AIEEE 2012 Paper 1 (B.E./B.Tech) May 19 Single slot Question Paper

Conducted by the Central Board of Secondary Education (CBSE)

Time Allowed: 3 Hours **B.E./B.Tech.** **Maximum Marks: 360**

General Instructions

(i) This is the **All India Engineering Entrance Examination (AIEEE) 2012** engineering paper, conducted by the **Central Board of Secondary Education (CBSE)** on **19 May 2012** in **Computer based** mode.

(ii) The paper contains **90 questions**, carrying **360 marks**. The time allowed is **3 hours**.

(iii) The subjects appear in the following order: Mathematics: 30 questions (120 marks); Physics: 30 questions (120 marks); Chemistry: 30 questions (120 marks). Questions are numbered continuously in this edition.

(iv) All questions are compulsory. Each question has four options. Select the correct answer.

(v) Each correct answer carries **+4 marks**. Each incorrect answer carries **-1 marks**. Unanswered questions carry **0 marks**.

1. Let $p, q, r \in R$ and $r > p > 0$. If the quadratic equation $px^2 + qx + r = 0$ has two complex roots α and β, then $|\alpha| + |\beta|$ is

(1) equal to 1

(2) less than 2 but not equal to 1

(3) greater than 2

(4) equal to 2

2. Consider a quadratic equation $ax^2 + bx + c = 0$, where $2a + 3b + 6c = 0$ and let $g(x) = a\frac{x^3}{3} + b\frac{x^2}{2} + cx$. Statement 1 : The quadratic equation has at least one root in the interval $(0, 1)$. Statement 2: The Rolle's theorem is applicable to function $g(x)$ on the interval $[0, 1]$.

(1) Statement 1 is false, Statement 2 is true.

(2) Statement 1 is true, Statement 2 is false.

(3) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 1 .

(4) Statement 1 is true, Statement 2 is true, , Statement 2 is a correct explanation for Statement 1 .

3. Let Z and W be complex numbers such that $|Z| = |W|$, and arg Z denotes the principal argument of Z. Statement 1 :If $\arg Z + \arg W = \pi$, then $Z = -\bar{W}$. Statement 2: $|Z| = |W|$, implies $\arg Z - \arg \bar{W} = \pi$.

(1) Statement 1 is true, Statement 2 is false.

(2) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 1 .

(3) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 1 .

(4) Statement 1 is false, Statement 2 is true.

4. The number of arrangements that can be formed from the letters a, b, c, d, e, f taken 3 at a time without repetition and each arrangement containing at least one vowel, is

(1) 96

(2) 128

(3) 24

(4) 72

5. The sum of the series $1 + \frac{4}{3} + \frac{10}{9} + \frac{28}{27} + \ldots$ upto n terms is

(1) $\frac{7}{6}n + \frac{1}{6} - \frac{2}{3.2^{n-1}}$

(2) $\frac{5}{3}n - \frac{7}{6} + \frac{1}{2.3^{n-1}}$

(3) $n + \frac{1}{2} - \frac{1}{2.3^n}$

(4) $n - \frac{1}{3} - \frac{1}{3.2^{n-1}}$

6. If $n = {}^mC_2$, then the value of ${}^nC_2$ is given by

(1) $3\left({}^{m+1}C_4\right)$

(2) ${}^{m-1}C_4$

(3) ${}^{m+1}C_4$

(4) $2\left({}^{m+2}C_4\right)$

7. Suppose θ and $\phi(\neq 0)$ are such that $\sec(\theta + \phi)$, $\sec\theta$ and $\sec(\theta - \phi)$ are in A.P. If $\cos\theta = k\cos\left(\frac{\phi}{2}\right)$ for some k, then k is equal to

(1) $\pm\sqrt{2}$

(2) ± 1

(3) $\pm\frac{1}{\sqrt{2}}$

(4) ± 2

8. Let L be the line $y = 2x$, in the two dimensional plane. Statement 1 : The image of the point $(0, 1)$ in L is the point $\left(\frac{4}{5}, \frac{3}{5}\right)$ Statement 2: The points $(0, 1)$ and $\left(\frac{4}{5}, \frac{3}{5}\right)$ lie on opposite sides of the line L and are at equal distance from it.

(1) Statement 1 is true, Statement 2 is false.

(2) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 1 .

(3) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 1 .

(4) Statement 1 is false, Statement 2 is true.

