

EAMCET

ENGINEERING ENTRANCE EXAM

SOLVED PAPER-1991

PHYSICS

- The apparent coefficient of expansion of a liquid, when heated in a copper vessel is c and when heated in a silver vessel is s . If A is linear coefficient of expansion of copper then linear coefficient of expansion of silver is :
 (a) $\frac{c+s-3A}{3}$ (b) $\frac{c+3A-s}{3}$
 (c) $\frac{s+3A-c}{3}$ (d) $\frac{c+s+3A}{3}$
- If c is velocity of light in free space, the time taken by the light to travel a distance x in a medium of refractive index μ is given by :
 (a) $\mu \times c$ (b) $\frac{\mu x}{c}$ (c) $\frac{\mu c}{x}$ (d) $\frac{x}{\mu}$
- The pair of physical quantities having the same dimensional formula is :
 (a) energy and torque
 (b) torque and entropy
 (c) entropy and power
 (d) power and angular momentum
- A charged bead is capable of sliding freely through a string held vertically in tension. An electric field is applied parallel to the string, so that the bead stays at rest at middle of the string. If the electric field is switched off momentarily and switched on :
 (a) the bead moves downwards and stops as soon the field is switched on
 (b) the bead moves downwards when the field is off and moves upwards when the field is switched on
 (c) the bead moves downwards with constant acceleration till it reaches the bottom of the string
 (d) the bead moves downwards with constant velocity till it reaches the bottom of the string
- If the work done in stretching a wire by 1 mm is 2 J, the work necessary for stretching another wire of same material but with double radius of cross-section and half the length by 1 mm (in joule) is :
 (a) 16 (b) 8 (c) 4 (d) $1/4$
- An element X decays first by positron emission and then two α -particles are emitted in successive radioactive decay. If the product nucleus has mass number 227 and atomic number 89 the mass number and atomic number of element X are :
 (a) (273, 93) (b) (235, 94)
 (c) (238, 93) (d) (237, 92)
- Keeping the banking angle same, to increase the maximum speed with which a vehicle can travel on a curved road by 10 per cent the radius of curvature of the road has to be changed from 20 m to :
 (a) 6 m (b) 18 m
 (c) 24.2 m (d) 30.5 m
- The spheres of different materials one with double the radius and one-fourth wall thickness of the other are filled with ice. If the time taken for complete melting of ice in the larger radius one is 25 minutes and that for smaller one is 16 minutes, the ratio of thermal conductivities of materials of larger sphere to smaller sphere is :
 (a) 4:5 (b) 5:4 (c) 25:8 (d) 1:25
- Earth is flattened at poles and bulging at the equator. This is due to :
 (a) centrifugal force is less at the equator than at poles
 (b) angular velocity is more at poles
 (c) centrifugal force is more at the equator than at poles
 (d) none of the above

