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 **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, Roll Number and Signature in the columns given above. Please also write Question Booklet Sl. 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 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 4 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.

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

1. Which of the following coordination compounds will give precipitate with an aqueous solution of $AgNO_3$?

(A) $[Cr(NH_3)_6]Cl_3$ (B) $[Cr(NH_3)_3Cl_3]$ (C) $[Cr(NH_3)_5Cl]SO_4$
(D) $Na_3[Cr(CN)_6]$ (E) $Na_3[CrCl_6]$

2. Which of the following complexes exists as pair of enantiomers?

(A) trans-$[Co(en)_2Cl_2]^+$ (B) $[Co(NH_3)_4Cl_2]^+$ (C) $[Co\{P(C_2H_5)_3\}_2ClBr]$
(D) $[Pt\{P(C_2H_5)_3\}_2Cl_2]$ (E) $[Cr(en)_3]^{+3}$

3. Which one of the following complex ions is diamagnetic?

(A) $[FeF_6]^{3-}$ (B) $[CoF_6]^{3-}$ (C) $[Co(C_2O_4)_3]^{3-}$ (D) $[Fe(CN)_6]^{3-}$ (E) $[MnCl_6]^{3-}$

4. In a reaction, $2A \rightarrow$ products the concentration of A decreases from 0.50 M to 0.38 M in 10 min. What is the rate of the reaction (in Ms^{-1}) during this interval?

(A) 0.012 (B) 0.024 (C) 2×10^{-3} (D) 2×10^{-4} (E) 1×10^{-2}

5. Among the following cells

Leclanche cell (I)
Nickel – Cadmium cell (II)
Lead storage battery (III)
Mercury cell (IV)

primary cells are

(A) I and II (B) I and III (C) II and III (D) III and IV (E) I and IV

Space for rough work

6. One kilogram of a sea water sample contains 6 mg of dissolved O_2. The concentration of O_2 in the sample in ppm is

(A) 0.6 (B) 6.0 (C) 60.0 (D) 16.0 (E) 32.0

7. A hydrocarbon is composed of 75% carbon. The empirical formula of the compound is

(A) CH_2 (B) CH_3 (C) C_2H_5 (D) C_2H_7 (E) CH_4

8. Which one of the following ions is the most resonance stabilized?

(A) ethoxide (B) phenoxide (C) tertiary butoxide
(D) isopropoxide (E) *n*-butoxide

9. Glycerine is purified by

(A) vacuum distillation (B) simple distillation (C) steam distillation
(D) sublimation (E) solvent extraction

10. The major product of the addition of water molecule to propyne in the presence of mercuric sulphate and dilute sulphuric acid is

(A) ethanal (B) ethyne (C) 2-propanol (D) propane (E) propanone

11. What is the IUPAC name of the following alkene?

$CH_2=CH-CH(CH_3)_2$

(A) Isopropyl ethylene (B) 2-Methylbut-3-ene (C) Isopentene
(D) 3-Methylbut-1-ene (E) 3, 3-Dimethylprop-1-ene

Space for rough work

12. The correct order of reactivity of the halides, ethyl chloride (I), isopropyl chloride (II) and benzyl chloride (III) in S_N1 reaction is

(A) I > II > III (B) III > II > I (C) II > I > III (D) I > III > II (E) III > I > II

13. Homolytic fission of a covalent bond leads to the formation of

(A) electrophile (B) nucleophile (C) free radical (D) carbocation (E) carbanion

14. Which of the following isomeric heptanes can yield seven different monochlorinated products upon free radical chlorination?

(A) 3-methylhexane (B) 2, 2-dimethylpentane (C) 2-methylhexane
(D) 2, 3-dimethylpentane (E) 2, 4-dimethylpentane

15. The substituent which is predominantly ortho–para directing but deactivating in aromatic electrophilic substitutions

(A) $-NO_2$ (B) $-OH$ (C) $-OCH_3$ (D) $-CH_3$ (E) $-Cl$

16. Total number of optically active compounds obtained when n-pentane is subjected to monochlorination is

(A) 4 (B) 2 (C) 0 (D) 6 (E) 8

Space for rough work

17. Which one of the following is optically active?

(A) 3-Chloropentane (B) 2-Chloropropane (C) Meso-tartaric acid
(D) Glycine (E) Sucrose

