MHT CET 2025 25th April Morning Shift Question Paper 2025

Time Allowed :180 minutes	Maximum Marks :200	Total Questions :150 / 200

General Instructions

1. **Structure:** PCM candidates face 150 questions (50 each in Physics, Chemistry, and Mathematics), while PCB candidates face 200 questions (100 in Biology, 50 each in Physics and Chemistry).
2. **Timing & Duration:** The total time is 3 hours (180 minutes), divided into two sections (90 mins each). Once the 90-minute limit for a section ends, it locks automatically.
3. **Marking Scheme:** +1 mark for each correct answer in Physics and Chemistry, and +2 marks for Mathematics and Biology. There is no negative marking.
4. **Language:** The exam is available in English, Marathi, and Urdu, specifically for Physics, Chemistry, and Biology sections.
5. **Login:** Candidates must login using the credentials provided on their admit card at least 30 minutes before the exam starts.
6. **Interface & Answer Selection:** Select one correct option from the four alternatives. You must use 'Save and Next' to secure your answer. A calculator is not permitted.
7. **Required Items:** Candidates must carry their admit card (two copies, one with a photo) and a valid government-issued photo ID.
8. **Technical Issues:** Immediately inform the invigilator if there is any computer malfunction or technical issue.

CHEMISTRY

1. Which among the following salts turns blue litmus red in its aqueous solution?

(A) KCN
(B) Na_2CO_3
(C) $NaNO_3$
(D) $CuCl_2$

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2. Which of the following is NOT obtained when mixture of methyl bromide and ethyl bromide is treated with sodium metal in presence of dry ether?

(A) Ethane
(B) Propane

(C) Butane
(D) Pentane

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3. Which of the following species acts as an weakest reducing agent?

(A) Li
(B) Li^+
(C) F_2
(D) F^-

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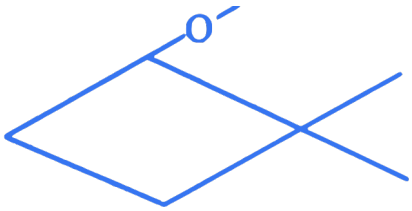
4. What is IUPAC name of following compound?



(A) 1-Methoxy-2,2-dimethylbutane
(B) 2-Methoxy-1,1-dimethylbutane
(C) 1-Methoxy-2,2-dimethylcyclobutane
(D) 2-Methoxy-1,1-dimethylcyclobutane

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5. Calculate ΔH° for a reaction if $\Delta S^\circ = 120\,\mathbf{J\ K^{-1}}$ and $\Delta G^\circ = 28000\,\mathbf{J}$

(A) 15.94 kJ
(B) 31.83 kJ
(C) 94.12 kJ
(D) 63.76 kJ

---

6. Calculate the number of particles present per unit cell if mass of a particle is $8.0 \times 10^{-23}\,\mathbf{g}$ $[\rho \times a^3 = 3.2 \times 10^{-22}\,\mathbf{g}]$

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

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7. Identify the medium required for formation of p-Hydroxyazobenzene from benzene diazonium chloride and phenol.

(A) Strong acidic
(B) Mild alkaline
(C) Alcoholic
(D) Ether

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8. Identify source of Eugenol from following.

(A) Clove
(B) Indian gooseberry
(C) Wintergreen
(D) Citrus fruits

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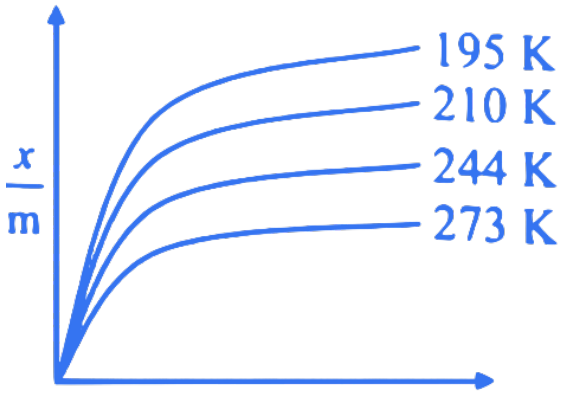
9. Find the temperature from following graph so that highest amount of a gas is adsorbed



(A) 195 K
(B) 210 K
(C) 244 K
(D) 273 K

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10. Which of the following is existing oxoacid of fluorine?

(A) HFO
(B) HFO_2
(C) HFO_3
(D) HFO_4

---

11. Which of the following compounds is formed when ether is dissolved in cold concentrated sulphuric acid?

(A) Alkanol
(B) Alkanoic acid
(C) Alkyl hydrogen sulphate
(D) Oxonium salt

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12. Calculate the work done in joule if 1 mole of ideal gas is compressed from $25\,\mathbf{dm^3}$ to $13\,\mathbf{dm^3}$ at constant external pressure 4 bar.

(A) 2400 J
(B) 4800 J
(C) 6000 J
(D) 7200 J

---

13. Calculate the edge length of unit cell if a metal with atomic radius 128 pm forming fcc unit cell structure.

(A) 3.62×10^{-8} cm
(B) 2.56×10^{-8} cm
(C) 2.96×10^{-8} cm
(D) 3.12×10^{-8} cm

---

14. Which from following is NOT a globular protein?

(A) Legumelin
(B) Egg albumin
(C) Myosin
(D) Insulin

---

15. Which pair of elements from following is used to make alloy for trophies?

(A) Cr and Zn
(B) Ni and Cu
(C) Cu and Sn
(D) Ni and Zn

---

16. Calculate percentage atom economy when 46 g ethanol is obtained from 64.5 g chloroethane and $56\,\mathbf{g\,KOH_{(aq)}}$.

(A) 25.25%
(B) 38.17%
(C) 50.25%
(D) 64.17%

---

17. The solubility product of the sparingly soluble salt AB_2 is 2.56×10^{-10} at 298 K. Calculate its solubility in mol dm^{-3} at the same temperature?

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

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18. Which of the following statements is NOT correct about ozone?