9. If the line $y = mx + 1$ meets the circle $x^2 + y^2 + 3x = 0$ in two points equidistant from and on opposite sides of x-axis, then

(1) $3m + 2 = 0$

(2) $3m - 2 = 0$

(3) $2m + 3 = 0$

(4) $2m - 3 = 0$

10. The equation of the normal to the parabola, $x^2 = 8y$ at $x = 4$ is

(1) $x + 2y = 0$

(2) $x + y = 2$

(3) $x - 2y = 0$

(4) $x + y = 6$

11. If the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ coincide with the foci of the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$, then b^2 is equal to

(1) 8

(2) 10

(3) 7

(4) 9

12. If $f(x) = 3x^{10} - 7x^8 + 5x^6 - 21x^3 + 3x^2 - 7$, then $\lim_{\alpha \to 0} \frac{f(1-\alpha)-f(1)}{\alpha^3+3\alpha}$ is

(1) $-\frac{53}{3}$

(2) $\frac{53}{3}$

(3) $-\frac{55}{3}$

(4) $\frac{55}{3}$

13. Let p and q be two Statements. Amongst the following, the Statement that is equivalent to $p \to q$ is

(1) $p \wedge \sim q$

(2) $\sim p \vee q$

(3) $\sim p \wedge q$

(4) $p \vee \sim q$

14. The median of 100 observations grouped in classes of equal width is 25 . If the median class interval is 20-30 and the number of observations less than 20 is 45 , then the frequency of median class is

(1) 10

(2) 20

(3) 15

(4) 12

15. If three distinct points A, B, C are given in the 2dimensional coordinate plane such that the ratio of the distance of each one of them from the point $(1, 0)$ to the distance from $(-1, 0)$ is equal to $\frac{1}{2}$, then the circumcentre of the triangle ABC is at the point

(1) $\left(\frac{5}{3}, 0\right)$

(2) $(0, 0)$

(3) $\left(\frac{1}{3}, 0\right)$

(4) $(3, 0)$

16. If A^T denotes the transpose of the matrix $A = \begin{bmatrix} 0 & 0 & a \\ 0 & b & c \\ d & e & f \end{bmatrix}$, where a, b, c, d, e and f are integers such that $abd \neq 0$, then the number of such matrices for which $A^{-1} = A^T$ is

(1) $2(3!)$

(2) $3(2!)$

(3) 2^3

(4) 3^2

17. If a, b, c, are non zero complex numbers satisfying $a^2 + b^2 + c^2 = 0$ and $\begin{vmatrix} b^2+c^2 & ab & ac \\ ab & c^2+a^2 & bc \\ ac & bc & a^2+b^2 \end{vmatrix} = ka^2b^2c^2$, then k is equal to

(1) 1

(2) 3

(3) 4

(4) 2

18. A value of $\tan^{-1}\left(\sin\left(\cos^{-1}\left(\sqrt{\frac{2}{3}}\right)\right)\right)$ is

(1) $\frac{\pi}{4}$

(2) $\frac{\pi}{2}$

(3) $\frac{\pi}{3}$

(4) $\frac{\pi}{6}$

19. If $P(S)$ denotes the set of all subsets of a given set S, then the number of one-to-one functions from the set $S = \{1, 2, 3\}$ to the set $P(S)$ is

(1) 24

(2) 8

(3) 336

(4) 320

20. Let $f:[1,3]\to R$ be a function satisfying $\frac{x}{[x]}\le f(x)\le\sqrt{6-x}$, for all $x\neq 2$ and $f(2)=1$, where R is the set of all real numbers and $[x]$ denotes the largest integer less than or equal to x. Statement 1 : $\lim_{x\to 2^-} f(x)$ exists. Statement 2: f is continuous at $x=2$.

(1) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 1 .

(2) Statement 1 is false, Statement 2 is true.

(3) Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation for Statement 1 .

(4) Statement 1 is true, Statement 2 is false.

21. The weight W of a certain stock of fish is given by $W=nw$, where n is the size of stock and w is the average weight of a fish. If n and w change with time t as $n=2t^2+3$ and $w=t^2-t+2$, then the rate of change of W with respect to t at $t=1$ is

