Deeksha

ABHYAS KCET 2024

FREE TEST SERIES

MOCK TEST 4

PDF

QUESTION PAPER

Deeksha - CET

Subject	Topic	
C + M + P	Complete Syllabus	

Max. Marks: 180 **Duration: 3 Hours**

1. **This paper consists of 180 questions with 3 parts of Chemistry, Mathematics and Physics**

   - **Chemistry:** *(Q. No. 1 to 60) Multiple Choice Questions with one correct answer. A correct answer carries 1 Mark. No Negative marks.*
   - **Mathematics:** *(Q. No. 61 to 120) Multiple Choice Questions with one correct answer. A correct answer carries 1 Mark. No Negative marks.*
   - **Physics:** *(Q. No. 121 to 180) Multiple Choice Questions with one correct answer. A correct answer carries 1 Mark. No Negative marks.*

2. **The OMR sheet for 200 questions is to be used**

3. **Use of calculators and log tables is prohibited**

4. **Darken the appropriate bubble using a pen in the OMR sheet provided to you. Once entered, the answer cannot be changed. Any corrections or modifications will automatically draw a penalty of 1 mark**

5. **No clarification will be entertained during the examination. Doubts in the paper can be reported to the coordinator after the exam**

6. **If the details in the OMR Sheet are not filled, If the OMR sheet is mutilated, torn, white Ink used, the circles filled and scratched, then the OMR sheet will not be graded**

All the best!!

Useful Data

At. Wt.:

$N = 14;\ O = 16;\ H = 1;\ S = 32;\ Cl = 35.5;\ Mn = 55;\ Na = 23;\ C = 12;\ Ag = 108;\ K = 39;\ Fe = 56;\ Pb = 207$

Physical Constants:

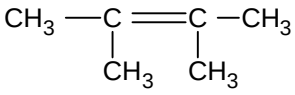
$h = 6.626 \times 10^{-34}\,\text{Js},\ \text{N}_\text{a} = 6.022 \times 10^{23}\,\text{mol}^{-1},\ \text{c} = 2.998 \times 10^{8}\,\text{m s}^{-1},\ \text{m}_\text{e} = 9.1 \times 10^{-31}\,\text{kg},\ R = 8.314\ \text{J mol}^{-1}\ \text{K}^{-1}$

Chemistry

Multiple Choice Questions with one correct answer. A correct answer carries 1 mark. No negative mark. **60 x 1 = 60**

1. Hyper – conjugation is not possible in

   (a) $CH_3-CH=CH_2$ (b) $CH_2=CH_2$

   (c) $CH_3-\overset{+}{C}H-CH_3$ (d) 

2. When hydrogen chloride gas is treated with propene in presence of benzoyl peroxide, it gives

   (a) 2 – Chloropropane (b) Allyl chloride (c) no reaction (d) 1 – Chloropropane

3. Which of the following compounds has highest boiling point?

   (a) $CH_3CH_2CH_2Cl$ (b) $CH_3CH_2CH_2CH_2Cl$

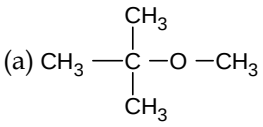
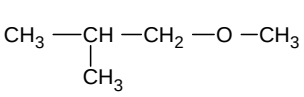
   (c) $CH_3CH(CH_3)CH_2Cl$ (d) $(CH_3)_3CCl$

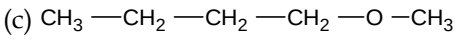
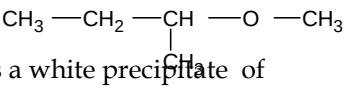
4. Which one of the following forms propane nitrile as the major product?

   (a) ethyl bromide + alcoholic KCN (b) propyl bromide + alcoholic KCN

   (c) propyl bromide + alcoholic $AgCN$ (d) ethyl bromide + alcoholic $AgCN$

5. Among following ethers, which one will produce methyl alcohol on treatment hot concentrated HI ?

   (a)  (b) 

   (c)  (d) 

6. Phenol when treated with excess of bromine water gives a white precipitate of

   (a) 2, 4, 6 – tribromophenol (b) o – bromophenol

   (c) p – bromophenol (d) bromobenzene

7. Vapours of an alcohol X when passed over hot reduced copper, produce an aldehyde, the alcohol is

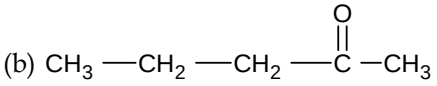
   (a) primary alcohol (b) secondary alcohol (c) tertiary alcohol (d) dihydric alcohol

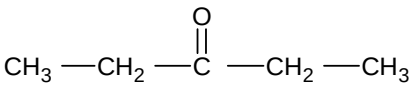
8. Benzoquinone is produced by reaction of phenol with

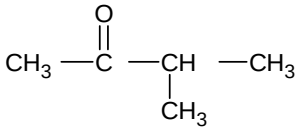
   (a) $Na_2Cr_2O_7$, H_2SO_4 (b) $KMnO_4$, H_2SO_4 (c) Na_2CrO_4, HCl (d) K_2MnO_4, H_2SO_4

9. Which of the following is the most reactive isomer?

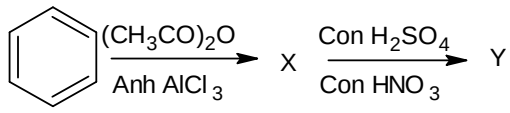
   (a) $CH_3-CH_2-CH_2-CH_2-CHO$

   (b) 

   (c) 

   (d) 

10. Identify the products (X) and (Y) in the given reaction:



(a) X : Acetophenone Y : $m-$Nitroacetophenone

(b) X : Toluene Y : $p-$Nitrotoluene

(c) X : Acetophenone Y : o and p Nitroacetophenone

(d) X : Benzaldehyde Y : $m-$ Nitrobenzaldehyde

11. Which of the following compounds undergo Cannizzaro reaction?

(a) CH_3CHO (b) CH_3COCH_3 (c) C_6H_5CHO (d) $C_6H_5CH_2CHO$

12. Which of the following compounds would have the smallest value for pKa ?

(a) $CHF_2CH_2CH_2COOH$ (b) $CH_3CH_2CF_2COOH$ (c) $CH_2FCHFCH_2COOH$ (d) $CH_3CF_2CH_2COOH$

13. Which of the following amines does not react with Hinsberg reagent?

(a) $CH_3CH_2-NH_2$ (b) $CH_3-NH-CH_3$ (c) $(CH_3)_3N$ (d) $CH_3CH_2CH_2-NH_2$

14. The action of nitrous acid on an aliphatic primary amine gives

(a) secondary amine (b) nitroalkanes (c) alcohol (d) alkyl nitrite

15. Which of the following orders is true regarding the basic nature of $-NH_2$ group?

(a) $O-$Toluidine $>$aniline $>O-$nitroaniline (b) $O-$Toluidine $<$aniline $>O-$nitroaniline

(c) $O-$Toluidine $>$aniline $<O-$nitroaniline (d) $O-$Toluidine $>$aniline $<O-$nitroaniline

