SAMPLE TEST PAPER

for

AIEEE–2010

Time: 3 Hours **Marks: 432**

INSTRUCTIONS

1. The Test Booklet consists of **90** questions. The maximum marks are **432**.
2. It is mandatory to fill the **Test Id** and **Student Id** on the OMR Sheet.
3. There are **three** parts in the question paper.
   The distribution of marks subjectwise in each part is as under for each correct response.

   Part A–Chemistry (144 marks) – Question No. 1 to 24 consist **FOUR (4)** marks each and Question No. 25 to 30 consist **EIGHT (8)** marks each for each correct response.

   Part B–Mathematics (144 marks) – Question No. 31 to 32 and 39 to 60 consist **FOUR (4)** marks each and Question No. 33 to 38 consist **EIGHT (8)** marks each for correct response

   Part C–Physics (144 marks) – Question No. 61 to 84 consist **FOUR (4)** marks each and Question No. 85 to 90 consist **EIGHT (8)** marks each for correct response
4. Candidates will be awarded marks as stated above in instructions No. 2 for correct response of each question. **1/4 (one fourth)** mark will be deducted for indicating incorrect response of each question. **No deduction** from the total score will be **made if no response** is indicated for an item in the answer sheet.
5. Use **Blue/Black Ball Point Pen only** for writing particulars/marking responses on the Answer Sheet. **Use of pencil is strictly prohibited.**
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. except the Admit Cad inside the examination hall/room.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only. This space is given at the bottom of each pages.
8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. **However, the candidates are allowed to take away this Test Booklet with them.**

Part–A : CHEMISTRY

Useful Data :

Atomic Mass : H = 1, C = 12, N = 14, O = 16, Na = 23, S = 32, Cl = 35.5, K = 39, Fe = 56, Cu = 63.5.

1. Number of atoms in 558.5 gram Fe (atomic weight of Fe = 55.85 g mol^{-1}) is

(a) twice that in 60g carbon
(b) 6.023×10^{22}
(c) half that in 8g He
(d) $558.5 \times 6.023 \times 10^{23}$

2. Alum helps in purifying water by

(a) forming Si complex with clay partiles
(b) sulphate part which combines with the dirt and removes it
(c) coagulating the mud particles
(d) making mud water soluble

3. A square planar complex is formed by hybridization of which atomic orbitals?

(a) s, p_x, p_y, d_{yz}
(b) s, p_x, p_y, $d_{x^2-y^2}$
(c) s, p_x, p_y, d_{x^2}
(d) s, p_y, d_z, d_{xy}

4. Polymer formation from monomers starts by

(a) condensation reaction between monomers
(b) coordinate reaction between monomers
(c) conversion of monomer to monomer ions by protons
(d) hydrolysis of monomers

5. The type of isomerism present in nitropentamine chromium (III) chloride is

(a) optical
(b) linkage
(c) ionization
(d) polymerization

——————————————— ***Space for rough work*** ———————————————

6. Arrangement of $(CH_3)_3 - C -$, $(CH_3)_2 - CH -$, $CH_3 - CH_2 -$ when attached to benzyl or an unsaturated group in increasing order of inductive effect

(a) $(CH_3)_3 - C - < (CH_3)_2 - CH - < CH_3 - CH -$

(b) $CH_3 - CH_2 - < (CH_3)_2 - CH - < (CH_3)_3 - C -$

(c) $(CH_3)_2 - CH - < (CH_3)_3 - C - < CH_3, -CH_2$

(d) $(CH_3)_3 - C - < CH_3 - CH_2 - (CH_3)_2 - CH -$

7. $CH_3 - Mg - Br$ is an organo metallic compound due to

(a) Mg – Br bond (b) C – Mg bond

(c) C – Br bond (d) C – H bond

8. When $KMnO_4$ acts as an oxidizing agent and ultimately forms $[MnO_4]^{-1}$, MnO_2, MnO_3, Mn^{+2} then the number of electrons transferred in each case respectively is

(a) 4, 3, 1, 5 (b) 1, 5, 3, 7

(c) 1, 3, 4, 5 (d) 3, 5, 7, 1

9. Species acting as both Bronsted acid and base is

(a) $(HSO_4)^{-1}$ (b) Na_2CO_3

(c) NH_3 (d) OH^{-1}

10. Let the solubility of an aqueous solution of $Mg(OH)_2$ be x then its k_{sp} is

(a) $4x^3$ (b) $108x^5$

(c) $27x^4$ (d) $9x$

———————————————— ***Space for rough work*** ————————————————

11. Units of rate constant of first and zero order reactions in terms of molarity M unit are respectively

(a) sec^{-1}, $Msec^{-1}$
(b) sec^{-1}, M
(c) $Msec^{-1}$, sec^{-1}
(d) M, sec^{-1}

12. In XeF_2, XeF_4, XeF_6 the number of lone pairs on Xe are respectively

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

13. In which of the following species the interatomic bond angle is 109°28'?

(a) NH_3, $(BF_4)^{-1}$
(b) $(NH_4)^4$, BF_3
(c) NH_3, BF_4
(d) $(NH_2)^{-1}$, BF_3

14. For the reaction $A + 2B \rightarrow C$, rate is given by $R = [A]\,[B]^2$ then the order of the reaction is

(a) 3
(b) 6
(c) 5
(d) 7

15. RNA is different from DNA because RNA contains

(a) ribose sugar and thymine
(b) ribose sugar and uracil
(c) deoxyribose sugar and thymine
(d) deoxyribose sugar and uracil

——————————————— ***Space for rough work*** ———————————————

16. Which of the following are arranged in an increasing order of their bond strengths?

(a) $O_2^- < O_2 < O_2^+ < O_2^{2-}$

(b) $O_2^{2-} < O_2^- < O_2 < O_2^+$

(c) $O_2^- < O_2^{2-} < O_2 < O_2^+$

(d) $O_2^+ < O_2 < O_2 < O_2^{2-}$

17. If an endothermic reaction is non-spontaneous at freezing point of water and becomes feasible at its boiling point, then

(a) ΔH is –ve, ΔS is +ve
(b) ΔH and ΔS both are +ve
(c) ΔH and ΔS both are –ve
(d) ΔH is +ve, ΔS is –ve

18. Which of the following is a redox reaction?

(a) $NaCl + KNO_2 \rightarrow NaNO_3 + KCl$
(b) $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$
(c) $Mg(OH)_2 + 2NH_4Cl \rightarrow MgCl_2 + 2NH_4OH$
(d) $Zn + 2AgCN \rightarrow 2ASg + Zn(CN)_2$