(A) It is strong reducing agent
(B) It has angular shape
(C) It is good bleaching agent
(D) It absorbs harmful Ultra Violet radiation from the sun

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19. Identify the product 'B' in the following reaction.
Sodium phenoxide $\xrightarrow[\textbf{6 atm}]{\textbf{CO}_2\textbf{, 398 K}}$ **A** $\xrightarrow{\textbf{H}_3\textbf{O}^+}$ **B**

(A) Picric acid
(B) Sulphonic acid
(C) Salicylic acid
(D) Salicylaldehyde

---

20. Which from following d-orbitals has different shape as compared with others?

(A) d_{xy}
(B) d_{yz}
(C) d_{xz}
(D) d_{z^2}

---

21. Which from following pairs of solutions in water exhibits same osmotic pressure at same temperature?
[**molar mass of urea** $= 60\ g\ mol^{-1}$ **sucrose** $= 342\ g\ mol^{-1}$]

(A) 3 $g\ L^{-1}$ urea and $17.1 gL^{-1}$ sucrose
(B) 6 $g\ L^{-1}$ urea and $17.1 gL^{-1}$ sucrose
(C) 3 $g\ L^{-1}$ urea and 34.2 gL^{-1} sucrose
(D) 6 $g\ L^{-1}$ urea and 8.6 $g\ L^{-1}$ sucrose

---

22. Identify glycosidic linkage in maltose.

(A) $\alpha - 1, 4$
(B) $\alpha - 1, 6$
(C) $\alpha - 2, 4$
(D) $\beta - 1, 4$

---

23. Which lanthanoid from following has highest ionisation (IE_1) enthalpy?

(A) Tm
(B) Dy
(C) Nd
(D) Yb

---

24. For a reaction $A \rightarrow$ Product, rate constant is $6.93 \times 10^{-3} hour^{-1}$. What is order of reaction?

(A) Zero
(B) 1
(C) 1.5
(D) 2

---

25. Calculate the value of dissociation constant of weak acid, which dissociates to 0.01% in its 0.1 M solution?

(A) 10^{-3}
(B) 10^{-4}
(C) 10^{-5}
(D) 10^{-9}

---

26. What is the number of electrons in bonding molecular orbitals and antibonding molecular orbitals respectively in F_2 molecule?

(A) 12 and 6
(B) 10 and 8

(C) 8 and 10
(D) 6 and 12

---

27. Which of the following is likely to undergo racemization during alkaline hydrolysis by S_N1 mechanism?

(A) $CH_3 - CH(Cl) - CH_3$
(B) $CH_3 - CH_2 - CH(Cl) - CH_3$
(C) $CH_3 - CH_2 - CH(Cl) - CH_2 - CH_3$
(D) $(CH_3)_3C - CH_2 - Cl$

---

28. Identify the name of reaction if carbonyl group of aldehydes and ketones is reduced to methylene group on treatment with hydrazine followed by heating with sodium hydroxide in ethylene glycol.

(A) Wolf-Kishner reduction
(B) Clemmensen reduction
(C) Stephen reaction
(D) Etard reaction

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29. A solution of 5 g nonvolatile solute in 50 g water decreases its freezing point by 0.2 K. Calculate the molar mass of solute if K_f of water is $1.86\ K\ kg\ mol^{-1}$

(A) $840 gmol^{-1}$
(B) $930 gmol^{-1}$
(C) $960 g\ mol^{-1}$
(D) $870 g\ mol^{-1}$

---

30. Identify polyamide polymer from following.

(A) SBR
(B) Melamine formaldehyde polymer
(C) Bakelite
(D) Nylon 6,6

---

31. What is the number of unpaired electrons in $[Co(NH_3)_6]^{3+}$ complex?

(A) 4
(B) 3

(C) 2
(D) Zero

---

32. If $r = k[A]^2[B]$ is rate law equation for reaction $A + B \rightarrow C$ at $[A] = 1M$ and $[B] = 0.2M$ Calculate rate of reaction if rate constant is $6.25M^{-2}s^{-1}$

(A) 1.25 $moldm^{-3}s^{-1}$
(B) 3.40 $moldm^{-3}s^{-1}$
(C) 5.88 $moldm^{-3}s^{-1}$
(D) 8.58 $moldm^{-3}s^{-1}$

---

33. Which of the following is used in preparation of hydrogen peroxide by Merck process?

(A) $CaCO_{3(s)}$
(B) $BaO_2 \cdot 8H_2O$
(C) $CaCl_{2(s)}$
(D) $Na_2O_{2(aq)}$

---

34. Identify ' A ' in the following reaction.
$A_{(excess)} + Acetyl\ chloride \frac{Anhydrous}{AlCl_3} >$ **2-Chloroacetophenone + 4-Chloroacetophenone**

(A) Benzene
(B) Chlorobenzene
(C) Toluene
(D) Phenol

---

35. The vapour density of a certain gas is 16. What is the volume occupied by 8 g of gas at STP assuming ideal behaviour?

(A) $2.80dm^3$
(B) $5.6dm^3$
(C) $11.2dm^3$
(D) $2.24dm^3$

---

36. For the cell involving following reaction.
$Zn_{(s)} + Ni^{+2}_{(aq)} \longrightarrow Zn^{+2}_{(aq)} + Ni_{(s)}, E^*_{cell} = 0.5\ V.$
What is standard Gibb's energy change of cell reaction?

(A) $-193kJ$
(B) $-905\ kJ$
(C) -96.5 kJ
(D) $-89.65\ kJ$

---

37. Which of the following alkenes, on oxidation by $KMnO_4$ in dil. H_2SO_4 forms adipic acid?

(A) Hex-1-ene
(B) Hex-2-ene
(C) Hex-3-ene
(D) Cyclohexene

---

38. Calculate the molality of the solution containing nonvolatile solute if boiling point elevation of solution is 0.39 K
$[K_b$ **of** $water = 0.52K\ kg\ mol^{-1}]$

(A) 0.52 $mol\ kg^{-1}$
(B) 0.65 $mol\ kg^{-1}$
(C) 0.75 $mol\ kg^{-1}$
(D) 0.86 $mol\ kg^{-1}$

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39. Which from following polymers is used to obtain rubber belts?

(A) Buna-N
(B) Perspex
(C) PVC
(D) Polycarbonate

---

40. Identify anionic ligand from following.

(A) Isothiocyanato
(B) Ammine
(C) Aqua
(D) Ethylenediamine

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41. The rate constant is doubled when temperature increases from $27°C$ to $37°C$ What is activation energy in kJ ?

