

MHT CET 2025 PCM April 26 Shift 1

Question Paper

Conducted by Maharashtra State CET Cell



General Instructions

- (i) **Duration:** The total duration of the examination is 3 hours (180 minutes).
- (ii) **Total Questions:** The complete paper contains 150 multiple choice questions.
- (iii) **Structure:** The paper has 3 Sections:
 - **Section A:** 50 Multiple Choice Questions (Physics)
 - **Section B:** 50 Multiple Choice Questions (Chemistry)
 - **Section C:** 50 Multiple Choice Questions (Mathematics)
- (iv) **Compulsory Questions:** All 150 questions are compulsory.
- (v) Each question has four options. Only **one** option is correct.
- (vi) **Right Answer:** +1 marks for every correct answer in Physics and Chemistry. +2 marks for every correct answer in Mathematics.
- (vii) **Incorrect Answer:** No negative marking for incorrect answers.
- (viii) **Unanswered/Marked for Review:** 0 marks.
- (ix) The question paper is based on the syllabus prescribed by the Maharashtra State Board of Secondary and Higher Secondary Education.
- (x) Candidates must follow all examination rules and regulations during the test.

CHEMISTRY

1. Which cation from following exhibits no magnetic moment?

- (a) Cr^{3+}
 - (b) Sc^{3+}
 - (c) Cu^{2+}
 - (d) V^{3+}
-

2. What is the common name of Benzene-1,3-diol?

- (a) Catechol
 - (b) Resorcinol
 - (c) Quinol
 - (d) Pyrogallol
-

3. What is the number of oxygen atoms bonded to chlorine in its strongest oxoacid?

- (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
-

4. Calculate the edge length of bcc unit cell if radius of a particle present in it is 186 pm.

- (a) 4.296×10^{-8} cm
- (b) 7.301×10^{-8} cm
- (c) 3.715×10^{-8} cm
- (d) 5.419×10^{-8} cm

5. If $E^\circ(\text{Cu}^{2+}/\text{Cu}) = +0.34 \text{ V}$. What is potential for $\text{Cu}(s) \rightarrow \text{Cu}^{2+}(aq)(0.1\text{M}) + 2e^-$ at 298 K?

- (a) +0.3696 V
- (b) -0.3696 V
- (c) +0.3104 V
- (d) -0.3104 V

6. Calculate ΔS_{total} for a certain reaction if $\Delta H = -150 \text{ kJ}$ and $\Delta S = 32 \text{ J K}^{-1}$ at 300 K.

- (a) 266.00 J K^{-1}
- (b) 532.00 J K^{-1}
- (c) 798.00 J K^{-1}
- (d) 468.00 J K^{-1}

7. Calculate the molality of the solution of nonvolatile solute if it freezes at -0.36°C . [K_f for solvent = $1.86 \text{ K kg mol}^{-1}$]

- (a) 0.218 mol kg^{-1}
- (b) 0.193 mol kg^{-1}
- (c) 0.401 mol kg^{-1}
- (d) 0.520 mol kg^{-1}

8. Identify a pair of molecules having similar shapes of both members.

- (a) NH_3, SO_2
- (b) $\text{XeF}_4, \text{SF}_4$
- (c) $\text{H}_2\text{O}, \text{SCl}_2$
- (d) $\text{PCl}_5, \text{BrF}_5$

9. The compound forming ccp structure contains 9.6×10^{23} atoms. Find the number of tetrahedral voids formed in it.

- (a) 1.00×10^{24}
- (b) 1.68×10^{24}
- (c) 1.92×10^{24}
- (d) 1.56×10^{24}

10. In the equation, $\text{BiO}_3^- + 6\text{H}^+ + xe^- \rightarrow \text{Bi}^{3+} + 3\text{H}_2\text{O}$ What is the value of x?

- (a) 2
- (b) 3
- (c) 4
- (d) 6

11. Which from following compounds is obtained when phenol reacts with dilute nitric acid at low temperature?

- (a) o-Nitrophenol only
- (b) p-Nitrophenol only
- (c) 2, 4, 6-trinitrophenol
- (d) Mixture of ortho and para nitrophenols

12. Identify the technique used to know binding nature of nanomaterials?

- (a) SEM
- (b) TEM
- (c) XRD

(d) FTIR

13. Which from following compounds is an example of primary amines?

- (a) N-methylmethanamine
 - (b) 4-Bromobenzenamine
 - (c) N-Phenylbenzenamine
 - (d) N-Ethyl-N-methylpropan-2-amine
-

14. What are the compounds used to obtain nylon salt?

- (a) Adipic acid and ammonia
 - (b) Terephthalic acid and hexamethylenediamine
 - (c) Adipic acid and hexamethylenediamine
 - (d) β -hydroxybutyric acid and hexamethylenediamine
-

15. For the cell reaction, $A_{(s)} + B_{(aq)}^{2+} \rightarrow A_{(aq)}^{2+} + B_{(s)}$ if equilibrium constant of reaction is 10^4 at 298 K. What is standard emf of cell?

- (a) 0.0592 V
 - (b) 0.1184 V
 - (c) 0.1776 V
 - (d) 0.2368 V
-

16. Calculate % by mass of a H_2O_2 solution that is 67.2 by volume.

- (a) 13.60% by mass
- (b) 20.40% by mass

- (c) 22.44% by mass
(d) 17.60% by mass
-

17. Which of the following compounds does not exhibit optical isomerism?

- (a) 3-Iodohexane
(b) 2-Iodopentane
(c) 2-Iodo-2-methylbutane
(d) 2-Iodo-3-methylbutane
-

18. Identify the product when chlorobenzene is heated with nitrating mixture.

- (a) Only 1-chloro-4-nitrobenzene
(b) Only 1-chloro-2-nitrobenzene
(c) Mixture of 1-chloro-2-nitrobenzene and 1-chloro-4-nitrobenzene
(d) 2,4,6-trinitrochlorobenzene
-

19. What is the difference in molar mass of Undecane and Dodecane?

- (a) 10 g mol^{-1}
(b) 20 g mol^{-1}
(c) 140 g mol^{-1}
(d) 14 g mol^{-1}
-

20. Calculate rate constant of a first order reaction having pre-exponential factor $1.6 \times 10^{-13} \text{ s}^{-1}$. ($E_a/2.303RT = 21$)

- (a) 1.6×10^{-13}
(b) 3.2×10^{-13}
-

- (c) 3.2×10^{-8}
(d) 1.6×10^{-34}
-

21. Which of the following statements is false about oxygen and sulphur?

- (a) Atoms of oxygen and sulphur consist two unpaired electrons in valence shell.
(b) Oxygen and sulphur show -2, +4 and +6 oxidation states.
(c) Oxygen is gas while sulphur is solid at room temperature.
(d) Hydride of oxygen is more stable than hydride of sulphur.
-

22. "It is impossible to determine simultaneously the exact position and exact momentum of an electron." This statement is called

- (a) Pauli's exclusion principle
(b) Hund's rule
(c) Aufbau rule
(d) Heisenberg uncertainty principle
-

23. Identify from following the correct set of thermodynamic conditions for a reaction to be nonspontaneous at all temperatures.

