-1}
(D) 60 Nm^{-1}
(E) 40 Nm^{-1}

81. In an inelastic collision

(A) momentum is not conserved
(B) momentum is conserved but kinetic energy is not conserved
(C) both momentum and kinetic energy are conserved
(D) neither momentum nor kinetic energy is conserved
(E) kinetic energy is conserved but not momentum

82. A particle moving in a circular path has an angular momentum of L. If the frequency of rotation is halved, then its angular momentum becomes

(A) $\dfrac{L}{2}$
(B) L
(C) $\dfrac{L}{3}$
(D) $\dfrac{L}{4}$
(E) 2 L

83. The torque of a force $\vec{F} = 2\hat{i} - 3\hat{j} + 5\hat{k}$ acting at a point whose position vector $\vec{r} = 3\hat{i} - 3\hat{j} + 5\hat{k}$ about the origin is

(A) $-3\hat{j} + 5\hat{k}$
(B) $-5\hat{j} + 3\hat{k}$
(C) $-5\hat{j} - 3\hat{k}$
(D) $3\hat{i} - 5\hat{j} + 3\hat{k}$
(E) $3\hat{i} - 3\hat{j} + 5\hat{k}$

Space for rough work

84. If two planets of radii R_1 and R_2 have densities d_1 and d_2, then the ratio of their respective accelerations due to gravity is

(A) $R_1 d_1 : R_2 d_2$

(B) $R_1^2 d_1 : R_2^2 d_2$

(C) $R_1^3 d_1 : R_2^3 d_2$

(D) $R_1 d_1^2 : R_2^2 d_2^2$

(E) $R_1 d_1^3 : R_2^2 d_2^3$

85. If T_1 and T_2 are the time-periods of oscillation of a simple pendulum on the surface of earth (of radius R) and at a depth d, then d is equal to

(A) $(1 - \dfrac{T_1^2}{T_2^2})R$

(B) $(1 - \dfrac{T_2^2}{T_1^2})R$

(C) $(1 - \dfrac{T_1}{T_2})R$

(D) $(1 - \dfrac{T_2}{T_1})R$

(E) $\dfrac{T_1^2}{T_2^2}R$

Space for rough work

86. Two spherical soap bubbles of diameters 10 cm and 6 cm are formed, one at each end of a narrow horizontal glass tube. If the surface tension of the soap solution is 0.03 Nm^{-1}, then the pressure difference in pascal between the two ends of the tube is

(A) 16

(B) 1.6

(C) 0.016

(D) 0.08

(E) 0.16

87. The ratio of inertial force to viscous force of a fluid is called

(A) coefficient of viscosity
(B) surface tension
(C) Reynolds number
(D) specific gravity
(E) Lorentz number

88. A steel wire of length l and cross section area A is stretched by 1 cm under a given load. When the same load is applied to another steel wire of double its length and half of its cross section area, the amount of stretching is

(A) 0.5 cm   (B) 2 cm   (C) 4 cm   (D) 1.5 cm   (E) 3 cm

Space for rough work

89. During an adiabatic process of an ideal gas, if P is proportional to $\frac{1}{V^{1.5}}$, then the ratio of specific heat capacities at constant pressure to that at constant volume for the gas is

(A) 1.5   (B) 0.25   (C) 0.75   (D) 0.4   (E) 0.45

90. The average kinetic energy of a gas molecule at absolute temperature T is

(A) directly proportional to T^2
(B) inversely proportional to T^2
(C) directly proportional to T
(D) inversely proportional to T
(E) directly proportional to $\sqrt{T}$

91. In a reversible cyclic process of a gaseous system

(A) $\Delta Q = \Delta U$ (B) $\Delta U = \Delta W$ (C) $\Delta W = 0$ (D) $\Delta Q = 0$ (E) $\Delta U = 0$

92. A particle executing simple harmonic motion covers a distance equal to half its amplitude in one second. Then the time period of the simple harmonic motion is

(A) 4 s   (B) 6 s   (C) 8 s   (D) 12 s   (E) 20 s

Space for rough work

93. A particle moving in uniform circle makes 18 revolutions in 1 minute. If the radius of the circle is 10 cm, the speed of the particle is

(A) $3\pi \times 10^{-2}$ ms^{-1}
(B) $4\pi \times 10^{-2}$ ms^{-1}
(C) $5\pi \times 10^{-2}$ ms^{-1}
(D) $7\pi \times 10^{-2}$ ms^{-1}
(E) $6\pi \times 10^{-2}$ ms^{-1}

94. A travelling wave reflected at an open boundary undergoes a phase change of

(A) π (B) 0   (C) $\dfrac{\pi}{2}$ (D) $\dfrac{\pi}{3}$ (E) $\dfrac{\pi}{4}$

95. A tube open at both the ends has a fundamental frequency f in air. If the tube is dipped vertically in water so that half of it is water, then the fundamental frequency of the air column is

(A) $\dfrac{f}{2}$ (B) $\dfrac{3f}{2}$ (C) $\dfrac{3f}{4}$ (D) f (E) $2f$

96. Which one of the following electrical meter has the smallest resistance?

(A) Ammeter
(B) Milliammeter
(C) Galvanometer
(D) Voltmeter
(E) Millivoltmeter

Space for rough work

97. The force of repulsion between two electrons at a certain distance is F. The force between two protons separated by the same distance is ($m_p = 1836\, m_e$).

