Deeksha

ABHYAS KCET 2024

FREE TEST SERIES

MOCK TEST 3 PDF

QUESTION PAPER

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. The pair of species having same percentage of carbon is

   (a) $C_6H_{12}O_6$ and $C_{12}H_{22}O_{11}$ (b) CH_3COOH and C_2H_5OH

   (c) CH_3COOH and $C_6H_{12}O_6$ (d) $HCOOH$ and CH_3COOH

2. Which of the following sets of quantum numbers represents an impossible arrangement?

	n	ℓ	m	s
(a)	2	2	−2	$+\frac{1}{2}$
(b)	4	0	0	$-\frac{1}{2}$
(c)	5	2	0	$+\frac{1}{2}$
(d)	3	3	+2	$+\frac{1}{2}$

3. Which of the following statements is correct

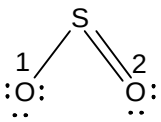
   (a) Ionization enthalpy of Mg is less than that of Na and Al

   (b) The atomic radius of F is more than that of O

   (c) Negative electron gain enthalpy of F is less than that of O

   (d) Among Be, B and C, B has lowest ionization enthalpy

4. Formal charge on two O atoms in



   (a) $-1, +1$ (b) $-1, 0$ (c) $0, +1$ (d) $-1, -1$

5. A gaseous mixture was prepared by taking equal mole of CO and N_2 of the total pressure of the mixture was found to be 1atm, the partial pressure of nitrogen (N_2) in the mixture is

   (a) 0.5atm (b) 0.8atm (c) 0.9atm (d) 1atm

6. For which of the following reaction, ΔS is not positive?

   (a) $I_2(s) \rightarrow I_2(g)$ (b) $CuO(s) + H_2(g) \rightarrow Cu(g) + H_2O(l)$

   (c) $2O_3(g) \rightarrow 3O_2(g)$ (d) $2Ag_2O(s) \rightarrow 4Ag + O_2(g)$

7. The heat of combustion of carbon to CO_2 is $-393.5\,\text{kJ/ mol}$

   The heat released for the formation of $22g$ of CO_2 from carbon and oxygen is

   (a) $-393.5\,\text{kJ/ mol}$ (b) $-39.3\,\text{kJ/ mol}$ (c) $-19.6\,\text{kJ/ mol}$ (d) $-196.75\,\text{kJ/ mol}$

8. The precipitate of Calcium fluoride (CaF_2) with $K_{sp} = 1.7 \times 10^{-10}$ is obtained when equal volumes of the following are mixed. The mixture which gives precipitate is

(a) $10^{-4} MCa^{2+}$ and $10^{-4} MF^-$ (b) $10^{-2} MCa^{2+}$ and $10^{-3} MF^-$

(c) $10^{-5} MCa^{2+}$ and $10^{-3} MF^-$ (d) $10^{-5} MCa^{2+}$ and $10^{-5} MF^-$

9. Ka_1, Ka_2 and Ka_3 are respective constants for the following reactions.

$H_2S \rightleftharpoons H^+ + HS^-$ Ka_1

$HS^- \rightleftharpoons H^+ + S^{2-}$ Ka_2

$H_2S \rightleftharpoons 2H^+ + S^{2-}$ Ka_3

The correct relationship between Ka_1, Ka_2 and Ka_3 is

(a) $Ka_3 = Ka_1 \times Ka_2$ (b) $Ka_3 = Ka_1 + Ka_2$

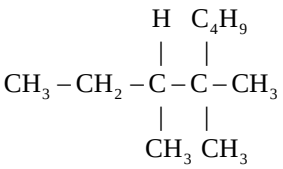
(c) $Ka_3 = Ka_1 - Ka_1$ (d) $Ka_3 = \dfrac{Ka_1}{Ka_2}$

10. $3C1O^-(aq) \rightarrow C1O_3^- + 2C1^-$ is an example of

(a) Oxidation reaction (b) Reduction reaction

(c) Disproportionation reaction (d) Displacement reaction

11. The IUPAC name of



(a) 3,4,4- Trimethylheptane (b) 3,4,4- Trimethyloctane

(c) 2-Butyl-2-methyl-3-ethylbutane (d) 2-Ethyl-3,3-dimethylheptane

12. The number of atoms in 52 u of *He* are

(a) 13 (b) $13 \times 6.022 \times 10^{23}$ (c) 52 (d) $4 \times 6.022 \times 10^{23}$

13. The total number of isomeric alcohols with the molecular formula C_4H_9OH is:

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

14. In Duma's method $0.03g$ of an organic compound gave $41.9\,ml$ of nitrogen at STP. The percentage of N is

(a) 29.46% (b) 25.2% (c) 17.37% (d) 39.2%

15. Which of the following is most reactive towards sodium?

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

(c) $CH_3 - CH_2 - C \equiv CH$ (d) $CH \equiv CH$

16. In the following sequence of reaction, the end product is

$$CaC_2 \xrightarrow{H_2O} A \xrightarrow{Hg^{2+}/H_2SO_4} B \xrightarrow{[O]} C \xrightarrow{Ca(OH)_2} \xrightarrow{Heat} E$$

(a) Acetaldehyde (b) Formaldehyde (c) Acetic acid (d) Acetone

17. Which of the following is ***not*** a conductor of electricity?

(a) Solid NaCl (b) Cu (c) Fused NaCl (d) Brine solution

18. For an ideal binary liquid mixture

(a) $\Delta H_{(mix)} = 0; \Delta S_{(mix)} < 0$ (b) $\Delta S_{(mix)} > 0; \Delta G_{(mix)} < 0$

(c) $\Delta S_{(mix)} = 0; \Delta G_{(mix)} = 0$ (d) $\Delta V_{(mix)} = 0; \Delta G_{(mix)} > 0$

19. The molal elevation constant is the ratio of elevation in boiling point to

(a) Molarity (b) Boiling point of pure liquid

(c) Mole fraction of solute (d) Molality

20. A plant cell shrinks when placed in

(a) Water (b) Hypotonic solution

(c) Isotonic solution (d) Hypertonic solution

21. Two moles of a non-volatile solute are dissolved in 5 moles of water. The vapour pressure of the solute relative to that of water is

(a) $\frac{2}{5}$ (b) $\frac{2}{7}$ (c) $\frac{4}{7}$ (d) $\frac{5}{7}$

22. In the Laclanche dry cell, anode is

(a) Graphite rod (b) Carbon (c) Zinc container (d) $MnO_2 + C$

23. The emf of the cell at $25°C$

$Cu / Cu^{2+}(0.01M) \| Ag^{+}(0.1\text{M}) / Ag$ is

$\left(\text{Given } E^{\circ}_{cell\frac{2t}{Cu}} = 0.34V \text{ and } E^{\circ}_{\frac{Ag^{+}}{Ag}} = 0.80V \right)$

(a) $0.46V$ (b) $1.14V$ (c) $0.43V$ (d) $1.29V$

24. The quantity of electricity needed to separate the electrolyte of 1M solution of $ZnSO_4$, $AlCl_3$ and $AgNO_3$ completely is in the ratio of

(a) $2:3:1$ (b) $2:1:1$ (c) $2:1:3$ (d) $2:2:1$

25. What is the activation energy for a reaction if its rate doubles when the temperature is raised from $300\,\text{k}$ to $310\,\text{k}$?