- (a) $\Delta H < 0$ and $\Delta S < 0$
(b) $\Delta H > 0$ and $\Delta S > 0$
(c) $\Delta H < 0$ and $\Delta S > 0$
(d) $\Delta H > 0$ and $\Delta S < 0$
-

24. Calculate vapour pressure of volatile liquid A at given temperature if mole fraction and vapour pressure of volatile liquid B are 0.4 and 900 mm Hg respectively [$P_{\text{total}} = 600 \text{ mmHg}$].

- (a) 450 mm Hg
 - (b) 560 mm Hg
 - (c) 500 mm Hg
 - (d) 400 mm Hg
-

25. What is the numerical value of osmotic pressure of 1 M urea solution if numerical value of osmotic pressure of 0.5 M urea solution is 'x'?

- (a) x
 - (b) $x/2$
 - (c) 2x
 - (d) 3x
-

26. Which among the following has highest boiling point?

- (a) Butyric acid
 - (b) Valeric acid
 - (c) Acetic acid
 - (d) Formic acid
-

27. Identify a medicinal compound having amide linkage.

- (a) Aspirin
 - (b) Methylsalicylate
 - (c) Curcumin
 - (d) Paracetamol
-

28. Which among the following compounds does NOT form intermolecular hydrogen bonding?

- (a) Ethoxyethane
 - (b) Butane
 - (c) Phenol
 - (d) Butan-1-ol
-

29. Which lanthanoid from following may exhibit +4 oxidation state with f^0 configuration?

- (a) Eu
 - (b) Tb
 - (c) Ce
 - (d) Lu
-

30. Which among the following salt turns blue litmus red in its aqueous solution?

- (a) CuSO_4
 - (b) Na_2CO_3
 - (c) Na_2SO_4
 - (d) NaNO_3
-

31. Find out the total number of electrons present in 3.2 g methane?

- (a) 6.022×10^{23}
 - (b) 1.204×10^{24}
 - (c) 3.201×10^{23}
 - (d) 4.821×10^{22}
-

32. Rate of the reaction $\text{A} + \text{B} \rightarrow \text{product}$ is $3.6 \times 10^{-2} \text{ mol dm}^{-3} \text{ s}^{-1}$ and rate law is $r = k[\text{A}][\text{B}]^2$. What is rate constant of the reaction if $[\text{A}] = 0.2 \text{ M}$ and $[\text{B}] = 0.1 \text{ M}$?

- (a) $18 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
 - (b) $10 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
 - (c) $24 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
 - (d) $4.8 \text{ mol}^{-2} \text{ dm}^6 \text{ s}^{-1}$
-

33. Identify the product 'A' formed in the following reaction (Addition of Br_2 to an alkene).



- (a) 2,3-dibromopentane
 - (b) 2-Bromo-3-methylbutane
 - (c) 3-Bromo-2-methylbutane
 - (d) 2,3-dibromo-2-methylbutane
-

34. What are the positions of 'N' atoms present in purine ring of nucleic acids?

- (a) 1, 3 and 5
 - (b) 1, 3 and 9
 - (c) 1, 5, 7 and 9
 - (d) 1, 3, 7 and 9
-

35. Which from following compounds contains complex anions?

- (a) Sodium hexanitrocobaltate (III)
- (b) Triamminetrinitrocobalt (III)
- (c) Pentaammineaquacobalt (II)iodide
- (d) Hexaammincobalt (III) chloride

36. Which among the following gases is least adsorbed on solid at similar conditions of temperature and pressure?

- (a) Cl_2
- (b) NH_3
- (c) SO_2
- (d) H_2

37. Dissociation constant of 0.01 M weak acid is 10^{-4} . What is percent dissociation of acid?

- (a) 2%
- (b) 6%
- (c) 10%
- (d) 1.5%

38. Equal masses of helium and oxygen are mixed in an empty container at 25°C . What is the fraction of the total pressure exerted by helium?

- (a) $1/2$
- (b) $1/4$
- (c) $8/9$
- (d) $7/9$

39. Calculate the change in internal energy of the system if work done by the system is 18 joule and absorbs heat 50 joule in a particular reaction.

- (a) 20 J
- (b) 32 J

- (c) 48 J
 - (d) 68 J
-

40. What is the expected order of basic strength of different compounds from following (in gaseous phase)?

- (a) $R_3N < R_2NH < R-NH_2 < NH_3$
 - (b) $NH_3 < R-NH_2 < R_2NH < R_3N$
 - (c) $R_2NH < R_3N < R-NH_2 < NH_3$
 - (d) $NH_3 < R_3N < R_2NH < R-NH_2$
-

41. Which of the following does NOT exhibit haloform reaction?

- (a) Ethanal
 - (b) Propanal
 - (c) Propanone
 - (d) Butanone
-

42. Which from following polymers does NOT contain either -COO- or -CO-NH- linkage in it?

- (a) Perspex
 - (b) Polyacrylamide
 - (c) Glyptal
 - (d) Thermocol
-

43. What is the coordination number of a particle in simple cubic close packed structure?

- (a) 12
- (b) 4

(c) 6

(d) 8

44. Identify the products of following reaction: Formaldehyde + Benzaldehyde $\xrightarrow{i.conc. NaOH \text{ ii. } H_3O^+}$

Products.