(1) 1

(2) 8

(3) 13

(4) 5

22. If $f(x)=\int\left(\frac{x^2+\sin^2 x}{1+x^2}\right)\sec^2 x\,dx$ and $f(0)=0$, then $f(1)$ equals

(1) $\tan 1-\frac{\pi}{4}$

(2) $\tan 1+1$

(3) $\frac{\pi}{4}$

(4) $1-\frac{\pi}{4}$

23. The value of the integral $\int_0^{0.9}[x-2[x]]dx$, where [.] denotes the greatest integer function is

(1) 0.9

(2) 1.8

(3) -0.9

(4) 0

24. The area of the region bounded by the curve $y=x^3$, and the lines, $y=8$, and $x=0$, is

(1) 8

(2) 12

(3) 10

(4) 16

25. The general solution of the differential equation $\frac{dy}{dx}+\frac{2}{x}y=x^2$ is

(1) $y=cx^{-3}-\frac{x^2}{4}$

(2) $y=cx^3-\frac{x^2}{4}$

(3) $y=cx^2+\frac{x^3}{5}$

(4) $y=cx^{-2}+\frac{x^3}{5}$

26. If $a+b+c=0$, $|\vec{a}|=3$, $|\vec{b}|=5$ and $|\vec{c}|=7$, then the angle between $\vec{a}$ and $\vec{b}$ is

(1) $\frac{\pi}{3}$

(2) $\frac{\pi}{4}$

(3) $\frac{\pi}{6}$

(4) $\frac{\pi}{2}$

27. If the three planes $x=5$, $2x-5ay+3z-2=0$ and $3bx+y-3z=0$ contain a common line, then (a,b) is equal to

(1) $\left(\frac{8}{15},-\frac{1}{5}\right)$

(2) $\left(\frac{1}{5},-\frac{8}{15}\right)$

(3) $\left(-\frac{8}{15},\frac{1}{5}\right)$

(4) $\left(-\frac{1}{5},\frac{8}{15}\right)$

28. Statement 1 : The shortest distance between the lines $\frac{x}{2}=\frac{y}{-1}=\frac{z}{2}$ and $\frac{x-1}{4}=\frac{y-1}{-2}=\frac{z-1}{4}$ is $\sqrt{2}$. Statement 2: The shortest distance between two parallel lines is the perpendicular distance from any point on one of the lines to the other line.

(1) Statement 1 is true, Statement 2 is false.

(2) Statement 1 is true, Statement 2 is true, Statement 2 is a correct explanation for Statement 1 .

(3) Statement 1 is false, Statement 2 is true.

(4) Statement 1 is true, Statement 2 is true, , Statement 2 is not a correct explanation for Statement 1 .

29. If $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}, \vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{c} = r\hat{i} + \hat{j} + (2r - 1\hat{k}$ are three vectors such that $\vec{c}$ is parallel to the plane of $\vec{a}$ and $\vec{b}$, then r is equal to

(1) 1

(2) -1

(3) 0

(4) 2

30. If six students, including two particular students A and B, stand in a row, then the probability that A and B are separated with one student in between them is

(1) $\frac{8}{15}$

(2) $\frac{4}{15}$

(3) $\frac{2}{15}$

(4) $\frac{1}{15}$

31. The amount of heat produced in an electric circuit depends upon the current (I), resistance (R) and time (t). If the error made in the measurements of the above quantities are 2%, 1% and 1% respectively then the maximum possible error in the total heat produced will be

(1) 1%

(2) 2%

(3) 6%

(4) 3%

32. A goods train accelerating uniformly on a straight railway track, approaches an electric pole standing on the side of track. Its engine passes the pole with velocity u and the guard's room passes with velocity v. The middle wagon of the train passes the pole with a velocity.

(1) $\frac{u+v}{2}$

(2) $\frac{1}{2}\sqrt{u^2+v^2}$

(3) $\sqrt{uv}$

(4) $\sqrt{\left(\frac{u^2+v^2}{2}\right)}$

33. Sand is being dropped on a conveyer belt at the rate of 2 kg per second. The force necessary to keep the belt moving with a constant speed of 3 ms^{-1} will be

(1) 12 N

(2) 6 N

(3) zero

(4) 18 N

34. A block of weight W rests on a horizontal floor with coefficient of static friction μ. It is desired to make the block move by applying minimum amount of force. The angle θ from the horizontal at which the force should be applied and magnitude of the force F are respectively.

(1) $\theta = \tan^{-1}(\mu), F = \frac{\mu W}{\sqrt{1+\mu^2}}$

(2) $\theta = \tan^{-1}\left(\frac{1}{\mu}\right), F = \frac{\mu W}{\sqrt{1+\mu^2}}$

(3) $\theta = 0, F = \mu W$

(4) $\theta = \tan^{-1}\left(\frac{\mu}{1+\mu}\right), F = \frac{\mu W}{1+\mu}$

35. Two point masses of mass $m_1 = fM$ and $m_2 = (1-f)M (f < 1)$ are in outer space (far from gravitational influence of other objects) at a distance R from each other. They move in circular orbits about their centre of mass with angular velocities ω_1 for m_1 and ω_2 for m_2. In that case

(1) $(1-f)\omega_1 = f\omega$

(2) $\omega_1 = \omega_2$ and independent of f

(3) $f\omega_1 = (1-f)\omega_2$

(4) $\omega_1 = \omega_2$ and depend on f

36. A moving particle of mass m, makes a head on elastic collision with another particle of mass $2m$, which is initially at rest. The percentage loss in energy of the colliding particle on collision, is close to

(1) 33%

(2) 67%

(3) 90%

(4) 10%

37. A steel wire can sustain 100 kg weight without breaking. If the wire is cut into two equal parts, each part can sustain a weight of

(1) 50 kg

(2) 400 kg

(3) 100 kg

(4) 200 kg

38. A large number of droplets, each of radius, r coalesce to form a bigger drop of radius, R. An engineer designs a machine so that the energy released in this process is converted into the kinetic energy of the drop. Velocity of the drop is ($T =$ surface tension, $\rho =$ density)