16. The anomeric carbon in $D(+)$glucose is

(a) $C-1$carbon (b) $C-2$ carbon (c) $C-5$carbon (d) $C-6$ carbon

17. In fibrous proteins, polypeptide chains are held together by

(a) Vander Waal's forces (b) electrostatic forces of attraction

(c) hydrogen bonds (d) covalent bonds

18. A unit in nucleic acid which contains base sugar – phosphate unit is called

(a) nucleotide (b) nucleoside (c) phosphotide (d) polypeptide

19. Which of the following complex has minimum magnitude of Δ_0 ?

(a) $\left[Cr(CN)_6\right]^{3-}$ (b) $\left[Co(NH_3)_6\right]^{3+}$ (c) $[CoCl_6]^{3-}$ (d) $\left[Cr(H_2O)_6\right]^{3+}$

20. The two isomers X and Y with the formula $Cr(H_2O)_5ClBr_2$ were taken for experiment on depression in freezing point. It was found that one mole of X gave depression corresponding to 2 moles of particles and one mole of Y gave depression due to 3 moles of particles. The structural formula of X and Y respectively are

Options:

(a) $\left[Cr(H_2O)_5Cl\right]Br_2$ $\left[Cr(H_2O)_4Br_2\right]Cl.H_2O$ (b) $\left[Cr(H_2O)_5Cl\right]Br_2$ $\left[Cr(H_2O)_3Cl\ Br_2\right]2H_2O$

(c) $\left[Cr(H_2O)_5Br\right]BrCl$ $\left[Cr(H_2O)_4ClBr\right]Br.H_2O$ (d) $\left[Cr(H_2O)_4Br_2\right]Cl.H_2O$ $\left[Cr(H_2O)_5Cl\right]Br_2$

21. Platinum dissolves in aqua regia to form

(a) $PtCl_4$ (b) H_2PtCl_6 (c) $Pt(NO_3)_4$ (d) $\left[PtCl_2(NO_3)_2\right]$

22. In $Fe(CO)_5$ the $Fe \leftarrow CO$ σ bond results by the overlap between filled sp hybrid orbital of $C-$atom of CO molecule and vacant

(a) d^2sp^3 hybrid orbitals of Fe (b) sp^3 hybrid orbitals of Fe

(c) dsp^3 hybrid orbitals of Fe (d) dsp^2 hybrid orbitals of Fe

23. The acidic, basic and amphoteric nature of Mn_2O_7, V_2O_5 and CrO are respectively

(a) Acidic, acidic and basic (b) Basic, amphoteric and basic

(c) Acidic, amphoteric, basic (d) Acidic, basic, amphoteric

24. The catalytic activity of transition metals and their compounds is mainly due to

(a) their ability to adopt variable oxidation state (b) their chemical reactivity

(c) their magnetic behavior (d) their unfilled $d-$orbitals

25. The titanium (atomic number 22) compound that does not exist as

(a) TiO (b) TiO_2 (c) K_2TiF_6 (d) K_2TiO_4

26. For which one of the following metals, the standard potential $\left(E^{\circ}_{M^{2+}/M}\right)$ value has a positive sign?

(a) $Cu(Z=29)$ (b) $Fe(Z=26)$ (c) $Co(Z=27)$ (d) $Ni(Z=28)$

27. Which of the following statement is wrong?

(a) In highest oxidation states, the transition metals show acidic character.

(b) Metals in highest oxidation states are more stable in oxides than in fluorides.

(c) Mn^{3+} and Co^{3+} are oxidation agents in aqueous solution

(d) All elements of 3d series exhibit variable oxidation states.

28. The incorrect statement in respect to Chromyl chloride test is

(a) Formation of red vapours (b) Formation of lead chromate

(c) Formation of Chromyl chloride (d) Liberation of Chlorine

29. The species having tetrahedral shape is:

(a) $\left[PdCl_4\right]^{2-}$ (b) $\left[Ni(CN)_4\right]^{2-}$ (c) $\left[Pd(CN)_4\right]^{2-}$ (d) $\left[NiCl_4\right]^{2-}$

30. According to crystal field theory, the M–L bond in a complex is

(a) Purely ionic (b) purely covalent

(c) purely co-ordinate (d) partially covalent

31. Activation energy (E_a) and rate constant $(k_1$ and $k_2)$ for a chemical reaction at two different temperatures T_1 and T_2 are related by:

(a) $\ln\frac{k_2}{k_1}=\frac{E_a}{2.303R}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$ (b) $\ln\frac{k_2}{k_1}=+\frac{E_a}{R}\left(\frac{1}{T_2}-\frac{1}{T_1}\right)$

(c) $\ln\frac{k_2}{k_1}=-\frac{E_a}{R}\left(\frac{1}{T_2}+\frac{1}{T_1}\right)$ (d) $\ln\frac{k_2}{k_1}=\frac{E_a}{R}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$

32. The cathode reaction in the dry cell will be

(a) $Zn(s) \rightarrow Zn^{+2} + 2e^-$ (b) $MnO_2 + NH_4^+ + e^- \rightarrow MnO(OH) + NH_3$

(c) $Zn(Hg) + 2OH^- \rightarrow ZnO(s) + H_2O + 2e^-$ (d) $MnO(OH) + NH_3 \rightarrow MnO_2 + NH_4^+ + 2e^-$

33. Which of the following aqueous solution has the highest freezing point?

(a) 0.01 M NaCl (b) 0.01 M Na_2SO_4 (c) 0.1 M Sucrose (d) 0.1 M NaCl

34. The rate of the reaction

$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$ is given by the equation.

$\text{rate} = k[CH_3COOC_2H_5][NaOH]$

The unit of rate constant is

(a) $\text{mol}^{-2}L^2S^{-1}$ (b) $\text{mol}\,L^{-1}S^1$ (c) $L\,\text{mol}^{-1}S^{-1}$ (d) S^{-1}

35. The half-life of the first order reaction $X \rightarrow Y$ with the initial concentration of X to be $0.01\text{mol}\,L^{-1}$ and initial rate to be $0.00352\,\text{mol}\,L^{-1}\,\text{min}^{-1}$ will be

(a) 19.68 min (b) 1.968 min (c) 77.5 min (d) 7.7 min

36. For a reaction $P + Q \rightarrow 2R + S$, which of the following statements are incorrect?

(a) rate of disappearance of P = rate of appearance of S

(b) rate of disappearance of $Q = 2\times$ rate of appearance of R

(c) rate of disappearance of P = rate of appearance of R

(d) rate of disappearance of $Q = \frac{1}{2}\times$ rate of appearance of R

37. What will be the rate equation for the reaction $2X + Y \rightarrow Z$, if the order of the reaction is zero?

(a) rate $= k[X][Y]$ (b) rate $= k$

(c) rate $= k[X]^\circ[Y]$ (d) rate $= k[X][Y]^\circ$

38. Which of the following is not an application of electrochemical series?

(a) to compare the relative oxidising and reducing power of substances

(b) to predict evolution of hydrogen gas on reaction of metal with acid

(c) to predict spontaneity of a redox reaction

(d) to calculate the amount of metal deposited on cathode

39. The reduction potential for the following half-cell reaction at $298\,K$?

$\left(\text{given}: \left[Ag^+\right] = 0.1\text{M and } E^\circ_{\text{cell}} = +0.80\,\text{V}\right)$