(a) Phenylmethanol and methanol

(b) Methanol and benzoic acid

(c) Methanoic acid and phenylmethanol

(d) Methanoic acid and benzoic acid

45. Identify the order of following reaction: $2NO_2(g) \rightarrow 2NO(g) + O_2(g)$.

(a) 1

(b) 1.5

(c) 2

(d) 3

46. Which from following is a weak field ligand?

(a) EDTA

(b) CO

(c) F^-

(d) NH_3

47. Identify neutral amino acid from following list represented by three letter symbols.

(a) Arg

- (b) Asp
 - (c) Leu
 - (d) His
-

48. Which of the following changes takes place at positive electrode during recharging of lead accumulator?

- (a) Pb is oxidised to PbSO_4
 - (b) PbSO_4 is oxidised to PbO_2
 - (c) PbSO_4 is reduced to Pb
 - (d) PbO_2 is reduced to PbSO_4
-

49. Which of the following reagents is used to convert $\text{C} \equiv \text{C}$ triple bond to $\text{C}=\text{C}$ double bond to give Cis isomer of alkene?

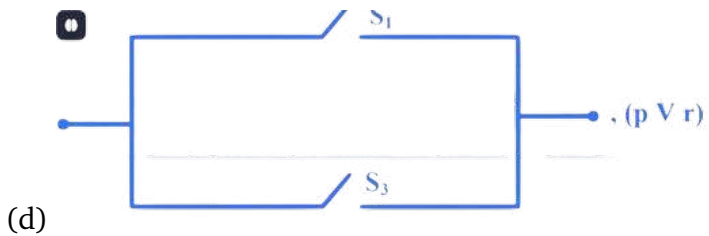
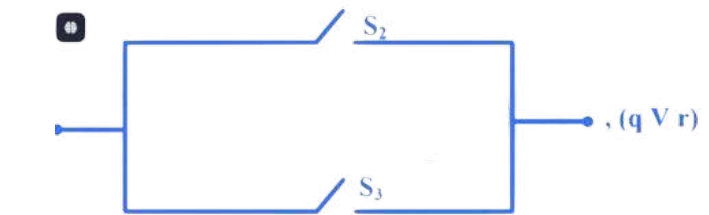
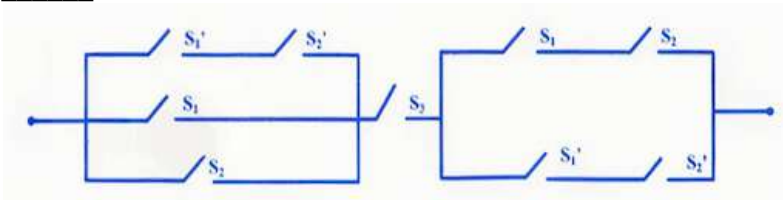
- (a) ZnCl_2/HCl
 - (b) Pd-C/quinoline
 - (c) Na / liquid NH_3
 - (d) Na/Hg in H_2O
-

50. The solubility product of AgBr is 4.9×10^{-13} at a certain temperature. Calculate the solubility.

- (a) $4 \times 10^{-6} \text{ mol dm}^{-3}$
 - (b) $4 \times 10^{-7} \text{ mol dm}^{-3}$
 - (c) $7 \times 10^{-7} \text{ mol dm}^{-3}$
 - (d) $3 \times 10^{-8} \text{ mol dm}^{-3}$
-

MATHEMATICS

1. Consider statements $p : S_1$ is closed; $q : S_2$ is closed; $r : S_3$ is closed. The simplified equivalent circuit diagram and its logical statement for the switching circuit is respectively _____.



2. The volume of tetrahedron with co-terminus edges $\vec{a}, \vec{b}, \vec{c}$ is $\frac{64}{3}$ cubic units, then volume of parallelopiped considering co-terminus edges given by the vectors $\vec{a} + \vec{b}, \vec{b} + \vec{c}, \vec{c} + \vec{a}$ is _____ cubic units.

- (a) 384
- (b) $\frac{128}{3}$
- (c) 256
- (d) $\frac{32}{3}$

3. If $y = \tan^{-1}\left(\sqrt{\frac{1+\sin x}{1-\sin x}}\right)$, $0 \leq x < \frac{\pi}{2}$, then $y'\left(\frac{\pi}{6}\right) = \underline{\hspace{2cm}}$.

- (a) $-\frac{1}{4}$
- (b) $\frac{1}{6}$
- (c) $\frac{1}{4}$
- (d) $\frac{1}{2}$

4. If $f(x) = \frac{\sin^2 x}{1+\cot x} + \frac{\cos^2 x}{1+\tan x}$, then the value of $f'\left(\frac{\pi}{6}\right)$ is equal to $\underline{\hspace{2cm}}$.

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

5. $\int \frac{\sqrt{\tan x}}{\sin x \cdot \cos x} dx = \underline{\hspace{2cm}}$.

- (a) $2\sqrt{\sec x} + c$, where c is a constant of integration
- (b) $2\sqrt{\tan x} + c$, where c is a constant of integration
- (c) $\frac{2}{\sqrt{\tan x}} + c$, where c is a constant of integration
- (d) $\frac{2}{\sqrt{\sec x}} + c$, where c is a constant of integration

6. If $\int \frac{dx}{x^4+5x^2+4} = A \tan^{-1} x + B \tan^{-1} \frac{x}{2} + c$ where c is a constant of integration, then $\underline{\hspace{2cm}}$.

- (a) $A = \frac{1}{2}, B = \frac{1}{4}$
- (b) $A = \frac{1}{3}, B = -\frac{1}{6}$
- (c) $A = \frac{1}{3}, B = \frac{1}{6}$

(d) $A = \frac{1}{2}, B = -\frac{1}{4}$

7. The number of positive integral solutions of $\tan^{-1} x + \cos^{-1} \left(\frac{y}{\sqrt{1+y^2}} \right) = \sin^{-1} \left(\frac{3}{\sqrt{10}} \right)$ are _____.

- (a) 1
 - (b) 2
 - (c) 3
 - (d) 4
-

8. If the plane $\frac{x}{2} + \frac{y}{3} + \frac{z}{6} = 1$ cuts the co-ordinate axes at points A, B, C respectively, then area of the triangle ABC is _____.