10. The total mechanical energy of a harmonic oscillator of $A = 1$ m and force constant 200 N/m is 150 J. Then :
 (a) the minimum potential energy is zero
 (b) the minimum PE is 100 J
 (c) the minimum PE is 50 J
 (d) the maximum KE is 150 J
11. A wooden block is dropped from the top of a cliff 100 m high. Simultaneously a bullet of mass 10 g is fired from the foot of the cliff upwards with a velocity of 100 m/s. The bullet and wooden block will meet each other after a time :
 (a) 10 s (b) 0.5 s (c) 1 s (d) 7 s
12. A parallel plate capacitor is charged and the charging battery is then disconnected. If the plates of the capacitor are moved further apart by means of insulating handles :
 (a) the charge in the capacitor becomes zero
 (b) the capacitance becomes infinite
 (c) the capacitance increases
 (d) the voltage across the plates increases
13. The average force that is necessary to stop a hammer with 25 N/s momentum in 0.05 s is :
 (a) 500 N (b) 125 N (c) 50 N (d) 25 N
14. The work done to get n smaller equal size spherical drops from a bigger size spherical drop of water is proportional to :
 (a) $\left(\frac{1}{n^{2/3}} - 1\right)$ (b) $\left(1 - \frac{1}{n^{1/3}}\right)$
 (c) $\left(n^{2/3} - 1\right)$ (d) $\left(n^{4/3} - 1\right)$
15. Light of frequency 1.5 times the threshold frequency, incident on a photo sensitive material. If the frequency of incident light is halved and the intensity is doubled the photo current becomes :
 (a) one fourth (b) doubled
 (c) halved (d) zero
16. ' ϕ ' of vibration of any particle in a standing wave produced along a stretched string depends on :
 (a) frequency of incident wave
 (b) T of reflected wave
 (c) location of particle
 (d) time
17. A charge q is placed at the centre of line joining two equal charges Q . The system of 3 charges will be in equilibrium if q is equal to :
 (a) $-Q/2$ (b) $-Q/4$ (c) $Q/4$ (d) $Q/2$
18. A piece of aluminium and germanium each are cooled from T_1 K to T_2 K. The resistance of :
 (a) each of them decreases
 (b) each of them increases
 (c) aluminium increases and that of germanium decreases
 (d) aluminium decreases and that of germanium increases
19. When a material is placed in magnetic fields B magnetic moment proportional to B but opposite in direction is induced. The material is :
 (a) diamagnetic (b) paramagnetic
 (c) ferromagnetic (d) anti-ferromagnetic
20. If \vec{A}, \vec{B} are perpendicular vectors $\vec{A} = 5\hat{i} + 7\hat{j} - 3\hat{k}$, $\vec{B} = 2\hat{i} + 2\hat{j} - c\hat{k}$. The value of c is :
 (a) -2 (b) 8 (c) -7 (d) -8

Fill in the Blanks

1. A radioactive source has a half-life of 3 hours. A freshly prepared sample of the same exhibits radioactivity 16 times the permissible safe value. The minimum time after which it would be possible to work safely with the source is hours.
2. If surface tension of H_2O is 7.3×10^{-2} N/m. The excess pressure inside spherical drop of radius 1 mm is N/m².
3. The energy level stationed at the centre of forbidden energy gap of an intrinsic semiconductor is
4. From Bohr's theory when electrons jump from higher energy orbits to second orbit spectral lines that occur belongs to series.

5. A car tyre has air at 1.5 atm at 300 K. If P increases to 1.75 atm with V same. The temperature will be
6. A body vibrating with a certain frequency sends waves of wavelength 15 cm in a medium A and 20 cm in medium B . If v of waves in A is 120 m/s. That in B will be m/s.
7. Ice contracts on melting when subjected to pressure and the pressure is increased the melting point
8. The resistance to be used to convert a 50 Ω resistance galvanometer of 10 mA into 500 V range voltmeter is
9. A ball of 1 g released down an inclined plane describes a circle of radius 10 cm in the vertical plane on reaching the bottom. The minimum height of the inclined plane is cm.
10. In photoelectric effect the slope of the straight line graph between stopping potential and frequency of incident radiation gives the ratio of Planck constant to
11. A double convex lens of $f = 6$ cm is made of glass of refractive index 1.5. The radius of curvature of the surface which is doubled that of other surface will be cm.
12. A railway truck of mass $m = 2 \times 10^4$ kg travelling at 0.5 m/s collides with another of half of its mass moving in opposite direction with a velocity 0.4 m/s. If they collide each other the combined velocity is m/s.
13. In deriving Newton's formula for velocity of sound, the changes in volume of air are assumed to be
14. A body freely falling from rest has a velocity v after it falls through a distance h . The distance it has to fall down further, for its velocity to become double, is times h .
15. Five equal capacitors connected in series have a resultant capacitance of 4 μF . The total energy stored in these when these are connected in parallel and charged to 400 V, is joules.
16. If the escape velocity on earth is 11.2 km/sec, its value for a planet having double the radius and 8 times the mass of earth is m/s.
17. When the radius of a circular current carrying coil is doubled, and current in it is halved, the magnetic dipole moment of coil originally 4 units become units.
18. A body of mass m thrown horizontally with velocity v , from the top of tower of height h , touches the level of ground at a distance of 250 m from the foot of the tower. A body of mass $2m$, thrown horizontally with velocity $v/2$, from the top of a tower of height $4h$ will touch the level ground at a distance metres from the foot of the tower.
19. To minimise spherical aberration two lenses of focal length f_1 and f_2 are placed with a distance of separation equal to
20. A simple harmonic oscillation is represented by the equation $Y = 0.40 \sin \left(\frac{40t}{7} + 0.61 \right)$ where Y and t are in metres and seconds respectively. The value of time period is sec.
21. If 4×10^{20} eV of energy is required to move a charge of 6.25 C between two points, the PD between them is volts.
22. A particle of mass $4m$ which is at rest explodes into three fragments. Two of the fragments each of mass m are found to move with a speed of v each in mutually perpendicular direction. The total energy released in the process is
23. The method of connecting the negative pole of battery to p -material and positive pole to n -material of a p - n junction is called connection.
24. The distance between the eye lense and cross wire in a Ramsden eye peice, which has a field lens of focal length 1.2 cm is cm.
25. Siemen is the SI unit for
26. When boron is added as impurity to silicon, the resulting material is semiconductor.
27. The acceleration due to gravity at a height (take $g = 10 \text{ m/s}^2$ on earth surface) above earth's surface is 9 m/s^2 . Its value at a point, at an equal distance below the surface of the earth is m/s^2 .