(1) $\left[\frac{T}{\rho}\left(\frac{1}{r}-\frac{1}{R}\right)\right]^{1/2}$

(2) $\left[\frac{6T}{\rho}\left(\frac{1}{r}-\frac{1}{R}\right)\right]^{1/2}$

(3) $\left[\frac{3T}{\rho}\left(\frac{1}{r}-\frac{1}{R}\right)\right]^{1/2}$

(4) $\left[\frac{2T}{\rho}\left(\frac{1}{r}-\frac{1}{R}\right)\right]^{1/2}$

39. A large cylindrical rod of length L is made by joining two identical rods of copper and steel of length $\left(\frac{L}{2}\right)$ each. The rods are completely insulated from the surroundings. If the free end of copper rod is maintained at $100^{\circ}\mathrm{C}$ and that of steel at $0^{\circ}\mathrm{C}$ then the temperature of junction is (Thermal conductivity of copper is 9 times that of steel)

(1) $90^{\circ}\mathrm{C}$

(2) $50^{\circ}\mathrm{C}$

(3) $10^{\circ}\mathrm{C}$

(4) $67^{\circ}\mathrm{C}$

40. This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements.
Statement 1 : An inventor claims to have constructed an engine that has an efficiency of 30% when operated between the boiling and freezing points of water. This is not possible. Statement 2: The efficiency of a real engine is always less than the efficiency of a Carnot engine operating between the same two temperatures.

(1) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1 .

(2) Statement 1 is true, Statement 2 is false.

(3) Statement 1 is false, Statement 2 is true.

(4) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1 .

41. The pressure of an ideal gas varies with volume as $P=\alpha V$, where α is a constant. One mole of the gas is allowed to undergo expansion such that its volume becomes ' m ' times its initial volume. The work done by the gas in the process is

(1) $\frac{\alpha V}{2}\left(m^2-1\right)$

(2) $\frac{\alpha^2 V^2}{2}\left(m^2-1\right)$

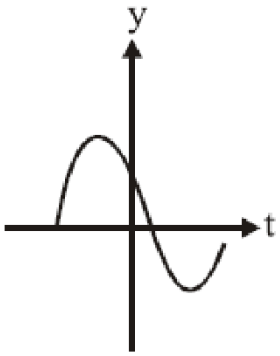
(3) $\frac{\alpha}{2}\left(m^2-1\right)$

(4) $\frac{\alpha V^2}{2}\left(m^2-1\right)$

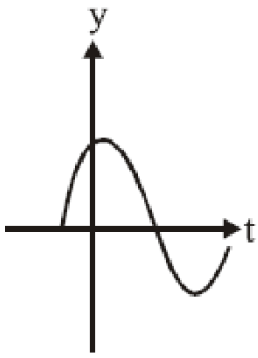
42. The displacement $y(t)=A\sin(\omega t+\phi)$ of a pendulum for $\phi=\frac{2\pi}{3}$ is correctly represented by

42. (continued)

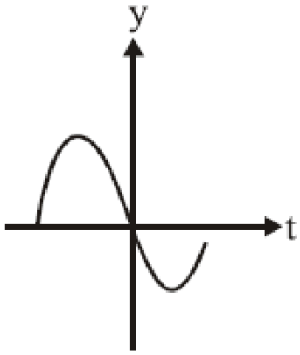
(1)



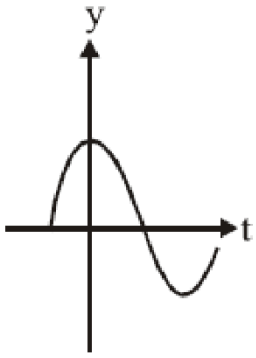
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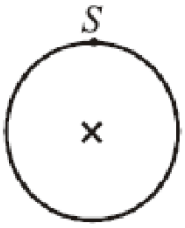
(3)



(4)



43. A ring is suspended from a point S on its rim as shown in the figure. When displaced from equilibrium, it oscillates with time period of 1 second. The radius of the ring is (take $g = \pi^2$)



(1) 0.15 m
(2) 1.5 m
(3) 1.0 m
(4) 0.5 m

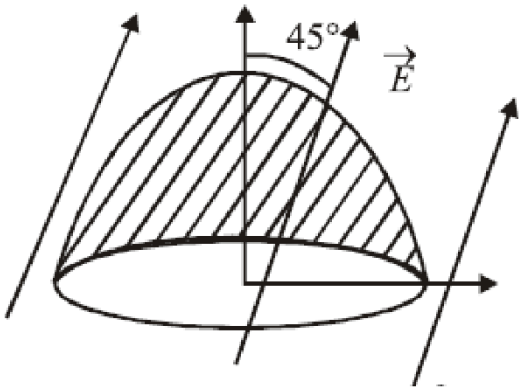
44. A uniform tube of length 60.5 cm is held vertically with its lower end dipped in water. A sound source of frequency 500 Hz sends sound waves into the tube. When the length of tube above water is 16 cm and again when it is 50 cm, the tube resonates with the source of sound. Two lowest frequencies (in Hz), to which tube will resonate when it is taken out of water, are (approximately).