(a) $535\,\text{kJ mol}^{-1}$ (b) $5350\,\text{kJ mol}^{-1}$ (c) $53.5\,\text{kJ mol}^{-1}$ (d) $5.35\,\text{kJ mol}^{-1}$

26. The time required for 100 percent completion of a zero order reaction is:

(a) $\frac{2k}{a}$ (b) $\frac{a}{2k}$ (c) $\frac{a}{k}$ (d) ak

27. A first order reaction is half completed in 45 minutes. How long does it need for 99.9% of the reaction to be completed?

(a) 10 hr (b) 20 hr (c) 5 hr (d) 7.5 hr

28. Aluminium is more reactive than iron but aluminium is less easily corroded than iron because

(a) aluminium is a noble metal

(b) oxygen forms a protective oxide layer on aluminium surface

(c) iron undergoes reaction easily with water

(d) iron form both divalent and trivalent ions.

29. The quantity of electricity required to liberate $112\ cm^3$ of hydrogen at STP from acidulated water is

(a) 965 C (b) 1 Faraday (c) 0.1F (d) 96500 C

30. Which of the following has the maximum number of unpaired electrons?

(a) Mg^{2+} (b) Ti^{3+} (c) V^{3+} (d) Fe^{2+}

31. Which of the following statement is wrong regarding Lanthanoids?

(a) Ln(III) compounds are generally colourless

(b) Ln(III) compounds are predominantly ionic in character.

(c) The ionic size of Ln(III) ions decreases with increasing atomic number

(d) Ln(III) hydroxides are mainly basic in nature.

32. In the coordination compound $K_4\left[Ni(CN)_4\right]$, the oxidation state of nickel is

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

33. The formula of pentaaquanitratochromium(III) nitrate is

(a) $\left[Cr(H_2O)_6\right](NO_3)_3$ (b) $\left[Cr(H_2O)_5NO_3\right](NO_3)_2$

(c) $\left[Cr(H_2O)_6\right](NO_2)_2$ (d) $\left[Cr(H_2O)_5NO_2\right]NO_3$

34. Among the following the square planar geometry is for

(a) XeF_3 (b) XeF_4 (c) XeF_2 (d) XeO_3

35. The number of moles of $KMnO_4$ that will be needed to react with one mole of sulphite ion in acidic solution is

(a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{4}{5}$ (d) 1

36. Which of the following pairs has the same size?

(a) Zr^{4+}, Hf^{4+} (b) Zn^{2+}, Hf^{4+} (c) Fe^{2+}, Ni^{2+} (d) Zr^{4+}, Ti^{4+}

37. The ion sowing a magnetic moment of $2.83BM$ among the following is

(a) Ti^{3+} (b) Ni^{2+} (c) Cr^{3+} (d) Mn^{2+}

38. The crystal field splitting energy for octahedral (Δ_o) and tetrahedral (Δt) complexes is related as

(a) $\Delta_t = \frac{1}{2}\Delta_o$ (b) $\Delta_t = \frac{4}{9}\Delta_o$ (c) $\Delta_t = \frac{3}{5}\Delta_o$ (d) $\Delta_t = \frac{2}{5}\Delta_o$

39. Which of the following statements is not correct?

(a) $[FeF_6]^{3-}$ has five unpaired electrons (b) $\left[Co(NH_3)_3Cl_3\right]$ is an non-conductor

(c) Tetrahedral complexes do not show geometrical isomerism

(d) In CN group, bonding occurs through N

40. Which of the following is a outer orbital complex?

(a) $\left[Fe(CN)_6\right]^{4-}$ (b) $[CoF_6]^{3-}$ (c) $\left[Co(NH_3)_6\right]^{3+}$ (d) $\left[Fe(cn)_3\right]^{2+}$

41. The addition of a catalyst during a chemical reaction alters which of the following quantities?

(a) Entropy (b) Internal energy (c) Enthalpy (d) Activation energy

42. The rate for the first order reaction is $0.0069\,\text{mol}\,L^{-1}\,\text{min}^{-1}$ and the initial concentration is $0.2\,\text{mol}\,L^{-1}$. The half-life period is

(a) 10mins (b) 20mins (c) 15 min (d) 7 min

43. Ethyl isocyanide is prepare by the reaction between

(a) C_2H_5Br and $KCN\,(alc)$ (b) C_2H_5Br and $AgCN\,(alc)$

(c) C_2H_5Br and HCN (d) C_2H_5Br and ammonia

44. $1,3-$ Dibromopropane reacts with metallic zinc to form

(a) Propene (b) Propane (c) Hexane (d) Cyclopropane

45. Which of the following is most reactive towards S_N1 reaction?

(a) Methyl bromide (b) Tertiary butyl bromide

(c) Secondary butyl bromide (d) Ethyl bromide

46. An alkene $CH_3CH=CH_2$ is treated with B_2H_6 in presence of H_2O_2. The final product formed is

(a) CH_3CH_2CHO (b) $CH_3CH(OH)CH_3$ (c) $CH_3CH_2CH_2OH$ (d) $(CH_3CH_2CH_2)_3B$

47. Acid catalysed dehydration of $t-$ butanol is faster than that of $n-$ butanol because

(a) tertiary carbocation is more stable than primary carbocation

(b) primary carbocation is more stable than tertiary carbocation

(c) $t-$ butanol has higher boiling point

(d) rearrangement takes place during dehydration of $t-$ butanol

48. Cumene on reaction with oxygen followed by hydrolysis gives

(a) CH_4OH and $C_6H_5COCH_3$ (b) C_6H_5OH and $(CH_3)_2O$

(c) $C_6H_5OCH_3$ and CH_3OH (d) C_6H_5OH and CH_3COCH_3

49. Anisole on reaction with chloromethane in presence of anhydrous $AlCl_3$ gives

(a) $o-$ methylanisole and $p-$ methoxyanisole

(b) $p-$ methylanisole and $p-$ methoxyanisole

(c) $o-$ methylanisole and $p-$ methoxyanisole

(d) $o-$ methoxyacetophenone and $p-$ methoxyacetophenone

50. The most acidic among the following

(a) Phenol (b) $p-$ Cresol (c) $p-$ Nitrophenol (d) $2,4-$ Dinitrophenol

51. Which of the following compound does not react with $NaHSO_3$?

(a) $HCHO$ (b) $C_6H_5COCH_3$ (c) CH_3COCH_3 (d) CH_3CHO

52. A compound (X) with a molecular formula $C_5H_{10}O$ gives a positive $2,4-DNP$ test but a negative Tollen's test. On oxidation it gives carboxylic acid (Y) with a molecular formula $C_3H_6O_2$. Potassium salt of (Y) undergoes Kolbe's reaction to give a hydrocarbon (2). X. Y and Z respectively are