18. In the eclipsed conformation of ethane, the dihedral angle between the hydrogen atoms of adjacent methyl groups is

(A) 60° (B) 120° (C) 0° (D) 180° (E) $109^{\circ}28'$

19. Which of the following is the least reactive towards nucleophile?

(A) CH_3CH_2Cl (B) CH_3Cl (C) $CH_2{=}CH{-}CH_2Cl$
(D) C_6H_5Cl (E) $CH_3CH(Cl)CH_3$

20. The major product formed when 2-bromobutane is treated with alcoholic KOH is

(A) 2-Butanol (B) 1-Butene (C) 1-Butanol
(D) Trans-2- butene (E) Isobutyl alcohol

21. Chronic chloroform exposure may cause damage to liver and kidney, due to the formation of

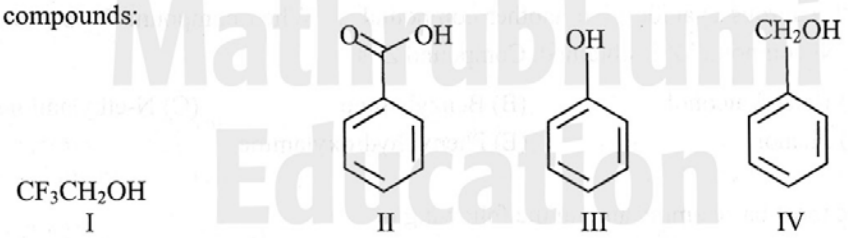
(A) phosgene (B) methylene chloride (C) methyl chloride
(D) carbon tetrachloride (E) phosphoryl chloride

22. Methyl bromide reacts with AgF to give methyl fluoride and AgBr. This reaction is called

(A) Finkelstein reaction (B) Swarts reaction (C) Fittig reaction
(D) Wurtz reaction (E) Wurtz-Fittig reaction

Space for rough work

23. What is the correct order of acidity from weakest to strongest acid for these compounds:



CF_3CH_2OH I

II III IV

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

24. Some carboxylic acids and their IUPAC names are given below. Which of the following is not correctly matched?

(A) Formic acid – Methanoic acid (B) Acetic acid – Ethanoic acid
(C) *n*-Butyric acid – Butanoic acid (D) Isobutyric acid – 2-Methylbutanoic acid
(E) Malonic acid – Propanedioic acid

25. An orange dye, *p*-hydroxyazobenzene may be synthesized from benzene diazonium chloride by

(A) Sandmeyer reaction (B) Gomberg reaction (C) Coupling reaction
(D) Gattermann reaction (E) Etard reaction

Space for rough work

26. Aniline is treated with $NaNO_2$ / HCl at 0°C to give compound X which on treatment with cuprous cyanide give another compound Y. When compound Y is treated with H_2/Ni compound Z is obtained. Compound Z is

(A) Benzyl alcohol (B) Benzylamine (C) N-ethylaniline
(D) Phenol (E) Phenyl hydroxylamine

27. The most basic amine among the following is

(A) *p*-toludine (B) *o*-nitroaniline (C) *p*-nitroaniline
(D) 2, 4-dinitroaniline (E) *p*-fluoroaniline

28. Secondary structure of protein is mainly governed by

(A) Hydrogen bonds (B) Covalent bonds (C) Ionic bonds
(D) Disulphide bonds (E) Dative bonds

29. In aqueous solution, an amino acid exists as

(A) cation (B) anion (C) dianion
(D) zwitter ion (E) neutral molecule

Space for rough work

30. The monomer of polystyrene is

(A) C_2H_5–CH=CH_2 (B) CH_2=CHCl (C) C_6H_5–CH=CH_2
(D) CH_2=CHCHO (E) C_6H_5–CH_2=CHCHO

31. Which one of the following is not a tranquilliser?

(A) Equanil (B) Veronal (C) Salvarsan (D) Serotonin (E) Luminal

32. Arsenic containing medicine used for the treatment of syphilis, is

(A) Erythromycin (B) Ofloxacin (C) Tetracycline
(D) Salvarsan (E) Penicillin

33. The secondary precursors of photochemical smog are

(A) SO_2 and NO_2 (B) SO_2 and hydrocarbons (C) NO_2 and hydrocarbons
(D) NO_2 and PAN (E) O_3 and PAN