(1) 28 1,562
(2) 28 1,843
(3) 276,552
(4) 272,544

45. A charge of total amount Q is distributed over two concentric hollow spheres of radii r and $R(R > r$) such that the surface charge densities on the two spheres are equal. The electric potential at the common centre is

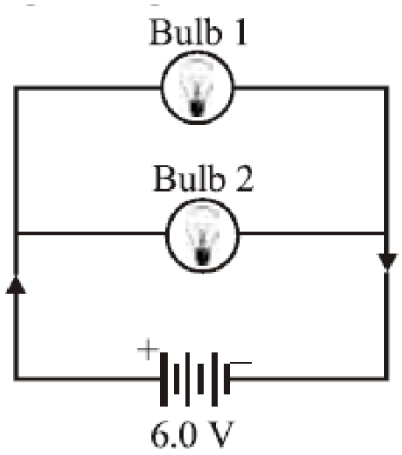
(1) $\frac{1}{4\pi\varepsilon_0}\frac{(R-r)Q}{(R^2+r^2)}$
(2) $\frac{1}{4\pi\varepsilon_0}\frac{(R+r)Q}{2(R^2+r^2)}$
(3) $\frac{1}{4\pi\varepsilon_0}\frac{(R+r)Q}{(R^2+r^2}\Big)$
(4) $\frac{1}{4\pi\varepsilon_0}\frac{(R-r)Q}{2(R^2+r^2)}$

46. The flat base of a hemisphere of radius a with no charge inside it lies in a horizontal plane. A uniform electric field $\vec{E}$ is applied at an angle $\frac{\pi}{4}$ with the vertical direction. The electric flux through the curved surface of the hemisphere is



(1) $\pi a^2 E$
(2) $\frac{\pi a^2 E}{\sqrt{2}}$
(3) $\frac{\pi a^2 E}{2\sqrt{2}}$
(4) $\frac{(\pi+2\pi\phi^2 E}{\left(2\sqrt{2}^2\right)}$

47. A 6.0 volt battery is connected to two light bulbs as shown in figure. Light bulb 1 has resistance 3 ohm while light bulb 2 has resistance 6ohm. Battery has negligible internal resistance. Which bulb will glow brighter?



(1) Bulb 1 will glow more first and then its brightness will become less than bulb 2
(2) Bulb 1
(3) Bulb 2
(4) Both glow equally

48. A generator has armature resistance of 0.1Ω and develops an induced emf of 120 V when driven at its rated speed. Its terminal voltage when a current of 50 A is being drawn is

(1) 120 V

(2) 5 V

(3) 115 V

(4) 70 V

49. A proton and a deuteron are both accelerated through the same potential difference and enter in a magnetic field perpendicular to the direction of the field. If the deuteron follows a path of radius R, assuming the neutron and proton masses are nearly equal, the radius of the proton's path will be

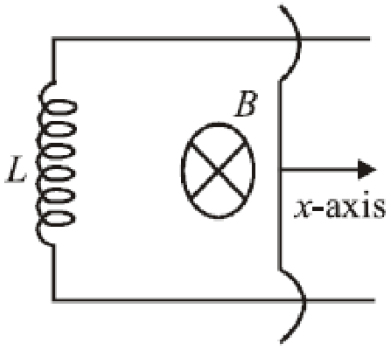
(1) $\sqrt{2}R$

(2) $\frac{R}{\sqrt{2}}$

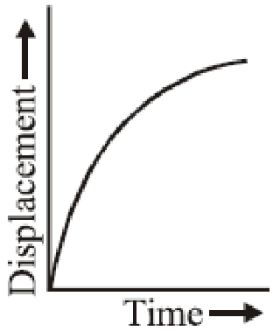
(3) $\frac{R}{2}$

(4) R

50. A coil of self inductance L is connected at one end of two rails as shown in figure. A connector of length l, mass m can slide freely over the two parallel rails. The entire set up is placed in a magnetic field of induction B going into the page. At an instant $t = 0$ an initial velocity v_0 is imparted to it and as a result of that it starts moving along x-axis. The displacement of the connector is represented by the figure.

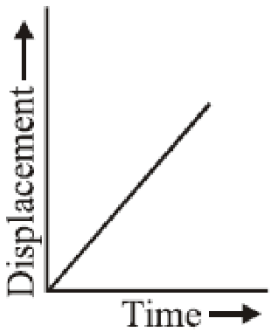


(1)

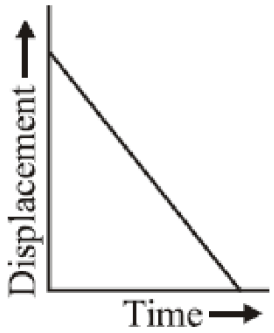


50. (continued)

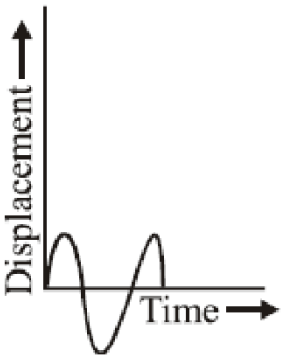
(2)



(3)



(4)



51. This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements.
Statement 1 : Self inductance of a long solenoid of length L, total number of turns N and radius r is less than $\frac{\pi\mu_0 N^2 r^2}{L}$. Statement 2: The magnetic induction in the solenoid in Statement 1 carrying current I is $\frac{\mu_0 NI}{L}$ in the middle of the solenoid but becomes less as we move towards its ends.