(a) Pentan $-3-$ one, propanoicacid, butane

(b) Pentanol, pentanoic acid, octane

(c) $2-$ Methylbutanone, butanoic acid, hexane

(d) $2,2-$ dimethylpropanone, propanoic acid, hexane

53. Complete the missing links $(X),(Y)$ and (Z) by making an appropriate choice

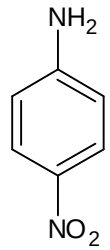
$$CH_3COOH \xrightarrow{PBr_3/Br_3} X \xrightarrow{KCN} Y \xrightarrow{H_3O} Z$$

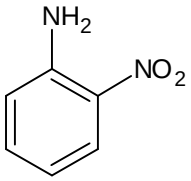
	X	Y	Z
(a)	CH_3COBr	CH_3COCN	CH_3COOH
(b)	$BrCH_2COOH$	$CH_2(CN)-COOH$	$HOOC-CH_2-COOH$
(c)	$BrCH_2COOH$	$CH_2(CN)COOH$	$COOH-COOH$
(d)	$Br_2CH-COOH$	$Br_2C(CN)COOH$	CH_3CH_2COOH

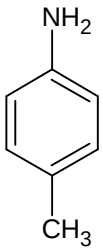
54. Which of the following will form isocyanide on reaction with $CHCl_3$ and KOH ?

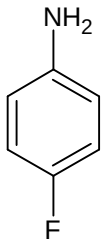
(a) $C_6H_5NHCH_3$ (b) $CH_3C_6H_4NH_2$ (c) $C_6H_5NHC_4H_9$ (d) $C_6H_5N(C_2H_5)_2$

55. The most basic amine among the following is

(a) 

(b) 

(c) 

(d) 

56. On oxidation with a mild oxidising agent like Br_2/H_2O the glucose is oxidised to

(a) Saccharic acid (b) Glucaric acid (c) Gluconic acid (d) Valeric acid

57. Which of the following vitamins is water soluble?

(a) Vitamin E (b) Vitamin D (c) Riboflavin (d) Retinol

58. In fibrous proteins polypeptide chains are held together by

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

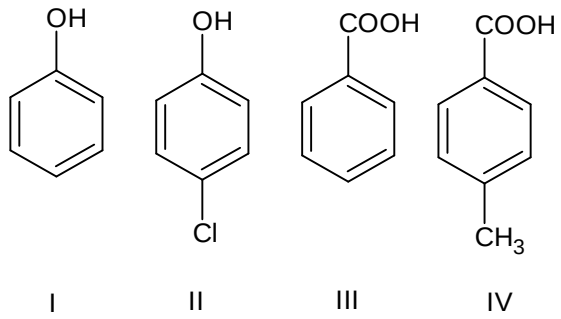
(c) Hydrogen bonds (d) Covalent bonds

59. Hofmann's bromamide reaction is to convert

(a) alcohol to acid (b) acid to alcohol

(c) amine to amide (d) amide to amine

60. The correct acidity order of the following is



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

Mathematics

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

61. In the set $A=\{1,2,3,4,5\}$, a relation R is defined by $R=\{x,y):x,\ y\in A,\ x<y\}$. Then R is

(a) Reflexive (b) Symmetric (c) Transitive (d) None of these

62. The domain of the function $f(x)=\sqrt{\left(2-2x-x^2\right)}$ is

(a) $-1\le x\le\sqrt{3}$ (b) $-1-\sqrt{3}\le x\le -1+\sqrt{3}$

(c) $-2\ \le x\ \le 2$ (d) None of these

63. The mapping $f:R^+\to R$ defined by $f(x)=\log_{10}x$, (where R^+ is the set of all positive real numbers) is

(a) Only one-one mapping (b) Only onto mapping

(c) Both one-one and onto (d) None of these

64. If $g(x)=1+\sqrt{x}$ and $f(g(x))=3+2\sqrt{x}+x$ then $f(x)=$

(a) $1+2x^2$ (b) $2+x^2$ (c) $1+x$ (d) $2+x$

65. Let, $f:R\to R$ be defined by $f(x)=\begin{cases}2x & x>3\\ x^2 & 1<x\le 3\\ 3x & x\le 1\end{cases}$ *Then* $f(-1)+f(2)+f(4)=$

(a) 9 (b) 14 (c) 5 (d) None of these

66. If one root of the equation $5x^2+13x+k=0$ is reciprocal of other, then the value of k is

(a) 0 (b) 5 (c) $\frac{1}{6}$ (d) 6

67. The number of ways in which ten candidates $A_1,A_2,.....,A_{10}$ be ranked, if A_1 is always above A_2 is

(a) $2\times 8!$ (b) $9!$ (c) $10!$ (d) $5\times 9!$

68. If $A=\begin{pmatrix}0 & c & -b\\ -c & 0 & a\\ b & -a & 0\end{pmatrix}$ and $B=\begin{pmatrix}a^2 & ab & ac\\ ab & b^2 & bc\\ ac & bc & c^2\end{pmatrix}$

Then $AB=$

(a) B (b) A

(c) O, where O is null matrix (d) I_3, where I_3 is unit matrix of order 3

69. If $A=\begin{pmatrix}x & 1\\ 0 & x\end{pmatrix}$, then $A^n=$

(a) $\begin{pmatrix}x^n & nx^{n-1}\\ 0 & x^n\end{pmatrix}$ (b) $\begin{pmatrix}nx^{n-1} & x^n\\ 0 & x^n\end{pmatrix}$ (c) $\begin{pmatrix}x^n & 0\\ nx^{n-1} & x^n\end{pmatrix}$ (d) $\begin{pmatrix}x^n & x^n\\ 0 & x^{n-1}\end{pmatrix}$

70. The value of $\Delta=\begin{vmatrix}5^2 & 5^3 & 5^4\\ 5^3 & 5^4 & 5^5\\ 5^4 & 5^6 & 5^7\end{vmatrix}$ is

(a) 5^2 (b) 0 (c) 5^{13} (d) 5^9

71. The maximum value of $\Delta=\begin{vmatrix}1 & 1 & 1\\ 1 & 1+\sin\theta & 1\\ 1+\cos\theta & 1 & 1\end{vmatrix}$ is

$(\theta$ is real numbers$)$

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

72. Solution set of the inequation $\frac{1}{x+2}<\frac{3}{x-3}$ is

(a) $\left(-\frac{9}{2},2\right)\cup(3,\infty)$ (b) $\left(-\infty,-\frac{9}{2}\right)\cup(2,3)$ (c) $\left(-\frac{9}{2},2\right)\cup(2,3)$ (d) $\left(-\infty,-\frac{9}{2}\right)\cup(3,\infty)$

