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	**A 1**	**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 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.

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Mathrubhumi
Education

PLEASE ENSURE THAT THIS BOOKLET CONTAINS 120 QUESTIONS SERIALLY NUMBERED FROM 1 TO 120 (Printed Pages : 32)

1. The velocity of particle A is 0.1 ms^{-1} and that of particle B is 0.05 ms^{-1}. If the mass of particle B is five times that of particle A, then the ratio of de Broglie wavelengths associated with the particles A and B is

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

2. In hydrogen atomic spectrum, a series limit is found at 12186.3 cm^{-1}. Then it belongs to

   (A) Lyman series (B) Balmer series (C) Paschen series
   (D) Brackett series (E) Pfund series

3. The number of significant figures in 10.3106 g is

   (A) 2 (B) 3 (C) 1 (D) 4 (E) 6

4. The molecule which has the highest bond order is

   (A) C_2 (B) N_2 (C) B_2 (D) O_2 (E) F_2

5. The molecular geometry of BF_3 is

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

(Space for rough work)

6. The types of hybridisation on the five carbon atoms from left to right in the molecule $CH_3–CH=C=CH–CH_3$ are

(A) $sp^3, sp^2, sp^2, sp^2, sp^3$ (B) $sp^3, sp, sp^2, sp^2, sp^3$ (C) $sp^3, sp^2, sp, sp^2, sp^3$
(D) $sp^3, sp^2, sp^2, sp, sp^3$ (E) sp^3, sp, sp, sp^2, sp^3

7. Which of the following comparisons of the average kinetic energy and the average molecular speeds of H_2 and N_2 gases at 300 K is correct?

	Average Kinetic Energy	Average Molecular Speed
(A)	$H_2 = N_2$	$H_2 = N_2$
(B)	$H_2 < N_2$	$H_2 > N_2$
(C)	$H_2 = N_2$	$H_2 < N_2$
(D)	$H_2 > N_2$	$H_2 = N_2$
(E)	$H_2 = N_2$	$H_2 > N_2$

8. The number of atoms per unit cell of bcc structure is

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

9. Which one of the following forms a molecular solid when solidified?

(A) Silicon carbide (B) Calcium fluoride (C) Rock salt
(D) Silica (E) Methane

10. Which one of the following does not react with water even under red hot condition?

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

(Space for rough work)

11. The element with atomic number 117 has not been discovered yet. In which family would you place this element if discovered?

(A) Alkali metals (B) Alkaline earth metals (C) Halogens
(D) Noble gases (E) Coinage metals

12. Which one of the following statements is incorrect with regard to ortho and para-dihydrogen?

(A) They are nuclear spin isomers
(B) The ortho isomer has zero nuclear spin whereas the para isomer has one nuclear spin
(C) The para isomer is favoured at low temperatures
(D) The thermal conductivity of the para isomer is 50% greater than that of the ortho isomer
(E) It is never possible to obtain 100 % pure ortho isomer

13. Which one of the following metals forms super oxide?

(A) Ca (B) Zn (C) Al (D) Ti (E) K

14. Which one of the following ores is concentrated by chemical leaching method?

(A) Galena (B) Copper pyrite (C) Cinnabar
(D) Argentite (E) Copper glance

15. Autoreduction is employed in the metallurgy of

(A) Hg (B) Al (C) Ti (D) Zn (E) Cr

(Space for rough work)

16. The main reason that $SiCl_4$ is easily hydrolyzed as compared to CCl_4 is that

(A) Si - Si bond is weaker (B) $SiCl_4$ can form hydrogen bonds
(C) $SiCl_4$ is covalent (D) $SiCl_4$ is ionic
(E) Si can extend its coordination number beyond four