(A) 21.32
(B) 34.12
(C) 53.60
(D) 43.54

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42. What is the oxidation number of phosphorus in calcium phosphate?

(A) +3
(B) +4
(C) +5
(D) +6

---

43. Which of the following forms 2-Methylbut-2-ene on heating with concentrated sulphuric acid?

(A) Butan-2-ol
(B) 2-Methyl-2-propanol
(C) 2-Methylbutan-1-ol
(D) 2-Methylbutan-2-ol

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44. If $E^{\circ}(Zn^{+2}_{(aq)}|Zn_{(s)}) = -0.76\ V$. Calculate potential for $Zn_{(s)} \rightarrow Zn^{+2}(0.01M) + 2e^{-}$ at 298 K.

(A) +0.8192 V
(B) -0.8192 V
(C) +0.7008 V
(D) -0.7008 V

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45. Which among the following is NOT dicarboxylic acid?

(A) Malonic acid
(B) Caproic acid
(C) Glutaric acid
(D) Succinic acid

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46. Which from following transformations is endothermic in nature?

(A) $H_2O_{(l)} \rightarrow H_2O_{(s)}$
(B) $H_2O_{(s)} \rightarrow H_2O_{(l)}$

(C) $H_2O_{(g)} \rightarrow H_2O_{(l)}$
(D) $H_2O_{(g)} \rightarrow H_2O_{(s)}$

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47. Which of the following dopant is used in silicon to produce p-type semiconductor?

(A) Ga
(B) Sb
(C) As
(D) P

---

48. Which from following amines has lowest pK_b value?

(A) $C_2H_5NH_2$
(B) $(CH_3)_3N$
(C) $C_6H_5NH_2$
(D) $C_6H_5CH_2NH_2$

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49. Which from following compounds does NOT contain oxygen as heteroatom?

(A) Furan
(B) THF
(C) 4H-Pyran
(D) Pyrrole

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50. Find out total number of electrons present in 1.6 g methane?

(A) 6.022×10^{23}
(B) 6.022×10^{22}
(C) 6.022×10^{21}
(D) 4.022×10^{20}

MATHEMATICS

51. If $f(x) = \log\left(\frac{1+x}{1-x}\right)$ and $g(x) = \frac{3x+x^3}{1+3x^2}$, then $(flog)(x) =$

(A) $2f(x)$
(B) $3f(x)$
(C) $4f(x)$
(D) $-f(x)$

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52. If $\sec x + \tan x = 2$, $0 < x < \frac{\pi}{2}$ **then** $\sin \frac{x}{4} =$

(A) $\frac{1}{\sqrt{10+3\sqrt{10}}}$
(B) $\frac{1}{\sqrt{2(10+3\sqrt{10})}}$
(C) $\frac{1}{\sqrt{10-3\sqrt{10}}}$
(D) $\frac{1}{2\sqrt{10}-3\sqrt{10}}$

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53. The eccentricity of the curve represented by $x = 3(\cos t + \sin t)$, $y = 4(\cos t - \sin t)$ **is**

(A) $\frac{\sqrt{7}}{4}$
(B) $\frac{\sqrt{7}}{3}$
(C) $\frac{7}{16}$
(D) $\frac{\sqrt{8}}{4}$

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54. The rate at which the population of a city increases varies as the population. In a period of 20 years, the population increased from 4 lakhs to 6 lakhs. In another 20 years the population will be

(A) 8 lakhs
(B) 12 lakhs
(C) 9 lakhs
(D) 10 lakhs

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55. If $\overline{a} = \hat{i} + \hat{j} + \hat{k}$, $\overline{b} = \hat{j} - \hat{k}$ **then a vector** $\overline{c}$ **such that** $\overline{a} \times \overline{c} = \overline{b}$ **and** $\overline{a} \cdot \overline{c} = 3$ **is**

(A) $\frac{5}{3}\hat{i} + \frac{2}{3}\hat{j} + \frac{2}{3}\hat{k}$
(B) $\hat{i} - 2\hat{j} + 4\hat{k}$
(C) $\hat{i} + 2\hat{k}$
(D) $2\hat{i} - 3\hat{j} + 4\hat{k}$

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56. The solution set of the constraints $|x - y| \leq 1$, $x, y \geq 0$ **is**

(A) a finite set
(B) an unbounded set
(C) a convex polygon
(D) such that feasible region does not exist

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57. The lines $\frac{x-0}{1} = \frac{y-2}{2} = \frac{z+3}{\lambda}$ and $\frac{x-2}{2} = \frac{y-6}{3} = \frac{z-3}{\lambda}$ are coplanar and p is the plane containing these lines, then which of the following points does not lie on the plane?

(A) $(1, 6, 4)$
(B) $(2, 8, 7)$
(C) $(1, 2, 3)$
(D) $(4, 10, 9)$

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58. $\int_1^3 \frac{\log x^2}{\log(16x^2-8x^3+x^4)}dx =$

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

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59. If $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then $\frac{d^2y}{dx^2}$ is

(A) $\frac{-b^4}{a}$
(B) $\frac{b^4}{a^2}$
(C) $\frac{-b^4}{y^3}$
(D) $\frac{-b^4}{a^2 \cdot y^3}$

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60. If Rolle's theorem holds for the function $x^3 + ax^2 + bx$, $1 \leq x \leq 2$ at the point $\frac{4}{3}$, then the values of a and b are respectively

(A) 5, 8
(B) -8, 5
(C) -8, -5
(D) -5, 8

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61. $\int \frac{1}{e^x+1}dx =$

(A) $x + \log(e^x + 1) + c$
(B) $x - \log(e^x + 1) + c$
(C) $\log(e^x - 1) + x + c$
(D) $\log(e^x - 1) - x + c$

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62. If $y = \tan^{-1}\left(\frac{4x}{1+5x^2}\right) + \cot^{-1}\left(\frac{3-2x}{2+3x}\right)$ then $\frac{dy}{dx}$ is equal to

(A) $\frac{5}{1+25x^2}$
(B) $\frac{1}{1+25x^2}$
(C) $\frac{1}{1+5x^2}$
(D) $\frac{5}{1+5x^2}$

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63. The differential equation $x\frac{dy}{dx} = 2y$ represents

(A) a family of circles with radius c
(B) a family of parabolas with vertex at the origin and axis along the positive Y-axis
(C) a family of parabolas with vertex at origin and axis along the positive X-axis
(D) a family of ellipses

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64. $\int e^x \left(\frac{x+5}{(x+6)^2}\right) dx$ is

(A) $\frac{e^x}{(x+6)^2} + c$, where c is the constant of integration.
(B) $\frac{e^x}{x+5} + c$, where c is the constant of integration.
(C) $\frac{e^x}{(x+5)^2} + c$, where c is the constant of integration.
(D) $\frac{e^x}{x+6} + c$, where c is the constant of integration.