Space for rough work

34. The line spectrum of He^+ ion will resemble that of

(A) Hydrogen atom (B) Li^+ ion (C) Helium atom
(D) Lithium atom (E) Be^{2+} ion

35. If 1.5 moles of oxygen combines with Al to form Al_2O_3, the mass of Al in g [Atomic mass of Al = 27] used in the reaction is

(A) 2.7 (B) 54 (C) 40.5 (D) 81 (E) 27

36. The mass of 2.24×10^{-3} m^3 of a gas is 4.4 g at 273.15 K and 101.325 kPa pressure. The gas may be

(A) NO (B) NO_2 (C) C_3H_8 (D) NH_3 (E) CH_4

37. Pick out the incorrect statement from the following

(A) sp hybrid orbitals are equivalent and are at an angle of 180° with each other.
(B) sp^2 hybrid orbitals are equivalent and bond angle between any two of them is 120°.
(C) sp^3d^2 hybrid orbitals are equivalent and are oriented towards corners of a regular octahedron.
(D) sp^3d^3 hybrid orbitals are not equivalent.
(E) dsp^2 hybrid orbitals are equivalent with a bond angle of 90° between any two of them.

Space for rough work

38. The molecule not having π-bond is

(A) Cl_2 (B) O_2 (C) N_2 (D) CO_2 (E) CO

39. The hybridization of the central atom in BrF_5 molecule is

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

40. The incorrect statement among the following is

(A) The boiling point of a liquid at one bar is called standard boiling point of the liquid.
(B) The vapour pressure of a liquid is a constant at a constant temperature.
(C) The SI unit of coefficient of viscosity of a liquid is pascal second.
(D) The surface tension of a liquid decreases with increases of temperature.
(E) The boiling point of a liquid is the same at all external pressures.

41. An evacuated glass vessel weighs 50 g when empty, 144.0 g when filled with a liquid of density 0.47 g ml^{-1} and 50.5 g when filled with an ideal gas at 760 mm Hg at 300 K. The molar mass of the ideal gas is: (R= 0.0821 L atm. K^{-1} mol^{-1})

(A) 61.575 (B) 130.98 (C) 123.75 (D) 47.87 (E) 87.943

42. The crystal with metal deficiency defect is

(A) NaCl (B) FeO (C) KCl (D) ZnO (E) LiCl

Space for rough work

43. Atom of which of the following elements has the greatest ability to attract electrons?

(A) silicon (B) sulphur (C) sodium (D) nitrogen (E) chlorine

44. The atom/ion that has the highest number of unpaired electrons is

(A) Mg^{2+} (B) F (C) N (D) S^{2-} (E) Ti^{3+}

45. Zeolite used to soften hardness of water is, hydrated

(A) Potassium aluminium borate (B) Sodium aluminium silicate
(C) Calcium aluminium silicate (D) Zinc aluminium borate
(E) Zinc aluminium silicate

46. Which among the following is kinetically inert towards water?

(A) Na (B) Be (C) Ca (D) K (E) Sr

47. Which one of the following metals is required as cofactor by all enzymes utilizing ATP in phosphate transfer ?

(A) K (B) Ca (C) Na (D) Mg (E) Li

48. Choose the paramagnetic oxide in the following

(A) Na_2O (B) MgO (C) BeO (D) CaO (E) KO_2

Space for rough work

49. Reaction of diborane with ammonia gives initially

(A) $B_2H_6.NH_3$ (B) Borazole (C) $B_2H_6.3NH_3$
(D) $[BH_2(NH_3)_2]^+[BH_4]^-$ (E) $B_2N_4H_{10}$

50. The correct order of matching of the following compounds is

1.	Borazole	(a)	$CaSO_4.\frac{1}{2}H_2O$
2.	Plaster of Paris	(b)	C_{60}
3.	Boric acid	(c)	SiO_2
4.	Quartz	(d)	$B_3N_3H_6$
5.	Buckminsterfullerene	(e)	H_3BO_3