17. The number of carbon atoms in Buckminsterfullerene is

(A) 50 (B) 350 (C) 60 (D) 70 (E) 80

18. The anion, $(Si_6O_{18})^{12-}$ is present in

(A) Pyroxene (B) Beryl (C) Mica (D) Albite (E) Asbestos

19. The solid product formed on heating $AgNO_3$ strongly to 980 K is

(A) Silver carbonate (B) Silver nitride (C) Silver oxide
(D) Silver metal (E) Silver nitrite

20. The maximum oxidation state shown by Mn in its compounds is

(A) +4 (B) +5 (C) +6 (D) +7 (E) +8

21. The approximate percentage of iron in mischmetall is

(A) 10 (B) 20 (C) 50 (D) 95 (E) 5

(Space for rough work)

22. One gram of $^{198}Au_{79}$ ($t_{1/2}$ = 65 hrs) decays by β-emission to produce stable mercury. The amount of mercury that would be present after 260 hours is

(A) 0.8745 g (B) 0.9375 g (C) 1.234 g
(D) 0.5849 g (E) 0.0625 g

23. Critical mass of $^{235}U_{92}$ in nuclear fission is

(A) 1 to 100 g (B) 100 to 1000 mg (C) 1 to 100 kg
(D) 1 to 100 amu (E) 1 to 10 ton

24. The neutron to proton ratio of the daughter element after a nuclide $^{238}U_{92}$ loses an alpha particle and a beta particle successively is

(A) 144/90 (B) 143/91 (C) 144/91 (D) 234/91 (E) 145/90

25. A reaction cannot take place spontaneously at any temperature when

(A) both ΔH and ΔS are positive
(B) both ΔH and ΔS are negative
(C) ΔH is negative and ΔS is positive
(D) ΔH is zero and ΔS is positive
(E) ΔH is positive and ΔS is negative

26. The heats of atomization of $PH_3(g)$ and $P_2H_4(g)$ are 954 kJ mol^{-1} and 1485 kJ mol^{-1} respectively. The P-P bond energy in kJ mol^{-1} is

(A) 213 (B) 426 (C) 318 (D) 1272 (E) 107

(Space for rough work)

27. Pick out the wrong statement

(A) The standard free energy of formation of all elements is zero

(B) A process accompanied by decrease in entropy is spontaneous under certain conditions

(C) The entropy of a perfectly crystalline substance at absolute zero is zero

(D) A process that leads to increase in free energy will be spontaneous

(E) Enthalpy of combustion is always negative

28. Which one of the following has a pH value of 10.5?

(A) Lemon juice (B) Blood (C) Milk

(D) Soft drink (E) Lime water

29. For the equilibrium, $H_2 + I_2 \rightleftharpoons 2\ HI$, which of the following will affect the equilibrium constant?

(A) Pressure change (B) Concentration change (C) Catalyst

(D) Promoter (E) Temperature change

30. The precipitate of $Ag_2CrO_4(K_{sp} = 9 \times 10^{-12})$ is obtained when equal volumes of the following are mixed

(A) 10^{-5}M Ag^+ and 10^{-3}M CrO_4^{2-}

(B) 10^{-5}M Ag^+ and 10^{-2}M CrO_4^{2-}

(C) 10^{-4}M Ag^+ and 10^{-2}M CrO_4^{2-}

(D) 10^{-7}M Ag^+ and 10^{-3}M CrO_4^{2-}

(E) 10^{-4}M Ag^+ and 10^{-4}M CrO_4^{2-}

(Space for rough work)

31. At 300 K the vapour pressure of an ideal solution containing 1 mole of liquid A and 2 moles of liquid B is 500 mm of Hg. The vapour pressure of the solution increases by 25 mm of Hg, if one more mole of B is added to the above ideal solution at 300 K. Then the vapour pressure of A in its pure state is

(A) 300 mm of Hg (B) 400 mm of Hg (C) 500 mm of Hg
(D) 600 mm of Hg (E) 200 mm of Hg

32. Which of the following concentration terms is/are independent of temperature?

(A) Molality only
(B) Molality and mole fraction
(C) Molarity and mole fraction
(D) Molality and normality
(E) Molarity only

33. Henry's law constant of oxygen is 1.4×10^{-3} mol.lit^{-1}.atm^{-1} at 298 K. How much of oxygen is dissolved in 100 mL at 298 K when the partial pressure of oxygen is 0.5 atm?