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65. The principal solutions of $(5 + 3\sin\theta)(2\cos\theta + 1) = 0$ are

(A) $\frac{-\pi}{3}, \frac{2\pi}{3}$
(B) $\frac{2\pi}{3}, \frac{5\pi}{3}$
(C) $\frac{2\pi}{3}, \frac{4\pi}{3}$
(D) $\frac{2\pi}{3}, \frac{7\pi}{3}$

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66. Let X denote the number of hours you study on a Sunday. It is known that

$$P(X = x) = \begin{cases} 0.1 & \text{if } x = 0 \\ kx & \text{if } x = 1 \text{ or } 2 \\ k(5-x) & \text{if } x = 3 \text{ or } 4 \\ 0 & \text{otherwise} \end{cases}$$

where k is constant. Then the probability that

you study at least two hours on a Sunday is

(A) 0.55
(B) 0.15
(C) 0.75
(D) 0.3

---

67. The principal value of $\cos^{-1}\left[\frac{1}{\sqrt{2}}\left(\cos\frac{9\pi}{10}-\sin\frac{9\pi}{10}\right)\right]$ **is**

(A) $\frac{3\pi}{20}$
(B) $\frac{17\pi}{20}$
(C) $\frac{7\pi}{10}$
(D) $\frac{\pi}{10}$

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68. The length of the perpendicular from the point $(1,\frac{3}{2},2)$ **to the plane** $2x-2y+4z+17=0$ **is**

(A) $\sqrt{6}$ units
(B) $3\sqrt{3}$ units
(C) $4\sqrt{3}$ units
(D) $2\sqrt{6}$ units

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69. A tetrahedron has vertices $O(0,0,0), A(1,2,1), B(2,1,3), C(-1,1,2)$**. Then the angle between the faces OAB and ABC will be**

(A) $\cos^{-1}\left(\frac{19}{35}\right)$
(B) $\cos^{-1}\left(\frac{-1}{35}\right)$
(C) $\cos^{-1}\left(\frac{9}{35}\right)$
(D) $\cos^{-1}\left(\frac{4}{35}\right)$

---

70. If $A=\begin{bmatrix}3 & -3 & 4\\ 2 & -3 & 4\\ 0 & -1 & 1\end{bmatrix}$**, then** $A^{-1}=$

(A) A
(B) A^2
(C) A^3
(D) A^4

---

71. The area bounded by the parabolas $y = 9x^2, y = \frac{x^2}{16}$ and the line $y = 1$ is

(A) $\frac{22}{9}$ sq. units
(B) $\frac{44}{9}$ sq. units
(C) $\frac{8}{9}$ sq. units
(D) $\frac{26}{9}$ sq. units

---

72. $\int \frac{dx}{3\cos 2x+5}$ equals

(A) $\frac{1}{2}\tan^{-1}(\tan x) + c$, where c is the constant of integration.
(B) $\frac{1}{2}\tan^{-1}\left(\frac{\tan x}{2}\right) + c$, where c is the constant of integration.
(C) $\frac{1}{4}\tan^{-1}\left(\frac{1}{2}\tan x\right) + c$, where c is the constant of integration.
(D) $\frac{1}{4}\tan^{-1}(\tan x) + c$, where c is the constant of integration.

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73. The solution of the equation $x^2y - x^3\frac{dy}{dx} = y^4\cos x$, where $y(0) = 1$, is

(A) $y^3 = 3x^2\sin x$
(B) $x^3 = 3y^3\sin x$
(C) $x^3 = y^3\sin x$
(D) $y^3 = 4x^3\sin x$

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74. If the statements p, q and r are true, false and true statements respectively, then the truth value of the statement pattern $[\sim q \wedge (p \vee \sim q) \wedge \sim r] \vee p$ and the truth value of its dual statement respectively are

(A) T, T
(B) F, T
(C) T, F
(D) F, F

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75. If the lines $\frac{x-1}{2} = \frac{7y+4}{2\lambda} = \frac{z-5}{2}$ and $\frac{7-7x}{3\lambda} = \frac{y-1}{7} = \frac{6-z}{5}$ are at right angle, then the value of λ is:

(A) $\frac{4}{7}$
(B) $\frac{7}{4}$
(C) $\frac{20}{7}$
(D) $\frac{5}{4}$

---

76. The negation of the statement "The triangle is an equilateral or isosceles triangle and the triangle is not isosceles and it is right angled" is:

(A) The triangle is not an equilateral or not an isosceles triangle or it is not right angled
(B) The triangle is not an equilateral triangle or not isosceles triangle and it is isosceles or it is not right angled
(C) If the triangle is an equilateral triangle or an isosceles triangle then it is an isosceles triangle or not right angled
(D) If the triangle is an equilateral triangle or an isosceles triangle then it is not isosceles triangle and it is not right angled

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77. $f(x) = \frac{x}{2} + \frac{2}{x}$ $x \neq 0$ **is strictly decreasing in:**

(A) (2,3)
(B) (1,3)
(C) (-2,2)
(D) (1,2)

---

78. If $f(x) = \frac{\sin(\pi \cos^2 x)}{3x^2}$ $x \neq 0$ **is continuous at** $x = 0$ **then** $f(0) =$

(A) 0
(B) $\frac{\pi}{3}$
(C) $\frac{-\pi}{3}$
(D) $\frac{3}{\pi}$

---

79. Let z be the complex number with $Im(z) = 10$ **and satisfying** $\frac{2z-n}{2z+n} = 2i-1$**, where** $i = \sqrt{-1}$**, for some natural number n, then:**