- (a) $\sqrt{14}$ sq. units
 - (b) $3\sqrt{14}$ sq. units
 - (c) $\frac{1}{\sqrt{14}}$ sq. units
 - (d) $3\sqrt{13}$ sq. units
-

9. Matrix A is non-singular matrix and $(A - 3I)(A - 5I) = 0$, then $\frac{15}{8}A^{-1} = \dots\dots$

- (a) $I - 8A$
 - (b) $2I - \frac{1}{15}A$
 - (c) $I - \frac{1}{8}A$
 - (d) $8I - 15A$
-

10. $\int_{1/2}^2 \frac{1}{x} \csc^{101} \left(x - \frac{1}{x} \right) dx = \dots\dots$

- (a) 0
- (b) 1

- (c) $\frac{1}{4}$
(d) $\frac{101}{2}$
-

11. The differential equation which represents the family of curves $y = c_1 e^{c_2 x}$, where c_1, c_2 are arbitrary constants is _____.

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

12. $\lim_{x \rightarrow \infty} \frac{(2x+1)^{50} + (2x+2)^{50} + (2x+3)^{50} + \dots + (2x+100)^{50}}{(2x)^{50} + (10)^{50}} = \underline{\hspace{2cm}}$.

- (a) 50
(b) 100
(c) 25
(d) 200
-

13. The number of ways in which a team of 11 players can be formed out of 25 players, if 6 out of them are always to be included and 5 of them are always to be excluded, is _____.

- (a) 2002
(b) ${}^{20}C_{11}$
(c) ${}^{20}C_6$
(d) ${}^{14}C_5$
-

14. A box contains 8 red and x number of green balls. 3 balls are drawn at random, if the probability that 3 balls being red is $\frac{7}{15}$, then number of green balls is _____.

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

15. The equation of a curve passing through (1,0) and having slope of tangent at any point (x, y) of the curve as $\frac{y-1}{x^2+x}$ is _____.

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

16. If $y = \alpha \log x + \beta x^2 - x$ has extreme values at $x = -1$ and $x = 1$, then α and β are respectively _____.

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

17. The equation of the tangent to the curve $(1+x^2)y = 2-x$, where it crosses the X-axis, is _____.

- (a) $x + 5y = 2$
 - (b) $x - 5y = 2$
 - (c) $5x - y = 10$
 - (d) $5x + y - 10 = 0$
-

18. The following is p.d.f. of continuous random variable X: $f(x) = \frac{x}{8}$ for $0 < x < 4$. Then $F(0.5)$, $F(1.7)$ and $F(5)$ is respectively _____.

- (a) $\frac{1}{64}$, 1, 0.18
 - (b) 0.0156, 0.18, 1
 - (c) 0.18, 0.0156, 1
 - (d) 1, 0.0156, 0.18
-

19. A manufacturer sells x items at a price of $(6 - \frac{x}{40})$ each. The cost price of x items is $(\frac{x}{5} + 193)$. The maximum profit in is _____.

- (a) 134.4
 - (b) 144.3
 - (c) 143.4
 - (d) 133.4
-

20. The mirror image of the point $P(-1, 2, -4)$ in the plane $x - y - 2z + 1 = 0$ is _____.

- (a) (3, -4, 1)
 - (b) (1, 0, 0)
 - (c) (4, 1, 0)
 - (d) (2, -3, 0)
-

21. The cumulative distribution function of a discrete random variable X is given. Then $\frac{P(X \leq 0)}{P(X > 0)} =$ _____.

$X = x$	-4	-2	0	2	4	6	8	10
$F(X = x)$	0.1	0.3	0.5	0.65	0.75	0.85	0.90	1

- (a) $\frac{1}{2}$

- (b) 1
 - (c) $\frac{1}{3}$
 - (d) $\frac{1}{5}$
-

22. If $\vec{a} = \lambda x\hat{i} + y\hat{j} + 4z\hat{k}$, $\vec{b} = x\hat{i} + y\hat{j} + 3y\hat{k}$, and $\vec{c} = -2\hat{i} - 2z\hat{j} - (\lambda + 1)\hat{k}$ such that $\vec{a} + \vec{b} - \vec{c} = \vec{0}$, then the value of λ is _____.

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

23. A triangle ABC is formed by A(1, -1, 0), B(3, 5, 3), C(-11, -5, 6). The equation of the internal angle bisector of angle A is _____.

- (a) $\frac{1-x}{2} = \frac{y-(-1)}{2} = \frac{z}{3}$
 - (b) $\frac{x+1}{2} = \frac{y-1}{2} = \frac{z}{3}$
 - (c) $\frac{x-1}{2} = \frac{y+1}{2} = \frac{z}{3}$
 - (d) $\frac{x-2}{1} = \frac{y+3}{2} = \frac{z}{3}$
-

24. The circumcenter of the triangle formed by lines $xy + 2x + 2y + 4 = 0$ and $x + y + 2 = 0$ is _____.

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

25. The angle between lines whose direction cosines satisfy the equation $l + m + n = 0$ and $l^2 - m^2 - n^2 = 0$, is _____.

- (a) $\pi/2$
 - (b) $\pi/3$
 - (c) $\pi/4$
 - (d) $\pi/6$
-

26. The solution for minimizing the function $z = x + y$ under an L.P.P with constraints $x + y \geq 2$, $x + 2y \leq 8$, $y \leq 3$, $x, y \geq 0$ is _____.

- (a) at the point (0, 3)
 - (b) at the point (8, 0)
 - (c) at infinite number of points but bounded set
 - (d) at unbounded set
-

27. The angle between the tangents drawn from the point (1, 4) to the parabola $y^2 = 4x$, is _____.

- (a) $\pi/6$
 - (b) $\pi/2$
 - (c) $\pi/3$
 - (d) $\pi/4$
-

28. If $\int \frac{(x^4+1)}{x(x^2+1)^2} dx = A \log|x| + \frac{B}{1+x^2} + c$, then $A - B$ is _____.

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

(d) -1

29. Let \vec{a} , \vec{b} and \vec{c} be vectors of magnitude 2, 3 and 4 respectively. If $\vec{a} \cdot (\vec{b} + \vec{c}) = 0$, $\vec{b} \cdot (\vec{c} + \vec{a}) = 0$ and $\vec{c} \cdot (\vec{a} + \vec{b}) = 0$, then the magnitude of $\vec{a} + \vec{b} + \vec{c}$ is _____.

- (a) 29
 - (b) $\sqrt{28}$
 - (c) $\sqrt{29}$
 - (d) 28
-

30. If \vec{a} , \vec{b} , \vec{c} are three coplanar vectors such that $|\vec{a}| = 1$, $|\vec{b}| = 2$, $\vec{b} \cdot \vec{c} = 8$, the angle between \vec{b} and \vec{c} is 45° , then $|\vec{a} \times (\vec{b} \times \vec{c})| =$ _____.