28. The ratio of magnetic moments of two short magnets which give deflection in $\tan \theta$ position when placed at 12 cm and 18 cm from centre of a deflection magnetometer is
29. A boat is moving with a velocity $3\hat{i} + 4\hat{j}$; with respect to ground the water in the

river is moving with a velocity $-3\hat{i} - 4\hat{j}$ w.r.t. ground. The relative velocity of boat w.r.t. water is

30. Material getting magnetized by orientation of atomic magnetic moment in external magnetic fields are

CHEMISTRY

- Which of the gases contain the same number of molecules as that of 16 g oxygen?
(a) 16 g of O_3 (b) 32 g of SO_2
(c) 16 g of SO_2 (d) All of the above
- An organic compound has an empirical formula CH_2O . Its vapour density is 45. The molecular formula of compound is:
(a) CH_2O (b) C_2H_4O
(c) $C_2H_4O_2$ (d) $C_3H_6O_3$
- When $4p$ orbital in any atom is filled completely, the next electron goes in:
(a) $5s$ (b) $3d$ (c) $4d$ (d) $4f$
- A radio isotope has a half life 10 days. If today there is 125 g of it left, what was its weight 40 days earlier?
(a) 600 g (b) 1000 g
(c) 1250 g (d) 2000 g
- Which one of the following series of lines is found in the UV region of atomic spectrum of hydrogen?
(a) Balmer (b) Paschen
(c) Brackett (d) Lyman
- Aniline is treated with $NaNO_2$ and HCl at $0^\circ C$, the product formed is:
(a) nitroaniline (b) chloroaniline
(c) benzene diazonium salt
(d) amino phenol
- A gaseous mixture contains 56 g of N_2 , 44 g of CO_2 and 16 g of CH_4 . The total pressure of the mixture is 720 mm Hg. The partial pressure of CH_4 is:
(a) 180 mm (b) 360 mm
(c) 540 mm (d) 720 mm
- The energy of the electron in the hydrogen atom is given by the expression:
(a) $-\frac{e^2}{r^2}$ (b) $-\frac{n^2 h^2}{2\pi^2 m a_0^2}$
- The rms velocity of an ideal gas at $27^\circ C$ is 0.3 m/s. Its rms velocity at $927^\circ C$ (in m/s.) is:
(a) 3.0 (b) 2.4 (c) 0.9 (d) 0.6
- Three faradays of electricity was passed through an aqueous solution of iron (II) bromide. The weight of iron metal (at. wt. = 56) deposited at the cathode is (in grams):
(a) 56 (b) 84 (c) 112 (d) 168
- The relative lowering of vapour pressure is equal to:
(a) ratio of the number of solute molecules to the total number of molecules in solution
(b) ratio of the number of solvent molecules to the number of solute molecules
(c) ratio of the number of solvent molecules to the number of solute molecules
(d) ratio of the number of solvent molecules to the total number of molecules
- In which one of the following reactions does the heat change represent the heat of formation of water?
(a) $2H_2 + O_2 \longrightarrow 2H_2O$; $\Delta H = -116$ kcal
(b) $H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$; $\Delta H = -58$ kcal
(c) $H^+ + OH^- \longrightarrow H_2O(l)$; $\Delta H = -13.7$ kcal
(d) $C_2H_2 + 2\frac{1}{2}O_2 \longrightarrow 2CO_2 + H_2O$; $\Delta H = -3$ kcal
- Which of the following statements about the halogen is correct?
(a) They are all diatomic and forms univalent ions
(b) They are all diatomic and forms divalent ions
(c) They are all capable of exhibiting several oxidation states
(d) They can mutually displace each other from the solution of their compound with metals