(A) 1.4 g (B) 3.2 g (C) 22.4 mg (D) 2.24 mg (E) 3.2 mg

34. A solution of nickel sulphate in which nickel rod is dipped is diluted 10 times. The reduction potential of Ni at 298 K

(A) decreases by 60 mV (B) decreases by 30 mV (C) decreases by 30 V
(D) increases by 30 mV (E) increases by 30 V

(Space for rough work)

35. The standard reduction potentials for Cu^{2+} / Cu ; Zn^{2+} / Zn ; Li^{+} / Li ; Ag^{+} / Ag and H^{+} / H_2 are + 0.34 V, –0.762 V, –3.05 V, +0.80 V and 0.00 V respectively. Choose the strongest reducing agent among the following

(A) Zn (B) H_2 (C) Ag (D) Li (E) Cu

36. The number of electrons involved in the reduction of one nitrate ion to hydrazine is

(A) 8 (B) 5 (C) 3 (D) 7 (E) 4

37. For a first order reaction the rate constant is 6.909 min^{-1}. The time taken for 75% conversion in minutes is

(A) 3/2 log 2 (B) 2/3 log 3 (C) 2/3 log 2
(D) 3/2 log 3/4 (E) 2/3 log 4/3

38. The unit, mol L^{-1} s^{-1} is meant for the rate constant of the reaction having the order

(A) 0 (B) 2 (C) 1 (D) 3 (E) 4

39. The half-life of a reaction is inversely proportional to the square of the initial concentration of the reactant. Then the order of the reaction is

(A) 0 (B) 1 (C) 2 (D) 3 (E) 0.5

40. The gas which is least adsorbed on charcoal (under identical conditions) is

(A) HCl (B) O_2 (C) CO_2 (D) NH_3 (E) SO_2

(Space for rough work)

41. Commonly used catalyst in the preparation of acrylonitrile from propylene, ammonia and oxygen is

(A) silver (B) bismuth molybdates (C) caesium chloride
(D) nickel (E) organochromium compounds

42. Hair cream is an example of

(A) Gel (B) Sol (C) Aerosol (D) Foam (E) Emulsion

43. The crystal field splitting energy for octahedral (Δ_0) and tetrahedral (Δ_t) complexes is related as

(A) $\Delta_t = -\frac{1}{2}\Delta_0$ (B) $\Delta_t = -\frac{4}{9}\Delta_0$ (C) $\Delta_t = -\frac{3}{5}\Delta_0$
(D) $\Delta_t = -\frac{2}{5}\Delta_0$ (E) $\Delta_t = -\frac{9}{4}\Delta_0$

44. The charge on the central metal ion in the complex $[Ni(CO)_4]$ is

(A) +2 (B) +4 (C) 0 (D) +3 (E) +1

45. Facial and meridional isomerism will be exhibited by

(A) $[Co(NH_3)_3Cl_3]$ (B) $[Co(NH_3)_4Cl_2]Cl$ (C) $[Co(en)_3]Cl_3$
(D) $[Co(NH_3)_5Cl]Cl_2$ (E) $K_3[Co(CN)_4Cl_2]$

46. The masses of carbon, hydrogen and oxygen in an organic compound are in the ratio 6:1:8 respectively. Which of the following pairs of formulas correspond to above information?