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

31. In a triangle ABC, with usual notations, $(a + b + c)(a + b - c) = 3ab$, then $\angle C =$ _____.

- (a) $\pi/2$
 - (b) $\pi/4$
 - (c) $\pi/3$
 - (d) $\pi/6$
-

32. In a triangle ABC, with usual notations, $\cot\left(\frac{A+B}{2}\right) \cdot \tan\left(\frac{A-B}{2}\right) =$ _____.

- (a) $\frac{a+b}{a-b}$

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

33. If the truth value of the expression $[(p \vee q) \wedge (q \rightarrow r) \wedge (\sim r)] \rightarrow (p \wedge q)$ is False, then truth values of p, q, r are respectively _____.

- (a) T, T, T
(b) T, F, F
(c) F, F, F
(d) F, T, T
-

34. $\int_0^1 \tan^{-1} x \, dx =$ _____.

- (a) $\pi/4 - \log 2$
(b) $\pi/4 - \log \sqrt{2}$
(c) $\pi/4 + \log 2$
(d) $\pi/4 + \log \sqrt{2}$
-

35. If $f(x) = \frac{\cos ax - \cos bx}{\cos cx - \cos bx}$ for $x \neq 0$ and $f(0) = -1$ is continuous at $x = 0$, then a^2, b^2, c^2 are in _____.

- (a) Geometric progression
(b) Arithmetic progression
(c) Harmonic progression
(d) Arithmetico-Geometric progression
-

36. The area of smaller part between the circle $x^2 + y^2 = 4$ and the line $x = 1$ is _____ sq. units.

- (a) $\frac{4\pi}{3} - \sqrt{3}$
(b) $\frac{8\pi}{3} - \sqrt{3}$
(c) $\frac{4\pi}{3} + \sqrt{3}$
(d) $\frac{5\pi}{3} + \sqrt{3}$
-

37. If $[x]^2 - 5[x] + 6 = 0$, where $[.]$ denotes the greatest integer function, then _____.

- (a) $x \in (2, 4)$
(b) $x \in [2, 4]$
(c) $x \in [2, 4)$
(d) $x \in (2, 4]$
-

38. The modulus of the square root of the complex number $6 + 8i$ (where $i = \sqrt{-1}$) is _____.

- (a) $\sqrt{5}$
(b) $2\sqrt{5}$
(c) $\sqrt{2} \cdot \sqrt{5}$
(d) $2\sqrt{10}$
-

39. If $f(x) = \sqrt{1 + \cos^2(x^2)}$, then $f'(\frac{\sqrt{\pi}}{2})$ is _____.

- (a) $\frac{\sqrt{\pi}}{6}$
(b) $-\frac{\sqrt{\pi}}{6}$
(c) $\frac{\pi}{\sqrt{6}}$
(d) $\sqrt{\frac{\pi}{6}}$
-

40. The equation of the directrix of the parabola $y^2 + 4y + 4x + 2 = 0$ is _____.

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

41. Let $\vec{a} = \alpha\hat{i} + 3\hat{j} - \hat{k}$, $\vec{b} = 3\hat{i} - \hat{j} + \beta\hat{k}$ and $\vec{c} = \hat{i} + 2\hat{j} - 2\hat{k}$ where $\alpha, \beta \in \mathbb{R}$, be three vectors. If the projection of \vec{a} on \vec{c} is $\frac{10}{3}$ and $\vec{b} \times \vec{c} = -6\hat{i} + 10\hat{j} + 7\hat{k}$, then the value of $(\alpha + \beta)$ is _____.

- (a) 5
 - (b) 3
 - (c) 4
 - (d) 6
-

42. If $\sin^{-1}(4x) + \sin^{-1}(4\sqrt{3}x) = -\frac{\pi}{2}$, then the value of x is _____.

- (a) $\pm\frac{1}{8}$
 - (b) $\pm\frac{1}{6}$
 - (c) $\pm\frac{2}{3}$
 - (d) $\pm\frac{1}{4}$
-

43. In a triangle ABC, with usual notations, if $a = 5$, $b = 7$, $\sin A = \frac{3}{4}$, then total number of triangles possible are _____.

- (a) 1
 - (b) 0
 - (c) 2
 - (d) 5
-

44. If the foot of the perpendicular drawn from the origin to a plane is $P(-1, -1, 2)$, then the equation of the plane is _____.

- (a) $x + y - 2z + 6 = 0$
 - (b) $2x + y + z + 1 = 0$
 - (c) $x + y + 2z - 2 = 0$
 - (d) $x - y - z + 2 = 0$
-

45. The least distance of the point $A(10, 7)$ from the circle $x^2 + y^2 - 4x - 2y - 20 = 0$ is length of seg AM . If MM' is the diameter of the circle, then the lengths of AM and AM' are respectively _____, _____ units.

- (a) 5, 10
 - (b) 5, 15
 - (c) 4, 15
 - (d) 2, 10
-

46. The money invested in a company is compounded continuously. If Rs. 400 invested today becomes Rs. 800 in 6 years, then at the end of 30 years, it will become (in Rs.) _____.

- (a) 18101.76
 - (b) 12800
 - (c) 9050.88
 - (d) 12804
-

47. The line MN whose equation is $x - y - 2 = 0$ cuts the X -axis at M and coordinates of N are $(4, 2)$. The line MN is rotated about M through 45° in anticlockwise direction. The equation of the line MN in the new position is _____.

- (a) $y = -\sqrt{2}$

- (b) $y = 2$
 - (c) $x = -2$
 - (d) $x = 2$
-

48. If $\tan(\pi \cos \theta) = \cot(\pi \sin \theta)$, then $\sin\left(\frac{\pi}{4} + \theta\right) = \underline{\hspace{2cm}}$.

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

49. The probability that a person is not a sportsperson is $1/6$. Then the probability that out of 6 members of the family, 5 are sportspersons is $\underline{\hspace{2cm}}$.

- (a) $(5/6)^5$
 - (b) $6(5/6)^5$
 - (c) $5(5/6)^6$
 - (d) $(5/6)^6$
-

50. The general solution of the differential equation $\frac{dy}{dx} = \cot x \cdot \cot y$ is $\underline{\hspace{2cm}}$.