(a) 0.741 V (b) 0.80 V (c) –0.80 V (d) –0.741 V

40. Henry's law constant for molality of methane in benzene at $298\,K$ is 4.27×10^5 mm Hg. The mole fraction of methane in benzene at $298\,K$ under 760 mm Hg is

Options:

(a) 1.78×10^{-3} (b) 17.43 (c) 0.114 (d) 2.814

41. What is the mole fraction of ethanol in the vapour phase, if the solution contains equimolar mixture of ethanol and methanol? Given($P^{\circ}_{ethanol} = 90$ mm of Hg , $P^{\circ}_{methanol} = 46$ mm of Hg)

Options:

(a) 0.34 (b) 0.5 (c) 0.66 (d) 0.8

42. Which of the following solution exhibits highest boiling point?

(a) 0.1m urea solution (b) 1m urea solution (c) 0.01m urea solution (d) 0.001m urea solution

43. Which of the following is more stronger acid than phenol?

(a) Ethanol (b) Phenylethanol (c) $p-$ Nitrophenol (d) $p-$ Cresol

44. The arrangement of following compounds:

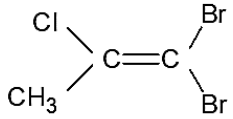
(i) bromomethane (ii) bromoform (iii) chloromethane (iv) dibromomethane

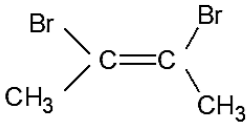
(a) IV < III < I < II (b) I < II < III < IV (c) III < I < IV < II (d) II < III < I < IV

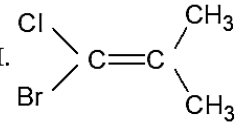
45. A compound 'A' when treated with HNO_3 (in presence of H_2SO_4) gives compound B, which is then reduced with Sn and HCl to aniline. The compound 'A' is

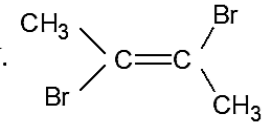
(a) Toluene (b) Benzene (c) Ethane (d) Acetamide

46. Which is a pair of geometrical isomers?

I. 

II. 

III. 

IV. 

(a) I and II (b) I and III (c) II and IV (d) III and IV

47. For the reaction, $CO_{(g)} + Cl_{2(g)} \leftrightarrows COCl_{2(g)}$ the value of Kp / Kc is equal to

(a) 1.0 (b) RT (c) $\sqrt{RT}$ (d) $\frac{1}{RT}$

48. The solubility product of MgF_2 is 7.4×10^{-11} calculate the solubility of MgF_2 in 0.1M NaF solution

(a) 7.4×10^{-9} (b) 3.7×10^{-9} (c) 3.7×10^{-11} (d) 7.4×10^{-11}

49. A sample of pure compound contains 1.15g of sodium, 3.1×10^{22} atoms of carbon and 0.1mole of oxygen atom. Its empirical formula is

(a) Na_2CO_3 (b) $NaCO_2$ (c) Na_2CO (d) Na_2CO_2

50. Which of the following sets of quantum numbers is not possible?

(a) $n = 4,\ l = 1,\ m = 0,\ s = +\frac{1}{2}$ (b) $n = 4,\ l = 3,\ m = 3,\ s = -\frac{1}{2}$

(c) $n = 4,\ l = 1,\ m = +2,\ s = -\frac{1}{2}$ (d) $n = 4,\ l = 0,\ m = 0,\ s = -\frac{1}{2}$

51. Which of the following element is expected to have highest electron affinity?

(a) $1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^5$ (b) $1S^2\ 2S^2\ 2P^3$ (c) $1S^2\ 2S^2\ 2P^4$ (d) $1S^2\ 2S^2\ 2P^5$

52. Which of the following compound has $\mu = 0$?

(a) CCl_4 (b) $CHCl_3$ (c) HF (d) NH_3

53. Which of the following relationships is true?

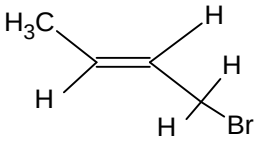
(a) Bond dissociation energy of O_2 and O_2^- are same

(b) Bond dissociation energy of O_2^+ is higher that O_2

(c) Bond dissociation energy of O_2^- and O_2^{2-} are same

(d) Bond dissociation energy of O_2^{2-} is higher than O_2^-

54. IUPAC name of the compound



(a) Bromo butene (b) 1-Bromobut-2-ene (c) 1-Bromobut-3-ene (d) 2-Bromo-2-butene

55. What will be the heat of reaction for the following reaction? Will the reaction be exothermic or endothermic?

$Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_2O$

$\Delta H_f^\circ (H_2O) = -285.83\,kJ\,mol^{-1}$

$\Delta H_f^\circ (Fe_2O_3) = -824.2\,kJ\,mol$

(a) $-824.2\,kJ$, exothermic (b) $+33.3$, kJ endothermic

(c) -33.3, kJ exothermic (d) $+824.2$ kJ, endothermic

56. Which of the following statements is not correct

(a) For a spontaneous process, ΔG° must be negative

(b) Enthalpy, entropy, free energy etc are state variables

(c) A spontaneous process is reversible in nature

(d) Total of all possible kinds of energy of a system is called internal energy

57. Oxidation number of Sulphur in peroxomonosulphuric acid (H_2SO_5) is

(a) $+4$ (b) $+2$ (c) $+6$ (d) -2

58. What is the reaction given below called?

$H_2O(l) + H_2O(l) \leftrightarrows H_3O^+(aq) + OH^-(aq)$

(a) hydrolysis of water (b) hydration of water

(c) disproportionation of water (d) auto – protolysis of water

59. The No. of electrons present in 18 mL of water is

(a) 6.02×10^{25} (b) 6.02×10^{23} (c) 6.02×10^{24} (d) None of these

60. The scientific notation of 0.0000000540 is

(a) 5.40×10^{-7} (b) 5.40×10^{-8} (c) 54.0×10^{-7} (d) 54.0×10^{-8}

Mathematics

Multiple Choice Questions with one correct answer. A correct answer carries 1 mark. No negative mark. **60 x 1 = 60**

61. The value of $\left(z^2+5z\right)^2+z(z+5)$ when $z=\frac{-5+\sqrt{3}i}{2}$ is

(a) 42 (b) 49 (c) 53 (d) 60

62. If $5\le x\le 8$, then

(a) $(x-5)(x-8)\ge 0$ (b) $(x-5)(x-8)>0$ (c) $(x-5)(x-8)\le 0$ (d) $(x-5)(x-8)<0$

63. If $\cos(\alpha+\beta)=\frac{4}{5}$ and $\sin(\alpha-\beta)=\frac{5}{13}$, where $0\le\alpha,\beta\le\frac{\pi}{4}$, then $\tan 2\alpha$ is equal to