73. If n is any positive integer then the value of $\frac{i^{4n+1}-i^{4n-1}}{2}=$

(a) 1 (b) -1 (c) i (d) $-i$

74. The equation of the line passing through $(1,2)$ and perpendicular to $x+y+7=0$ is

(a) $y-x+1=0$ (b) $y-x-1=0$ (c) $y-x+2=0$ (d) $y-x-2=0$

75. The major axis of an ellipse is three times the minor axis. Then the eccentricity is

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

76. If $\operatorname{cosec}A+\cot A=\frac{11}{2}$, then $\tan A$ is

(a) $\frac{21}{22}$ (b) $\frac{15}{16}$ (c) $\frac{44}{117}$ (d) $\frac{117}{43}$

77. The $A+B+C=180°$ then $\sin 2A+\sin 2B+\sin 2C=$

(a) $4\sin A\cdot\sin B\cdot\sin C$ (b) $4\cos A\cdot\cos B\cdot\cos C$

(c) $2\sin A\cdot\sin B\cdot\sin C$ (d) $8\sin A\cdot\sin B\cdot\sin C$

78. If $\cos\theta-4\ \sin\theta=1$, then $\sin\theta+4\ \cos\theta=$

(a) ±1 (b) 0 (c) ±2 (d) ±4

79. If $\vec{a}=i-j+2k, \vec{b}=2i+3j+k$ and $\vec{c}=i-k$ then the magnitude of $\vec{a}+2\vec{b}-3\vec{c}$ is

(a) $\sqrt{87}$ (b) $\sqrt{78}$ (c) $\sqrt{89}$ (d) $\sqrt{101}$

80. If $\left|\vec{a}\right|=4, \left|\vec{b}\right|=2$ and angle between $\vec{a}$ and $\vec{b}$ is $\frac{\pi}{6}$, then $\left(\vec{a}\times\vec{b}\right)$ is

(a) 48 (b) 16 (c) $\vec{a}$ (d) 15

81. The feasible solution for a LPP is shown in the following figure. Let $Z=3x-4y$, be the objective function. Maximum of Z occurs at

(a) $(5,0)$ (b) $(6,5)$ (c) $(6,8)$ (d) $(4,10)$

82. The coordinates of the point $P=(3,4,5)$, then the direction cosines of $\vec{OP}$ are

(a) $3,4,5$ (b) $\frac{1}{3},\frac{1}{4},\frac{1}{5}$

(c) $\frac{3}{50},\frac{4}{50},\frac{1}{10}$ (d) $\frac{3}{5\sqrt{2}},\frac{4}{5\sqrt{2}},\frac{1}{\sqrt{2}}$

83. The angle between the lines $\frac{x+1}{2}=\frac{y-2}{5}=\frac{z+3}{4}$ and $\frac{x-1}{1}=\frac{y+2}{2}=\frac{z-3}{-3}$ is

(a) 45° (b) 30° (c) 60° (d) 90°

84. $\lim\limits_{x\to0}\frac{1-\cos5x}{\sin4x}=$

(a) $\frac{5}{4}$ (b) $\frac{4}{5}$ (c) 0 (d) $-\frac{5}{4}$

85. $\lim\limits_{x\to0}\frac{e^x-(1+x)}{x^2}=$

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

86. Let $f(x)=\begin{cases}\frac{3}{x^2}\sin2x^2 & x<0\\ \frac{x^2+2x+x}{1-3x^2} & x\geq0, x\neq\frac{1}{\sqrt{3}}\\ 0 & x=\frac{1}{\sqrt{3}}\end{cases}$, f be continuous at $x=0$, then $c=$

(a) -6 (b) 6 (c) 5 (d) -5

87. Let $f(x)=|\cos x|$. Then

(a) f is every where differentiable

(b) f is every where continuous not differentiable at $x=n\pi, n\in Z$

(c) f is every continuous but not differentiable at $x=(2n+1)\frac{\pi}{2}, n\in Z$

(d) None of these

88. $\frac{d}{dx}\left(\frac{3e^x+4}{2e^x-3}\right)=$

(a) $\frac{-17e^x}{\left(2e^x-3\right)^2}$ (b) $\frac{17e^x}{\left(2e^x-3\right)^2}$ (c) $\frac{e^x}{\left(2e^x-3\right)^2}$ (d) $\frac{e^x}{2e^x-3}$

89. If $y=\sin^{-1}\left[\frac{1-x^2}{1+x^2}\right]$, then $\frac{dy}{dx}=$

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

90. If $y=e^{\left(x^e\right)}$ then $\frac{dy}{dx}=$

(a) $e^{\left(x^2\right)}.\left(x^2\right)$ (b) $e^{\left(x^2\right)}\cdot x^2\log x$ (c) $e^{\left(x^e\right)}\cdot ex^{e-1}$ (d) None of these

91. If $y=(\sin x)^{\tan x}$, then $\frac{dy}{dx}=$

(a) $(\sin x)^{\tan x}\left[1+\sec^2 x\cdot\log\sin x\right]$

(b) $\tan x\cdot(\sin x)^{\tan x-1}$

(c) $\tan x\cdot(\sin x)^{\tan x-1}\cdot\cos x$

(d) $(\sin x)^{\tan x}\cdot\log(\sin x)\cdot\sec^2 x$

92. A rod of length 13 meters has one end P on the $x-$axis and the other end Q on the $y-$axis. If P moves along the $x-$axis with a speed of 12 m/sec, then the speed of the other end Q when it is 12 meters from the origin is

(a) -3m/sec (b) -4m/sec (c) -5m/sec (d) -4m/sec

93. $\int_0^1(x-1)e^{-x}\,dx=$

(a) 0 (b) e (c) $\frac{1}{e}$ (d) $-\frac{1}{e}$

94. $\int_{-\pi}^{\pi}\frac{\cos^2 x}{1+a^x}dx=(a>0)$

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

95. $\int_1^2 \frac{dx}{x\left(1+x^4\right)} =$

(a) $\frac{1}{4}\log\left(\frac{17}{32}\right)$ (b) $\frac{1}{4}\log\left(\frac{17}{2}\right)$ (c) $\log\left(\frac{17}{2}\right)$ (d) $\frac{1}{4}\log\left(\frac{32}{17}\right)$

96. The value of $\int_{-\pi/2}^{\pi/2}\left(x^3 + x\cos x + \tan^5 x + 1\right) dx$

(a) 0 (b) 2 (c) π (d) 1

97. $\int \frac{\sin^6 x}{\cos^8 x}\, dx =$

(a) $-\frac{\tan^7 x}{7} + C$ (b) $\frac{\tan^7 x}{7} + C$ (c) $\frac{7}{\cos^7 x} + C$ (d) $\frac{1}{7\cos^7 x} + C$

98. $\int e^x \left(\frac{1+\sin x \cdot \cos x}{1+\cos 2x}\right) dx =$

(a) $e^x \tan x$ (b) $\frac{1}{2}e^x \tan x$ (c) $\frac{1}{2}e^x \cot x$ (d) $2e^x \tan x$