(A) CH_2O and CH_3CHO (B) CH_2O and C_3H_6O (C) C_3H_6O and $C_2H_6O_2$
(D) $C_3H_6O_3$ and HCHO (E) C_2H_4O and $C_4H_8O_2$

(Space for rough work)

47. In the Dumas method of estimation of nitrogen, the nitrogen in the organic compound is finally converted into

(A) NO_2 (B) N_2 (C) NH_3 (D) $(NH_4)_2SO_4$ (E) HNO_3

48. The number of primary, secondary and tertiary carbons in 3,4-dimethylheptane are respectively

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

49. Which among the following will not exhibit geometrical isomerism?

(A) 2-methyl-2-butene (B) 2-butene (C) 2, 3-dichloro-2-butene
(D) 1-chloro-1-pentene (E) 1, 2-dichloroethene

50. Which of the following is a 3-methylbutyl group?

(A) $CH_3CH_2CH_2CH_2CH_2–$ (B) $(CH_3CH_2)_2CH–$ (C) $(CH_3)_3CCH_2–$
(D) $(CH_3)_2CHCH_2CH_2–$ (E) $CH_3CH_2CH(CH_3)CH_2–$

51. When neopentyl bromide is subjected to Wurtz reaction, the product formed is

(A) 2, 2, 4, 4-tetramethylhexane
(B) 2, 2, 4, 4-tetramethylpentane
(C) 2, 2, 5, 5-tetramethylhexane
(D) 2, 2, 3, 3-tetramethylhexane
(E) 2, 2, 3, 3-tetramethylpentane

(Space for rough work)

52. Which among the following groups when attached to benzene ring will direct the incoming electrophile predominantly to the meta position

(1) $-CH_3$ (2) $-CH_2Cl$ (3) $-\overset{+}{N}H_3$ (4) $-CCl_3$ (5) $-NHCOCH_3$

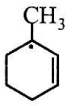
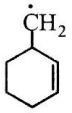
(A) 3 only (B) 1, 2 and 5 (C) 3 and 5 only

(D) 3, 4 and 5 (E) 3 and 4 only

53. An example of electrophile is

(A) NO_2 (B) NH_3 (C) $^+NO_2$ (D) H_2O (E) ^-OH

54. Which among the following free radical is most stable?

(A)  (B)  (C) $\dot{C}H_3$ (D) $\dot{C}H_2$  CH_2 (E) $H\dot{C}=CH_2$

55. Diastereomerism will not be exhibited by

(A) 2, 3-dichlorobutane (B) 2-hydroxy propanoic acid

(C) tartaric acid (D) 2, 3-butane diol (E) threonine

56. The molecule which is free from angular strain is

(A) cyclopropane (B) cyclobutane (C) cyclopentane

(D) cyclohexane (E) cycloheptane

(Space for rough work)

57. The number of chain isomers possible for the hydrocarbon C_5H_{12} is

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

58. Which one of the following gives only one monochloro derivative?

(A) n-hexane (B) 2-methylpentane (C) 2, 3-dimethylpentane
(D) 3-methylpentane (E) neopentane

59. Treatment of calcium carbide with water gives

(A) ethene (B) ethyne (C) ethane (D) benzene (E) methane

60. The major product of the reaction between *tert*-butyl chloride and sodium ethoxide is

(A) 2-Methylprop-1-ene (B) 1-Butene (C) 2-Butene
(D) Ethene (E) 2-Ethoxy-2-methylpropane

61. Which among the following does not answer iodoform test?

(A) 1-Propanol (B) Ethanol (C) 2-Propanol
(D) Ethanal (E) Propanone

62. Chlorination of toluene in the presence of light and heat followed by treatment with aqueous KOH gives

(A) o-cresol (B) m-cresol (C) p-cresol
(D) benzyl alcohol (E) 2-chloro-4-hydroxytoluene

(Space for rough work)