(a) $\frac{25}{16}$ (b) $\frac{56}{33}$ (c) $\frac{19}{12}$ (d) $\frac{20}{7}$

64. If $\sin\theta=\frac{21}{29}$ and θ lies in the second quadrant, then the value of $\sec\theta+\tan\theta$ is

(a) $\frac{2}{5}$ (b) $\frac{5}{2}$ (c) $-\frac{2}{5}$ (d) $-\frac{5}{2}$

65. $\tan\left(\frac{\pi}{4}+\theta\right)\tan\left(\frac{3\pi}{4}+\theta\right)$ is equal to

(a) -2 (b) -1 (c) 1 (d) None of these

66. The value of $\left(1+\cos\frac{\pi}{6}\right)\left(1+\cos\frac{\pi}{3}\right)\left(1+\cos\frac{2\pi}{3}\right)\left(1+\cos\frac{7\pi}{6}\right)$ is

(a) $\frac{3}{16}$ (b) $\frac{3}{8}$ (c) $\frac{3}{4}$ (d) $\frac{1}{2}$

67. If $\tan\theta=\operatorname{cosec}2\theta-\sin 2\theta$, then the value of $\tan^2\theta$ is equal to

(a) $2-\sqrt{5}$ (b) $-2+\sqrt{5}$ (c) $\frac{9+4\sqrt{5}}{2-\sqrt{5}}$ (d) None of these

68. If the sum of an infinite geometric series is $\frac{4}{3}$ and its 1st term is $\frac{3}{4}$, then its common ratio is

(a) $\frac{7}{16}$ (b) $\frac{9}{16}$ (c) $\frac{1}{9}$ (d) $\frac{7}{9}$

69. If $C(12,4)+C(12,5)=C(n,5)$, then n is equal to

(a) 11 (b) 13 (c) 12 (d) None of these

70. The straight lines $x+y=0$, $3x+y-4=0$, $x+3y-4=0$ form a triangle which is

(a) isosceles (b) equilateral (c) right angled (d) None of these

71. The parabolas $x^2=4y$ and $y^2=4x$ intersect

(a) in a unique point (b) on the line $y=x$ (c) on the line $x+y=0$ (d) none of these

72. Which of the following is not a measure of dispersion?

(a) Mean (b) Variance (c) Mean deviation (d) Range

73. A man speaks truth in 75% cases. He throws a dice and reports that it is a six. The probability that it is actually a six is

(a) $\frac{3}{8}$ (b) $\frac{1}{5}$ (c) $\frac{3}{24}$ (d) None of these

74. A team of 8 married couples attend a party at which four persons are chosen for a prize. The chance that the selected persons are of the same sex is

(a) $\frac{^8C_4}{^{16}C_4}$ (b) $\frac{2\times{}^8C_4}{^{16}C_4}$

(c) $\frac{^{16}C_1\times{}^{14}C_1\times{}^{12}C_1\times{}^{10}C_1}{^{16}C_4}$ (d) None of these

75. For two events A and B, if $P(A)=P\left(\frac{A}{B}\right)=\frac{1}{4}$ and $P\left(\frac{B}{A}\right)=\frac{1}{2}$, then

(a) A and B are independent events (b) $P\left(\frac{A'}{B}\right)=\frac{3}{4}$

(c) $P\left(\frac{B'}{A}\right)=\frac{1}{2}$ (d) All of these

76. If A and B are two independent events such that $P(A)=\frac{1}{2}$ and $P(B)=\frac{1}{3}$, then P (neither A nor B)is equal to

(a) $\frac{2}{3}$ (b) $\frac{1}{6}$ (c) $\frac{5}{6}$ (d) $\frac{1}{3}$

77. Three numbers are chosen at random from 1 to 20. The probability that they are consecutive is

Options:

(a) $\frac{3}{190}$ (b) $\frac{1}{60}$ (c) $\frac{1}{57}$ (d) None of these

78. The domain of the function $f(x)=\frac{x^2-x+1}{x^2+x+1}$ is

(a) $\mathbf{R}-\{-1\}$ (b) $\mathbf{R}-\{0,-1\}$ (c) $\mathbf{R}$ (d) None of these

79. The range of the function $f(x)=x+\frac{1}{x},\ x\neq 0$ is

(a) $[2,\infty)$ (b) $(-\infty,-2]$ (c) $(-\infty,-2]\cup[2,\infty)$ (d) None of these

80. If $f(x)=1-\frac{1}{x}$, then $f\left(f\left(\frac{1}{x}\right)\right)$ is

(a) $\frac{1}{x}$ (b) $\frac{1}{1+x}$ (c) $\frac{x}{x-1}$ (d) $\frac{1}{x-1}$

81. If $f(x)=x^2+3x$ and $A=\{x\in R: f(x)=f(2x)\}$ then A is

(a) $\{0,-1\}$ (b) $\{1,-4\}$ (c) $\{0,1,-1\}$ (d) None of these

82. If $f(x)=\begin{cases}2x-3, x\geq 2\\ x, x<2\end{cases}$ then $f(2)$ is equal to

(a) $2f(2)$ (b) $f(1)$ (c) $-f(2)$ (d) $\frac{1}{2}f(2)$

83. The vector $2\hat{i}+\hat{j}-\hat{k}$ is perpendicular to $\hat{i}-4\hat{j}-\lambda\hat{k}$, if λ is equal to

(a) 0 (b) –1 (c) 2 (d) –3

84. If $\hat{a}$ and $\hat{b}$ are two unit vectors inclined at an angle 60° to each other, then which one of the following is correct?

(a) $|a+b|<1$ (b) $|a+b|>1$ (c) $|a-b|<1$ (d) $|a-b|>1$

85. The area of the parallelogram, whose diagonals are given by the vectors $3\hat{i}+\hat{j}-2\hat{k}$ and $\hat{i}-3\hat{j}+4\hat{k}$, is

(a) $10\sqrt{3}$ (b) $5\sqrt{3}$ (c) 8 (d) 4

86. A line makes the same angle θ with each of the X and $Z-axes$. If it makes the angle β and $Y-axies$ such that $\sin^2\beta=3\sin^2\theta$, then $\cos^2\theta$ equals

(a) 3/5 (b) 1/5 (c) 2/5 (d) 2/3

87. The lines $\frac{x-1}{1}=\frac{y-1}{2}=\frac{z-3}{0}$ and $\frac{x-2}{0}=\frac{y-3}{0}=\frac{z-4}{1}$ are

(a) parallel (b) coincident (c) skew (d) perpendicular

88. The angle between the lines $x=1, y=2$ and $y=-1, z=0$ is

(a) 30° (b) 60° (c) 90° (d) 0°

89. $\underset{x\to 0}{Lt}\frac{(1+x)^8-1}{(1+x)^2-1}$ is equal to

(a) 8 (b) 6 (c) 4 (d) 2

90. $\underset{x\to\frac{\pi}{4}}{Lt}\frac{\cot 2x}{\tan\left(\frac{\pi}{4}-x\right)}$ is equal to

(a) 0 (b) –2 (c) 2 (d) None of these

91. $\underset{x\to 0}{Lt}\, x[x]$ is equal to

(a) 0 or 1 (b) 0 or –1 (c) 0 (d) does not exist

92. $\frac{d}{dx}\left(x\sqrt{a^2-x^2}+a^2\sin^{-1}\left(\frac{x}{a}\right)\right)$ is equal to