- (a) $\cos x = c \csc y$
 - (b) $\sin x = c \sec y$
 - (c) $\sin x = c \cos y$
 - (d) $\cos x = c \sin y$
-

PHYSICS

1. In series LCR circuit $C = 2\mu\text{F}$, $L = 5\text{mH}$ and $R = 5\Omega$. The ratio of energy stored in the inductor to that in capacitor, when maximum current flows through the circuit is _____.

- (a) 200 : 1
 - (b) 100 : 1
 - (c) 300 : 1
 - (d) 500 : 1
-

2. A boy throws a ball vertically upwards from a bridge with velocity 5 m/s. It strikes water surface after 2 s. The height of the bridge is (Take $g = 10 \text{ m/s}^2$) _____.

- (a) 20 m
 - (b) 15 m
 - (c) 12 m
 - (d) 10 m
-

3. In Sonometer experiment, the frequency of a tuning fork used is 288 Hz. Harmonics will 'NOT' be produced at the frequency _____.

- (a) 288 Hz
 - (b) 576 Hz
 - (c) 844 Hz
 - (d) 864 Hz
-

4. The ratio of energies of photons produced due to transition of electron of hydrogen atom from its (i) third to 2nd energy level and (ii) highest energy level to 3rd level is _____.

- (a) 3 : 2
- (b) 5 : 4
- (c) 5 : 3

(d) 8 : 3

5. A magnetic field 4×10^{-2} T acts at right angles to a coil of area 100 cm^2 with 50 turns. The average e.m.f. induced in the coil is 0.1 V, when it is removed from the field in time 't'. The value of 't' is _____.

- (a) 0.02 second
 - (b) 0.05 second
 - (c) 0.2 second
 - (d) 2 second
-

6. A sphere of mass 'm', moving with velocity '3u' collides head-on with another identical sphere at rest. If 'e' is coefficient of restitution then what will be the ratio of velocity of the second sphere to that of first sphere after collision?

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

7. In Paschen series, wavelength of first line is ' λ_1 ' and for Brackett series, wavelength of first line is ' λ_2 ' then ratio $\frac{\lambda_1}{\lambda_2}$ is _____.

- (a) $\frac{7}{400}$
 - (b) $\frac{9}{144}$
 - (c) $\frac{81}{175}$
 - (d) $\frac{108}{509}$
-

8. An air column is of length 17 cm. The ratio of frequencies of 5th overtone if the air column is closed at one end to that open at both ends is (velocity of sound in air = 340 ms^{-1}) _____.

- (a) $\frac{9}{11}$

- (b) $\frac{5}{7}$
(c) $\frac{11}{12}$
(d) $\frac{13}{9}$
-

9. A body weighs 45 N on the surface of the earth. The gravitational force on a body due to earth at a height equal to half the radius of earth will be _____.

- (a) 20 N
(b) 22.5 N
(c) 30 N
(d) 36 N
-

10. Moment of inertia of the rod about an axis passing through the centre and perpendicular to its length is ' I_1 '. The same rod is bent into a ring and its moment of inertia about the diameter is ' I_2 '. Then I_1/I_2 is _____.

- (a) $\frac{3\pi^2}{2}$
(b) $\frac{2\pi^2}{3}$
(c) $\frac{\pi^2}{3}$
(d) $\frac{\pi^2}{9}$
-

11. The potentiometer wire is 5 m long and potential difference of 4 V is maintained between the ends. The e.m.f. of the cell which balances against a length of 200 cm of the potentiometer wire is _____.

- (a) 0.4 V
(b) 0.8 V
(c) 1.2 V
(d) 1.6 V
-

12. The error in the measurement of length and mass is 3% and 4% respectively. The error in the measurement of density will be _____.

- (a) 6%
 - (b) 13%
 - (c) 9%
 - (d) 15%
-

13. A bar of iron having magnetic moment 2.4 Am^2 weighs 66 g. If the density of the material of the bar is 7700 kg/m^3 , the intensity of magnetisation in Am^{-1} is _____.

- (a) 1.4×10^5
 - (b) 2.8×10^5
 - (c) 1.4×10^4
 - (d) 2.8×10^4
-

14. L, C and R are connected in series to an a.c. source. Which one of the following is true? Phase relation between current and voltage is such that _____.

- (a) both are out of phase with each other in 'R'.
 - (b) both are in phase in 'L' and out of phase in 'C'.
 - (c) both are out of phase in 'L' and in phase in 'C'.
 - (d) both are out of phase in both 'C' and 'L'.
-

15. In Young's double slit experiment, the distance between the slits is 2 mm and the slits are 1 m away from the screen. Two interference patterns can be obtained on the screen due to light of wavelength ' λ_1 ' and ' λ_2 ' respectively. The separation on the screen between the 3rd order bright fringes on the two interference patterns is ($\lambda_2 = 1.5\lambda_1$) _____.

- (a) $(0.75 \times 10^{-3})\lambda_1$
 - (b) $(1.75 \times 10^{-3})\lambda_1$
 - (c) $(2.00 \times 10^{-3})\lambda_1$
 - (d) $(0.75 \times 10^3)\lambda_1$
-

16. A source of sound emits sound wave of frequency 'f' and moves towards an observer with a velocity $V/3$ where V is the velocity of sound. If the observer moves away from the source with a velocity $V/5$ the apparent frequency heard by him will be _____.

- (a) $\frac{15}{2}f$
 - (b) $\frac{8}{15}f$
 - (c) $\frac{6}{5}f$
 - (d) $\frac{15}{18}f$
-

17. The ratio of the frequencies of two simple pendulums is 4 : 3 at the same place. The ratio of their respective lengths is _____.

- (a) 3 : 4
 - (b) 4 : 3
 - (c) 9 : 16
 - (d) 16 : 9
-

18. Two circuits A and B are connected to identical d.c. sources each of e.m.f. 10 volt. Self-inductances are $L_A = 10$ H and $L_B = 10$ mH. The total resistance of each circuit is 40Ω . The ratio of energy consumed in circuit A and circuit B to build up the current to steady value is _____.

- (a) 800
 - (b) 1000
 - (c) 1200
 - (d) 1400
-

19. Moment of inertia of a solid sphere about its diameter is 'I'. It is then casted into 27 small spheres of same diameter. The moment of inertia of each small sphere about its diameter is _____.