99. $\int \frac{dx}{(x+3)(x-3)} =$

(a) $\frac{1}{3}\log\left(\frac{x+3}{x-3}\right) + C$ (b) $\frac{1}{6}\log(3x) + C$ (c) $\frac{1}{6}\log\left(\frac{x-3}{x}\right) + C$ (d) $\frac{1}{6}\log\left(\frac{x-3}{x+3}\right) + C$

100. The differential equation for $y = A\cos\alpha x + B\sin\alpha x$ where A and B are arbitrary constants is

(a) $\frac{d^2y}{dx^2} - \alpha^2 y = 0$ (b) $\frac{d^2y}{dx^2} + \alpha^2 y = 0$ (c) $\frac{d^2y}{dx^2} + \alpha y = 0$ (d) $\frac{d^2y}{dx^2} - \alpha y = 0$

101. The general solution of $\frac{dy}{dx} = 2xe^{x^2-y}$ is

(a) $e^{x^{2-y}} = c$ (b) $e^{-y} + e^{x^2} = c$ (c) $e^y = e^{x^2} + c$ (d) $e^{x^2+y} = c$

102. A die is thrown and a card is selected at random from a deck of 52 playing cards. The probability of getting an even number on the die and a spade card is

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{1}{8}$ (d) $\frac{167}{168}$

103. In a college of 30 students fail in physics, 25 fail in mathematics and 10 fail in both. One student is chosen at random. The probability that she fails in physics, if she failed in mathematics is

(a) $\frac{1}{10}$ (b) $\frac{2}{5}$ (c) $\frac{9}{20}$ (d) $\frac{1}{3}$

104. A and B are two students. Their chances of solving a problem correctly are $\frac{1}{3}$ and $\frac{1}{4}$ respectively. If the probability of their making a common error is $\frac{1}{20}$ and they obtain the same answer, then the probability of their answer to be correct is

(a) $\frac{1}{12}$ (b) $\frac{1}{40}$ (c) $\frac{13}{120}$ (d) $\frac{10}{13}$

105. Which of the following is correct?

(a) $A \cap \phi = A$ (b) $A \cap \phi = \phi$ (c) $A \cap \phi = U$ (d) $A \cap \phi = A'$

106. If $P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$ is the adjoint of a 3×3 matrix A and $|A| = 4$, then α is equal to

(a) 4 (b) 11 (c) 5 (d) 0

107. If the sum of series $\sum_{n=0}^{\infty} r^n = S$ for $|r| < 1$, then the sum of the series $\sum_{n=0}^{\infty} r^n$, is

(a) S^2 (b) $\frac{S^2}{2S+1}$ (c) $\frac{2S}{S^2-1}$ (d) $\frac{S^2}{2S-1}$

108. The sum of the coefficients in the expansion of $\left(1+x-3x^2\right)^{3148}$ is

(a) 8 (b) 7 (c) 1 (d) -1

109. If the system of equations $x+ky-z=0,\ 3x-ky-z=0$ and $x-3y+z=0$, has non-zero solution, then k is equal to

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

110. The function $f(x) = x - \cot x$

(a) always increases (b) always decreases

(c) never decreases (d) sometimes increases and sometimes decreases

111. The value of $\cos 15° \cos 7\frac{1°}{2} \sin 7\frac{1°}{2}$ is

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

112. The value of $\sin 50° - \sin 70° + \sin 10°$ is

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

113. The projection of $a = 3\hat{i} - \hat{j} + 5\hat{k}$ on $b = 2\hat{i} + 3\hat{j} + \hat{k}$ is

(a) $\frac{8}{\sqrt{35}}$ (b) $\frac{8}{\sqrt{39}}$ (c) $\frac{8}{\sqrt{14}}$ (d) $\sqrt{14}$

114. If the direction cosines of two lines are such that $l+m+n=0,\ l^2+m^2-n^2=0$, then the angle between them is

(a) π (b) $\pi/3$ (c) $\pi/4$ (d) $\pi/6$

115. The difference between two numbers is 48 and the difference between their arithmetic mean and their geometric mean is 18. Then the greater of two numbers is

(a) 96 (b) 60 (c) 54 (d) 49

116. On the interval $[0,1]$, the function $x^{25}(1-x)^{75}$ takes its maximum value at the point

(a) 0 (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) $\frac{1}{3}$

117. If the radius of a circle is increasing at a uniform rate of $2\,cm/s$. The area of increasing of area of circle, at the instant when the radius is $20cm$, is

(a) $70\pi\,cm^2/s$ (b) $70\,cm^2/s$ (c) $80\pi\,cm^2/s$ (d) $80\,cm^2/s$

118. If $2\tan^{-1}(\cos x)=\tan^{-1}(2\cos ecx)$, then the value of x is

(a) $\frac{3\pi}{4}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) None of these

119. The number of real solutions of $\tan^{-1}\left\{\sqrt{x(x+1)}\right\}+\sin^{-1}\left\{\sqrt{x^2+x+1}\right\}=\frac{\pi}{2}$, is

(a) 0 (b) 1 (c) 2 (d) ∞

120. The value of $\cos^{-1}\left(-\frac{1}{2}\right)$ among the following, is

(a) $\frac{9\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) $\frac{5\pi}{3}$ (d) $\frac{11\pi}{3}$

Physics

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

121. The maximum and minimum distances of a comet from the sun are 8×10^{12} m and 1.6×10^{12} m respectively. If its velocity when nearest to the sun is $60\,ms^{-1}$, what will be its velocity in ms^{-1} when it is farthest?

(a) 12 (b) 60 (c) 112 (d) 6

122. A steel cable with a radius 2 cm supports a chairlift at a ski area. If the maximum stress is not to exceed $10^8\,Nm^{-2}$, the maximum load the cable can support is

(a) $4\pi\times10^5$ N (b) $4\pi\times10^4$ N (c) $2\pi\times10^5$ N (d) $2\pi\times10^4$ N

123. A ring of radius 0.5 m and mass 10 kg is rotating about its diameter with angular velocity of 20 rad s^{-1}. Its rotational kinetic energy is

(a) 10 J (b) 100 J (c) 500 J (d) 250 J

124. A 20 cm long capillary tube is dipped in water. The water rises up to 8 cm. If the entire arrangement is put in a freely falling elevator the length of water column in the capillary tube will be

(a) 10 cm (b) 8 cm (c) 20 cm (d) 4 cm

125. When the temperature of a rod increases from t to $(t+\Delta t)$, its moment of inertia increases from I to $(I+\Delta I)$. If α be the coefficient of llinear expansion of the rod, then the value of $\frac{\Delta I}{I}$ is

(a) $2\alpha\Delta t$ (b) $\alpha\Delta t$ (c) $\frac{\alpha\Delta t}{2}$ (d) $\frac{\Delta t}{2}$

126. The pressure is P, volume V and temperature T of a gas in jar A and the other gas in jar B is at pressure P, volume $V/4$ and temperature $2T$, then the ratio of the number of molecules in jar A and B will be

(a) 1:1 (b) 1:2 (c) 2:1 (d) 8:1

127. Two moles of helium gas $(\gamma = 5/3)$ are initially at temperature $27\,°C$ and occupy a volume of 20 litres. The gas is first expanded at constant pressure until the volume is doubled. Then, it undergoes an adiabatic change until the temperature returns to the initial value. What is the final volume of the gas?