(a) $\sqrt{a^2-x^2}$ (b) $2\sqrt{a^2-x^2}$ (c) $\frac{1}{\sqrt{a^2-x^2}}$ (d) None of these

93. $\frac{d}{dx}\left[\log\left\{e^x\left(\frac{x-2}{x+2}\right)^{3/4}\right\}\right]$ equals

(a) $\frac{x^2-1}{x^2-4}$ (b) 1 (c) $\frac{x^2+1}{x^2-4}$ (d) $e^x\left(\frac{x^2-1}{x^2-4}\right)$

94. If $y=\log\left(\sqrt{x}+\sqrt{x-a}\right)$, then $\frac{dy}{dx}$ is equal to

(a) $\frac{1}{\sqrt{x}+\sqrt{x-a}}$ (b) $\frac{1}{2\sqrt{x}\sqrt{x-a}}$ (c) $\frac{1}{\sqrt{x}\sqrt{x-a}}$ (d) None of these

95. If $x=a(\cos\theta+\theta\sin\theta)$, $y=a(\sin\theta-\theta\cos\theta)$, then $\frac{d^2y}{dx^2}=$

(a) $\frac{\sec^3\theta}{a\theta}$ (b) $\frac{\sec^2\theta}{\theta}$ (c) $a\theta\cos^2\theta$ (d) $\frac{\sec^2\theta}{a}$

96. Let $F(x)=\begin{cases}3x-4 \text{ for } 0\le x\le 2\\ 2x+\lambda \text{ for } 2<x\le 3\end{cases}$. If $F(x)$ is continuous at $x=2$, then $\lambda=$

(a) -2 (b) -1 (c) 0 (d) 2

97. The function $f(x)=[x]$ is

(a) derivable for all x (b) continuous for all x

(c) a constant function (d) discontinuous only for integral x

98. The function $f(x)=x^2-2x$ is increasing in the interval

(a) $x\neq -1$ (b) $x\ge -1$ (c) $x\neq 1$ (d) $x\ge 1$

99. The smallest value of the polynomial x^3-18x^2+96x in the interval $[0,9]$ is

(a) 126 (b) 0 (c) 135 (d) 160

100. If $f(x)=kx-\cos x$ is monotonically increasing for all $x\in R$, then

(a) $k>1$ (b) $k<1$ (c) $k>-1$ (d) None of these

101. Let x, y be two variables and $x>0$, $xy=1$, then minimum value of $x+y$ is

(a) 1 (b) 2 (c) $2\frac{1}{2}$ (d) $3\frac{1}{3}$

102. The graph of the inequality $2x+3y>6$ is

(a) half plane that contains the origin

(b) half plane not containing the origin excluding the points on the line $2x+3y=6$

(c) whole XOY-plane excluding the points on the line $2x+3y=6$

(d) none of these

103. If $P=\left\{\theta:\sin\theta-\cos\theta=\sqrt{2}\cos\theta\right\}$ and $Q=\left\{\theta:\sin\theta+\cos\theta=\sqrt{2}\sin\theta\right\}$ are two sets. Then,

(a) $P\subset Q$ and $Q-P\neq\phi$ (b) $Q\not\subset P$ (c) $P\not\subset Q$ (d) $P=Q$

104. $\int\frac{1}{\sqrt{1-x}}dx$ is equal to

(a) $\sqrt{1-x}$ (b) $-2\sqrt{1-x}$ (c) $2\sqrt{1-x}$ (d) None of these

105. $\int\frac{1-\tan^2 x}{1+\tan^2 x}dx$ is equal to

(a) $\sin 2x$ (b) $\frac{\sin 2x}{2}$ (c) $-\frac{\sin 2x}{2}$ (d) None of these

106. $\int \frac{1}{e^x + e^{-x}} dx$ is equal to

(a) $\log\left(e^x + e^{-x}\right) + C$ (b) $\log\left(e^{2x} + 1\right) + C$

(c) $\tan^{-1}\left(e^x\right) + C$ (d) None of these

107. $\int (x-1)e^{-x} dx$ is equal to

(a) $xe^{-x} + C$ (b) $-xe^{-x} + C$ (c) $(x-1)e^{-x} + C$ (d) None of these

108. $\int_0^{\pi/2} \frac{dx}{1+\tan^n x}$ is equal to

(a) 0 (b) 1 (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

109. If $\int_0^{\pi/2} \frac{\cos x}{4 - \sin^2 x} dx = \lambda \log 3$ then λ is equal to

(a) $\frac{1}{4}$ (b) $-\frac{1}{4}$ (c) $\frac{1}{2}$ (d) None of these

110. $\int_0^1 \frac{1}{\sqrt{x^2+1}} dx$ is equal to

(a) $\sqrt{2}$ (b) $\sqrt{2}+1$ (c) $\frac{1}{2}\log\left(\sqrt{2}+1\right)$ (d) $\log\left(\sqrt{2}+1\right)$

111. The integral $\int_{-1}^{1} \frac{|x+2|}{x+2} dx$ is equal to

(a) 1 (b) 2 (c) 0 (d) –1

112. Which of the following functions is a solution of the differential equation $\left(\frac{dy}{dx}\right)^2 - x\left(\frac{dy}{dx}\right) + y = 0$?

(a) $y = 2x^2 - 4$ (b) $y = 2x - 4$ (c) $y = 2x$ (d) $y = 2$

113. Integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{x}$ is

(a) $\frac{x}{e^x}$ (b) $\frac{e^x}{x}$ (c) xe^x (d) e^x

114. If $\theta = \tan^{-1} x$ then $\sin 2\theta$ is equal to

(a) $\frac{2x}{1+x^2}$ (b) $\frac{2x}{1-x^2}$ (c) $\frac{1-x^2}{1+x^2}$ (d) None of these

115. If $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \frac{3\pi}{2}$, then the value of $x^9 + y^9 + z^9 - \frac{1}{x^9 y^9 z^9}$ is

(a) 0 (b) 1 (c) 2 (d) 3

116. The value of $\det A$ where $A=\begin{bmatrix} 1 & \sin\theta & \theta \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{bmatrix}$ lies in the interval

(a) $[1, 2]$ (b) $[0, 2]$ (c) $(1, 2)$ (d) None of these

117. If A is a square matrix such that $A^3 = I$ then A^{-1} is equal to

(a) I (b) A (c) A^2 (d) None of these

118. If $A=\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$, then for all natural numbers n, A^n is equal to

(a) $\begin{bmatrix} n & 0 \\ 1 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 0 \\ n & 1 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 0 \\ 1 & n \end{bmatrix}$ (d) None of these

119. If $A=[x\ y\ z]$, $B=\begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$ and $C=[x\ y\ z]^t$, then ABC is

(a) not defined (b) a 3×3 matrix (c) a 1×1 matrix (d) none of these

120. The number of terms in the expansion of $(a+b+c)^{10}$ is

(a) 11 (b) 21 (c) 55 (d) 66

Physics

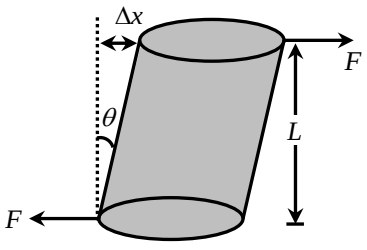
Multiple Choice Questions with one correct answer. A correct answer carries 1 mark. No negative mark. **60 x 1 = 60**

121. The mean radius of earth is R, its angular speed on its own axis is ω and the acceleration due to gravity at earth's surface is g. What will be the radius of the orbit of a satellite?