(A) 1 – c ; 2 – a ; 3 – b ; 4 – e ; 5 – d
(B) 1 – a ; 2 – e ; 3 – c ; 4 – d ; 5 – b
(C) 1 – e ; 2 – b ; 3 – a ; 4 – c ; 5 – d
(D) 1 – d ; 2 – a ; 3 – e ; 4 – c ; 5 – b
(E) 1 – d ; 2 – a ; 3 – e ; 4 – b ; 5 – c

51. $B(OH)_3$ is a

(A) Lewis acid (B) Lewis base (C) Bronsted base
(D) Bronsted acid (E) Neutral compound

Space for rough work

52. Which of the following shows nitrogen with its increasing order of oxidation number?

(A) $NO < N_2O < NO_2 < NO_3^- < NH_4^+$ (B) $NH_4^+ < N_2O < NO_2 < NO_3^- < NO$
(C) $NH_4^+ < N_2O < NO < NO_2 < NO_3^-$ (D) $NH_4^+ < NO < N_2O < NO_2 < NO_3^-$
(E) $N_2O < NO < NO_2 < NO_3^- < NH_4^+$

53. Among the oxides, Mn_2O_7 (I), V_2O_3 (II), V_2O_5 (III), CrO (IV) and Cr_2O_3 (V) the basic oxides are

(A) I and II (B) II and III (C) III and IV (D) II and IV (E) III and V

54. Which one of the following ions has the maximum magnetic moment?

(A) Sc^{3+} (B) Ti^{3+} (C) Cr^{3+} (D) V^{3+} (E) Fe^{3+}

55. Identify the product and its colour when MnO_2 is fused with solid KOH in the presence of O_2

(A) $KMnO_4$, purple (B) K_2MnO_4, dark green (C) MnO, colourless
(D) Mn_2O_3, brown (E) MnO_3, black

56. Which one of the following demonstrates a decrease in entropy?

(A) Dissolving a solid into solution (B) An expanding universe
(C) Burning a log in a fireplace (D) Raking up leaves into a trash bag
(E) Spilling a glass of water

Space for rough work

57. A certain reaction is at equilibrium at 82°C and the enthalpy change for this reaction is 21.3 kJ. The value of ΔS (in JK mol^{-1}) for the reaction is

(A) 55.0 (B) 60.0 (C) 68.5 (D) 120.0 (E) 80.0

58. The K_a of a weak monobasic acid is 1×10^{-5}. The percentage of ionization in a decimolar acid solution is

(A) 0.1 (B) 10 (C) 0.01 (D) 0.5 (E) 1

59. In an exothermic equilibrium

$A + 3B \rightleftarrows AB_3$

all the reactants and product are in gaseous state. The formation of AB_3 is favoured at

(A) Low temperature and low pressure
(B) Low temperature and high pressure
(C) High temperature and high pressure
(D) High temperature and low pressure
(E) High temperature and very low pressure

60. The K_{sp} of $PbCrO_4$ is 1.0×10^{-16}. Then the molar solubility of $PbCrO_4$ is

(A) 1.0×10^{-6} (B) 1.0×10^{-4} (C) 1.0×10^{-16} (D) 1.0×10^{-8} (E) 1.0×10^{-12}

Space for rough work

61. The solubility of a gas in water at 300 K under a pressure of 100 atmospheres is 4×10^{-3} kgL^{-1}. Therefore, the mass of the gas in kg dissolved in 250 mL of water under a pressure of 250 atmospheres at 300 K is

(A) 2.5×10^{-3} (B) 2.0×10^{-3} (C) 1.25×10^{-3} (D) 5.0×10^{-3} (E) 3×10^{-3}

62. 1 g of a non-volatile, non-electrolyte solute of molar mass 250 g/mol was dissolved in 51.2 g of benzene. If the freezing point depression constant K_f of benzene is 5.12 kg K mol^{-1}. The freezing point of benzene is lowered by

(A) 0.3 K (B) 0.5 K (C) 0.2 K (D) 0.6 K (E) 0.4 K

63. Negative deviation from Raoult's law is observed in which one of the following binary liquid mixtures?

(A) ethanol and acetone (B) benzene and toluene
(C) acetone and chloroform (D) chloroethane and bromoethane
(E) acetone and carbon disulphide

64. The average oxidation state of sulphur in $Na_2S_4O_6$ is

(A) +2.5 (B) +2 (C) +3.0 (D) +3.5 (E) +4

65. How many moles of Pt may be deposited on the cathode when 0.80 F of electricity is passed through a 1.0 M solution of Pt^{4+} ?