(a) 113.13 lit (b) 115.2 lit (c) 120 lit (d) 125 lit

128. Two equations of two S.H.M. are $x = a\sin(\omega t - \alpha)$ and $y = b\cos(\omega t - \alpha)$. The phase difference between the two is

(a) 0° (b) $\alpha°$ (c) 90° (d) 180°

129. The ratio of fundamental frequency of an organ pipe opened at both ends to that of the organ pipe closed at one end is

(a) 1:1 (b) 1.5:1 (c) 2:1 (d) 3:1

130. The charges on two spheres are $+7\mu C$ and $5\mu C$ respectively. They experience a force F. If each of them is given and additional charge of $-2\mu C$, the new forces of attraction will be

(a) F (b) $F/2$ (c) $F/\sqrt{3}$ (d) $2F$

131. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will

(a) increase four times (b) be reduced to half
(c) remain the same (d) be doubled

132. Four charges $q_1 = 2\times10^{-8}$C, $q_2 = -2\times10^{-8}$C, $q_3 = -3\times10^{-8}$C, and $q_4 = 6\times10^{-8}$ C are placed at four corners of a square of side $\sqrt{2}$ m. What is the potential at the centre of the square?

(a) 270 V (b) 300 V (c) zero (d) 100 V

133. A pendulum bob of mass 30.7×10^{-6} kg carrying a charge 2×10^{-8} C is at rest in a horizontal uniform electric field of 20000 Vm^{-1}. The tension in the thread of the pendulum is $\left(g = 9.8\,\text{ms}^{-2}\right)$

(a) 3×10^{-4} N (b) 4×10^{-4} N (c) 5×10^{-4} N (d) 6×10^{-4} N

134. The electric potential at a point (x, y, z) is given by $V = -x^2y - xz^3 + 4$. The electric field $\vec{E}$ at that point is

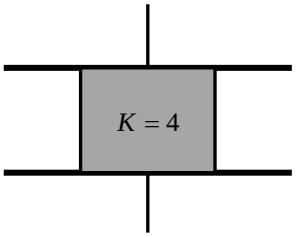
(a) $\vec{E} = \hat{i}2xy + \hat{j}\left(x^2 + y^2\right) + \hat{k}\left(3xz - y^2\right)$

(b) $\vec{E} = \hat{i}z^3 + \hat{j}xyz + \hat{k}z^2$

(c) $\vec{E} = \hat{i}\left(2xy - z^3\right) + \hat{j}xy^2 + \hat{k}3z^2x$

(d) $\vec{E} = \hat{i}\left(2xy + z^3\right) + \hat{j}x^2 + \hat{k}3xz^2$

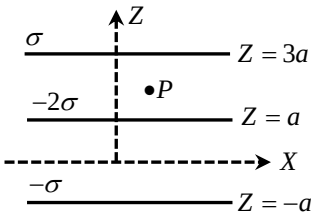
135. Consider a parallel plate capacitor of $10\,\mu F$ (micro-farad) with air filled in the gap between the plates. Now one half of the space between the plates is filled with a dielectric of dielectric constant 4, as shown in the figure. The capacity of the capacitor changes to



(a) $25\ \mu F$ (b) $20\ \mu F$

(c) $40\ \mu F$ (d) $5\ \mu F$

136. Three infinitely long charge sheets are placed as shown in figure. The electric field at point P is



(a) $\frac{2\sigma}{\varepsilon_0}\hat{k}$ (b) $\frac{4\sigma}{\varepsilon_0}\hat{k}$

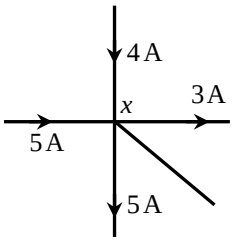
(c) $-\frac{2\sigma}{\varepsilon_0}\hat{k}$ (d) $-\frac{4\sigma}{\varepsilon_0}\hat{k}$

137. The electric field intensity just sufficient to balance the earth's gravitational attraction on an electron will be: (given mass and charge of an electron respectively are 9.1×10^{-31} kg, 1.6×10^{-19} C and $g=10\,\text{m s}^{-2}$)

(a) $-5.6\times10^{-11}\ \text{NC}^{-1}$ (b) $-4.8\times10^{-15}\ \text{NC}^{-1}$

(c) $-1.6\times10^{-19}\ \text{NC}^{-1}$ (d) $-3.2\times10^{-19}\ \text{NC}^{-1}$

138. Five conductors are meeting at a point x as shown in the figure. What is the value of current in fifth conductor



(a) 3A away from x

(b) 1A away from x

(c) 4 A away from x

(d) 1 A away from x

139. An electric current passes through a circuit containing two wires of the same material connected in parallel. If the lengths of the wires are in the ratio of $4/3$ and radius of the wires are in the ratio of $2/3$, then the ratio of the currents passing through the wires will be

(a) 3 (b) 1/3 (c) 3/9 (d) None of these

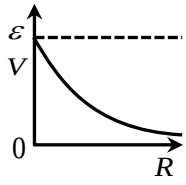
140. When the current i is flowing through a conductor, the drift velocity is v. If $2i$ current flows through the same metal but having double the area of cross-section, then the drift velocity will be

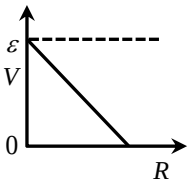
(a) $\frac{v}{4}$ (b) $\frac{v}{2}$ (c) v (d) $4v$

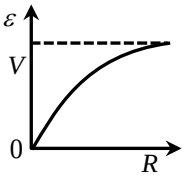
141. A small power station supplies electricity to 5000 lamps connected in parallel. Each lamp has a resistance of $220\,\text{ohm}$ and is operated at $220\,\text{V}$. The total current supplied by the station is

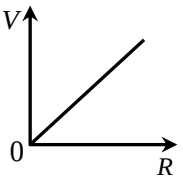
(a) 2500 A (b) 3500 A (c) 5000 A (d) 10000 A

142. Cell having an emf ε and internal resistance r is connected across a variable external resistance R. As the resistance R is increased, the plot of potential difference V across R is given by

(a) 

(b) 

(c) 

(d) 

143. The resistance of a bulb filmnet is $100\,\Omega$ at a temperature of $100\,°C$. If its temperature of coefficient be 0.005 per $°C$, its resistance will become $200\,\Omega$ at a temperature of

(a) 300°C (b) 400°C (c) 500°C (d) 200°C

144. An electron enters a region where magnetic field (B) and electric field (E) are mutually perpendicular, then

(a) it will always move in the direction of B (b) it will always move in the direction of E