14. The pK_a of a certain weak acid is 4.0. What should be the [salt] to [acid] ratio, if we have to prepare a buffer with a $pH=5$ using the acid and one of the salts ?
 (a) 4:5 (b) 5:4 (c) 10:1 (d) 1:10
15. The bonds in $K_4Fe(CN)_6$ are :
 (a) ionic (b) covalent
 (c) ionic and covalent
 (d) ionic, covalent and co-ordinate covalent bond
16. Which of the following oxides of nitrogen is anhydride of HNO_3 ?
 (a) N_2O_3 (b) N_2O_4
 (c) N_2O_5 (d) N_2O
17. 9.8 g of H_2SO_4 is present in two litres of a solution. The molarity of the solution is :
 (a) 0.1 M (b) 0.05 M
 (c) 0.2 M (d) 0.01 M
18. One atom of $^{39}_{19}K$ contains :
 (a) 19p; 20n and 19 e^-
 (b) 19p; 20n and 20 e^-
 (c) 20p; 19n and 20 e^-
 (d) 20p; 19n and 19 e^-
19. The reagent that has action on glass is :
 (a) aqua regia (b) hydrofluoric acid
 (c) oleum (d) fuming HNO_3

Fill in the Blanks

20. When an electron in an excited hydrogen atom jumps from an energy level for which $n=5$ level for which $n=2$ the spectral line is observed in theseries of the hydrogen spectrum.
21. The number of moles of barium carbonate which contains 1.5 moles of O_2 atoms is
22. The rate of diffusion of He is the rate of diffusion of CH_4 .
23. The conjugate base of HSO_4^- ion is
24. Among the alkali metals, the metal with the highest ionisation potential is
25. If the pressure and the absolute temperature of a given mass of gas are doubled, the new volume will be the initial volume.
26. Phosgene is formed when is exposed to air and sun light.
27. The process of slow cooling of glass is called
28. Chloroform reacts with HNO_3
29. In the reaction
 $C_2O_4^{2-} + MnO_4^- + H^+ \longrightarrow H_2O + Mn^{2+} + CO_2$
 the reductant is
30. The non-metallic element present in the mineral cryolite is
31. Among the SO_2 , H_2SO_4 and sodium thiosulphate, sulphur has the highest oxidation state in
32. Reduction of acetaldehyde in presence of $LiAlH_4$ gives
33. The maximum number of electrons that can be accommodated in all the orbitals for which $l=3$, is
34. The mass number of a nuclide is 125. Its nuclear radius is fermi.
 CH_3
35. $CH_3-CH_2-\overset{\overset{CH_3}{|}}{CH}-CH_2-CH_2-CH_3$
 IUPAC name is
36. The number of σ bonds in the ethylene molecule is
37. Besides SiO_2 and Al_2O_3 the other major ingredient in portland cement is
38. The magnetic quantum number m for the outermost electron in the Na atom is
39. The normal boiling point of CS_2 , H_2O and CCl_4 are $41.3^\circ C$, $100^\circ C$ and $77^\circ C$ respectively. The liquid in which the intermolecular forces are the weakest is
40. Water has a higher boiling point than corresponding hydrides H_2S , H_2Se and H_2Te . This is because of in water.
41. The reaction between Baeyer reagent gives ethylene glycol.
42. In the reaction $^{19}_8O + {}^1_1H^2 \longrightarrow ^{18}_8O + X$, X is