(A) 1.0 mol (B) 0.20 mol (C) 0.40 mol (D) 0.80 mol (E) 0.60 mol

Space for rough work

66. Consider the following four electrodes,

P = Cu^{2+} (0.0001M) / Cu(s)
Q = Cu^{2+} (0.1M) / Cu(s)
R = Cu^{2+} (0.01M) / Cu(s)
S= Cu^{2+} (0.001M) / Cu(s)

If the standard reduction potential of Cu^{2+}/Cu is + 0.34 V, the reduction potentials in volts of the above electrodes follow the order

(A) P > S > R > Q (B) S > R > Q > P (C) R > S > Q > P
(D) P > Q > R > S (E) Q > R > S > P

67. For a reaction A + 2B → C, the amount of C formed by starting the reaction with 5 moles of A and 8 moles of B is

(A) 5 moles (B) 8 moles (C) 16 moles (D) 4 moles (E) 1 mole

68. The rate law for the reaction 2X + Y → Z is Rate = k[X][Y]. The correct statement with regard to this relation is

(A) The unit of k is s^{-1}
(B) The rate of the reaction is independent of [X] and [Y]
(C) For this reaction $t_{½}$ is independent of initial concentrations of reactant
(D) The rate of formation of Z is twice the rate of disappearance of X
(E) The rate of disappearance of X is equal to rate of disappearance of Y

Space for rough work

69. Consider the following statements:

1. increase in concentration of reactant increases the rate of a zero order reaction
2. rate constant k is equal to collision frequency A if $E_a = 0$.
3. rate constant k is equal to collision frequency A if $E_a = \infty$.
4. ln k vs T is a straight line
5. ln k vs 1/T is a straight line

Correct statements are

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

70. Adsorption is accompanied by

(A) decrease in enthalpy and increase in entropy
(B) increase in enthalpy and increase in entropy
(C) decrease in enthalpy and decrease in entropy
(D) increase in enthalpy and decrease in entropy
(E) no change in enthalpy and entropy

71. The formation of micelles takes place only above

(A) Inversion temperature (B) Boyle temperature (C) Critical temperature
(D) Kraft temperature (E) Wein temperature

72. Colloidion is a 4% solution of which one of the following in alcohol-ether mixture

(A) nitroglycerine (B) celluloseacetate (C) glycoldinitrate
(D) nitrocellulose (E) methylcellulose

Space for rough work

73. Identify the false statement

(A) Inside a charged or neutral conductor electrostatic field is zero

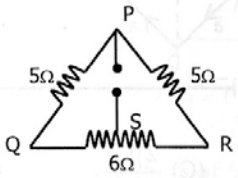
(B) The electrostatic field at the surface of the charged conductor must be tangential to the surface at any point

(C) There is no net charge at any point inside the conductor

(D) Electrostatic potential is constant throughout the volume of the conductor

(E) Electric field at the surface of a charged conductor is proportional to the surface charge density

74. Three resistances 5 Ω, 5 Ω and 6 Ω are connected as shown in figure. If the point S divides the resistance 6 Ω into two equal halves, the resistance between points P and S is



(A) 11 Ω (B) 8 Ω (C) 6 Ω (D) 10 Ω (E) 4 Ω

75. A rise of temperature of 4°C is observed in a conductor by passing a current. If the current is tripled, the rise of temperature will be

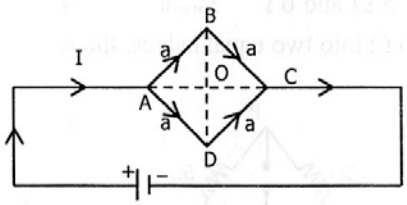
(A) 8°C (B) 12°C (C) 16°C (D) 36°C (E) 24°C

Space for rough work

76. Two electric bulbs marked 40 W, 220 V and 60 W, 220 V when connected in series, across same voltage supply of 220 V, the effective power is P_1 and when connected in parallel, the effective power is P_2. Then $\frac{P_1}{P_2}$ is