(1) Statement 1 is true, Statement 2 is false.

(2) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1 .

(3) Statement 1 is false, Statement 2 is true.

(4) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1 .

52. An electromagnetic wave with frequency ω and wavelength λ travels in the $+y$ direction. Its magnetic field is along $+x$-axis. The vector equation for the associated electric field (of amplitude E_0) is

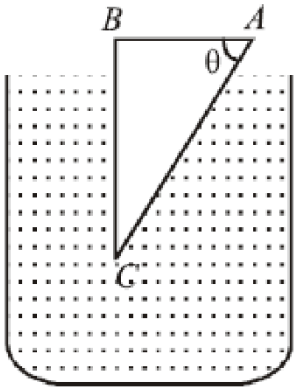
(1) $\vec{E} = -E_0 \cos\left(\omega t + \frac{2\pi}{\lambda} y\right)\hat{x}$

(2) $\vec{E} = E_0 \cos\left(\omega t - \frac{2\pi}{\lambda} y\right)\hat{x}$

(3) $\vec{E} = E_0 \cos\left(\omega t - \frac{2\pi}{\lambda} y\right)\hat{z}$

(4) $\vec{E} = -E_0 \cos\left(\omega t + \frac{2\pi}{\lambda} y\right)\hat{z}$

53. A glass prism of refractive index 1.5 is immersed in water (refractive index $\frac{4}{3}$) as shown in figure. A light beam incident normally on the face AB is totally reflected to reach the face BC, if



(1) $\sin\theta > \frac{5}{9}$

(2) $\sin\theta > \frac{2}{3}$

(3) $\sin\theta > \frac{8}{9}$

(4) $\sin\theta > \frac{1}{3}$

54. Two coherent plane light waves of equal amplitude makes a small angle $\alpha(<< 1)$ with each other. They fall almost normally on a screen. If λ is the wavelength of light waves, the fringe width Δx of interference patterns of the two sets of waves on the screen is

(1) $\frac{2\lambda}{\alpha}$

(2) $\frac{\lambda}{\alpha}$

(3) $\frac{\lambda}{(2\alpha)}$

(4) $\frac{\lambda}{\sqrt{\alpha}}$

55. This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements.
Statement 1 : A metallic surface is irradiated by a monochromatic light of frequency $v > v_0$ (the threshold frequency). If the incident frequency is now doubled, the photocurrent and the maximum kinetic energy are also doubled. Statement 2: The maximum kinetic energy of photoelectrons emitted from a surface is linearly dependent on the frequency of the incident light. The photocurrent depends only on the intensity of the incident light.

(1) Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1 .

(2) Statement 1 is false, Statement 2 is true.

(3) Statement 1 is true, Statement 2 is false.

(4) Statement 1 is true, Statement 2 is true, Statement 2 is not the correct explanation of Statement 1 .

56. Ionisation energy of Li (Lithium) atom in ground state is 5.4eV. Binding energy of an electron in Li^+ion in ground state is 75.6eV. Energy required to remove all three electrons of Lithium (Li) atom is

(1) 81.0eV

(2) 135.4eV

(3) 203.4eV

(4) 156.6eV

57. The decay constants of a radioactive substance for α and β emission are λ_α and λ_β respectively. If the substance emits α and β simultaneously, then the average half life of the material will be

(1) $\frac{2T_\alpha T_\beta}{T_\alpha + T_\beta}$

(2) $T_\alpha + T_\beta$

(3) $\frac{T_\alpha T_\beta}{T_\alpha + T_\beta}$

(4) $\frac{1}{2}(T_\alpha + T_\beta)$

58. Which one of the following is the Boolean expression for NOR gate?

(1) $Y = \overline{A + B}$

(2) $Y = \overline{A \cdot B}$

(3) $Y = A \cdot B$

(4) $Y = \bar{A}$

59. Given the electric field of a complete amplitude modulated wave as $\vec{E} = \hat{i}E_c\left(1 + \frac{E_m}{E_c}\cos\omega_m t\right)\cos\omega_c t$ Where the subscript c stands for the carrier wave and m for the modulating signal. The frequencies present in the modulated wave are

(1) ω_c and $\sqrt{\omega_c^2 + \omega_m^2}$

(2) $\omega_c, \omega_c + \omega_m$ and $\omega_c - \omega_m$

(3) ω_c and ω_m

(4) ω_c and $\sqrt{\omega_c\omega_m}$

60. N divisions on the main scale of a vernier calliper coincide with $(N + 1)$ divisions of the vernier scale. If each division of main scale is ' a ' units, then the least count of the instrument is