63. The best combination of reagents for carrying out the conversion $RCH_2CH_2OH \rightarrow RCH_2CH_2COOH$ is

(A) PBr_3, KCN, H_3O^+ (B) PBr_3, KCN, H_2/Pt (C) KCN, H_3O^+
(D) PBr_3, H_3O^+ (E) $LiAlH_4$, PBr_3

64. Nitrobenzene is reduced to azoxybenzene using

(A) Sn/HCl (B) Zn/NH_4Cl (C) As_2O_3/NaOH
(D) Zn/NaOH (E) H_2/Pd-C/C_2H_5OH

65. Benzenediazonium chloride on treatment with water gives

(A) benzene (B) o-chlorophenol (C) anisole
(D) chlorobenzene (E) phenol

66. A primary amine that can be obtained both by the reduction of cyanides and amides is

(A) methylamine (B) benzylamine (C) aniline
(D) isopropylamine (E) tertiary butylamine

67. The monomer(s) used to prepare polyvinyl polythene is

(A) vinyl chloride and ethene
(B) ethene
(C) isoprene
(D) 1, 3-butadiene and acrylonitrile
(E) 1, 3-butadiene

(Space for rough work)

68. A peptide hormone is

(A) estrone (B) testosterone (C) insulin
(D) corticoid (E) progesterone

69. The polymer used in orthopaedic devices and in controlled drug release is

(A) Orlon (B) PTFE (C) SBR (D) PHBV (E) PVC

70. The greenhouse gas is

(A) CO_2 (B) SO_2 (C) N_2 (D) H_2S (E) N_2O

71. A dye that imparts different colours to the fabric with different metal ions is called

(A) mordant dye (B) disperse dye (C) vat dye
(D) direct dye (E) acid dye

72. Photochemical smog is due to the presence of

(A) oxides of sulphur (B) oxides of nitrogen (C) oxides of carbon
(D) lead (E) chlorofluorocarbons

(Space for rough work)

73. Which one of the following quantities has not been expressed in proper unit?

(A) torque : newton metre

(B) stress : newton metre^{-2}

(C) modulus of elasticity : newton metre^{-2}

(D) power : newton metre second^{-1}

(E) surface tension : newton metre^{-2}

74. Area under velocity-time curve over a given interval of time represents

(A) acceleration (B) momentum (C) velocity

(D) displacement (E) kinetic energy

75. A car starts from rest and accelerates uniformly to a speed of 180 kmh^{-1} in 10 seconds. The distance covered by the car in this time interval is

(A) 500 m (B) 250 m (C) 100 m (D) 200 m (E) 150 m

76. The relation between the time of flight of a projectile T_f and the time to reach the maximum height t_m is

(A) $T_f = 2t_m$ (B) $T_f = t_m$ (C) $T_f = \frac{t_m}{2}$

(D) $T_f = \sqrt{2}\left(t_m\right)$ (E) $T_f = \frac{t_m}{\sqrt{2}}$

(Space for rough work)

77. The acceleration of an object moving with speed v in a circle of radius r is

(A) $\frac{v^2}{r}$ towards the centre (B) $\frac{v}{r}$ away from the centre

(C) $\frac{v}{r^2}$ away from the centre (D) $\frac{r}{v^2}$ towards the centre

(E) $\frac{v}{r}$ towards the centre

78. Newton's second and third laws of motion lead to the conservation of

(A) linear momentum (B) angular momentum (C) potential energy

(D) kinetic energy (E) force

79. A large force is acting on a body for a short time. The impulse imparted is equal to the change in

(A) acceleration (B) momentum (C) energy

(D) velocity (E) displacement

(Space for rough work)

80. The 'kilowatt-hour' is the unit of

(A) time (B) power (C) energy (D) force (E) impulse

81. According to work-energy theorem, the work done by the net force on a particle is equal to the change in its

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

82. A particle with position vector r has a linear momentum p. Which of the following statements is true in respect of its angular momentum L about the origin?