(A) 0.5 (B) 0.48 (C) 0.24 (D) 0.16 (E) 4.1

77. Magnetic field induction at the centre O of a square loop of side 'a' carrying current I as shown in figure is



(A) $\frac{\mu_o I}{\sqrt{2}\pi a}$ (B) $2\sqrt{2}\frac{\mu_o I}{\pi a}$ (C) $\frac{2\mu_o I}{\pi a}$ (D) $\frac{\mu_o I}{2\pi a}$ (E) zero

78. A domain in a ferromagnetic substance is in the form of a cube of side length 1 μm. If it contains 8×10^{10} atoms and each atomic dipole has a dipole moment of 9×10^{-24} Am^2, then the magnetization of the domain is

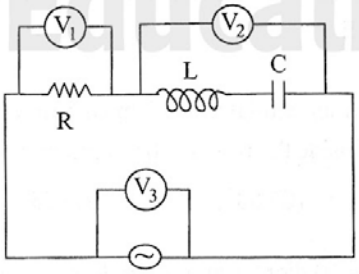
(A) 7.2×10^5 Am^{-1} (B) 7.2×10^3 Am^{-1} (C) 7.2×10^9 Am^{-1}
(D) 7.2×10^{12} Am^{-1} (E) 7.2×10^{18} Am^{-1}

Space for rough work

79. The unit of self-inductance is

(A) weber ampere (B) weber $^{-1}$ ampere (C) ohm second
(D) farad (E) tesla ampere $^{-1}$

80. In the figure shown, three AC voltmeters are connected. At resonance,



(A) $V_2 = 0$ (B) $V_1 = 0$ (C) $V_3 = 0$ (D) $V_1 = V_2 \neq 0$ (E) $V_3 = V_2 \neq 0$

81. A 0.1 m long conductor carrying a current of 50 A is held perpendicular to a magnetic field of 1.25 mT. The mechanical power required to move the conductor with a speed of 1 ms^{-1} is

(A) 62.5 mW (B) 625 mW (C) 6.25 mW (D) 12.5 mW (E) 125 mW

82. In an A.C. generator, when the plane of the armature is perpendicular to the magnetic field

(A) both magnetic flux and emf are maximum
(B) both magnetic flux and emf are zero
(C) both magnetic flux and emf are half of their respective maximum values
(D) magnetic flux is zero and emf is maximum
(E) magnetic flux is maximum and emf is zero

Space for rough work

83. Which one of the following is the property of a monochromatic, plane electromagnetic wave in free space?

(A) Electric and magnetic fields have a phase difference of $\pi/2$
(B) The energy contribution of both electric and magnetic fields are equal
(C) The direction of propagation is in the direction of $\mathbf{B} \times \mathbf{E}$
(D) The pressure exerted by the wave is the product of its speed and energy density
(E) The speed of the wave is B/E

84. For an angle of incidence θ on an equilateral prism of refractive index $\sqrt{3}$, the ray refracted is parallel to the base inside the prism. The value of θ is

(A) 30° (B) 45° (C) 60° (D) 75° (E) 15°

85. The power of a biconvex lens is 10 dioptre and the radius of curvature of each surface is 10 cm. Then the refractive index of the material of the lens is

(A) $\frac{3}{2}$ (B) $\frac{4}{3}$ (C) $\frac{9}{8}$ (D) $\frac{5}{3}$ (E) $\frac{3}{4}$

86. Young's experiment is performed with light of wavelength 6000 Å wherein 16 fringes occupy a certain region on the screen. If 24 fringes occupy the same region with another light, of wavelength λ, then λ is

(A) 6000 Å (B) 4500 Å (C) 5000 Å (D) 4000 Å (E) 5500 Å

Space for rough work

87. In a photoelectric experiment, if both the intensity and frequency of the incident light are doubled, then the saturation photoelectric current

(A) remains constant (B) is halved (C) is doubled
(D) becomes four times (E) becomes six times

88. The nucleus which has radius one-third of the radius of Os^{189} is

(A) Be^{9} (B) Li^{7} (C) F^{19} (D) C^{12} (E) O^{16}

89. Pick out the incorrect statement from the following:

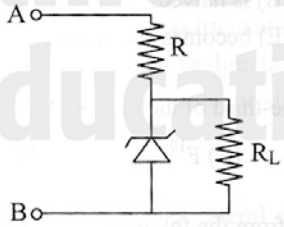
(A) β^- emission from the nucleus is always accompanied with a neutrino
(B) The energy of the α-particle emitted from a given nucleus is always constant
(C) γ-ray emission makes the nucleus more stable
(D) Nuclear force is charge-independent
(E) Fusion is the main process by which energy is released from a star