(A) $n = 20$ and $Re(z) = 10$
(B) $n = 20$ and $Re(z) = -10$
(C) $n = 40$ and $Re(z) = 10$
(D) $n = 40$ and $Re(z) = -10$

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80. The rate of change of the volume of a sphere with respect to its surface area, when the radius is 5 m is:

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

81. The maximum value of the function $a\sin x + b\cos x$ is:

(A) $\sqrt{a^2+b^2}$
(B) $\sqrt{a^2-b^2}$
(C) a^2+b^2
(D) a^2-b^2

---

82. The number of values of x in the interval $[0, 3\pi]$ satisfying the equation $2\sin^2 x + 5\sin x - 3 = 0$ is:

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

---

83. $\lim_{x\to 5} \frac{\sqrt{2-2\cos(x^2-12x+35)}}{(x-5)} = \ldots$

(A) -2/5
(B) -2
(C) -1/2
(D) -5

---

84. If ${}^nC_0 + \frac{1}{2}{}^nC_1 + \frac{1}{3}{}^nC_2 + \cdots + \frac{1}{n+1}{}^nC_n = \frac{1023}{10}$**, then** $n =$

(A) 7
(B) 8
(C) 9
(D) 10

---

85. A pair of fair dice is thrown 4 times. If getting the same number on both dice is considered as a success, then the probability of two successes are:

(A) 25/216
(B) 25/36
(C) 25/108
(D) 25/104

---

86. The position vectors of the points A, B, C are $\hat{i}+2\hat{j}-\hat{k}$, $\hat{i}+\hat{j}+\hat{k}$, $2\hat{i}+3\hat{j}+2\hat{k}$ respectively. If A is chosen as the origin, then the cross product of position vectors of B and C are:

(A) $-5\hat{i}+2\hat{j}+\hat{k}$
(B) $-\hat{i}+0\hat{j}-\hat{k}$
(C) $\hat{i}-\hat{k}$
(D) $5\hat{i}-2\hat{j}-\hat{k}$

---

87. If the area of a parallelogram whose diagonals are represented by vectors $3\hat{i}+\lambda\hat{j}+2\hat{k}$ and $\hat{i}-2\hat{j}+3\hat{k}$ is $\frac{\sqrt{117}}{2}$ sq. units, then $\lambda =$

(A) -1
(B) -2
(C) -3
(D) -4

---

88. $y=e^x(A\cos x+B\sin x)$ is the solution of the differential equation

(A) $x^2\frac{d^2y}{dx^2}+(1+y^2)=0$
(B) $\frac{d^2y}{dx^2}-\frac{dy}{dx}+y=0$
(C) $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=0$
(D) $x\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=0$

---

89. A family has 3 children. The probability that all the three children are girls, given that at least one of them is a girl is

(A) 1/8
(B) 7/8
(C) 1/7
(D) 2/7

---

90. In a triangle ABC, with usual notations, $\frac{2\cos A}{a}+\frac{\cos B}{b}+\frac{2\cos C}{c}=\frac{a}{bc}+\frac{b}{ca}$. Then $\angle A =$

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{6}$
(C) $\frac{\pi}{2}$
(D) $\frac{\pi}{3}$

---

91. A line passes through $P(-4,1)$ and meets the co-ordinate axes at points A and B. If P divides the segment AB internally in the ratio 1: 2, then the equation of the line is

(A) $x-2y+6=0$
(B) $x+10y-6=0$
(C) $2x+y+4=0$
(D) $x-y+5=0$

---

92. In 3-dimensional space, the equation $x^2-8x+12=0$ represents....

(A) two straight lines
(B) a pair of straight lines passing through the origin
(C) 2 planes parallel to YZ-plane
(D) 2 planes parallel to XZ-plane

---

93. A pair of tangents are drawn to the circle $x^2+y^2+6x-4y-12=0$ from a point $P(-4,-5)$, then the area enclosed between these tangents and the area of the circle is

(A) $25(\frac{4+\pi}{4})$ sq. units
(B) $25(\frac{4+\pi}{2})$ sq. units
(C) $25(\frac{4-\pi}{2})$ sq. units
(D) $25(\frac{4-\pi}{4})$ sq. units

---

94. If $\overline{a}$, b, c are non coplanar unit vectors such that $\overline{a}\times(\overline{b}\times\overline{c})=\frac{\overline{b}+\overline{c}}{\sqrt{2}}$ then the angle between $\overline{a}$ and $\overline{b}$ is

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

---

95. The joint equation of the bisector of the angle between the lines $2x^2+11xy+3y^2=0$ is

(A) $11x^2+2xy-11y^2=0$
(B) $x^2+2xy-y^2=0$
(C) $3x^2-11xy+2y^2=0$
(D) $11x^2-2xy-11y^2=0$

---

96. If a random variable X has the following probability distribution of X: $X = x$: 0, 1, 2, 3, 4, 5, 6, 7 $P(X = x)$: 0, k, 2k, 2k, 3k, k^2, $2k^2$, $7k^2 + k$ Then $P(x \geq 6) =$

(A) $\frac{19}{100}$
(B) $\frac{81}{100}$
(C) $\frac{9}{100}$
(D) $\frac{91}{100}$

---

97. $\int_0^1 \frac{1}{2+\sqrt{x}} dx =$

(A) $2\log(\frac{2e}{3})$
(B) $2\log(\frac{4e}{9})$
(C) $\log(\frac{2e}{3})$
(D) $\log(\frac{4e}{9})$

---

98. Let M and N be foots of the perpendiculars drawn from the point $P(a, a, a)$ on the lines $x-y = 0, z = 0$ and $x+y = 0, z = 1$ respectively and if $\angle MPN = 90^\circ$ then $a^2 =$

(A) 1
(B) 4
(C) 6
(D) 9

---

99. If $y = \log_3(\log_3 x)$ then $\frac{dy}{dx}$ at $x = 3$ is...

(A) $\frac{1}{3}(\log 3)^{-3}$
(B) $\frac{1}{3}(\log 3)$
(C) $\frac{1}{3} \cdot \frac{1}{(\log 3)^2}$
(D) $\frac{1}{3}(\log 3)^{-2}$

---

100. If in triangle ABC, with usual notations $\sin\frac{A}{2} \cdot \sin\frac{C}{2} = \sin\frac{B}{2}$ and 2s is the perimeter of the triangle, then the value of s is