19. Most common oxidation states of Ce (cerium) are

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

20. Arrange Ce^{+3}, La^{+3}, Pm^{+3} and Yb^{+3} in increasing order of their ionic radii

(a) $Yb^{+3} < Pm^{+3} < Ce^{+3} < La^{+3}$
(b) $Ce^{+3} > Yb^{+3} < Pm^{+3} < La^{+3}$
(c) $Yb^{+3} < Pm^{+3} < La^{+3} < Ce^{+3}$
(d) $Pm^{+3} < La^{+3} < Ce^{+3} < Yb^{+3}$

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21. KO_2 (potassium super oxide) is used in oxygen cylinders in space and submarines because it

(a) absorbs CO_2 and increases O_2 content
(b) eliminates moisture
(c) absorbs CO_2
(d) produces ozone

22. A similarity between optical and geometrical isomerism is that

(a) each forms equal number of isomers for a given compound
(b) if in a compound one is present then so is the other
(c) both are included in stereoisomerism
(d) they have no similarity

23. Which of the following does not show geometrical isomerism?

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

24. In case of nitrogen, NCl_3 is possible but not NCl_5 while in case of phosphorus, PCl_3 as well as PCl_5 are possible. It is due to

(a) availability of vacant d-orbitals in P but not in N
(b) lower electronegativity of P than N
(c) lower tendency of H-bond formation in P than N
(d) occurrence of P in solid while N in gaseous state at room temperature

25. For an ideal gas, number of moles per litre in terms of its pressure P, gas constant R and temperature T is

(a) PT/R
(b) PRT
(c) P/RT
(d) RT/P

——————————————————— ***Space for rough work*** ———————————————————

26. The formation of gas at the surface of tungsten due to adsorption is the reaction of order

(a) 0
(b) 1
(c) 2
(d) insufficient data

27. For the reaction

$CO_{(g)} + (1/2)O_2(g) \rightarrow CO_{2(g)}$, K_p/K_c is

(a) RT
(b) $(RT)^{-1}$
(c) $(RT)^{-1/2}$
(d) $(RT)^{1/2}$

28. How do we differentiate between Fe^{3+} and Cr^{3+} in group III?

(a) by taking excess of NH_4OH solution
(b) by increasing NH_4^+ ion concentration
(c) by decreasing OH^- ion concentration
(d) both (b) and (c)

29. In a compound C, H and N atoms are present in 9 : 1 : 35 by weight. Molecualr weight or compound is 108. Molecular formula of compound is

(a) $C_2H_6N_2$
(b) C_3H_4N
(c) $C_6H_8N_2$
(d) $C_9H_{12}N_3$

30. The functional group, which is found in amino acid is

(a) –COOH group
(b) $-NH_2$ group
(c) $-CH_3$ group
(d) both (a) and (b)

——————————————— ***Space for rough work*** ———————————————

Part–B : MATHEMATICS

31. If $f(x) = 3x + 4$ and $g(x) = x^2$ then $h(x) = fog$ has

(a) min. at $x = 1$ | (b) max. at $x = 0$
(c) min. at $x = 0$ | (d) neither max. nor minima at $x = 0$

32. If $x^2 + y^2 = 1$, then the difference of maximum and minimum value of $3x - 4y + 5$ is

(a) 5 | (b) 10
(c) 15 | (d) 20

33. If $I_n = \int_0^1 \frac{x^n}{n} dx$ then $I_1 + I_2 + I_3 + ... \infty$ is equal to

(a) 1/2 | (b) 1
(c) 2 | (d) ∞

34. If $\int \frac{x^3}{x+1} dx = Ax^3 + Bx^2 + Cx - \ln(x + 1) + k$ then $A + B + C$ is equal to

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

35. $\underset{n\to\infty}{\text{Lt}} \sum_{k=1}^{n} \frac{k}{n^2 + k^2}$ is equal to

(a) $\frac{1}{2}\log 2$ | (b) log 2
(c) $\pi/4$ | (d) $\pi/2$

———————————————— ***Space for rough work*** ————————————————

36. If the quadratic equation $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ $(a \neq b)$ have a common root, then the numerical value of a + b is

(a) 1 (b) –1

(c) 2 (d) –2

37. Range of $\ln |\sin x|$ is

(a) $(-\infty, \infty)$ (b) $[0, \infty)$

(c) $(-\infty, 0]$ (d) $[0, 1]$

38. Order of differential equation of family of curves $y = \sin x \sin c_1 \cos c_2 - \sin x \sin c_2 \cos c_1 + c_3\, e^{x+c_4}$ (where c_1 c_2, c_3, c_4 are arbitrary constant) is

(a) 1 (b) 2

(c) 3 (d) 4

39. If $(1 + x + x^2 + x^3)^n = a_0 + a_1x + a_2x^2 + a_3x^3 + a_4x^4 + \dots \dots\dots$, then value of $a_0 + a_4 + a_8 + a_{12} + \dots$ is

(a) – 1 (b) 0

(c) 4^{n-1} (d) n

40. Let $f : R \to R$ be a differentiable function and f(1) = 4. Then the value of $\lim_{x\to1} \int_4^{f(x)} \frac{2t}{x-1} dt$ is

(a) $8f'(1)$ (b) $4f'(1)$

(c) $2f'(1)$ (d) $f'(1)$

Space for rough work

41. If a, b, c, d $\in R^+$ and $a^2 + c^2 = b^2 + d^2 = 2$, then maximum value of ab + cd is

(a) 1 (b) 2

(c) 3 (d) 4

42. If $P(e^{i\theta_1})$, $Q(e^{i\theta_2})$, $R(e^{i\theta_3})$ be the vertices of a triangle PQR in the Argand plane, then the orthocentre of the triangle PQR is

(a) $\frac{e^{i\theta_1}+e^{i\theta_2}+e^{i\theta_3}}{3}$ (b) $(e^{i\theta_1}+e^{i\theta_2}+e^{i\theta_3})$

(c) $2(e^{i\theta_1}+e^{i\theta_2}+e^{i\theta_3})$ (d) $\frac{1}{3}(e^{i\theta_1}-e^{i\theta_2}+e^{i\theta_3})$