(a) $\left(R^2g/\omega^2\right)^{1/3}$ (b) $\left(Rg/\omega^2\right)^{1/3}$ (c) $\left(R^2\omega^2/g\right)^{1/3}$ (d) $\left(R^2g/\omega\right)^{1/3}$

122. If two equal and opposite deforming forces are applied parallel to the cross-sectional area of the cylinder as shown in the figure, there is a relative displacement between the opposite faces of the cylinder. The ratio of Δx to L is known as

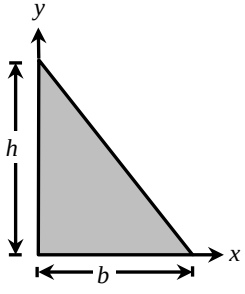
(a) Longitudinal strain
(b) Volumetric strain
(c) Shearing strain
(d) Poisson's ratio



123. The centre of mass of triangle system shown in figure has coordinates, if three equal masses placed at three vertices of the triangle

(a) $x=\frac{h}{2}, y=\frac{b}{2}$ (b) $x=\frac{b}{2}, y=\frac{h}{2}$

(c) $x=\frac{b}{3}, y=\frac{h}{3}$ (d) $x=\frac{h}{3}, y=\frac{b}{3}$



124. If the terminal speed of a sphere of gold(density $=19.5\,\text{kg/m}^3$) is $0.2\,\text{m/s}$ in a viscous liquid (density $=1.5\,\text{kg/m}^3$), find the terminal speed of a sphere of silver (density $=10.5\,\text{kg/m}^3$) of the same size in the same viscous liquid

(a) $0.4\,\text{m/s}$ (b) $0.133\,\text{m/s}$ (c) $0.1\,\text{m/s}$ (d) $0.2\,\text{m/s}$

125. A body initial at $80°\text{C}$ cools to $64°\text{C}$ in 5 minutes and to $52°\text{C}$ in 10 minutes. The tempearture of the body after 15 minutes will be

(a) $42.7°\text{C}$ (b) $35°\text{C}$ (c) $47°\text{C}$ (d) $40°\text{C}$

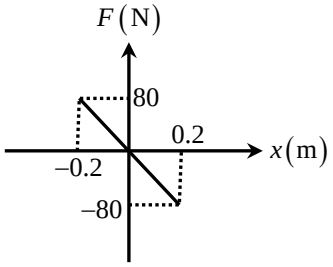
126. Four mole of hydrogen, two mole of helium and one mole of water vapour form an ideal gas mixture. What is the molar specific heat at constant pressure of mixture? (C_v for water vapour $=3R$)

(a) $\frac{16}{7}R$ (b) $\frac{7}{16}R$ (c) R (d) $\frac{23}{7}R$

127. In Carnot engine efficiency is 40% at hot reservoir temperature T. For efficiency 50% what will be temperature of hot reservoir?

(a) $\frac{T}{5}$ (b) $\frac{2T}{5}$ (c) $6T$ (d) $\frac{6T}{5}$

128. A body of mass $0.01\,\text{kg}$ executes simple harmonic motion about $x=0$ under the influence of a force as shown in figure. The time period of SHM is



(a) $1.05\,\text{s}$

(b) $0.52\,\text{s}$

(c) $0.25\,\text{s}$

(d) $0.03\,\text{s}$

129. Speed of sound in mercury at a certain temperature is $1450\,\text{m s}^{-1}$. If the density of mercury is $13.6\times10^3\,\text{kg m}^{-3}$, then the bulk modulus for mercury is

(a) $2.86\times10^{10}\,\text{N m}^{-3}$ (b) $3.86\times10^{10}\,\text{N m}^{-3}$ (c) $4.86\times10^{10}\,\text{N m}^{-3}$ (d) $5.86\times10^{10}\,\text{N m}^{-3}$

130. Two identical conducting spheres carrying different charges attract each other with a force F when placed in air medium at a distance 'd' apart. The sphere are brought into contact and then taken to their original positions. Now the two spheres repel each other with a force whose magnitude is equal to that of the initial attractive force. The ratio between initial charges on the spheres is

(a) $-\left(3+\sqrt{8}\right)$ only (b) $\left(-3+\sqrt{8}\right)$ only

(c) $-\left(3+\sqrt{8}\right)\text{or}\left(-3+\sqrt{8}\right)$ (d) $+\sqrt{3}$

131. The S.I. unit of electric flux is

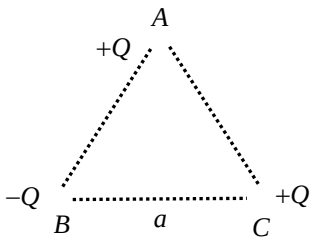
(a) Weber (b) Newton per coulomb

(c) Volt $\times$ metre (d) Joule per coulomb

132. A parallel plate air capacitor has a capacitance C. When it is half filled with a dielectric of dielectric constant 5, the percentage increase in the capacitance will be

(a) 400% (b) 66.6% (c) 33.3% (d) 200%

133. Three charges are placed at the vertices of an equilateral triangle of side 'a' as shown in the following figure. The force experienced by the charge placed at the vertex A in a direction normal to BC is



(a) $Q^2/\left(4\pi\varepsilon_0 a^2\right)$ (b) $-Q^2/\left(4\pi\varepsilon_0 a^2\right)$ (c) Zero (d) $Q^2/\left(2\pi\varepsilon_0 a^2\right)$

134. Each corner of a cube of side l has a negative charge, $-q$. The electrostatic potential energy of a charge q at the centre of the cube is

(a) $-\dfrac{4q^2}{\sqrt{2}\pi\varepsilon_0 l}$ (b) $\dfrac{\sqrt{3}q^2}{4\pi\varepsilon_0 l}$ (c) $\dfrac{4q^2}{\sqrt{2}\pi\varepsilon_0 l}$ (d) $-\dfrac{4q^2}{\sqrt{3}\pi\varepsilon_0 l}$

135. The electric potential at a point (x, y) in the $x-y$ plane is given by $V=-kxy$. The magnitude of field intensity at a distance r from the origin varies as (directly proportional)

(a) r^2 (b) r (c) $\dfrac{1}{r}$ (d) $\dfrac{1}{r^2}$

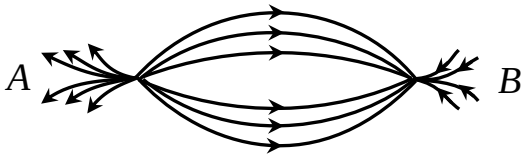
136. An electric dipole is kept in a non-uniform electric field. It experiences

(a) A force and a torque
(b) A force but not a torque
(c) A torque but no force
(d) Neither a force nor a torque

Sol: A force and a torque

Ans: (a)

137. The spatial distribution of electric field due to charges (A, B) is shown in figure. Which one of the following statement is correct?