(1) a

(2) $\frac{a}{N}$

(3) $\frac{N}{N+1} \times a$

(4) $\frac{a}{N+1}$

61. When $CO_{2(g)}$ is passed over red hot coke it partially gets reduced to $CO(g)$. Upon passing 0.5 L of $CO_2(g)$ over red hot coke, the total volume of the gases increased to 700 mL. The composition of the gaseous mixture at STP is
(1) $CO_2 = 300$ mL; $CO = 400$ mL
(2) $CO_2 = 0.0$ mL; $CO = 700$ mL
(3) $CO_2 = 200$ mL; $CO = 500$ mL
(4) $CO_2 = 350$ mL; $CO = 350$ mL

62. Which of the following paramagnetic ions would exhibit a magnetic moment (spin only) of the order of 5BM ? (At. Nos. $Mn = 25, Cr = 24, V = 23, Ti = 22$)
(1) Mn^{2+}
(2) Ti^{2+}
(3) V^{2+}
(4) Cr^{2+}

63. If the kinetic energy of an electron is increased four times, the wavelength of the de-Broglie wave associated with it would become
(1) one fourth
(2) half
(3) four times
(4) two times

64. Which pair of elements with the given atomic numbers is expected to have similar properties?
(1) 40,72
(2) 20,36
(3) 10,28
(4) 11,12

65. Which one of the following will react most vigorously with water?
(1) Li
(2) K
(3) Rb
(4) Na

66. Among the following, the molecule with the lowest dipole moment is
(1) $CHCl_3$
(2) CH_3Cl
(3) CH_2Cl_2
(4) CCl_4

67. Which of the following has the square planar structure?
(1) XeF_4
(2) NH_4^+
(3) BF_4^-
(4) CCl_4

68. The compound of xenon with zero dipole moment is
(1) XeO_3
(2) XeF_4
(3) $XeOF_4$
(4) XeO_2

69. An open vessel at 300 K is heated till $2/5^{th}$ of the air in it is expelled. Assuming that the volume of the vessel remains constant, the temperature to which the vessel is heated, is
(1) 1500 K
(2) 400 K
(3) 500 K
(4) 750 K

70. The enthalpy of neutralisation of NH_4OH with HCl is -51.46 kJ mol^{-1} and the enthalpy of neutralisation of NaOH with HCl is -55.90 kJ mol^{-1}. The enthalpy of ionisation of NH_4OH is
(1) -107.36 kJ mol^{-1}
(2) -4.44 kJ mol^{-1}
(3) $+107.36$ kJ mol^{-1}
(4) $+4.44$ kJ mol^{-1}

71. The value of K_p for the equilibrium reaction $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ is 2 . The percentage dissociation of $N_2O_4(g)$ at a pressure of 0.5 atm is
(1) 25
(2) 88
(3) 50
(4) 71

72. If K_{sp} of CaF_2 at 25°C is 1.7×10^{-10}, the combination amongst the following which gives a precipitate of CaF_2 is

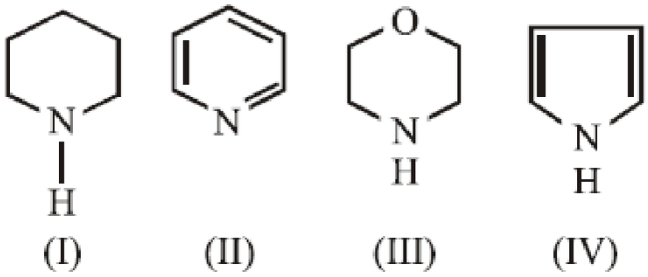
(1) $1 \times 10^{-2}MCa^{2+}$ and $1 \times 10^{-3}MF^-$

(2) $1 \times 10^{-4}MCa^{2+}$ and $1 \times 10^{-4}MF^-$

(3) $1 \times 10^{-2}MCa^{2+}$ and $1 \times 10^{-5}MF^-$

(4) $1 \times 10^{-3}MCa^{2+}$ and $1 \times 10^{-5}MF^-$

73. The order of basicity of the compounds is



(I) (II) (III) (IV)

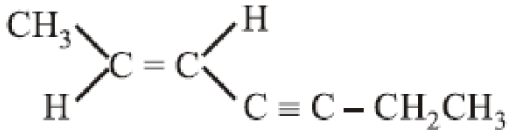
(1) IV > I > III > II

(2) I > III > II > IV

(3) III > I > IV > II

(4) II > I > III > IV

74. The IUPAC name of the following compound is



(1) (E)-2-hepten-4-yne

(2) (Z)-5-hepten-3-yne

(3) (E)-5-hepten-3-yne

(4) (Z)-2-hepten-4-yne

75. Beilstein test is used for the estimation of which one of the following elements?

(1) S

(2) Cl

(3) C and H

(4) N

76. Ammonium chloride crystallizes in a body centred cubic lattice with edge length of unit cell of 390 pm. If the size of chloride ion is 180pm, the size of ammonium ion would be