(c) it always possesses circular motion (d) it can go undeflected also

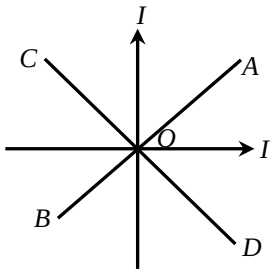
145. Magnetic field intensity at the centre of a coil of 50 turns, radius $0.5\,m$ and carrying a current of $2\,A$ is

(a) $0.5\times10^{-5}\,T$ (b) $1.25\times10^{-4}\,T$ (c) $3\times10^{-5}\,T$ (d) $4\times10^{-5}\,T$

146. A straight wire of length 0.5 metre and carrying a current of 1.2 ampere is placed in uniform magnetic field of induction 2 tesla. The magnetic field is perpendicular to the length of the wire. The force on the wire is

(a) $2.4\,N$ (b) $1.2\,N$ (c) $3.0\,N$ (d) $2.0\,N$

147. Two equal electric currents are flowing perpendicular to each other as shown in the figure. AB and CD are perpendicular to each other and symmetrically placed with respect to the current flow. Where do we expect the resultant magnetic field to be zero?



(a) on AB

(b) on CD

(c) on both AB and CD

(d) on both OD and BO

148. The magnetic lines of force inside a bar magnet

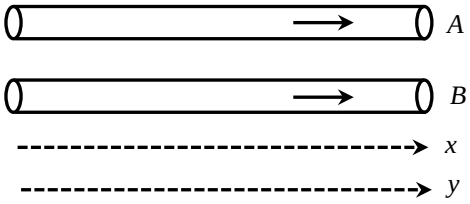
(a) are from N – pole to S – pole of magnet

(b) do not exist

(c) depend upon the area of cross section of bar magnet

(d) are from S – pole of magnet

149. A and B are two conductors carrying a current i in the same direction. x and y are two electron beams moving in the same direction. Then



(a) there will be repulsion between A and B, attraction between x and y

(b) there will be attraction between A and B, repulsion between x and y

(c) there will be repulsion between A and B and also x and y

(d) there will be attraction between A and B and also x and y

150. If a diamagnetic substance is brought near north or south pole of a bar magnet, it is

(a) attracted by the poles

(b) repelled by the poles

(c) repelled by north pole and attracted by the south pole

(d) attracted by the north pole and repelled by the south pole

151. A square coil of side 25 cm having 1000 turns is rotated with a uniform speed in a magnetic field about an axis perpendicular to the direction of the field. At an instant t, the emf induced in the coil is $e = 200\sin 100\pi t$. The magnetic field is

(a) $0.50\,\text{T}$ (b) $0.02\,\text{T}$ (c) 0.01T (d) 0.1T

152. The magnetic potential energy stored in a certain inductor is $25\,\text{mJ}$, when the current in the inductor is $60\,\text{mA}$. This inductor is of inductance

(a) $0.138\,\text{H}$ (b) $138.88\,\text{H}$ (c) $13.89\,\text{H}$ (d) $1.389\,\text{H}$

153. A resistance of $20\,\text{ohm}$ is connected to a source of an alternating potential $V = 200\cos(100\pi t)$. The time taken by the current to change from its peak value to rms value, is

(a) $2.5\times10^{-3}\,\text{s}$ (b) $25\times10^{-3}\,\text{s}$ (c) $0.25\,\text{s}$ (d) $0.20\,\text{s}$

154. In a circuit, L, C and R are connected in series with an alternating voltage source of frequency f. The current leads the voltage by $45°$. The value of C is

(a) $\dfrac{1}{\pi f\left(2\pi fL - R\right)}$ (b) $\dfrac{1}{2\pi f\left(2\pi fL - R\right)}$

(c) $\dfrac{1}{\pi f\left(2\pi fL + R\right)}$ (d) $\dfrac{1}{2\pi f\left(2\pi fL + R\right)}$

155. A transformer is used to light a $100\,\text{W}$ and $110\,\text{V}$ lamp from a $220\,\text{V}$ mains. If the main current is $0.5\,\text{A}$, the efficiency of the transformer is approximately

(a) 50% (b) 90% (c) 10% (d) 30%

156. The electric and the magnetic field associated with an E.M. wave, propagating along the $+z-$ axis, can be represented by

(a) $\left[\vec{E}=E_0\hat{i},\ \vec{B}=B_0\hat{j}\right]$ (b) $\left[\vec{E}=E_0\hat{k},\ \vec{B}=B_0\hat{i}\right]$

(c) $\left[\vec{E}=E_0\hat{j},\ \vec{B}=B_0\hat{i}\right]$ (d) $\left[\vec{E}=E_0\hat{j},\ \vec{B}=B_0\hat{k}\right]$

157. A concave mirror of focal length 'f_1' is placed at a distance of 'd' from a convex lens of focal length 'f_2'. A beam of light coming from infinity and falling on this convex-lens concave mirror combination returns to infinity. The distance 'd' must be equal to

(a) f_1+f_2 (b) $-f_1+f_2$ (c) $2f_2+f_1$ (d) $-2f_1+f_2$

158. A ray of light is incident at an angle of incidence, i, on one face of prism of angle A (assumed to be small) and emerges normally from the opposite face. If the refractive index of the prism is μ, the angle of incidence i, is nearly equal to

(a) μA (b) $\frac{\mu A}{2}$ (c) $\frac{A}{\mu}$ (d) $\frac{A}{2\mu}$

159. When a biconvex lens of glass having refractive index 1.47 is dipped in a liquid, it acts as a plane sheet of glass. This implies that the liquid must have refractive index

(a) equal to that of glass (b) less than one

(c) greater than that of glass (d) less than that of glass

160. A fish looking up through the water sees the outside world contained in a circular horizon. If the refractive index of water is $\frac{4}{3}$ and the fish is 12 cm below the surface, the radius of this circle in cm is

(a) $\frac{36}{\sqrt{7}}$ (b) $36\sqrt{7}$ (c) $4\sqrt{5}$ (d) $36\sqrt{5}$

161. Two identical light waves, propagating in the same direction, have a phase difference δ. After they superimpose, the intensity of the resulting wave will be proportional to

(a) $\cos\delta$ (b) $\cos(\delta/2)$ (c) $\cos^2(\delta/2)$ (d) $\cos^2\delta$

162. The locus of all particles in a medium, vibrating in the same phase is called

(a) Wavelet (b) fringe (c) wave front (d) None of these

163. A steel ball of mass m is moving with a kinetic energy K. The de-Broglie wavelength associated with the ball is

(a) $\frac{h}{2mK}$ (b) $\sqrt{\frac{h}{2mK}}$ (c) $\frac{h}{\sqrt{2mK}}$ (d) None of these

164. All electrons ejected from a surface by incident light of wavelength $200\,\text{nm}$ can be stopped before travelling 1m in the direction of uniform electric field of $4\ \text{NC}^{-1}$. The work function of the surface is

(a) 4 eV (b) 6.2 eV (c) 2 eV (d) 2.2 eV

165. In Rutherford's $\alpha-$particle scattering experiment, what will be correct angle for α scattering for an impact parameter $b=0$?