(A) 2b
(B) b
(C) 4b
(D) $\frac{b}{2}$

PHYSICS

101. Two planets A and B have densities ρ_1 and ρ_2 and have radii r_1 and r_2 respectively. The ratio of acceleration due to gravity on A to that of B is:

(A) $r_1 : r_2$
(B) $r_1\rho_1 : r_2\rho_2$
(C) $r_1^2\rho_1 : r_2^2\rho_2$
(D) $r_1\rho_2 : r_2\rho_1$

---

102. A rectangular black body of temperature $127°C$ has surface area $4\ cm \times 2\ cm$ and rate of radiation is E. If its temperature is increased by $400°C$ and surface area is reduced to half of the initial value then the rate of radiation is:

(A) 4E
(B) E
(C) 2E
(D) 16E

---

103. If the two sources of light emit waves of different amplitudes and interfere then

(A) there is some intensity of light in the region of destructive interference.
(B) fringe width is less.
(C) brightness of fringes is less.
(D) fringes disappear after short time.

---

104. The reactance of a capacitor is X_C. If the frequency and the capacitance are doubled, then the new reactance will be

(A) $\frac{X_C}{2}$
(B) X_C
(C) $\frac{X_C}{4}$
(D) $2X_C$

---

105. Two discs of moment of inertia I_1 and I_2 and angular speeds ω_1 and ω_2 are rotating along the collinear axes passing through their centre of mass and perpendicular to their plane. If the two discs are made to rotate together along the same axis. The rotational kinetic energy of the system will be

(A) $\frac{I_1\omega_1+I_2\omega_2}{2(I_1+I_2)^2}$
(B) $\frac{(I_1\omega_1-I_2\omega_2)^2}{2(I_1+I_2)}$

(C) $\frac{(I_1\omega_1+I_2\omega_2)^2}{2(I_1-I_2)}$
(D) $\frac{(I_1\omega_1+I_2\omega_2)^2}{2(I_1+I_2)}$

---

106. A wire has a mass 0.3 ± 0.003 g radius 0.5 ± 0.005 mm and length 6 ± 0.06 cm. The maximum percentage error in the measurement of its density is

(A) 2%
(B) 5%
(C) 4%
(D) 3%

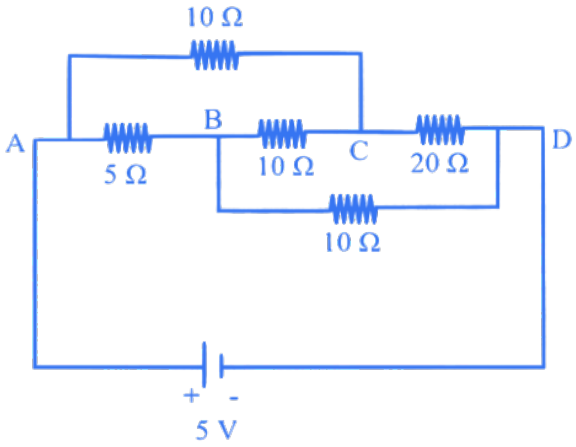
---

107. Two particles A and B execute SHMs of periods T and $\frac{3T}{2}$. If they start from the mean position, when the particle A completes two oscillations the phase difference between them will be

(A) $\frac{\pi}{3}$
(B) $\frac{\pi}{6}$
(C) $\frac{4\pi}{3}$
(D) $\frac{\pi}{4}$

---

108. The current (I) drawn from the battery in the given circuit is



(A) 0.2 A
(B) 0.5 A
(C) 0.6 A
(D) 0.8 A

---

109. If the electron in hydrogen atom jumps from third Bohr orbit to ground state directly and the difference between the energies of the two states is radiated in the

form of photons. If the work function of the material is 4.1 eV, then the stopping potential is nearly
[Energy of electron in n^{th} orbit $= -\frac{13.6}{n^2}eV$]

(A) 3V
(B) 4V
(C) 6V
(D) 8V

---

110. Vector $\vec{A}$ of magnitude $5\sqrt{3}$ units, another vector B of magnitude 10 units are inclined to each other at an angle of $30°$. The magnitude of vector product of two vectors is
$[\sin 30° = \frac{1}{2}]$

(A) $5\sqrt{3}$ units
(B) 10 units
(C) $25\sqrt{3}$ units
(D) 75 units

---

111. The magnetic field intensity H at the centre of a long solenoid having n turns per unit length and carrying a current I, when no material is kept in it is (μ_0 = permeability of free space)

(A) $\mu_0 nI$
(B) $\frac{I}{n}$
(C) nI
(D) $\frac{\mu_0}{nI}$

---

112. Four particles each of mass M are placed at the corners of a square of side L. The radius of gyration of the system about an axis perpendicular to the square and passing through its centre is

(A) $\frac{L}{2}$
(B) $\frac{L}{\sqrt{2}}$
(C) 2L
(D) $\frac{L}{4}$

---

113. In Fraunhofer diffraction pattern, slit width is 0.3 mm and screen is at 1.5 m away from the lens. If wavelength of light used is 4500 Å, then the distance between the first minimum on either side of the central maximum is:

(A) 1.5 mm
(B) 2.25 mm
(C) 3.25 mm
(D) 4.5 mm

---

114. Two boys are standing at points A and B on ground, where distance $AB = x$. The boy at B starts running simultaneously with velocity v_1. The boy at A starts running simultaneously with velocity v and meets the other boy in time t. The value of t is:

(A) $\left[\frac{x}{v-v_1}\right]^{1/2}$
(B) $\left[\frac{x}{v_1-v}\right]^{1/2}$
(C) $\left[\frac{x^2}{v^2-v_1^2}\right]^{1/2}$
(D) $\left[\frac{x^2}{v_1^2-v^2}\right]^{1/2}$

---

115. The temperature of an ideal gas is increased from 100 K to 400 K. If x is the root mean square velocity of its molecules at 100 K, the r.m.s. velocity becomes:

(A) $x/4$
(B) $2x$
(C) $3x$
(D) $4x$

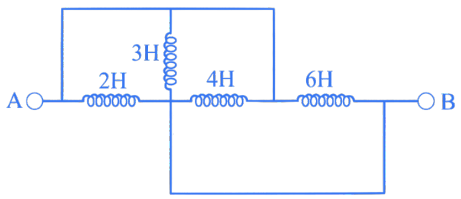
---

116. Current I is carried in a wire of length L. If wire is bent into a circular coil of single turn, the maximum torque in a given magnetic field B is:

(A) $\frac{L^2B}{4\pi}$
(B) $\frac{L^2IB}{4\pi}$
(C) $\frac{L^2B^2}{2}$
(D) $\frac{L^2IB}{2}$

---

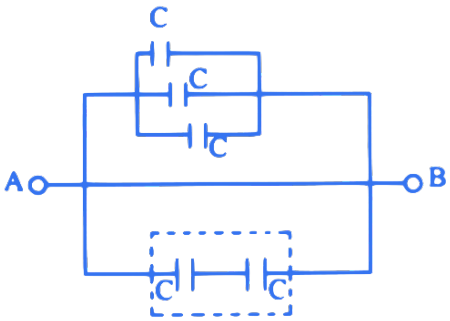
117. The equivalent inductance between A and B is equal to:



(A) $\frac{4}{5}H$
(B) $\frac{5}{4}H$
(C) $\frac{3}{10}H$
(D) 15 H

---

118. Five capacitors, each of capacity C, are connected as shown in the figure. The resultant capacity between A and B is $14\ \mu F$. The capacity of each capacitor is:



(A) $2\ \mu F$
(B) $3.5\ \mu F$
(C) $4\ \mu F$
(D) $2.8\ \mu F$

---

119. A machine gun fires a bullet of mass 35 g with a speed of $600\ m/s$. The person holding the gun can exert a maximum force of 147 N on it. The number of bullets that can be fired from the gun per second is:

(A) 3
(B) 5
(C) 7
(D) 9

---

120. According to the kinetic theory of gases, when two molecules of a gas collide with each other then:

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

---

121. An a.c. voltage is applied to a pure inductor. The current in the inductor:

(A) leads the voltage by $(\frac{\pi}{4})^c$
(B) leads the voltage by $(\frac{\pi}{2})^c$
(C) lags behind the voltage by $(\frac{\pi}{2})^c$
(D) lags behind the voltage by $(\frac{3\pi}{4})^c$

---

122. During the isothermal expansion, a confined ideal gas does (-150) J of work against its surroundings. This means that:

(A) 150 J of heat has been added to the gas
(B) 150 J of heat has been removed from the gas
(C) 300 J of heat has been added to the gas
(D) no heat is transferred because the process is isothermal

---

123. A single slit diffraction pattern is formed with light of wavelength 6384 Å. The second secondary maximum for this wavelength coincides with the third secondary maximum in the pattern for light of wavelength λ_0. The value of λ_0 is:

(A) 4242 Å
(B) 4560 Å
(C) 5474 Å
(D) 6384 Å

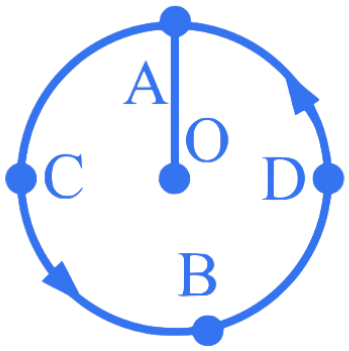
---

124. When a metal surface is illuminated by light of wavelength λ_1 and λ_2, the maximum velocities of photoelectrons ejected are V and 2V respectively. The work function of the metal is (h = Planck's constant, c = velocity of light, $\lambda_1 > \lambda_2$)

(A) $\frac{hc}{2\lambda_1\lambda_2}(\lambda_1 - \lambda_2)$
(B) $\frac{hc}{\lambda_1\lambda_2}(\lambda_1 - \lambda_2)$
(C) $\frac{hc}{\lambda_1\lambda_2}(\lambda_1 + \lambda_2)$
(D) $\frac{hc}{3\lambda_1\lambda_2}(4\lambda_2 - \lambda_1)$

---

125. A point mass m attached at one end of a massless, inextensible string of length r performs a vertical circular motion and the string rotates in vertical plane, as shown in the diagram. The increase in the centripetal acceleration of the point mass when it moves from point A (top) to point C (bottom) is [g = acceleration due to gravity.]



(A) 3g
(B) 2g
(C) g
(D) 6g

---

126. A body cools from $80°C$ to $50°C$ in 5 min. In the next time of 't' min, the body continues to cool from $50°C$ to $30°C$. The total time taken by the body to cool from $80°C$ to $30°C$ is [The temperature of the surroundings is $20°C$.]

(A) 10 min
(B) 7.5 min
(C) 15.0 min
(D) 12.5 min

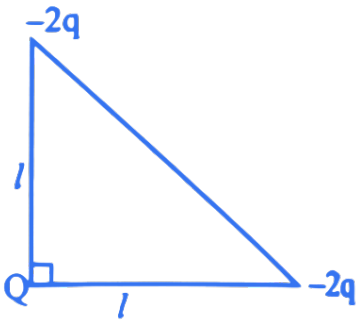
---

127. A square of side 'L' metre lies in $x - y$ plane in a region where the magnetic field is $\overline{B}$ and $\vec{B} = B_0(2\hat{i} + 3\hat{j} + 4\hat{k})$, where B_0 is constant. The magnitude of flux passing through the square (in weber) is

(A) $\sqrt{29}B_0L^2$
(B) $4\ B_0L^2$
(C) $2\ B_0L^2$
(D) $3\ B_0L^2$

---

128. Three charges $Q, (-2q)$ and $(-2q)$ are placed at the vertices of an isosceles right angled triangle as shown in figure. The net electrostatic potential energy is zero if Q is equal to



(A) $\sqrt{2}q$
(B) $\frac{q}{2}$
(C) $\frac{q}{\sqrt{2}}$
(D) $\frac{q}{2\sqrt{2}}$

---

129. In a capillary tube of area of cross-section 'a' water rises to height 'h'. To what height will water rise in a capillary tube of area of cross-section 4a?