- (a) $I/44$
- (b) $I/188$

- (c) $I/204$
 (d) $I/243$

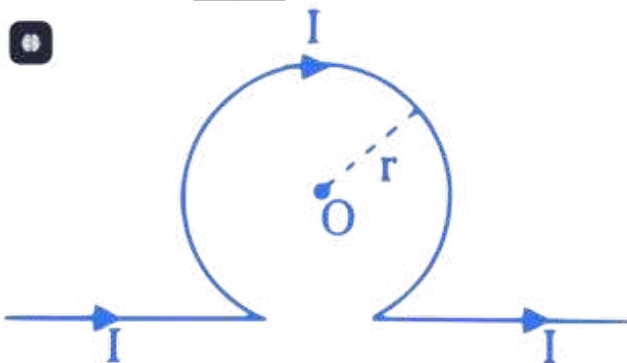
20. Fundamental frequency of sonometer wire is 'n'. If the tension and length are increased 3 times and diameter is increased twice, the new frequency will be _____.

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

21. Let R_1, R_2 and R_3 be the radii of three mercury drops. A big mercury drop is formed from them under isothermal conditions. The radius of the resultant drop is _____.

- (a) $(R_1^3 + R_2^3 + R_3^3)^{1/3}$
 (b) $(R_1^3 + R_2^3 - R_3^3)^{1/3}$
 (c) $(R_1^3 + R_2^3 + R_3^3)$
 (d) $(R_1 + R_2 + R_3)^3$

22. An infinitely long straight conductor carrying current 'I' is bent into a shape as shown in figure. The radius of the circular loop is 'r'. The magnetic induction at the centre of the loop at point 'O' is _____.



- (a) zero
 (b) $\frac{\mu_0 I}{4\pi r}(\pi - 1)$

(c) $\frac{\mu_0 I}{2\pi r}(\pi + 1)$

(d) $\frac{\mu_0 I}{2\pi r}(\pi - 1)$

23. The difference in length between two rods A and B is 60 cm at all temperatures. If $\alpha_A = 18 \times 10^{-6}/^\circ C$ and $\alpha_B = 27 \times 10^{-6}/^\circ C$, then the length of rod A and rod B at $0^\circ C$ is respectively _____.

(a) $l_A = 120$ cm, $l_B = 60$ cm

(b) $l_A = 180$ cm, $l_B = 120$ cm

(c) $l_A = 240$ cm, $l_B = 180$ cm

(d) $l_A = 270$ cm, $l_B = 210$ cm

24. Charges of $2\mu C$ and $-3\mu C$ are placed at two points A and B separated by distance of 1 m. The distance of the point from A where net potential is zero is _____.

(a) 0.667 m

(b) 0.5 m

(c) 0.4 m

(d) 0.6 m

25. The heat energy that must be supplied to 14 gram of nitrogen at room temperature to raise its temperature by $48^\circ C$ at constant pressure is (Molecular weight of nitrogen = 28, R = gas constant, $C_p = 7/2R$ for diatomic gas) _____.

(a) 76 R

(b) 84 R

(c) 90 R

(d) 96 R

26. The wavelength ' λ ' of a photon and the deBroglie wavelength of an electron have same value. The ratio of kinetic energy of the electron to the energy of a photon is _____.

- (a) $\frac{2\lambda mc}{h}$
 (b) $\frac{\lambda mc}{h}$
 (c) $\frac{h}{2\lambda mc}$
 (d) $\frac{h}{\lambda mc}$
-

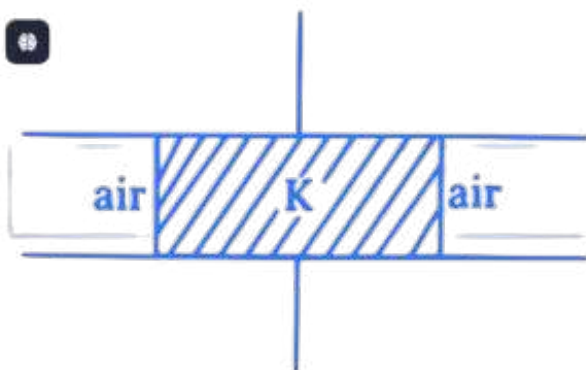
27. A monochromatic ray of light is incident normally on a thin prism of refracting angle A . The ray is deviated through an angle $(1.15)^\circ$ in passing through the prism. The ray reflected internally from the second face emerges from the first face making an angle of $(6.3)^\circ$ with the incident ray. The refractive index of the prism is _____.

- (a) 1.625
 (b) 1.575
 (c) 1.525
 (d) 1.515
-

28. Two black spheres P & Q have radii in the ratio 4 : 3. The wavelength of maximum intensity of radiation are in the ratio 4 : 5 respectively. The ratio of radiated power by P to Q is _____.

- (a) $\frac{625}{144}$
 (b) $\frac{125}{81}$
 (c) $\frac{25}{9}$
 (d) $\frac{5}{3}$
-

29. The capacity of air filled parallel plate capacitor is C_0 . One-half of the space between the plates is filled with a dielectric constant 'K' as shown in figure. The new capacity becomes C_n . The ratio C_n to C_0 is _____.



- (a) $\frac{K+1}{2}$
(b) $\frac{K+1}{3}$
(c) $\frac{K+1}{4}$
(d) $4(K + 1)$
-

30. A rigid body rotates about a fixed axis with variable angular velocity $(\alpha - \beta t)$ at time t , where α and β are constants. The angle through which it rotates before it comes to rest is _____.

- (a) $\frac{\alpha}{\beta}$
(b) $\frac{\alpha^2}{\beta}$
(c) $\frac{\alpha^2}{2\beta}$
(d) $\frac{\alpha}{2\beta}$
-

31. A resistor of 5Ω , inductor of self inductance $\left(\frac{2}{\pi}\right)$ H and a capacitor of unknown capacity are connected in series to an a.c. source of 100 V, 50 Hz supply. When the voltage and current are in phase, the value of capacitance is _____.

- (a) $\frac{10}{\pi} \mu\text{F}$
(b) $\frac{20}{\pi} \mu\text{F}$
(c) $\frac{40}{\pi} \mu\text{F}$
(d) $\frac{50}{\pi} \mu\text{F}$
-

32. A single slit diffraction pattern is formed with white light. For what wavelength of light the 4th secondary maximum in diffraction pattern coincides with the 3rd secondary maximum in the pattern of light of wavelength ' λ '?