43. The half life of a radioactive substance is 100 sec. Its disintegration constant is
44. Aqueous solution of FeCl_3 is acidic because of
45. The weight of oxalic acid crystals $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ required to prepare 500 mL of 0.2 N solution is
46. The kinetic energy of 8g of H_2 at 27°C is times more than the kinetic energy of 8g of O_2 at the same temperature.
47. 0.1 M HCl solution is diluted by 100 times. The pH of the solution so formed is
48. A few drops of an organic compound (liquid) are added to Schiff's reagent. A pink colour is produced. The organic compound is
49. The co-ordinating number of the ions in the CsCl crystal lattice is
50. Nucleides having different mass number and different atomic numbers, but the same number of neutrons are called

MATHEMATICS

1. If the function $f(x) = \frac{3x + 4\tan x}{x}$ is continuous, then what is the value of $f(x)$ at $x=0$?
 (a) 6 (b) 7
 (c) 5 (d) none of these
2. In how many ways can 5 red and 4 white balls be drawn from a bag containing 10 red and 8 white balls ?
 (a) ${}^8\text{C}_5 \times {}^{10}\text{C}_4$ (b) ${}^{10}\text{C}_5 \times {}^8\text{C}_4$
 (c) ${}^{18}\text{C}_9$ (d) none of these
3. The orthocentre of a triangle whose vertices are (0, 0), (8, 0), (4, 6), is :
 (a) (4, 3) (b) (4, 8/3)
 (c) (3, 4) (d) none of these
4. $y = \sin^{-1}\left(\frac{1-x^2}{1+x^2}\right)$, find $\frac{dy}{dx}$:
 (a) $\frac{2}{1+x^2}$ (b) $\frac{-2}{1+x^2}$
 (c) $\frac{2}{2-x^2}$ (d) $\frac{1}{2+x^2}$
5. $\tan 5x - \tan 3x - \tan 2x$ is equal to :
 (a) $\tan 8x \tan 2x \tan x$
 (b) $\sin 5x \sin 3x \sin 2x$
 (c) $\tan 5x \tan 3x \tan 2x$
 (d) $\cos 5x \cos 3x \cos 2x$
6. The number of non-zero terms in the expansion of $(1 + 3\sqrt{2}x)^9 + (1 - 3\sqrt{2}x)^9$ is equal to :
 (a) 0 (b) 5
 (c) 9 (d) 10
7. The unit vector perpendicular to each of $2\hat{i} - \hat{j} + \hat{k}$ and $3\hat{i} + 4\hat{j} - \hat{k}$ is :
 (a) $\frac{(-3, 5, 11)}{155}$ (b) $\frac{(-3, 5, 11)}{\sqrt{155}}$
 (c) $\frac{(3, 5, 11)}{\sqrt{155}}$ (d) $\frac{(3, -5, 11)}{\sqrt{155}}$
8. The probabilities of problem being solved by two students are $\frac{1}{2}$ and $\frac{1}{3}$. Find the probability of the problem being solved.
 (a) $\frac{2}{3}$ (b) 1 (c) $\frac{4}{3}$ (d) $\frac{1}{3}$
9. The length of the latus rectum of an ellipse is $\frac{1}{3}$ of the major axis. It's e is :
 (a) $\frac{2}{3}$ (b) $\sqrt{\frac{2}{3}}$
 (c) $\frac{5.4.3}{7^3}$ (d) $\left(\frac{3}{4}\right)^4$
10. If the mean and variance of a binomial distribution are $\frac{15}{4}$ and $\frac{15}{16}$. The number of trials are :
 (a) 2 (b) 4
 (c) 5 (d) 6
11. The locus represented by $|z-1| = |z+i|$ is :
 (a) circle of radius 1
 (b) an ellipse with foci at 1 & $-i$
 (c) a straight line through the origin
 (d) a circle on the line joining 1 and i as diameter