(A) L acts along p
(B) L acts along r
(C) L is maximum when p and r are parallel
(D) L is maximum when p is perpendicular to r
(E) L is minimum when p is perpendicular to r

(Space for rough work)

83. The moment of inertia of a circular disc of mass M and radius R about an axis passing through the center of mass is I_0. The moment of inertia of another circular disc of same mass and thickness but half the density about the same axis is

(A) $\frac{I_0}{8}$ (B) $\frac{I_0}{4}$ (C) $8I_0$ (D) $2I_0$ (E) $4I_0$

84. The escape velocity for an object from the surface of earth (radius R) is

(A) $\sqrt{gR}$ (B) gR (C) $\sqrt{gR^2}$ (D) $\sqrt{2gR}$ (E) $\sqrt{2gR^2}$

85. The energy required to move a satellite of mass '*m*' from an orbit of radius 2R to 3R around earth of mass M is

(A) $\frac{GMm}{12R}$ (B) $\frac{GMm}{R}$ (C) $\frac{GMm}{8R}$ (D) $\frac{GMm}{2R}$ (E) $\frac{GMm}{3R}$

86. The Young's modulus of the material of a wire is equal to the

(A) stress required to increase its length four times
(B) stress required to produce unit strain
(C) strain produced in it
(D) half the strain produced in it
(E) stress acting on it

(Space for rough work)

87. The working of venturimeter is based on

(A) Torricelli's law (B) Pascal's law (C) Bernoulli's theorem
(D) Archimedes' principle (E) Stokes's law

88. Excess of pressure in a gas bubble of radius r in a liquid is (liquid-gas interface surface tension is S)

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

89. No heat flows between the system and surrounding. Then the thermodynamic process is

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

90. The temperature of a radiating body increases by 30%. Then, the increase in the amount of radiation emitted will be approximately

(A) 185% (B) 285% (C) 325% (D) 245% (E) 130%

(Space for rough work)

91. Two beakers A and B are filled to the brim with water at 4°C. When A is heated and B is cooled, the water

(A) level in B decreases (B) will overflow in A only
(C) will overflow in B only (D) level in A decreases
(E) will overflow in both A and B

92. If a body oscillates at the angular frequency ω_d of the driving force, then the oscillations are called

(A) free oscillations (B) coupled oscillations
(C) forced oscillations (D) maintained oscillations
(E) damped oscillations

93. If the length of a seconds pendulum is increased by 2%, then in a day the pendulum

(A) loses 764 s (B) loses 924 s (C) gains 236 s
(D) loses 864 s (E) gains 346 s

94. If the phase difference between two sound waves of wavelength λ is 60°, the corresponding path difference is

(A) $\frac{\lambda}{6}$ (B) $\frac{\lambda}{2}$ (C) 2λ (D) $\frac{\lambda}{4}$ (E) $\frac{6}{\lambda}$

(Space for rough work)

95. A sonometer wire supports a 4 kg load and vibrates in fundamental mode with a tuning fork of frequency 416 Hz. The length of the wire between the bridges is now doubled. In order to maintain fundamental mode, the load should be changed to

(A) 1 kg (B) 2 kg (C) 4 kg (D) 8 kg (E) 16 kg

96. The total electric flux through a cube when a charge '$8q$' is placed at one corner of the cube is

(A) $\varepsilon_0 q$ (B) $\frac{\varepsilon_0}{q}$ (C) $4\pi\varepsilon_0 q$ (D) $\frac{q}{4\pi\varepsilon_0}$ (E) $\frac{q}{\varepsilon_0}$

97. An uniform electric field E exists along positive x-axis. The work done in moving a charge 0.5 C through a distance 2 m along a direction making an angle 60° with x-axis is 10 J. Then the magnitude of electric field is

(A) 5 Vm^{-1} (B) 2 Vm^{-1} (C) $\sqrt{5}$ Vm^{-1} (D) 40 Vm^{-1} (E) 20 Vm^{-1}

(Space for rough work)