43. Let a and b are two positive numbers. Let g and A be G.M. and A.M. of these numbers. Also G be G.M. of (a + 1) and (b + 1). If G and g are roots of equation $x^2 - 5x + 6 = 0$, then

(a) a = 12, b = 3/4 (b) a = 3/4 , b = 12

(c) a = 5/2, b = 8/5 (d) a = b = 2

44. Value of $\log_{(0.008)}\sqrt{5}$ is equal to

(a) $-\frac{1}{6}$ (b) $\frac{1}{6}$

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

45. If $a \in (0, \infty)$ then the least value of $\frac{a^4+a^2+4}{a}$ is equal to

(a) 4 (b) 2

(c) 5 (d) 6

——————————————— ***Space for rough work*** ———————————————

46. The sum of n terms of $\cot^{-1}3 + \cot^{-1}7 + \cot^{-1}13 + \cot^{-1}21 + ...$ is

(a) $\tan^{-1}(n + 1) + \pi/4$ (b) $\tan^{-1}\left(\frac{n}{n+2}\right)$

(c) $\cot^{-1}(n + 1)$ (d) $\cot^{-1}\left(\frac{n}{n+2}\right)$

47. Numbers of 6 digits numbers that can be formed using digits 1, 2, 3, 4 when each of digit appears in the number at least once

(a) 1520 (b) 1530

(c) 1560 (d) 1590

48. If the graph of $f(x) = 2x^3 + ax^2 + bx$, $a \in N$, $b \in N$, cuts the x-axis at three distinct points, then one of the values of a and b can be

(a) $a = 5, b = 4$ (b) $a = 3, b = 3$

(c) $a = 5, b = 3$ (d) $a = 2, b = 3$

49. The sum of the coefficients in the expansion of $(\alpha^2x^2 - 2\alpha x + 1)^{51}$, as a polynomial in x, vanishes. Position of the point $(\alpha, 2\alpha^2)$ with respect to the circle $x^2 + y^2 = 4$ is

(a) outside (b) inside

(c) on the circumference (d) can't be decided

50. If $z \in C$ lies on the circle whose equation is $|z - 3i| = 3\sqrt{2}$, then the argument of $\left(\frac{z-3}{z+3}\right)$ is

(a) $\tan^{-1}3$ (b) $\frac{\pi}{2}$

(c) $\frac{\pi}{4}$ (d) $\tan^{-1}3\sqrt{2}$

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51. Equation of the straight line, passing through (3, 4) and farthest from the circle $x^2 + y^2 + 8x + 6y + 16 = 0$, is

(a) $x - y + 1 = 0$ (b) $3x + 4y = 25$

(c) $x + y - 7 = 0$ (d) $x + y - 6 = 0$

52. If number of common tangents of the circles $x^2 + y^2 + 2x + 6y + 1 = 0$ and $x^2 + y^2 - 6x + k = 0$ is three, then value of k is

(a) 2 (b) 4

(c) 6 (d) 5

53. If in a ΔABC, $\Delta = a^2 - (b - c)^2$, then tan A is equal to

(a) 15/16 (b) 8/15

(c) 8/17 (d) $\frac{1}{2}$

54. The length of latus rectum of parabola whose vertex is at origin and axis is x-axis and the length of tangent drawn from (–4, 0) is of 10 unit is

(a) 9/4 (b) 9

(c) 36 (d) 18

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55. The locus of the point of intersection of the tangents to the ellipse $x^2/a^2 + y^2/b^2 = 1$ which are at right angles is

(a) a circle (b) a parabola
(c) an ellipse (d) a hyperbola

For Question No. 56 to 60

Each question contains **Statement – 1** and **Statement – 2**. Each question has 4 choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct. So select the correct choice :

(a) **Statement – 1** is True, **Statement – 2** is True; **Statement – 2 is** a correct explanation for **Statement – 1**.
(b) **Statement – 1** is True, **Statement – 2** is True; **Statement – 2 is NOT** a correct explanation for **Statement – 1**.
(c) **Statement – 1** is True, **Statement – 2** is False.
(d) **Statement – 1** is False, **Statement – 2** is True.

56. **Statement–1 :** If (3, 4) is a point of a hyperbola having focii (3, 0) and (λ, 0) and length of the transverse axis being 1 unit then λ can take the value 0 or 6.

Statement–2 : $|S'P - SP| = 2a$, where S and S′ are the two focus 2a = length of the transverse axis and P be any point on the hyperbola.

57. Consider the equation $(a^2 - 3a + 2)\, x^2 + (a^2 - 6a + 5)x + a^2 - 1 = 0$

Statement – 1: If a = 1, then above equation is true for all real x.

Statement – 2: If a = 1, then above equation will have two real and distinct roots.

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58. Let A and B be two independent events.

Statement–1 : If P(A) = 0.3 and $P\left(A \cup \overline{B}\right) = 0.8$ then P(B) is $\frac{2}{7}$.

Statement–2 : $P\left(\overline{E}\right) = 1 - P\left(E\right)$ where E is any event.

59. **Statement–1 :** If three points P, Q, R have position vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ respectively and $2\vec{a} + 3\vec{b} - 5\vec{c} = 0$, then the points P, Q, R must be collinear.

Statement–2 : If for three points A, B, C; $\overrightarrow{AB} = \lambda \overrightarrow{AC}$, then the points A, B, C must be collinear.

60. **Statement–1 :** The distance between the planes 4x – 5y + 3z = 5 and 4x – 5y + 3z + 2 = 0 is $\frac{3}{5\sqrt{2}}$.

Statement–2 : The distance between ax + by + cz + d_1 = 0 and ax + by + cz + d_2 = 0 is $\left|\frac{d_1 - d_2}{\sqrt{a^2 + b^2 + c^2}}\right|$.