(a) $90°$ (b) $270°$ (c) $0°$ (d) $180°$

166. According to the Bohr theory of $H-$atom, the speed of the electron, its energy and the radius of its orbit varies with the principal quantum number n, respectively, as

(a) $\frac{1}{n}, n^2, \frac{1}{n^2}$ (b) $n, \frac{1}{n^2}, n^2$ (c) $n, \frac{1}{n^2}, \frac{1}{n^2}$ (d) $\frac{1}{n}, \frac{1}{n^2}, n^2$

167. Energy of an electron in an excited hydrogen atom is $-3.4\,\text{eV}$. Its angular momentum will be

(a) 3.72×10^{-34} Js (b) 2.10×10^{-34} Js (c) 1.51×10^{-34} Js (d) 4.20×10^{-34} Js

168. M_n and M_p represent mass of neutron and proton respectively. If an element having atomic mass M and $N-$neutrons and $Z-$protons, then the correct relation will be

(a) $M < \left[NM_n + ZM_p\right]$ (b) $M > \left[NM_n + ZM_p\right]$ (c) $M = \left[NM_n + ZM_p\right]$ (d) $M = N\left[M_n + M_p\right]$

169. The binding energy per nucleon for ${}_1^2H$ and ${}_2^4He$ respectively are $1.1\,\text{MeV}$ and $7.1\,\text{MeV}$. The energy released in MeV when two ${}_1^2H$ nuclei to form ${}_2^4He$ is

(a) 4.4 (b) 8.2 (c) 24 (d) 28.4

170. Nuclear force exists between

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

171. When germanium is doped 1 part in a million with indium, its conductivity increases by a factor of about

(a) 10 (b) 10^3 (c) 10^5 (d) 10^6

172. Pure Si at $500\,\text{K}$ has equal number of electron (n_e) and hole (n_h) concentrations of $1.5\times10^{16}\,\text{m}^{-3}$. Doping by indium increases n_h to $4.5\times10^{22}\,\text{m}^{-3}$. The doped semiconductor is of

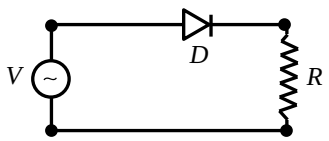
(a) $n-$type with electron concentration $n_e = 5\times10^{22}\,\text{m}^{-3}$

(b) $p-$type with electron concentration $n_e = 2.5\times10^{10}\,\text{m}^{-3}$

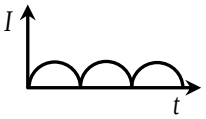
(c) $n-$type with electron concentration $n_e = 2.5\times10^{23}\,\text{m}^{-3}$

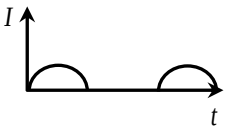
(d) $p-$type having electron concentration $n_e = 5\times10^{9}\,\text{m}^{-3}$

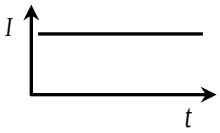
173. A $p-n$ junction (D) shown in the figure can act as a rectifier. An alternative current source (V) is connected in the circuit.

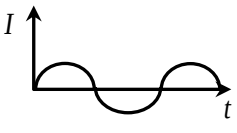


The current (I) in the resistor (R) can be shown by

(a) 

(b) 

(c) 

(d) 

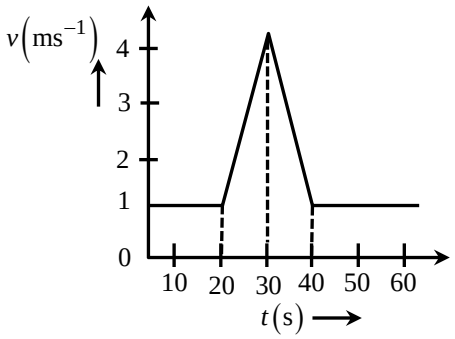
174. A charged particle with charge q enters a region of constant, uniform and mutually orthogonal fields $\vec{E}$ and $\vec{B}$ with a velocity $\vec{v}$ perpendicular to both $\vec{E}$ and $\vec{B}$, and comes out without any change in magnitude or direction of $\vec{v}$. Then

(a) $\vec{v} = \vec{B} \times \vec{E} / E^2$ (b) $\vec{v} = \vec{E} \times \vec{B} / B^2$ (c) $\vec{v} = \vec{B} \times \vec{E} / B^2$ (d) $\vec{v} = \vec{E} \times \vec{B} / E^2$

175. If momentum (P), area (A) and time (T) are taken to be fundamental quantities, then the energy has the dimensional formula

(a) $\left[P^1 A^{-1} T^1\right]$ (b) $\left[P^2 A^1 T^1\right]$ (c) $\left[P^1 A^{-1/2} T^1\right]$ (d) $\left[P^1 A^{1/2} T^{-1}\right]$

176. Velocity time $(v-t)$ graph for a moving object is shown in the figure. Total displacement of the object during the time interval when there is non-zero acceleration and retardation is



(a) 60 m (b) 50 m (c) 30 m (d) 40 m

177. A person aiming to reach the exactly opposite point on the bank of a stream is swimming with a speed of $0.5\,\text{ms}^{-1}$ at an angle of $120°$ with the direction of flow of water. The speed of water in the stream is

(a) $1\ \text{ms}^{-1}$ (b) $0.5\,\text{ms}^{-1}$ (c) $0.25\,\text{ms}^{-1}$ (d) $0.433\,\text{ms}^{-1}$

178. A conveyor belt is moving at a constant speed of $2\ \text{ms}^{-1}$. A box is gently dropped on it. The coefficient of friction between them is $\mu = 0.5$. The distance that the box will move relative to belt before coming to rest on it taking $g = 10\,\text{ms}^{-2}$, is

(a) 1.2 m (b) 0.6 m (c) zero (d) 0.4 m

179. A body of mass $5\,\text{kg}$ is moving with a momentum of $10\,\text{kg ms}^{-1}$. A force of $0.2\,\text{N}$ acts on it in the direction of motion of the body for 10 second. The increase in its kinetic energy is

(a) 4.4 J (b) 3.8 J (c) 3.2 J (d) 2.8 J

180. A thin uniform rod of length l and mass m is swinging freely about a horizontal axis passing through its end. Its maximum angular speed is ω. Its centre of mass rises to a maximum height of

(a) $\frac{1}{3}\frac{l^2\omega^2}{g}$ (b) $\frac{1}{6}\frac{l\omega}{g}$ (c) $\frac{1}{2}\frac{l^2\omega^2}{g}$ (d) $\frac{1}{6}\frac{l^2\omega^2}{g}$