(A) 4h
(B) 2h
(C) $\frac{h}{2}$
(D) $\frac{h}{4}$

---

130. A small sphere oscillates simple harmonically in a watch glass whose radius of curvature is 1.6 m. The period of oscillation of the sphere is (acceleration due to gravity $g = 10\ m/s^2$)

(A) 0.2π s
(B) 0.4π s
(C) 0.6π s
(D) 0.8π s

---

131. The logic gate for which the output goes 'HIGH' or '1' only when an odd number of 'HIGH' or '1' are at its input, is

(A) OR gate
(B) NAND gate
(C) Ex-OR gate
(D) NOR gate

---

132. A long straight wire of radius 'r' carries a steady current 'I'. The current is uniformly distributed over its cross-section. The ratio of the magnetic field 'B' and

B_1 **at radial distances** $\frac{r}{2}$ **and** $3r$ **respectively, from the axis of the wire is**

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

---

133. A sound source is moving towards a stationary observer with $(\frac{1}{10})^{th}$ **the speed of sound. The ratio of apparent to real frequency is**

(A) $\frac{10}{9}$
(B) $\frac{11}{10}$
(C) $(\frac{11}{10})^2$
(D) $(\frac{9}{10})^2$

---

134. The velocity of small spherical ball of mass 'm' and density d_1**, when dropped in a container filled with glycerine becomes constant after some time. The viscous force acting on the ball if density of glycerine is** d_2 **is**

(A) $mg(1 - \frac{d_2}{d_1})$
(B) $mg(1 + \frac{d_2}{d_1})$
(C) $mg(1 - \frac{d_1}{d_2})$
(D) $mg(1 + \frac{d_1}{d_2})$

---

135. The fundamental frequency of a closed pipe is 400 Hz. If $(\frac{1}{3})^{rd}$ **length of the pipe is filled with water, the frequency of the** 2^{nd} **harmonic of the pipe will be (Neglect end correction)**

(A) 1500 Hz
(B) 1200 Hz
(C) 600 Hz
(D) 1800 Hz

---

136. To get output of the following logic circuit as 0 (zero), the inputs A, B, C should NOT be, respectively,

(A) 1, 1, 0
(B) 0, 1, 0
(C) 1, 0, 1
(D) 0, 0, 1

---

137. The displacement of particle in S.H.M. is $x = A\ cos(\omega t + \frac{\pi}{6})$ at time t. Its speed will be maximum at time

(A) $\frac{\pi}{3\omega}$ s
(B) $\frac{\pi}{2\omega}$ s
(C) $\frac{\pi}{\omega}$ s
(D) $\frac{\pi}{4\omega}$ s

---

138. The power factor of a CR circuit is $\frac{1}{\sqrt{2}}$. If the frequency of a.c. signal is halved, then the power factor of the circuit will become

(A) $\frac{1}{\sqrt{3}}$
(B) $\frac{1}{\sqrt{5}}$
(C) $\frac{1}{\sqrt{7}}$
(D) $\frac{1}{\sqrt{11}}$

---

139. The image of an object approaching a convex mirror of radius of curvature 20 m along its optical axis is observed to move from $\frac{25}{3}$ m to $\frac{50}{7}$ m in 30 second. The speed of the object in km/hr is

(A) 5
(B) 2.5
(C) 4
(D) 3

---

140. The volume of given mass of a gas is increased by 7% at constant temperature. The pressure should be increased by

(A) 7%
(B) 14%
(C) 7.52%
(D) 14.52%

---

141. At poles, a stretched wire of a given length vibrates in unison with a tuning fork. At the equator, for same setting, to produce resonance with same fork, the vibrating length of wire

(A) should be decreased.
(B) should be increased.
(C) should be same.
(D) should be three times.

---

142. A radioactive element has rate of disintegration 9000 disintegration per minute at a particular instant. After two minutes it becomes 3000 disintegration per minute. The decay constant per minute is

(A) 0.5 $log_e 3$
(B) 0.2 $log_e 3$
(C) 0.5 $log_e 2$
(D) 0.2 $log_e 2$

---

143. Two point charges q_1 and q_2 are 'l' distance apart. If one of the charges is doubled and distance between them is halved, the magnitude of force becomes n times, where n is

(A) 1
(B) 2
(C) 8
(D) 16

---

144. A monoatomic ideal gas is compressed adiabatically to $(\frac{1}{27})$ of its initial volume. If initial temperature of the gas is T' K and final temperature is 'xT'K, the value of 'x' is

(A) 7
(B) 9
(C) 11
(D) 13

---

145. In LCR series circuit, when 'L' is removed from the circuit, the phase difference between voltage and current in the circuit is $\frac{\pi}{3}$. If 'C' is removed from the circuit instead of L then phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is $(\tan 60^\circ = \sqrt{3})$

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

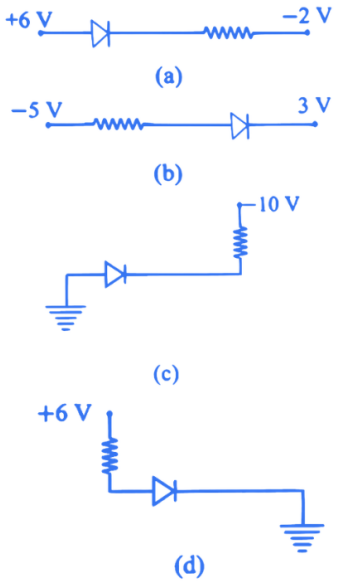
---

146. The value of the shunt resistance that allows 10% of the main current through the galvanometer of 99 Ω is

(A) 9 Ω
(B) 11 Ω
(C) 13 Ω
(D) 15 Ω

---

147. In which of the following figures, the p.n. junction diode is reverse biased?



(A) c
(B) d
(C) b
(D) a

---

148. Two tuning forks of frequencies 256 Hz and 258 Hz are sounded together. The time interval between two consecutive maxima is

(A) 250 s
(B) 252 s
(C) 2 s
(D) 0.5 s

149. 'n' identical small spherical drops of water, each of radius 'r' and charged to the same potential 'v' are combined to form a big drop. The potential of a big drop is

(A) nv
(B) $n\sqrt{v}$
(C) $n^{1/3}v$
(D) $n^{2/3}v$

---

150. Sodium and copper have work functions 2.3 eV and 4.5 eV respectively. The ratio of threshold wavelength of sodium to that of copper is nearest to

(A) 1:4
(B) 4:1
(C) 1:2
(D) 2:1