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Part–C : PHYSICS

61. A uniform cylinder of length L and mass M having cross-sectional area A is suspended, with its length vertical, from a fixed point by a massless spring, such that it is half-submerged in a liquid of density ρ at equilibrium position. When the cylinder is given a small downward push and released it starts oscillating vertically with small amplitude. If the force constant of the spring is k, the frequency of oscillation of the cylinder is

(a) $\frac{1}{2\pi}\left(\frac{k - A\rho g}{M}\right)^{1/2}$
(b) $\frac{1}{2\pi}\left(\frac{k + A\rho g}{M}\right)^{1/2}$
(c) $\frac{1}{2\pi}\left(\frac{k + \rho g L^2}{M}\right)^{1/2}$
(d) $\frac{1}{2\pi}\left(\frac{k + A\rho g}{A\rho g}\right)^{1/2}$

62. In the measurement of n from the formula $n = \frac{2Wgl}{\pi r^4 \theta}$, the quantity which should be measured with best care is

(a) W
(b) l
(c) r
(d) θ

63. Two equal point charges are fixed at x = –a and x = +a on the x-axis. Another point charge Q is placed at the origin. The change in the electrical potential energy of Q, when it is displaced by a small distance x along the x axis, is approximately proportional to

(a) x
(b) x^2
(c) x^3
(d) 1/x

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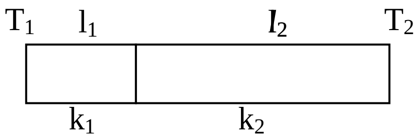
64. A quantity X is given by $\varepsilon_o L \frac{\Delta V}{\Delta t}$ where ε_o is the permittivity of the free space, L is a length, ΔV is a potential difference and Δt is a time interval. The dimensional formula for X is the same as that of

(a) resistance
(b) charge
(c) voltage
(d) current

65. In a uniform electric field,

(a) all points are at the same potential
(b) pairs of points separated by the same distance must have the same potential difference
(c) no two points can have the same potential
(d) none of the above

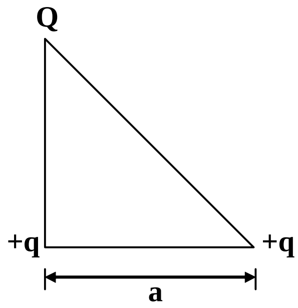
66. One end of a thermally insulated rod is kept at a temperature T_1 ands the other at T_2. The rod is composed of two sections of lengths l_1 and l_2 and thermal conductivities k_1 and k_2 respectively. The temperature at the interface of the two sections is



(a) $(k_1l_2T_1 + k_2l_1T_2) / (k_1 l_2 + k_2 l_1)$
(b) $(k_1l_1 T_1 + k_2l_2T_2) / (k_1 l_1 + k_2 l_2)$
(c) $(k_2l_2T_1 + k_1l_1T_2) / (k_1 l_1 + k_2 l_2)$
(d) $(k_2l_1 T_1 + k_1l_2T_2) / (k_2 l_1 + k_1 l_2)$

——————————————————— ***Space for rough work*** ———————————————————

67. Three charges Q, +q and +q are placed at the vertices of a right-angled isosceles triangle as shown. The net electrostatic energy of the configuration is zero if Q is equal to



(a) $\dfrac{-q}{1+\sqrt{2}}$ (b) $\dfrac{-2q}{2+\sqrt{2}}$

(c) –2q (d) +q

68. A particle moves along the x–axis in such a way that its coordinate (x) varies with time (t) according to the expression

$x = 2 - 5t + 6t^2$ m. The time t is in second.

The initial velocity of the particle is

(a) –5 m/s (b) –3 m/s

(c) 6 m/s (d) 3 m/s

69. Two bodies, one held 30 cm directly above the other are released simultaneously and fall freely under gravity. After 2 s their separation will be

(a) 10 cm (b) 20 cm

(c) 30 cm (d) zero

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70. A large open tank has two holes in the wall. One is a square hole of side L at a depth y from the top and the other is a circular hole of radius R at a depth 4y from the top. When the tank is completely filled with water the quantity of water flowing out per second from both holes are the same. Then, R is equal to

(a) $\frac{L}{\sqrt{2\pi}}$ (b) $2\pi L$

(d) L (c) $\frac{L}{2\pi}$

71. A spring balance is clamped to the ceiling and a mass of 40 kg is hung from its hook. The scale reads 40 kg. The ceiling exerts (on the spring)

(a) a force greater than 40g (b) no force

(c) a force less than 40g (d) a force exactly equal to 40g

72. Which of the following processes represents a gamma-decay?

(a) ${}^{A}X_{Z} + \gamma \rightarrow {}^{A}X_{Z-1} + a + b$ (b) ${}^{A}X_{Z} + {}^{1}n_{o} \rightarrow {}^{A-3}X_{Z-2} + c$

(c) ${}^{A}X_{Z} \rightarrow {}^{A}X_{Z} + f$ (d) ${}^{A}X_{Z} + e_{-1} \rightarrow {}^{A}X_{Z-1} + g$

73. If a star can convert all the He nuclei completely into oxygen nuclei. The energy released per oxygen nuclei is

[Mass of He nucleus is 4.0026 amu and mass of Oxygen nucleus is 15.9994 amu]

(a) 7.6 MeV (b) 56.12 MeV

(c) 10.24 MeV (d) 23.9 MeV

74. A mass m is initially in the position of rest. A constant force is applied on it. The speed acquired by it in a given displacement will be proportional to

(a) $\sqrt{m}$ (b) $\frac{1}{\sqrt{m}}$

(c) m (d) $\frac{1}{m}$

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75. A block moves through some distance on a rough surface. It is observed by two observers moving with respect to each other with a speed v along a straight line. The following quantities will be same as observed by the two observers.
(a) kinetic energy of the block at any instant
(b) work done by friction
(c) total work done on the block
(d) acceleration of the block

76. A coil having number of turns N and cross-sectional area A is rotated in a uniform magnetic field B with an angular velocity ω. The maximum value of the emf induced in it is

(a) $\frac{NBA}{\omega}$ (b) $NBA\omega$

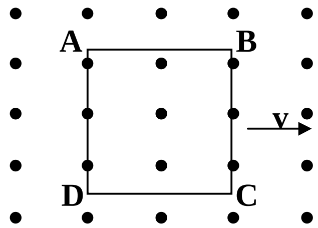
(c) $\frac{NBA}{\omega^2}$ (d) $NBA\omega^2$

77. A beam of electron is used in an YDSE experiment. The slit width is d. When the velocity of electron is increased, then

(a) no interference is observed (b) fringe width increases

(c) fringe width decreases (d) fringe width remains same

78. A metallic square loop ABCD is moving in its own plane with velocity v in a uniform magnetic field perpendicular to its plane as shown in the figure. An electric field is induced



(a) in AD, but not in BC
(b) in BC, but not in AD
(c) neither in AD nor in BC
(d) in both AD and BC