(1) 174pm

(2) 158pm

(3) 142pm

(4) 126pm

77. Liquids A and B form an ideal solution. At 30°C, the total vapour pressure of a solution containing 1 mol of A and 2 mol of B is 250 mmHg. The total vapour pressure becomes 300 mmHg when 1 more mol of A is added to the first solution. The vapour pressures of pure A and B at the same temperature are

(1) 150, 450mmHg

(2) 125, 150 mmHg

(3) 450, 150 mmHg

(4) 250, 300 mmHg

78. The standard potentials of Ag^+/Ag, $Hg_2^{2+}/2Hg$, Cu^{2+}/Cu and Mg^{2+}/Mg electrodes are 0.80, 0.79, 0.34 and −2.37 V, respectively. An aqueous solution which contains one mole per litre of the salts of each of the four metals is electrolyzed. With increasing voltage, the correct sequence of deposition of the metals at the cathode is

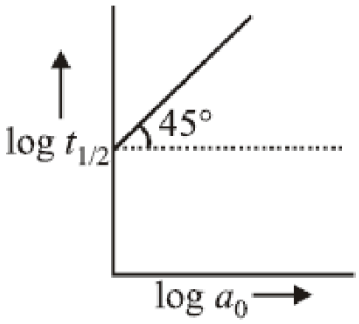
(1) Ag, Hg, Cu, Mg

(2) Cu, Hg, Ag only

(3) Ag, Hg, Cu only

(4) Mg, Cu, Hg, Ag

79. For a reaction $A \rightarrow$ Products, a plot of $\log t_{1/2}$ versus $\log a_0$ is shown in the figure. If the initial concentration of A is represented by a_0, the order of the reaction is



(1) one

(2) zero

(3) two

(4) three

80. On addition of 1 mL of 10%NaCl solution to 10 mL gold sol in the presence of 0.025 g of starch, the coagulation is just prevented. Starch has gold number

(1) 2.5

(2) 25

(3) 0.25

(4) 0.025

81. Fog is a colloidal solution of

(1) solid particles dispersed in gas

(2) solid particles dispersed in a liquid

(3) liquid particles dispersed in gas

(4) gaseous particles dispersed in a liquid

82. Extraction of zinc from zinc blende is achieved by

(1) roasting followed by self-reduction

(2) electrolytic reduction

(3) roasting followed by reduction with carbon

(4) roasting followed by reduction with another metal

83. Reagent used to convert allyl alcohol to acrolein is

(1) MnO_2

(2) H_2O_2

(3) OsO_4

(4) $KMnO_4$

84. The correct order of ligands in the spectrochemical series is

(1) $Cl^- > en > CN^- > NCS^-$

(2) $CN^- > en > NCS^- > Cl^-$

(3) $NCS^- > CN^- > Cl^- > en$

(4) $en > CN^- > Cl^- > NCS^-$

85. Square-planar geometry is shown by

(1) $[PtCl_2(NH_3)_2]$

(2) $[NiCl_4]^{2-}$

(3) MnO_4^-

(4) CrO_4^{2-}

86. The major product obtained in the photobromination of 2-methyl butane is

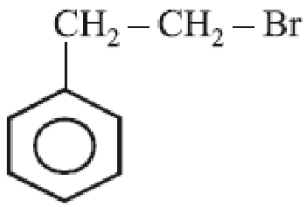
(1) 2-bromo-2-methylbutane

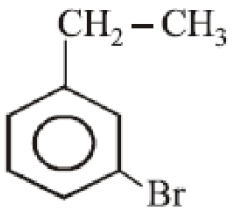
(2) 1-bromo-2-methylbutane

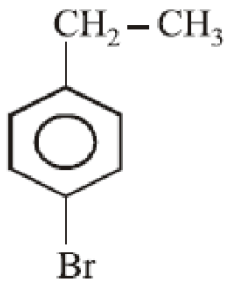
(3) 1-bromo-3-methylbutane

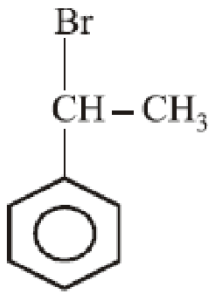
(4) 2-bromo-3-methylbutane

87. The product of the reaction between ethyl benzene and N-bromosuccinamide is

(1) 

(2) 

(3) 

(4) 

88. Which of the following is a polyamide?

(1) Teflon

(2) Orlon

(3) Nylon

(4) Terylene

89. Aspirin can be prepared by the reaction of

(1) Salicyldehyde with acetic anhydride in presence of H_2SO_4

(2) Salicylic acid with methanol in presence of H_2SO_4

(3) Salicylic acid with acetic anhydride in presence of H_2SO_4

(4) Cinnamic acid with acetic anhydride in presence of H_2SO_4

90. Which of the following is a non-reducing sugar?

(1) Lactose

(2) Fructose

(3) Sucrose

(4) Maltose