90. When the voltage drop across a *p-n* junction diode is increased from 0.65 V to 0.70 V, the change in the diode current is 5 mA. The dynamic resistance of the diode is

(A) 20 Ω (B) 50 Ω (C) 10 Ω (D) 80 Ω (E) 100 Ω

Space for rough work

91. If the voltage between the terminals A and B is 17 V and Zener breakdown voltage is 9 V, then the potential across R is



(A) 6 V (B) 8 V (C) 9 V (D) 17 V (E) 26 V

92. GaAs (with a band gap = 1.5 eV) as an LED can emit

(A) blue light (B) green light (C) ultraviolet rays (D) X-rays (E) infrared rays

93. If both the length of an antenna and the wavelength of the signal to be transmitted are doubled, the power radiated by the antenna

(A) is doubled (B) is halved (C) remains constant
(D) is quadrupled (E) increases 16 times

Space for rough work

94. If the maximum amplitude of an amplitude modulated wave is 25 V and the minimum amplitude is 5 V, the modulation index is

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

95. A modem is a

(A) modulating device only
(B) demodulating device only
(C) modulating and demodulating device
(D) transmitting device
(E) receiving device

Space for rough work

96. From the following pairs of physical quantities, choose the pair that does not have same dimensions

(A) Angular momentum and Planck's constant
(B) Moment of inertia and moment of force
(C) Work and torque
(D) Impulse and momentum
(E) Work and energy

97. A graph is drawn between velocity and time for the motion of a particle. The area under the curve between the time intervals t_1 and t_2 gives

(A) momentum of the particle
(B) displacement of the particle
(C) acceleration of the particle
(D) change in velocity of the particle
(E) force on the particle

98. Stopping distance of a moving vehicle is directly proportional to

(A) square of the initial velocity
(B) square of the initial acceleration
(C) the initial velocity
(D) the initial acceleration
(E) mass of the vehicle

99. The magnitude of the component of the vector $2i + 3j + k$ along $3i + 4k$ is

(A) $\frac{1}{2}$ (B) $\frac{14}{5}$ (C) 3 (D) $\frac{6}{5}$ (E) 2

Space for rough work

100. Centripetal acceleration is

(A) a constant vector (B) a constant scalar (C) a magnitude changing vector
(D) not a constant vector (E) time dependent scalar

101. Human heart is pumping blood with constant velocity v ms^{-1} at the rate of M kgs^{-1}. The force required for this is (in N)

(A) M (B) Mv (C) $\frac{M}{v}$ (D) $v\frac{dM}{dt}$ (E) $M\frac{dv}{dt}$

102. Which one of the following is not a force?

(A) Impulse (B) Tension (C) Thrust (D) Air resistance (E) Weight

103. The potential energy of a conservative system is given by $V(x) = (x^2 - 3x)$ joule. Then its equilibrium position is at

(A) $x = 1.5$ m (B) $x = 2$ m (C) $x = 2.5$ m (D) $x = 3$ m (E) $x = 0.33$ m

104. The average energy consumed by a human being in a day is

(A) 2400 cal (B) 2400 J (C) 2400 kJ (D) 2400 mJ (E) 2400 kcal

Space for rough work

105. The moment of inertia of a uniform circular disc of mass M and of radius R about one of its diameters is

(A) $\frac{1}{4}MR^2$ (B) $\frac{1}{2}MR^2$ (C) $\frac{2}{3}MR^2$ (D) $\frac{2}{5}MR^2$ (E) MR^2

106. In the absence of external torque for a body revolving about any axis, the quantity that remains constant is

(A) kinetic energy (B) potential energy (C) linear momentum
(D) angular momentum (E) linear velocity

107. Two point masses A and B having masses in the ratio 4:3 are separated by a distance of 1 m. When another point mass C of mass M is placed in between A and B, the force between A and C is $\frac{1}{3}$rd of the force between B and C. Then the distance of C from A is