———————————————— ***Space for rough work*** ————————————————

79. The equation of alternating current is

$I = 50\sqrt{2}\ \sin 400\ \pi t$ amp

Then the frequency and root mean square of current are respectively

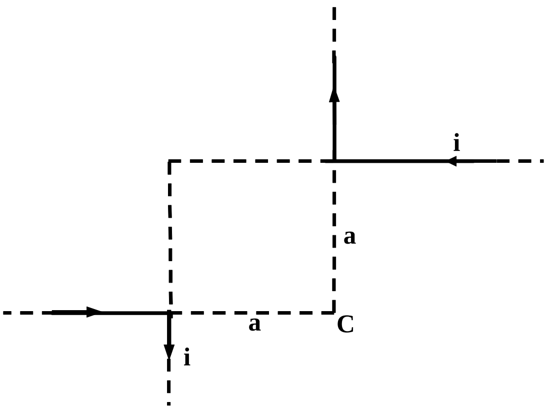
(a) 200 Hz, 50 amp (b) 400π Hz, $50\sqrt{2}$ amp

(c) 200 Hz, $50\sqrt{2}$ amp (d) 50 Hz, 200 amp

80. Two infinitely long wires carrying current i are bent, as shown in the figure. The magnetic induction at C is equal to

(a) zero (b) $\frac{\mu_o I}{2\pi a}$

(c) $\frac{\mu_o I}{4\pi a}$ (d) $\frac{\mu_o I}{\pi a}$



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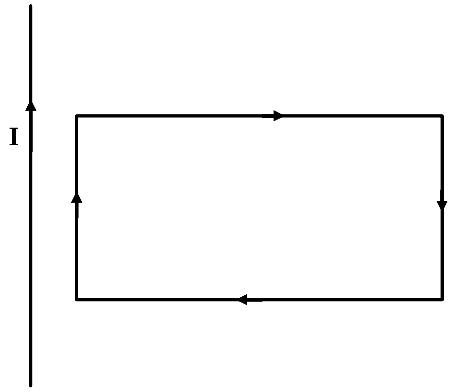
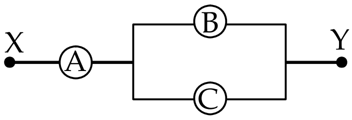
81. A rectangular loop carrying a current I is situated near a long straight wire such that the wire is parallel to one of the sides of loop. If a steady current I is established in the wire as shown in fig., the loop will



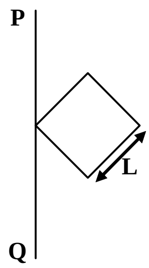
(a) rotate about an axis parallel to the wire
(b) move away from the wire
(c) move towards the wire
(d) remain stationary

82. Three voltmeters A, B and C, having resistances R, 1.5R and 3R, respectively, are connected as shown. When some potential difference is applied between X and Y, the voltmeter readings are V_A, V_B and V_C respectively. Then,



(a) $V_A \neq V_B = V_C$
(b) $V_A = V_B \neq V_C$
(c) $V_B \neq V_A = V_C$
(d) $V_A = V_B = V_C$

83. A square is made by joining four rods, each of mass M and length L. Its moment of inertia, about an axis PQ, in its plane and is passing through one of its end, is (as shown in the figure)



(a) $6ML^2$

(b) $\frac{4}{3}ML^2$

(c) $\frac{8}{3}ML^2$

(d) $\frac{10}{3}ML^2$

———————————————— ***Space for rough work*** ————————————————

84. Two S.H.M.'s are represented by the equations $y_1 = 10 \sin (3\pi t + \pi/4)$ and

$y_2 = 5 (\sin 3\pi t + \sqrt{3} \cos 3\pi t)$. Their amplitudes are in the ratio of

(a) 2 : 1 (b) 1 : 2

(c) 1 : 1 (d) 1 : 4

For Question No. 85 and 86

Each question contains **Statement – 1** and **Statement – 2**. Each question has four choices (a), (b), (c) and (d) out of which **ONLY ONE** is correct. So select the correct choice :

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(c) Statement-1 is True, Statement-2 is False
(d) Statement-1 is False, Statement-2 is True

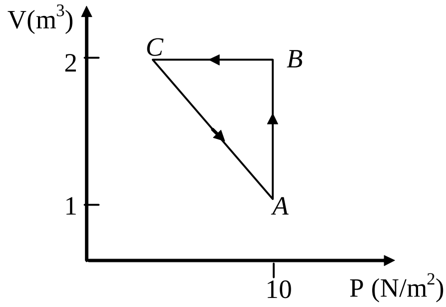
85. Statement–1 : Angular momentum of a system of a particle is always conserved.
Statement–2 : Torque = time rate of change of angular momentum.

86. Statement – 1 : The relative velocity between any two bodies moving in opposite direction is equal to sum of the magnitudes of velocity of two bodies.
Statement – 2 : Sometimes relative velocity between two bodies is equal to difference in magnitudes of velocity of the two bodies.

———————————————— ***Space for rough work*** ————————————————

87. An ideal gas is taken through the cycle $A \to B \to C \to A$, as shown in the figure. If the net heat supplied to the gas in the cycle is 5 J, the work done by the gas in the process $C \to A$ is

(a) –5 J (b) –10 J
(c) –15 J (d) –20 J



88. Two thermally insulated vessels 1 and 2 are filled with air at temperatures (T_1, T_2), volume (V_1, V_2) and pressure (P_1, P_2) respectively. If the valve joining the two vessels is opened, the temperature inside the vessel at equilibrium will be

(a) $T_1 + T_2$
(b) $(T_1 + T_2)/2$
(c) $\dfrac{T_1T_2(P_1V_1 + P_2V_2)}{(P_1V_1T_2 + P_2V_2T_1)}$
(d) $\dfrac{T_1T_2(P_1V_1 + P_2V_2)}{P_1V_1T_1 + P_2V_2T_2}$

89. Two lenses of power –15D and +5D are in contact with each other. The focal length of the combination is

(a) +20 cm (b) +10 cm
(c) –20 cm (d) –10 cm

90. A convex lens is in contact with concave lens. The magnitude of the ratio of their focal length is 2/3. Their equivalent focal length is 30 cm. What are their individual focal lengths?