12. The equation of the circle passing through (2, 1) and touching the co-ordinate axes, is :
 (a) $x^2 + y^2 - 2x - 2y + 1 = 0$
 (b) $x^2 + y^2 + 2x + 2y + 1 = 0$
 (c) $x^2 + y^2 - 2x - 2y - 1 = 0$
 (d) $x^2 + y^2 + 2x - 2y - 1 = 0$
13. The students while solving a quadratic equation in x , one copied the constant term incorrectly and got the roots 3 and 2. The other copied the constant term and coefficient of x^2 as -6 and 1 respectively. The correct roots are :
 (a) 3, -2 (b) -3, 2 (c) -6, -1 (d) 6, -1
14. The value of the integral $\int \sqrt{x} e^{\sqrt{x}} dx$ is :
 (a) $e^{\sqrt{x}} - 4\sqrt{x} e^{\sqrt{x}} + c$
 (b) $2\sqrt{x} e^{\sqrt{x}} - 4\sqrt{x} e^x + c$
 (c) $2x e^{\sqrt{x}} - 4\sqrt{x} e^{\sqrt{x}} + 4e^{\sqrt{x}} + c$
 (d) none of these
15. The smallest value of $x^2 - 3x + 3$ in the interval $(-3, 3/2)$ is equal to :
 (a) -20 (b) -15 (c) $3/4$ (d) 5
16. The circles $x^2 + y^2 - 4x + 6y + 8 = 0$ and $x^2 + y^2 - 10x - 6y + 14 = 0$, touch :
 (a) externally (b) internally
 (c) intersect (d) do not touch
17. The inverse element of ω^2 in the multiplicative catine group $\{1, \omega, \omega^2\}$ where ω is the cube roots of unity, is :
 (a) 1 (b) ω (c) ω^2 (d) ω^3
18. Derive $\sec^{-1}\left(\frac{1}{2x^2-1}\right)$ with respect to $\sqrt{1+3x}$ at $x = -\frac{1}{3}$:
 (a) does not exist (b) $\frac{1}{2}$
 (c) $\frac{1}{3}$ (d) none of these
19. The vector area of triangle whose two sides are given by $2\hat{i} - 7\hat{j} + \hat{k}$ and $4\hat{j} - 3\hat{k}$ is :
 (a) $\frac{17}{4}$ sq. units (b) $\frac{17}{2}$ sq. units
 (c) 17 sq. units (d) none of these
20. $X = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$; X^n is equal to :
 (a) $\begin{bmatrix} 3n & -4n \\ n & -n \end{bmatrix}$ (b) $\begin{bmatrix} 2+n & 5-n \\ n & -n \end{bmatrix}$
 (c) $\begin{bmatrix} 3n & (-4)^n \\ n & (-1)^n \end{bmatrix}$ (d) none of these