(A) $\frac{2}{3}$m (B) $\frac{1}{3}$m (C) $\frac{1}{4}$m (D) $\frac{2}{7}$m (E) $\frac{2}{5}$m

108. Acceleration due to gravity is maximum at (R is the radius of earth)

(A) a height $\frac{R}{2}$ from the earth's surface (B) the centre of the earth
(C) the surface of the earth (D) a depth $\frac{R}{2}$ from earth's surface
(E) a height R from earth's surface

Space for rough work

109. For most materials the Young's modulus is n times the rigidity modulus, where n is

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

110. The velocity of the surface layer of water in a river of depth 10 m is 5 ms^{-1}. The shearing stress between the surface layer and the bottom layer is (coefficient of viscosity of water, $\eta = 10^{-3}$ SI units)

(A) $0.6 \times 10^{-3}\ Nm^{-2}$ (B) $0.8 \times 10^{-3}\ Nm^{-2}$ (C) $0.5 \times 10^{-3}\ Nm^{-2}$
(D) $10^{-3}\ Nm^{-2}$ (E) $1\ Nm^{-2}$

111. If the atmospheric pressure is P_a, then the pressure P at depth h below the surface of a liquid of density ρ open to the atmosphere is

(A) $P_a - \frac{\rho gh}{2}$ (B) $P_a - \rho gh$ (C) P_a (D) $P_a + \frac{\rho gh}{2}$ (E) $P_a + \rho gh$

112. Certain amount of heat is given to 100 g of copper to increase its temperature by 21°C. If the same amount of heat is given to 50 g of water, then the rise in its temperature is (specific heat capacity of copper = 400 $Jkg^{-1}\ K^{-1}$ and that for water = 4200 $Jkg^{-1}\ K^{-1}$)

(A) 4°C (B) 5.25°C (C) 8°C (D) 6°C (E) 10.5°C

113. The property of water that has an important environmental effect is its

(A) low surface tension (B) high heat capacity (C) maximum density at 4°C
(D) low thermal conductivity (E) low viscosity

Space for rough work

114. The thermal radiation from a hot body travels with a velocity of

(A) 330 ms^{-1} (B) 2×10^8 ms^{-1} (C) 1200 ms^{-1} (D) 230 ms^{-1} (E) 3×10^8 ms^{-1}

115. A body of mass 500 g is attached to a horizontal spring of spring constant $8\pi^2$ Nm^{-1}. If the body is pulled to a distance of 10 cm from its mean position, then its frequency of oscillation is

(A) 2 Hz (B) 4 Hz (C) 8 Hz (D) 0.5 Hz (E) 4π Hz

116. The time period of the variation of potential energy of a particle executing SHM with period T is

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

117. The frequencies of two tuning forks A and B are respectively 1.5 % more and 2.5 % less than that of the tuning fork C. When A and B are sounded together, 12 beats are produced in 1 sec. The frequency of the tuning fork C is

(A) 200 Hz (B) 240 Hz (C) 360 Hz (D) 300 Hz (E) 400 Hz

118. The pressure variations in the propagation of sound waves in gaseous medium are

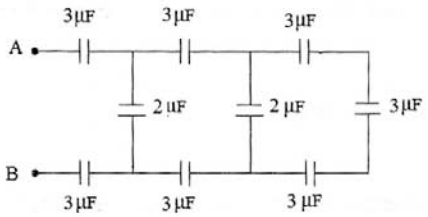
(A) adiabatic (B) isothermal (C) isobaric (D) isochoric (E) cyclic

Space for rough work

119. An electric dipole of moment **p** is placed in a uniform electric field **E**. Then (i) the torque on the dipole is $\mathbf{p} \times \mathbf{E}$ (ii) the potential energy of the system is **p.E** (iii) the resultant force on the dipole is zero.

(A) (i), (ii) and (iii) are correct
(B) (i) and (iii) are correct and (ii) is wrong
(C) Only (i) is correct
(D) (i) and (ii) are correct and (iii) is wrong
(E) (i), (ii) and (iii) are wrong.

120. The equivalent capacitance between A and B is (in μF)



(A) 25 (B) $\frac{84}{25}$ (C) 9 (D) $\frac{25}{84}$ (E) 1

Space for rough work