(a) -75, 50 (b) -10, 15
(c) 75, 50 (d) -15, 10

——————————————— ***Space for rough work*** ———————————————

SAMPLE TEST PAPER

(SOLUTIONS)

for

AIEEE–2010

1.	**a**	**2.**	**c**	**3.**	**b**	**4.**	**a**	**5.**	**b**
6.	**b**	**7.**	**b**	**8.**	**c**	**9.**	**a**	**10.**	**a**
11.	**a**	**12.**	**d**	**13.**	**a**	**14.**	**a**	**15.**	**b**
16.	**b**	**17.**	**b**	**18.**	**d**	**19.**	**c**	**20.**	**a**
21.	**b**	**22.**	**c**	**23.**	**c**	**24.**	**a**	**25.**	**c**
26.	**a**	**27.**	**c**	**28.**	**d**	**29.**	**c**	**30.**	**d**
31.	**3**	**32.**	**2**	**33.**	**2**	**34.**	**4**	**35**	**1**
36.	**2**	**37.**	**3**	**38.**	**2**	**39.**	**3**	**40.**	**1**
41.	**2**	**42.**	**2**	**43.**	**4**	**44.**	**1**	**45.**	**4**
46.	**2**	**47.**	**3**	**48.**	**3**	**49.**	**1**	**50.**	**3**
51.	**3**	**52.**	**4**	**53.**	**2**	**54.**	**2**	**55.**	**1**
56.	**1**	**57.**	**3**	**58.**	**2**	**59.**	**1**	**60.**	**4**
61.	**b**	**62.**	**c**	**63.**	**b**	**64.**	**d**	**65.**	**d**
66.	**a**	**67.**	**b**	**68.**	**a**	**69.**	**c**	**70.**	**a**
71.	**d**	**72.**	**c**	**73.**	**c**	**74.**	**b**	**75.**	**d**
76.	**b**	**77.**	**c**	**78.**	**d**	**79.**	**a**	**80.**	**b**
81.	**c**	**82.**	**d**	**83.**	**c**	**84.**	**c**	**85.**	**d**
86.	**b**	**87.**	**a**	**88.**	**c**	**89.**	**d**	**90.**	**d**

1. **a**
2. **c**
3. **b**
4. **a**
5. **b**
6. **b**
7. **b**
8. **c**
9. **a**
10. **a**
11. **a**
12. **d**
13. **a**
14. **a**
15. **b**
16. **b**
17. **b**
18. **d**
19. **c**
20. **a**
21. **b**
22. **c**
23. **c**
24. **a**
25. **c**
26. **a**
27. **c**
28. **d**
29. **c**
30. **d**
31. **c**

$h(x) = fog = 3x^2 + 4$

$h'(x) = 6x = 0$

$h''(x) = 6 > 0$

$\Rightarrow$ x = 0 is point of minimum

32. **b**

Put $x = \cos\theta$, $y = \sin\theta$

$k = 3\sin\theta - 4\cos\theta + 5$

$0 \le k \le 10$

So difference is 10.

33. **b**

$$I_n = \frac{1}{n(n+1)} = \frac{1}{n} - \frac{1}{n+1}$$

$$= -\left(\frac{1}{n+1} - \frac{1}{n}\right)$$

$$S_n = 1 - \frac{1}{n+1}$$

$S_\infty = 1$

34. **d**

$$\int \frac{x^3}{x+1}dx = \frac{x^3}{3} - \frac{x^2}{2} + x - \ln(x+1) + K$$

$$A + B + C = \frac{5}{6}$$

35. **a**
36. **b**
37. **c**

$0 < |\sin x| \le 1$

$\Rightarrow -\infty < \ln|\sin x| \le 0.$

38. **b**

y = sinx sin($c_1 - c_2$) + c_3 $e^{c_4}e^x$ $\Rightarrow$ order is 2.

39. **c**

Putting x = 1, –1, i, –i we get

$4^n = a_0 + a_1 + a_2 + a_3 + a_4 + ... + a_{3n}$

$0 = a_0 - a_1 + a_2 - a_3 + a_4 .....$

$0 = a_0 + a_1 i - a_2 - a_3 i + a_4 + ...$

$0 = a_0 - a_1 i - a_2 + a_3 i + a_4 - .....$

Adding we get

$a_0 + a_4 + a_8 + ... = 4^{n-1}$

40. **a**

41. **b**

$\frac{a^2+b^2}{2} \ge ab$ (A.M. ≥ G.M.)

$\frac{c^2+d^2}{2} \ge cd$

$\therefore \frac{a^2+b^2+c^2+d^2}{2} \ge ab + cd$

$\Rightarrow ab + cd \le 2$

42. **b**

$e^{i\theta_1}, e^{i\theta_2}, e^{i\theta_3}$ lie on a unit circle having centre at the origin

$\therefore$ circumcentre of ΔPQR is origin.

centroid is $\left(\frac{e^{i\theta_1}+e^{i\theta_2}+e^{i\theta_3}}{3}\right)$. Now centroid divides line joining orthocentre and circumcentre in the ratio 2 : 1

$\therefore$ orthocentre = $e^{i\theta_1}+e^{i\theta_2}+e^{i\theta_3}$

43. **d**

$g^2 = (a + 1)(b + 1) = 9$

and $g^2 = ab = 4$

$\Rightarrow a = b = 2$

44. **a**

Let x = $\log_{(0.008)}\sqrt{5}$

or, $2x = \log_{(0.008)}5$

or, $(0.008)^{2x} = 5$

or, $(0.2)^{6x} = 5$

or, $\left(\frac{1}{5}\right)^{6x} = 5$

or, $5^{-6x} = 5^1$

$\therefore x = -\frac{1}{6}$

45. **d**

Let y = $\frac{a^4+a^2+4}{a} = a^3 + a + 4/a$

$= a^3 + a + \frac{1}{a}+\frac{1}{a}+\frac{1}{a}+\frac{1}{a}$

As a^3, a, $\frac{1}{a},\frac{1}{a},\frac{1}{a},\frac{1}{a} > 0$

As A.M. ≥ G.M. $\therefore$ $\frac{a^3 + a + \frac{1}{a}+\frac{1}{a}+\frac{1}{a}+\frac{1}{a}}{6} \ge 1 \Rightarrow y \ge 6.$

46. **b**

$t_r = \cot^{-1}(1 + r + r^2)$

$t_r = \tan^{-1}\left(\frac{1}{1+r+r^2}\right)$

$t_r = \tan^{-1}\left(\frac{(r+1)-r}{1+r(r+1)}\right)$

$t_r = \tan^{-1}(r + 1) - \tan^{-1} r$

Now $t_1 = \tan^{-1}2 - \tan^{-1}1$

$t_2 = \tan^{-1}3 - \tan^{-1}2$

....