98. A capacitor of capacitance C is charged to a potential V. If it carries a charge Q, then the energy stored in it is

(A) $\frac{1}{2}CV$ (B) QV (C) $\frac{1}{2}QV^2$ (D) CV^2 (E) $\frac{1}{2}QV$

99. In a thermocouple, which of the following statements is not true?

(A) Neutral temperature depends upon the nature of materials in the thermocouple

(B) Temperature of inversion depends upon the temperature of cold junction

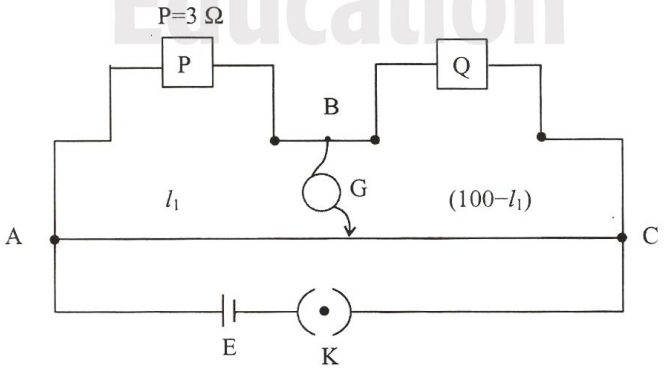
(C) When the temperature of the hot junction is equal to the temperature of inversion, the thermo emf becomes zero

(D) When the temperature of cold junction increases, the temperature of inversion also increases

(E) When the temperature of hot junction increases beyond the temperature of inversion the thermo emf increases in the opposite direction

(Space for rough work)

100. In a metre bridge experiment, resistances are connected as shown in figure. The balancing length l_1 is 55 cm. Now an unknown resistance x is connected in series with P and the new balancing length is found to be 75 cm. The value of x is



(A) $\frac{54}{13}\Omega$ (B) $\frac{20}{11}\Omega$ (C) $\frac{48}{11}\Omega$ (D) $\frac{11}{48}\Omega$ (E) 5Ω

(Space for rough work)

101. An electric bulb rated 220 V, 100 W is connected in series with another bulb rated 220 V, 60 W. If the voltage across the combination is 220 V, the power consumed by the 100 W bulb will be about

(A) 25 W (B) 14 W (C) 60 W (D) 100 W (E) 80 W

102. The relative permeability of iron is 6000. Its magnetic susceptibility is

(A) 5999 (B) 6001 (C) 6000×10^{-7} (D) 6000×10^{7} (E) 60

103. A galvanometer can be converted into an ammeter by connecting

(A) a high resistance in parallel

(B) a very small resistance in series

(C) a very small resistance in parallel

(D) a high resistance in series

(E) a low resistance in series

(Space for rough work)

104. The magnetic Lorentz force experienced by a charge q, entering a magnetic field B with a velocity v is

(A) $\sqrt{q}$ (B × v) (B) q (B × v) (C) q (v . B)

(D) q^2 (v × B) (E) q (v × B)

105. In a pure inductive a.c. circuit

(A) current leads the voltage by $\frac{\pi}{2}$

(B) current lags behind the voltage by $\frac{\pi}{2}$

(C) voltage lags behind the current by π

(D) current and voltage are in phase

(E) current lags behind the voltage by π

106. The power dissipated in an a.c. circuit is zero if the circuit is

(A) purely resistive

(B) purely inductive only

(C) either purely inductive or purely capacitive

(D) purely capacitive only

(E) LCR circuit

(Space for rough work)

107. Eddy current loss in a transformer is reduced by

(A) having a laminated core
(B) using thick wires
(C) using material with low hysteresis loss
(D) winding primary and secondary coils one over the other
(E) using iron core

108. The average electric field of electromagnetic waves in certain region of free space is 9×10^{-4} NC^{-1}. Then the average magnetic field in the same region is of the order of

(A) 27×10^{-4} T (B) 3×10^{-12} T (C) $\left(\frac{1}{3}\right) \times 10^{-12}$ T