Fill in the Blanks

1. If the relation between sub-normal and sub-tangent at any point on the curve $by^2 = (x+a)^3$ is $p(SN) = q(ST)^2$, then $\frac{p}{q} = \dots\dots\dots$
2. When two dice are thrown. The probability of getting equal numbers is $\dots\dots\dots$
3. The area between the curve $y = 1 - |x|$ and the x -axis is $\dots\dots\dots$
4. $\sqrt{\sqrt{3} - \sqrt{4 + \sqrt{5 + \sqrt{17 - 4\sqrt{15}}}}} = \dots\dots\dots$
5. If $u = \frac{x+y}{x-y}$, then $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = \dots\dots\dots$
6. $x = \cos \theta + \theta \sin \theta$, $y = \sin \theta - \theta \cos \theta$, then $\frac{d^2y}{dx^2} = \dots\dots\dots$
7. $2 \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 - bc & b^2 - ca & c^2 - ab \end{vmatrix} = \dots\dots\dots$
8. $(i)^{243} = \dots\dots\dots$
9. $\sum_{n=0}^{\infty} (-1)^n x^{n+1} = \dots\dots\dots$
10. Equation to the common tangent to the circle $x^2 + y^2 = 2a^2$ and the parabola $y^2 = 8ax$ is $\dots\dots\dots$
11. When two balls are drawn from bag containing 2 white, 4 red and 6 black balls, the chance for both of them to be red is $\dots\dots\dots$
12. $\int_1^3 \frac{dx}{2x-1}$, using simpson's rule with 4 equal intervals, The approximate value of $\int_1^3 \frac{dx}{2x-1} = \dots\dots\dots$

13. The orthocentre of triangle whose sides are $2y - x = 9$, $x + y = 9$, $2x - y = 9$ is ...
14. The remainder obtained when the polynomial $1 + x + x^3 + x^9 + x^{27} + x^{81} + x^{243}$ is divided by $x - 1$, is
15. The length of portion of tangent at any point on the curve $x^{2/3} + y^{2/3} = a^{2/3}$ intercepted between the axes is ...
16. The maximum value of $\frac{\log x}{x}$ in $0 < x \leq \infty$ is
17. If \vec{a} , \vec{b} , \vec{c} are mutually perpendicular unit vectors, then $|\vec{a} + \vec{b} + \vec{c}| = \dots\dots\dots$
18. The locus of the middle points of chord of the circle $x^2 + y^2 - 2x = 0$ passing through the origin is
19. ${}^{14}C_4 + \sum_{j=1}^4 {}^{18-j}C_3 = \dots\dots\dots$
20. The vector equation to the plane through the points $(1, -2, -3)$ and parallel to the vectors $(2, -1, 3)$ and $(2, 3, -6)$ is
21. If C_0, C_1, C_2, \dots are the binomial coefficients in the expansion of $(1 + x)^n$, then $C_0 + \frac{C_1}{2}x + \frac{C_2}{3}x^2 + \dots + \frac{C_n}{n+1}x^n = \dots\dots\dots$
22. The locus of the point of intersection of the perpendicular tangents to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is
23. In ΔABC , $a = \sqrt{3} + 1$, $\angle B = 30^\circ$, $\angle C = 45^\circ$, then $c = \dots\dots\dots$
24. $\lim_{x \rightarrow 0} \frac{x - \sin x}{x + \cos^2 x} = \dots\dots\dots$
25. The condition for $ax^2 + 2cxy + by^2 + 2bx + 2ay + c$ is resolvable into two linear factors, is
26. The greatest negative integer satisfying $x^2 - 4x - 77 = 0$ and $x^2 > 4$ is
27. Two die thrown simultaneously. The probability of getting even numbers on both the die is
28. If $u = \log \tan \left(\frac{\pi}{4} + \frac{\theta}{2} \right)$, then $\cosh u = \dots\dots\dots$
29. Given x is positive, the values of $f(x) = -3 \cos \sqrt{3+x+x^2}$ lie in the interval
30. $\int \frac{3 \cos x + 2 \sin x}{4 \sin x + 5 \cos x} dx = \dots\dots\dots$

Answers

Physics

1. (b) 2. (b) 3. (a) 4. (a) 5. (a) 6. (b) 7. (c) 8. (d) 9. (c) 10. (d)
11. (c) 12. (d) 13. (a) 14. (b) 15. (d) 16. (d) 17. (b) 18. (d) 19. (a) 20. (d)