$t_n = \tan^{-1}(n + 1) - \tan^{-1}n$

$t_1 + t_2 + ... + t_n = \tan^{-1}(n + 1) - \tan^{-1} 1$

$= \tan^{-1} \frac{(n+1)-1}{1+(n+1)} = \tan^{-1}\left(\frac{n}{n+2}\right).$

47. **c**

Case – I When any from 1, 2, 3, 4 repeats thrice

${}^4C_1 \frac{6!}{3!} = 480$

case– II when any two from 1, 2, 3, 4 repeats twice

${}^4C_2 \frac{6!}{2!2!} = 1080$

Total = 480 + 1080 = 1560.

48. **c**

$f(x) = x(2x^2 + ax + b)$

$\because$ f(x) cuts the x-axis at three distinct points therefore $2x^2 + ax + b$ has two distinct real roots

$\Rightarrow a^2 - 8b > 0$ and only option (c) satisfies this condition.

49. **a**

Sum of coefficients in expansion

$(\alpha^2x^2 - 2\alpha x + 1)^{51}$

$= (\alpha^2 - 2\alpha + 1)^{51} = 0$

$\Rightarrow (\alpha - 1)^{102} = 0$

$\therefore \alpha = 1$

$\Rightarrow$ Point $(\alpha, 2\alpha^2) \equiv (1, 2)$

Which is clearly outside the circle, $x^2 + y^2 - 4 = 0$

As $1 + 4 - 4 > 0$

50. **c**

Here points (–3) and (3) lie on the circle

$|Z-3i|=3\sqrt{2}$

$\Rightarrow$ AB = $3\sqrt{2}$

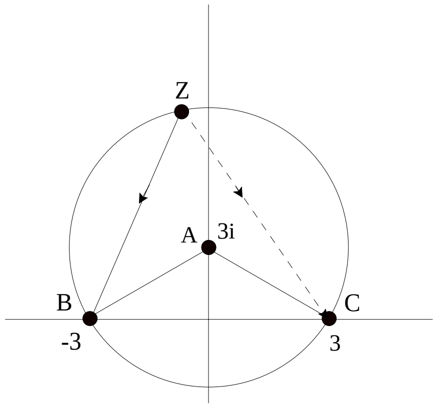
AC = $3\sqrt{2}$

BC = 6

Also, $AB^2 + AC^2 = BC^2$

$\therefore \angle BAC = \frac{\pi}{2}$

$\therefore \text{Arg}\left(\frac{Z-3}{Z+3}\right)=\frac{\pi}{4}$



51. **c**

Let P ≡ (3, 4) and C being the centre of circle, C ≡ (–4, –3). The line which is farthest from the circle is the line perpendicular to CP.

Slope of CP = $\frac{4+3}{3+4}=1$

$\therefore$ Slope of line perpendicular to CP = –1

$\therefore$ Equation of required line

y – 4 = –1(x – 3)

or, x + y – 7 = 0

52. **d**

As number of common tangents = 3

$\Rightarrow$ Both circles touch each other externally.

$\therefore$ Distance between centres = sum of their radii

$5=3+\sqrt{9-k}$

$\Rightarrow$ 9 – k = 4

$\therefore$ k = 5

53. **b**

$\Delta = (a + b - c)(a - b + c)$

$\Delta = (2s - 2c)(2s - 2b)$

or, $\Delta = 4(s - c)(s - b)$

or, $\sqrt{s(s-a)(s-b)(s-c)}=4(s-b)(s-c)$

or, $\sqrt{\frac{s(s-a)}{(s-b)(s-c)}}=4$

or, $\tan\frac{A}{2}=\frac{1}{4}$

$\therefore \tan A=\frac{2\times\frac{1}{4}}{1-\frac{1}{16}}=\frac{8}{15}$

54. **b**

AP = 10

or, $\sqrt{(at^2+4)^2+(2at)^2} = 10$ … (i)

Also equation of tangent at point P

$ty = x + at^2$

As it passes through (–4, 0)

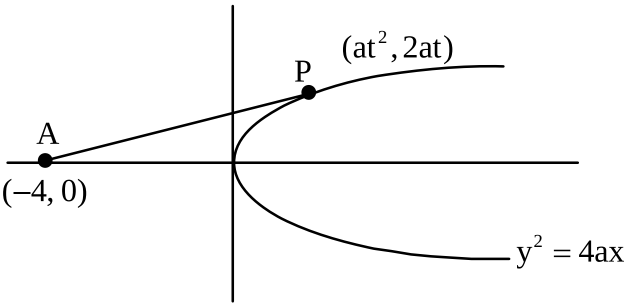
$\Rightarrow 0 = -4 + at^2$

$\therefore at^2 = 4$ … (ii)

from (i) and (ii)

$(4 + 4)^2 + 4a(4) = 100$

$\therefore$ 4a = 9



55. **a**

56. **a**

$\sqrt{(\lambda-3)^2+16} - 4 = 1 \Rightarrow$ λ = 0 or 6.

57. **c**

58. **a**

$$P\left(A \cup \bar{B}\right) = 1 - \left(\overline{A \cup \bar{B}}\right) = 1 - \left(\bar{A} \cap B\right) = 1 - P\left(\bar{A}\right)P\left(B\right)$$

0.8 = 1 – 0.7 × P(2)

$\Rightarrow$ P(2) = $\frac{2}{7}$.

59. **a**

$2\vec{a} + 3\vec{b} - 5\vec{c} = 0$

$\Rightarrow 3\left(\vec{b} - \vec{a}\right) = 5\left(\vec{c} - \vec{a}\right) \Rightarrow \overrightarrow{AB} = \frac{5}{3}\overrightarrow{AC}$

$\Rightarrow$ $\overrightarrow{AB}$ and $\overrightarrow{AC}$ must be parallel since there is common point A. The points A, B, C must be collinear .

Hence (a) is the correct answer.

60. **d**

Distance = $\left|\frac{5+2}{\sqrt{50}}\right| = \frac{7}{5\sqrt{2}}$.