(a) A is $+ve$ and $B-ve, |A|>|B|$
(b) A is $-ve$ and $B+ve, |A|=|B|$
(c) Both are $+ve$ but $A>B$
(d) Both are $-ve$ but $A>B$

138. Constantan wire is used for making standard resistance, because it has

(a) High melting point
(b) Low specific resistance
(c) High specific resistance
(d) Negligible temperature coefficient of resistance

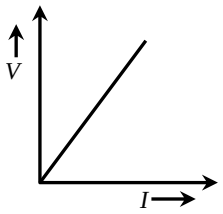
139. Two resistors of 6Ω and 9Ω are connected in series to a $120V$ source. The power consumed by 6Ω resistor is

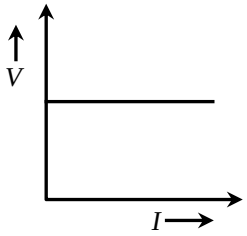
(a) $384\,W$ (b) $616\,W$ (c) $1500\,W$ (d) $1800\,W$

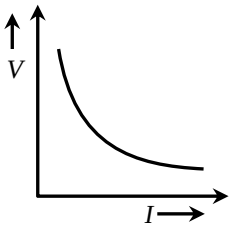
140. A 100 watt bulb working on 200 volt has resistance R and a bulb 200 watt bulb working on 100 volt has resistance S then R/S is

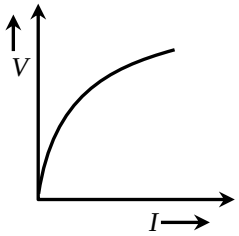
(a) $\frac{1}{8}$ (b) $\frac{1}{4}$ (c) 8 (d) 4

141. Which of the adjoining graphs represents ohmic resistance

(a) 

(b) 

(c) 

(d) 

142. Two wires A and B of the same material, having radii in the ratio $1:2$ and curry current in the ratio $4:1$. The ratio of drift speed of electrons in A and B is

(a) $16:1$ (b) $1:16$ (c) $1:4$ (d) $4:1$

143. When a piece of aluminium wire of finite length is drawn through a series of dies to reduce its diameter to half its original value, its resistance will become

(a) Two times (b) Four times (c) Eight times (d) Sixteen times

144. A charged particle of mass m and charge q travels in a circular path of radius r that is perpendicular to a magnetic field B. The time taken by the particle to complete one revolution is

(a) $\frac{2\pi qB}{m}$ (b) $\frac{2\pi m}{qB}$ (c) $\frac{2\pi mq}{B}$ (d) $\frac{2\pi q^2 B}{m}$

145. A charge moving with velocity v in $X-$direction is subjected to a magnetic field in negative $X-$direction. As a result, the charge will

(a) remain unaffected

(b) start moving in a circular path $Y-Z$ plane

(c) retard along $X-$axis (d) move along a helical path around $X-$axis

146. A galvanometer having a coil resistance of 100Ω gives a full scale deflection, when a current of $1mA$ is passed through it. The value of the resistance, which can convert this galvanometer into ammeter giving a full scale deflection for a current of $10A$, is

(a) $0.1\,\Omega$ (b) $3\,\Omega$ (c) $0.01\,\Omega$ (d) $2\,\Omega$

147. At what distance from a long straight wire carrying a current of $12\,A$ will the magnetic field be equal to $3\times10^{-5}\ Wb\,m^{-2}$?

(a) $8\times10^{-2}\ m$ (b) $12\times10^{-2}\ m$ (c) $18\times10^{-2}\ m$ (d) $24\times10^{-2}\ m$

148. Current I is flowing in a coil of area A and number of turns is N, then magnetic moment of the coil in M equal to

(a) NIA (b) NI/A (c) $NI/\sqrt{A}$ (d) N^2AI

149. A coil in the shape of equilateral triangle of side $0.2\,m$ is suspended from the vertex such that it is hanging in a vertical plane between the pole-pieces of a permanent magnet producing a horizontal magnetic field of 5×10^{-2} tesla. The couple acting on the coil when a current of $0.1A$ is passed through it and the magnetic field is parallel to its plane will be

(a) $3.28\times10^{-7}\ Nm$ (b) $5.28\times10^{-7}\ Nm$ (c) $8.66\times10^{-7}\ Nm$ (d) $1.23\times10^{-7}\ Nm$

150. Magnetic field intensity is defined as

(a) Magnetic moment per unit volume

(b) Magnetic force acting on a unit magnetic pole

(c) Number of lines of force crossing per unit area

(d) Number of lines of force crossing per unit volume

151. A short-circuited coil is placed in a time-varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be

(a) halved (b) the same (c) doubled (d) quadrupled

152. A copper wire of length $40\,cm$, diameter $2\,mm$ and resistivity $1.7\times10^{-8}\Omega m$ forms a square frame. If a uniform magnetic field B exists in a direction perpendicular to the plane of square frame and it changes at a steady rate $\frac{dB}{dt}=0.02\,T\,s^{-1}$, then find the current induced in the frame.

(a) $9.3\times10^{-2}\,A$ (b) $9.3\times10^{-1}\,A$ (c) $3.3\times10^{-2}\,A$ (d) $19.3\times10^{-2}\,A$

153. An inductance of $\left(\frac{200}{\pi}\right)mH$, a capacitance of $\left(\frac{10^{-3}}{\pi}\right)F$ and a resistance of 10Ω are connected in series with an a.c. source $220V$ $50Hz$. The phase angle of the circuit is

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{3}$

154. A resistor 30Ω, inductor of reactance 10Ω and capacitor of reactance 10Ω are connected in series to an a.c. voltage source $e=300\sqrt{2}\sin(\omega t)$. The current in the circuit is

(a) $10\sqrt{2}\,A$ (b) $10\,A$ (c) $30\sqrt{11}\,A$ (d) $\frac{30}{\sqrt{11}}A$

155. A 220 volts input is supplied to a transformer. The output circuit draws a current of 2.0 A at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is

(a) 3.6 A (b) 2.8 A (c) 2.5 A (d) 5.0 A

156. The electric field part of an electromagnetic wave in a medium is represented by $E_x = 0$;

$E_y = 2.5\,\mathrm{N\,C^{-1}} \cos\left[\left(2\pi \times 10^6\ \mathrm{rad\,m^{-1}}\right)t - \left(\pi \times 10^{-2}\ \mathrm{rad\,s^{-1}}\right)x\right]$;

$E_z = 0$. The wave is

(a) moving along x direction with frequency 10^6 Hz and wave length 100m

(b) moving along x direction with frequency 10^6 Hz and wave length 200m

(c) moving along $-x$ direction with frequency 10^6 Hz and wave length 200m

(d) moving along y direction with frequency $2\pi \times 10^6$ Hz and wave length 200m

157. A thin glass (refractive index 1.5) lens has optical power of $-5D$ in air. Its optical power in a liquid medium with refractive index 1.6 will be

(a) $-1D$ (b) $1D$ (c) $-25D$ (d) $25D$

158. For the angle of minimum deviation of a prism to be equal to its refractive angle, the prism must be made of a material whose refractive index

(a) lies between $\sqrt{2}$ and 1 (b) lies between 2 and $\sqrt{2}$

(c) is less than 1 (d) is greater than 2

159. When light travels from one medium to the other of which the refractive index is different, then which of the following will change?