Fill in the Blanks

- | | | | |
|------------------------------------|----------------------------|--------------------------|----------------------------|
| 1. 12 hr. | 2. 146 N/m^2 | 3. Fermi level | 4. Balmer series |
| 5. 350 K | 6. 160 m/s | 7. Increase | 8. $49.95 \text{ k}\Omega$ |
| 9. 25 cm | 10. Charge of one electron | | 11. 4.5 cm |
| 12. 0.2 m/s | 13. Isothermal | 14. $3h$ | 15. 8 J |
| 16. $22.4 \times 10^3 \text{ m/s}$ | 17. 8 units | 18. 250 m | 19. $f_2 - f_1$ |
| 20. $\frac{7\pi}{20} \text{ sec}$ | 21. 10.24 volt | 22. $\frac{3}{2} mv^2$ | 23. Reverse bias |
| 24. 0.3 cm | 25. Electrical conductance | | 26. p-type |
| 27. 9.5 m/s^2 | 28. 8 : 27 | 29. $\hat{i} + 8\hat{j}$ | 30. Paramagnetic |

Chemistry

1. (b) 2. (d) 3. (a) 4. (d) 5. (d) 6. (c) 7. (a) 8. (c) 9. (d) 10. (b)
 11. (a) 12. (b) 13. (a) 14. (c) 15. (d) 16. (c) 17. (b) 18. (a) 19. (b)

Mathematics

1. (b) 2. (b) 3. (b) 4. (b) 5. (c) 6. (b) 7. (b) 8. (a) 9. (b) 10. (c)
 11. (c) 12. (a) 13. (d) 14. (c) 15. (c) 16. (a) 17. (b) 18. (d) 19. (d) 20. (d)

Fill in the Blanks

1. $\frac{8b}{27}$ 2. $\frac{1}{6}$ 3. 1 sq unit 4. i
 5. $\frac{2}{x-y}$ 6. $\frac{\sec^3 \theta}{\theta}$ 7. 0 8. $-i$
 9. $\frac{x}{1+x}$ 10. $y = x + 2a$ and $y = -x - 2a$ 11. $\frac{6}{55}$
 12. 0.8111 13. (5, 5) 14. 7 15. a
 16. $\frac{1}{e}$ 17. 3 18. $x^2 + y^2 - x = 0$ 19. $^{18}\text{C}_4$
 20. $\vec{r} = (1+t+2s)\hat{i} - (2+t-3s)\hat{j} - (3+3t+6s)\hat{k}$ 21. $\frac{(1+x)^{n+1}}{x(n+1)}$
 22. $x^2 + y^2 = a^2 + b^2$ 23. $c = 2$
 24. 0 25. $a^3 + b^3 + c^3 = 3abc$ 26. $x^2 > 4$ 27. $\frac{1}{4}$
 28. $\sec \theta$ 29. $[-3, 3]$ 30. $\frac{23}{41}x + \frac{2}{41} \log(4 \sin x + 5 \cos x) + c$

Hints & Solutions

PHYSICS

- Apparent coefficient of liquid in copper vessel $\gamma_a = c$
 Volume expansion coefficient of copper $\gamma_g = 3\alpha$
 (\because Volume expansion coefficient is three times that of linear expansion coefficient)
 \therefore Coefficient of real expansion of liquid

$$\gamma_r = \gamma_a + \gamma_g$$

$$\gamma_r = c + 3\alpha \quad \dots(i)$$
 In silver vessel $\gamma_r = s + 3\alpha_s \quad \dots(ii)$
 where α_s = linear expansion coefficient of silver.
 From Eqs. (i) and (ii)

$$c + 3\alpha = s + 3\alpha_s$$
- Velocity of light in the medium $v = \frac{c}{\mu}$
 \therefore Time taken $t = \frac{x}{v} = \frac{x}{c/\mu}$

$$= \frac{\mu x}{c}$$
- Unit of energy and torque is J or N-m, so dimensional formula of these quantities will be same.
- Stretching force $F = \frac{Y \pi r^2 \Delta l}{l}$
 Both wires are of same material, so Y will be equal, extension in both the wire is same, so Δl will be equal.