- (a) $\frac{5\lambda}{7}$
(b) $\frac{7\lambda}{9}$
(c) $\frac{3\lambda}{4}$
(d) $\frac{9\lambda}{13}$

33. The temperature at which oxygen molecules will have same r.m.s. speed as helium molecules at 57°C is (molecular masses of oxygen and helium are 32 and 4 respectively.)

_____.

- (a) 1320 K
- (b) 2240 K
- (c) 2640 K
- (d) 3230 K

34. Out of the following statements which is NOT the characteristics of electric lines of force?

_____.

- (a) Electric lines of force originate from a positively charged object and end on negatively charged object.
- (b) The electric lines of force do not intersect each other.
- (c) The electric lines of force pass through the conductor.
- (d) The electric lines of force are crowded in a region where electric intensity is large.

35. An ideal gas expands adiabatically, ($\gamma = 1.5$). To reduce the r.m.s. velocity of the molecules 4 times, the gas has to be expanded _____.

- (a) 256 times
- (b) 128 times
- (c) 64 times
- (d) 8 times

36. The ratio of the distance of n^{th} bright band and m^{th} dark band from the central bright band in an interference pattern is _____.

- (a) $n : m$
- (b) $m : n$

- (c) $n : (m - 1/2)$
(d) $(n - 1/2) : m$
-

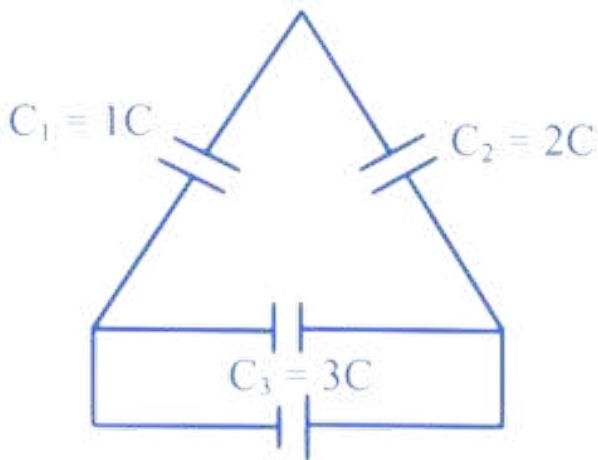
37. The material used for solar cell should have band gap _____.

- (a) equal to zero.
(b) less than 1.0 eV (non-zero).
(c) more than 1.8 eV.
(d) between 1.0 eV and 1.8 eV.
-

38. A spring executes S.H.M. with mass 1 kg attached to it. The force constant of the spring is 4 N/m. If at any instant its velocity is 20 cm/s, the displacement at that instant is (Amplitude of S.H.M. is 0.4 m) _____.

- (a) $\sqrt{0.11}$ m
(b) $\sqrt{0.15}$ m
(c) $\sqrt{0.17}$ m
(d) $\sqrt{0.19}$ m
-

39. Three capacitors are connected to a battery as shown in figure. The ratio of charge on capacitors C_3 and C_1 is _____.



(Assuming standard bridge configuration where C_1 is in series with parallel C_2, C_3 based on OCR artifacts, or the visual Delta where battery connects to the base)

- (a) 1.5
 - (b) 2.5
 - (c) 3.5
 - (d) 4.5
-

40. If $|\vec{a}| = \sqrt{26}$, $|\vec{b}| = 7$, $|\vec{a} \times \vec{b}| = 35$, find $\vec{a} \cdot \vec{b}$

- (a) 4
 - (b) 5
 - (c) 6
 - (d) 7
-

41. 125 small water drops of same size fall through air with constant velocity 4 cm/s. They coalesce to form a big drop. The terminal velocity of the big drop is _____.

- (a) 0.5 m/s
 - (b) 1 m/s
 - (c) 1.5 m/s
 - (d) 2.5 m/s
-

42. At a place, the length of the oscillating simple pendulum is made $1/4$ times keeping amplitude same then the total energy will be _____.

- (a) 2 times
 - (b) 4 times
 - (c) 8 times
 - (d) 16 times
-

43. When magnetic flux changes from 6.5×10^{-2} Wb to 11×10^{-2} Wb and the change in current is 0.03 A, the coefficient of mutual inductance will be _____.

- (a) 1.0 H
 - (b) 1.2 H
 - (c) 1.5 H
 - (d) 1.8 H
-

44. The work done in turning a magnet of magnetic moment 'M' by an angle of 90° from the meridian is 'n' times the corresponding work done to turn it through an angle of 60° where the value of 'n' is _____.

- (a) 0.5
 - (b) 2
 - (c) 0.25
 - (d) 1
-

45. A capillary tube when immersed vertically in water, the rise of water column is upto height h_1 on earth's surface. When this arrangement is taken into a mine of depth 'd', below earth's surface, the height of the water column is h_2 . If R is the radius of the earth, the ratio h_2/h_1 is _____.

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

46. Light of incident frequency 3 times the threshold frequency is incident on a photosensitive material. If the incident frequency is made (1/4)th and intensity is tripled then the photoelectric current will _____.

- (a) increase.
 - (b) decrease.
 - (c) be (1/3)rd
 - (d) be zero.
-

47. Applying forward bias to p-n junction, the potential barrier _____.

- (a) increases.
 - (b) decreases.
 - (c) remains unchanged.
 - (d) becomes zero.
-

48. In case of free expansion, which one of the following statements is WRONG _____.

- (a) It is an instantaneous change.
 - (b) The system is not in thermodynamic equilibrium.
 - (c) Free expansion can be plotted on a P-V diagram.
 - (d) It is an uncontrolled change.
-

49. In a common emitter transistor amplifier circuit, the input resistance is $1.8 \text{ k}\Omega$ and output is obtained across a load resistance of $9 \text{ k}\Omega$. The alternating current gain is 70. Corresponding to an a.c. input voltage of 6 mV , the output voltage will be _____.

- (a) 0.7 V
 - (b) 1.4 V
 - (c) 2.1 V
 - (d) 4.2 V
-

50. When a resistance of 100Ω is connected in series with a galvanometer of resistance 'G', its range is 'V'. To double its range, a resistance of 1000Ω is connected in series. The value of 'G' is _____.

- (a) 400Ω
 - (b) 800Ω
 - (c) 1000Ω
 - (d) 1200Ω
-