(a) Frequency, wavelength and velocity (b) Frequency and wavelength

(c) Frequency and velocity (d) Wavelength and velocity

160. Total internal reflection can take place only if

(a) Light goes from optically rarer medium (smaller refractive index) to optically denser medium

(b) Light goes from optically denser medium to rarer medium

(c) The refractive indices of the two media are close to different

(d) The refractive indices of the two media are widely different

161. By Huygen's wave theory of light, we cannot explain the phenomenon of

(a) Interference (b) Diffraction (c) Photoelectric effect (d) Polarisation

162. If two coherent sources are vibrating in phase then we have constructive interference at any point P whenever the path difference is

(a) $\left(n+\frac{1}{2}\right)\lambda$ (b) $\frac{n\lambda}{2}$ (c) $\left(n-\frac{1}{2}\right)\lambda$ (d) $n\lambda$

163. Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 9mW. The number of photons arriving per second on the average at a target irradiated by this beam is

(a) 3×10^{16} (b) 9×10^{15} (c) 3×10^{19} (d) 9×10^{17}

164. A proton accelerated through a potential difference of $100\,V$, has de-Broglie wavelength λ_0. The de-Broglie wavelength of an $\alpha-$particle, accelerated through $800\,V$ is

(a) $\frac{\lambda_0}{\sqrt{2}}$ (b) $\frac{\lambda_0}{2}$ (c) $\frac{\lambda_0}{4}$ (d) $\frac{\lambda_0}{8}$

165. The Rutherford $\alpha-$particle experiment shows that most of the $\alpha-$particles pass through almost unscattered while some are scattered through large angles. What information does it give about the structure of the atom?

(a) Atom is hollow

(b) The whole mass of the atom is concentrated a small centre called nucleus

(c) Nucleus is positively charged

(d) All the above

166. An electron in the hydrogen atom jumps from excited state n to the ground state. The wavelength so emitted illuminates a photosensitive material having work function $2.75\,eV$. If the stopping potential of the photoelectron is $10\,V$, the value of n is

(a) 3 (b) 4 (c) 5 (d) 2

167. According to Bohr's model of hydrogen atom

(a) the linear velocity of the electron is quantised

(b) the angular velocity of the electron is quantised

(c) the linear momentum of the electron is quantised

(d) the angular momentum of the electron is quantised

168. Nuclear force exists between

(a) Neutron-neutron (b) Proton-proton (c) Neutron-proton (d) all of these

169. A nucleus splits into two nuclear parts which have their velocity ratio equal to $2:1$. What will be the ratio of their nuclear radius?

(a) $2^{1/3}:1$ (b) $1:2^{1/3}$ (c) $3^{1/2}:1$ (d) $1:3^{1/2}$

170. The mass of a ${}^{7}_{3}Li$ nucleus is $0.042\,u$ less than the sum of the masses of all its nucleons. The binding energy per nucleon of ${}^{7}_{3}Li$ nucleus is nearly

(a) 46 MeV (b) 5.6 MeV (c) 3.9 MeV (d) 23 MeV

171. In order to prepare a $p-$type semiconductor, pure silicon can be doped with

(a) Phosphorus (b) Aluminium (c) Antimony (d) Germanium

172. The resistivity of a semiconductor at room temperature is in between

(a) 10^{-2} to $10^{-5}\Omega$ cm (b) 10^{-3} to $10^{6}\Omega$ cm (c) 10^{6} to $10^{8}\Omega$ cm (d) 10^{10} to $10^{12}\Omega$ cm

173. When an impurity is doped into an intrinsic semiconductor, the conductivity of the semiconductor

(a) Increases (b) Decreases (c) Remain the same (d) Become zero

174. The magnetic field $d\vec{B}$ due to a small current element $d\vec{\ell}$ at a distance $\vec{r}$ and element carrying current i is,

(a) $d\vec{B}=\frac{\mu_0}{4\pi}i\left(\frac{d\vec{\ell}\times\vec{r}}{r}\right)$ (b) $d\vec{B}=\frac{\mu_0}{4\pi}i^2\left(\frac{d\vec{\ell}\times\vec{r}}{r}\right)$ (c) $d\vec{B}=\frac{\mu_0}{4\pi}i^2\left(\frac{d\vec{\ell}\times\vec{r}}{r^2}\right)$ (d) $d\vec{B}=\frac{\mu_0}{4\pi}i\left(\frac{d\vec{\ell}\times\vec{r}}{r^3}\right)$

175. If E, m, J and G represent energy, mass, angular momentum and gravitational constant respectively, then the dimensional formula of EJ^2/m^5G^2 is same as that os

(a) angle (b) length (c) mass (d) time

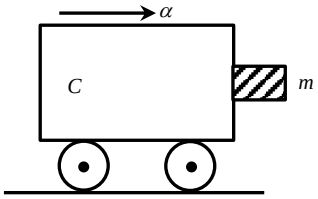
176. A man throws a ball downwards from the roof of a tower of height $400\,\text{m}$. At the same time another ball is thrown upwards with velocity of $50\,\text{m s}^{-1}$ from the surface of the tower, then at which height form the surface of the tower they will meet?

(a) $100\,\text{m}$ (b) $320\,\text{m}$ (c) $80\,\text{m}$ (d) $240\,\text{m}$

177. An object is projected with a velocity of $20\,\text{m/s}$ making an angle of $45°$ with horizontal. The equation for the trajectory is $h=Ax-Bx^2$ where h is height, x is horizontal distance, A and B are constants. The ratio $A:B$ is $\left(g=10\text{ms}^{-2}\right)$

(a) $1:5$ (b) $5:1$ (c) $1:40$ (d) $40:1$

178. A block of mass m is in contact with the cart C as shown in the figure. The coefficient of static friction between the block and the cart is μ. The acceleration α of the cart that will prevent the block from falling satisfies



(a) $\alpha>\frac{mg}{\mu}$ (b) $\alpha>\frac{g}{\mu m}$ (c) $\alpha\geq\frac{g}{\mu}$ (d) $\alpha<\frac{g}{\mu}$

179. A bullet of mass m moving horizontally with a velocity v strikes a block of wood of mass M and gets embedded in the block. The block is suspended from the ceiling by a massless string. The height to which block rises is

(a) $\frac{v^2}{2g}\left(\frac{m}{M+m}\right)^2$ (b) $\frac{v^2}{2g}\left(\frac{M+m}{m}\right)^2$ (c) $\frac{v^2}{2g}\left(\frac{m}{M}\right)^2$ (d) $\frac{v^2}{2g}\left(\frac{M}{m}\right)^2$

180. The angular momentum of a system of particle is conserved

(a) When no external force acts upon the system

(b) When no external torque acts upon the system

(c) When no external impulse acts upon the system

(d) When axis of rotation remains same