(A) 2 F   (B) F   (C) 1836 F

(D) $\dfrac{F}{1836}$ (E) $\dfrac{F}{4}$

98. A soap bubble is charged to a potential 12 V. If its radius is doubled, the potential of the bubble becomes

(A) 12 V   (B) 24 V   (C) 3 V

(D) 6 V   (E) 9 V

99. Two wires of the same material having equal area of cross section have lengths L and 2L. Their respective resistances are in the ratio

(A) 2 : 1   (B) 1 : 1   (C) 1 : 2

(D) 1 : 3   (E) 4 : 1

Space for rough work

100. Two bulbs 60 W and 100 W designed for voltage 220 V are connected in series across 220 V source. The net power dissipated is

(A) 80 W   (B) 160 W
(C) 37.5 W   (D) 60 W
(E) 120 W

101. The drift speed of electrons in a copper wire of diameter d and length l is v. If the potential difference across the wire is doubled, the new drift speed becomes

(A) v (B) $2v$

(C) $3v$ (D) $\dfrac{v}{2}$

(E) $\dfrac{v}{4}$

102. Two charged particles have charges and masses in the ratio 2 : 3 and 1 : 4 respectively. If they enter a uniform magnetic field and move with the same velocity, then the ratio of their respective time periods of revolution is

(A) 3 : 8   (B) 1 : 4

(C) 3 : 5   (D) 1 : 6

(E) 2 : 5

Space for rough work

103. Electromagnetic induction is not used in

(A) speedometer
(B) transformer
(C) A.C. generator
(D) induction furnace
(E) room heater

104. In an ionized gas the mobile charge carriers are

(A) electrons
(B) both positive and negative ions
(C) electrons and positively charged ions
(D) positive ions only
(E) negative ions only

105. A metal rod of length l cuts across a uniform magnetic field B with a velocity v. If the resistance of the circuit of which the rod forms a part is r, then the force required to move the rod is

(A) $\dfrac{B^2 l^2 v}{r}$

(B) $\dfrac{B l v}{r}$

(C) $\dfrac{B^2 l v}{r}$

(D) $\dfrac{B^2 l^2 v^2}{r}$

(E) $\dfrac{B l v^2}{r}$

Space for rough work

106. If both the resistance and the inductance in an LR ac series circuit are doubled the new impedance will be

(A) halved

(B) fourfold

(C) doubled

(D) quadrupled

(E) unchanged

107. A LCR circuit with L = 1.00 mH, C = 1.0 μF and R = 50 Ω, is driven with 5 V a.c. voltage. At resonance, the current through the circuit is

(A) 0.2 A
(B) 0.25 A
(C) 0.15 A
(D) 0.1 A
(E) 0.3 A

108. The number of waves of wavelength 5000 Å in 1 mm length is

(A) 1000

(B) 2000

(C) 5000

(D) 2500

(E) 1500

Space for rough work

109. When we close one slit in the Young's double slit experiment, then

(A) the bandwidth is increased
(B) the bandwidth is decreased
(C) the bandwidth remains unchanged
(D) the interference pattern is shifted
(E) the diffraction pattern is observed

110. The sun light reaches us as white light and not as its components because

(A) air medium is dispersive
(B) air medium is non-dispersive
(C) air medium scatter the sunlight
(D) air medium absorbs the sunlight
(E) speed of light depends on wavelength in vacuum

111. A beam of light is incident on a glass slab ($\mu = 1.54$) in a direction as shown in the figure. The reflected light is analysed by a polaroid prism. On rotating the polaroid, ($\tan 57° = 1.54$)

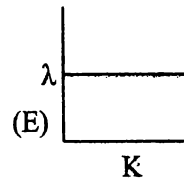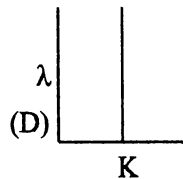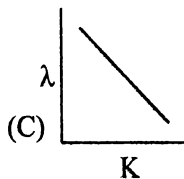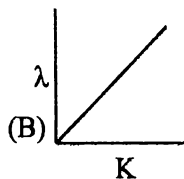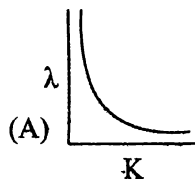(A) the intensity remains unchanged
(B) the intensity is reduced to zero and remains at zero
(C) the intensity gradually reduces to zero and then again increases
(D) the intensity increases continuously
(E) the intensity increases initially and remains constant afterwards.

Space for rough work

112. Identify the graph depicting the variation of the de Broglie wavelength λ of an electron with its kinetic energy K

113. The ratio of volumes of nuclei (assumed to be in spherical shape) with respective mass numbers 8 and 64 is

(A) 0.5   (B) 2   (C) 0.125   (D) 0.25   (E) 4

114. When alpha particle captures an electron, it becomes a

(A) helium atom
(B) hydrogen atom
(C) helium ion
(D) hydrogen ion
(E) lithium ion

Space for rough work

115. Photo cells convert

    (A) heat energy into electrical energy
    (B) light energy into mechanical energy
    (C) thermal energy into mechanical energy
    (D) light energy into electrical energy
    (E) electrical energy into light energy

116. The output of an AND gate is connected to both the inputs of a NOR gate, then this circuit will act as a

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

117. In p-type semiconductor, the acceptor level lies

    (A) near the conduction band
    (B) halfway between conduction and valence bands
    (C) within conduction band
    (D) near the valence band
    (E) within the valence band

118. If the feedback voltage is increased in a negative feedback amplifier, then

    (A) both gain and distortion decrease
    (B) the distortion increases
    (C) the gain decreases and distortion increases
    (D) the gain increases
    (E) both gain and distortion increase

Space for rough work

119. If the pulse duration varies in accordance with the modulating voltage then the modulation is called as

(A) PAM

(B) PWM

(C) PPM

(D) FM

(E) PCM

120. The increasing order of the frequency bands used for various communication services is

(A) space waves, sky waves, ground waves

(B) space waves, ground waves, sky waves

(C) sky waves, ground waves, space waves

(D) ground waves, sky waves, space waves

(E) sky waves, space waves, ground waves

Space for rough work

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