61. **b**

In equilibrium Mg = kx + A $\frac{L}{2}\rho g$

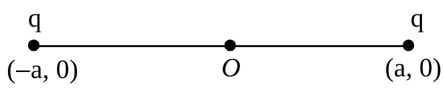
Let it be given a small downward push y and released then

$$F_r = Mg - k(x+y) + A\left(\frac{L}{2} + y\right)\rho g = -(k + A\rho g)y$$

$$\therefore \omega^2 = \frac{k + A\rho g}{M}$$

62. **c**

63. **b**



$$U_i = \frac{2KQq}{a}$$

$$U_f = \frac{KQq}{a+x} + \frac{KQq}{a-x} = \frac{2KQqa}{(a^2 - x^2)}$$

$$\Delta U = U_f - U_i = 2KQq\left[\frac{a}{a^2 - x^2} - \frac{1}{a}\right] = 2KQqa\left[\frac{x^2}{a(a^2 - x^2)}\right]$$

$$= \frac{2KQqax^2}{a^3} \quad (\text{since } a^2 - x^2 \approx a^2)$$

64. **d**

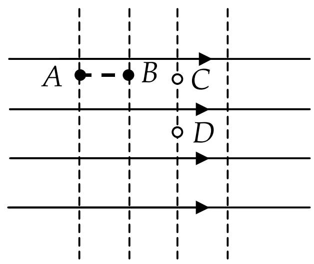
Using the relations $E = \frac{\sigma}{\varepsilon_o}$ and $\Delta V = E.L$, we get

$$X = \frac{\sigma}{E}.L.\frac{EL}{\Delta t} = \frac{q}{L^2}\frac{L^2}{\Delta t} = \frac{q}{\Delta t}$$

65. **d**

If all points are at same potential, there cannot exist an electric field, as

$$E = -\frac{dV}{dr}$$



Hence, (a) is not correct.

In a uniform electric field, the lines of force are parallel and equidistant (solid lines). The equipotentials (dotted lines), being perpendicular to lines of force, are also equidistant and parallel.

The distance between A and B is same as that between C and D. But, A and B will have some potential difference, whereas C and D being on the same equipotential, will have no potential difference. Hence, (b) is not correct.

Points on an equipotential are at the same potential. Hence, (c) is not correct.

66. **a**

Let temperature of interface be T. Since two section of rod are in series, rate of heat flow in them will be equal.

$$\Rightarrow \frac{k_1A(T_1 - T)}{l_1} = \frac{k_2A(T - T_2)}{l_2}$$

$$\Rightarrow T = \frac{k_1l_2T_1 + k_2l_1T_2}{k_1l_2 + k_2l_1}$$

67. **b**

$$U = \frac{kq^2}{a} + \frac{kqQ}{a} + \frac{kqQ}{\sqrt{2}\,a} = 0$$

68. **a**

$x = 2 - 5t + 6t^2$

$\therefore \quad v = \frac{dx}{dt} = -5 + 12\,t$

Initial velocity means velocity at t = 0

$\therefore \quad v_{initial} = -5$ m/s

69. **c**

Motion parameters i.e. the initial velocity and acceleration are same for both the bodies. Therefore, they will fall by the same distance in a given time, maintaining their initial separation.

70. **a**

$A_s v_s = A_c v_c \quad \Rightarrow (L^2)\sqrt{2gy} = (\pi R^2)\sqrt{2g(4y)}$

$\Rightarrow R = \frac{L}{\sqrt{2\pi}}$

71. **d**

The force exerted by the ceiling on the spring is the tension in the spring.

72. **c**

In gamma-decay, the atomic and mass number do not change.

73. ***c***

Mass defect = 4 $\times$ 4.0026 - 15.9994 = 0.011

Energy released by oxygen nuclei = 0.011 × 931 = 10.24 MeV

74. **b**

From work-kinetic energy theorem

$$\frac{1}{2}mv^2 = F.s$$

$$\therefore \quad v = \sqrt{\frac{2Fs}{m}} \Rightarrow v \propto \frac{1}{\sqrt{m}}$$

75. **d**

Both the observes are inertial observers. They will measure different values for work or kinetic energy. However, acceleration measured by both of them will be the same

76. **b**

The flux linking with the coil at any instant t is given as

$\Phi = NBA\cos\omega t$

$$\therefore \quad E = -\frac{d\Phi}{dt} = NBA\omega\sin\omega t$$

Therefore, the maximum value of emf is

$E_{max} = NBA\omega$

Hence, answer (b) is correct.

77. **c**

Momentum of the electron will increase. So the wavelength (λ = h/p)of electrons will decrease and fringe width decreases as $\beta \propto \lambda$

78. **d**

Due to the motion of the loop, an electric field will be induced both in AD and BC.

79. **a**

$2\pi nt = 400\,\pi t \qquad \therefore\ n = 200$

$I_o = 50\sqrt{2}$ amp.

R.m.s. current = $I_o/\sqrt{2}$ = 50 amp.

80. **b**

81. **c**

82. **d**

The division of current I into the two parallel branches will be as shown,

$\therefore \quad V_A = IR$

$V_B = \left(\frac{2I}{3}\right) 1.5\ R = IR$

$V_C = \left(\frac{I}{3}\right) 3R = IR$

$\therefore \quad V_A = V_B = V_C$

83. **c**

84. **c**

$y_2 = 5(\sin 3\pi t + \sqrt{3}\ \cos 3\pi t) = 10 \sin (3\pi t + \frac{\pi}{3})$

85. **d**

86. **b**

87. **a**

For the cyclic process $\Delta U = 0$

$\Delta W = W_{AB} + W_{BC} + W_{CA} = (10 + 0 + W_{CA})$ J

Given $\quad \Delta Q = 5$ J

From first law of thermodynamics $5 = 10 + 0 + W_{CA}$

$\Rightarrow \quad W_{CA} = -5$

88. **c**

Heat lost = Heat gained

$$\Rightarrow \quad \frac{P_1V_1}{RT_1}.C_V(T_1 - T) = \frac{P_2V_2}{RT_2}C_V(T - T_2) \quad \Rightarrow \quad T = \frac{P_1V_1 + P_2V_2}{\frac{P_1V_1}{T_1} + \frac{P_2V_2}{T_2}}$$

89. **d**

$P = P_1 + P_2 = [-15 + 5]D = -10D$

Focal length of the combination $f = \frac{1}{P} = -\frac{1}{10}m = -10cm$

90. **d**

$\frac{f_1}{f_2} = \frac{2}{3}$ *(1)*

$\frac{1}{f_1} - \frac{1}{f_2} = \frac{1}{30}$ *(2)*

Solving equations (1) and (2),

$\Rightarrow \quad f_2 = 15$ *cm* *(concave lens)*

$f_1 = 10$ cm (convex lens)