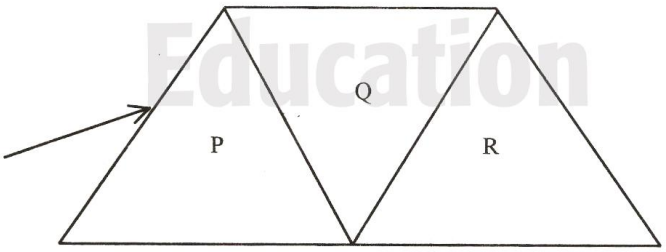
(D) 3×10^{12} T (E) $\left(\frac{1}{3}\right) \times 10^{12}$ T

109. When sunlight is scattered by atmospheric atoms and molecules, the amount of scattering of light of wavelength 440 nm is A. The amount of scattering for the light of wavelength 660 nm is approximately

(A) $\frac{4}{9}$ A (B) 2.25 A (C) 1.5 A (D) 0.66 A (E) $\frac{A}{5}$

(Space for rough work)

110. A ray of light suffers minimum deviation in equilateral prism P. Additional prisms Q and R of identical shape and of same material as that of P are now combined as shown in figure. The ray will now suffer



(A) greater deviation
(B) no deviation
(C) same deviation as before
(D) total internal reflection
(E) smaller deviation

111. In the measurement of the angle of a prism using a spectrometer, the readings of first reflected image are Vernier I : $320^{\circ}\ 40'$; Vernier II : $140^{\circ}\ 30'$ and those of the second reflected image are Vernier I : $80^{\circ}\ 38'$; Vernier II : $260^{\circ}\ 24'$. Then the angle of the prism is

(A) $59^{\circ}\ 58'$ (B) $59^{\circ}\ 56'$ (C) $60^{\circ}\ 2'$ (D) $60^{\circ}\ 4'$ (E) $60^{\circ}\ 0'$

(Space for rough work)

112. λ_e, λ_p and λ_α are the de Broglie wavelengths of electron, proton and α particle. If all are accelerated by same potential, then

(A) $\lambda_e < \lambda_p < \lambda_\alpha$ (B) $\lambda_e < \lambda_p > \lambda_\alpha$ (C) $\lambda_e > \lambda_p < \lambda_\alpha$

(D) $\lambda_e = \lambda_p > \lambda_\alpha$ (E) $\lambda_e > \lambda_p > \lambda_\alpha$

113. The SI unit for activity of a radioactive substance is

(A) Curie (B) Becquerel (C) Roentgen (D) Fermi (E) Rutherford

114. Pick out the unmatched pair from the following

(A) Moderator – Heavy water

(B) Nuclear fuel – $_{92}U^{235}$

(C) Pressurized water reactor – Water as the heat exchange system

(D) Safety rods – Carbon

(E) Reactor is critical – Multiplication factor is unity

115. In an NPN transistor, 108 electrons enter the emitter in 10^{-8}s. If 1% electrons are lost in the base, the fraction of current that enters the collector and current amplification factor are respectively

(A) 0.8 and 49 (B) 0.9 and 90 (C) 0.7 and 50

(D) 0.99 and 99 (E) 0.88 and 88

(Space for rough work)

116. If the two inputs of a NAND gate are shorted, the gate is equivalent to

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

117. The diode used as voltage regulator is

(A) photodiode (B) light emitting diode (C) Zener diode
(D) p-n junction diode (E) laser diode

118. The modulation in which pulse duration varies in accordance with the modulating signal is called

(A) PAM (B) PPM (C) PWM
(D) PCM (E) PFM

119. The height of a geostationary satellite is

(A) 1000 km (B) 32000 km (C) 36000 km
(D) 850 km (E) 38000 km

120. Which of the following has/have zero average value in a plane electromagnetic wave?

(A) Both magnetic and electric fields
(B) Electric field only
(C) Magnetic field only
(D) Magnetic energy
(E) Electric energy

(Space for rough work)

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