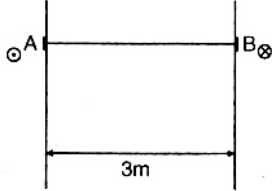# EAMCET

ENGINEERING ENTRANCE EXAM
SOLVED PAPER–1992

PHYSICS

1. The moment of inertia of thin uniform circular disc about one of the diameters is I. Its moment of inertia about an axis perpendicular to the circular surface and passing through its centre is :
   (a) $\sqrt{2}\,I$ (b) $2\,I$ (c) $\dfrac{I}{2}$ (d) $\dfrac{I}{\sqrt{2}}$

2. The displacement of a particle executing SHM is given by $Y = 10 \sin (6\,t + \pi/3)$ in meters and time t in seconds. The initial displacement and the velocity of the particle are respectively :
   (a) $5\sqrt{3}$ m and 30 m/s
   (b) 15 m and $5\sqrt{3}$ m/s
   (c) $15\sqrt{3}$ m and 30 m/s
   (d) $20\sqrt{3}$ m and 30 m/s

3. Two satellites A and B go around the earth in circular orbits at a height of R_A and R_B respectively from the surface of the earth. Assume earth to be a uniform sphere of radius R_e. The ratio of the magnitude of velocities of the satellites V_A/V_B :
   (a) $\sqrt{\dfrac{R_B}{R_A}}$ (b) $\dfrac{R_B + R_e}{R_A + R_e}$
   (c) $\sqrt{\dfrac{(R_B + R_e)}{(R_A + R_e)}}$ (d) $\left(\dfrac{R_A}{R_B}\right)^2$

4. Two particles P and Q located at distance r_P and r_Q respectively from the centre of a rotating disc such that $r_P > r_Q$:
   (a) both P and Q have the same acceleration
   (b) both P and Q do not have any acceleration
   (c) P has greater acceleration than Q
   (d) Q has greater acceleration than P

5. A ball of mass m moving with a velocity V collides head on elastically with another of the same mass m but moving with a $-\vec{V}$ (in the opposite direction). After the collision :
   (a) the velocities are exchanged between the two balls
   (b) both the balls come to rest
   (c) both of them move at right angles to the original line of motion
   (d) one ball comes to rest and the other ball travels back with velocity $2V$

6. For an electron in H-atom the frequency of photon for transition between levels 1 and 2 is v. The photon frequency for transition between levels 2 and 3 is closest to :
   (a) 0.2 v (b) 0.1 v (c) v (d) 0.5 v

7. The velocity of propagation of sound is 330 m/s, in air. If the third harmonic of the fundamental that can be exerted in an open ended tube is 450 Hz, the length of the tube is :
   (a) 3.3 m   (b) 1.1 m   (c) 2.2 m   (d) 4.5 m

8. Which one of the following statement is true ?
   (a) Paramagnetism ceases to exist below a certain temperature
   (b) Ferromagnetism ceases to exist below a certain temperature
   (c) Onset of paramagnetism requires the presence of paramagnet magnetic dipoles
   (d) Ferromagnetism ceases to exist above a certain temperature

9. To a charged particle which is moving with a constant initial velocity $\vec{v}$, uniform magnetic field is applied in the direction of the velocity :
   (a) the particle moves in a spiral path
   (b) the particle moves in a circular path
   (c) the particle moves in a parabolic path
   (d) there is no change in the motion of the particle

10. Let v_s be the speed of the source emitting waves, n the actual frequency of the source of sound, v the speed of the sound in the medium and n' the frequency of sound waves as perceived by a stationary observer to whom the source of sound is approaching. The formula for calculate for n' is :

(a) $n' = n\left(1 - \dfrac{v_s}{v}\right)$ (b) $n' = n/\left(1 - \dfrac{v_s}{v}\right)$

(c) $n' = n/\left(1 + \dfrac{v_s}{v}\right)$ (d) $n' = n$

11. A liquid of mass m and specific heat S is heated to a temperature T. Another liquid of mass $m/2$ and specific heat $2S$ is heated to temperature $2T$. If these two liquids are mixed, the resultant temperature of the mixture :

(a) $\dfrac{2}{3}T$ (b) $\dfrac{8}{5}T$ (c) $\dfrac{3}{4}T$ (d) $\dfrac{3}{2}T$

12. A certain number of beats are heard when two tuning forks of natural frequencies n_1 and n_2 are sounded together. The number of beats heard when one of the forks is loaded :
(a) increases
(b) decreases
(c) remains constant
(d) may increases or decrease

13. A and B are sections of two long parallel wires placed perpendicular to the plane of the paper. They carry currents of 5 A and 10 A respectively in the directions indicated in the figure. If the seperation between them is 3 m the zero of the magnetic field in the plane of the paper is at a point :

3m

(a) 3 m to the left of A
(b) 3 m to the right of B
(c) 2 m to the right of A
(d) 2 m to the left of B

14. When an ice cube melts and becomes water, the ice water system undergoes :
(a) the entropy of the system increases and the internal energy increases
(b) the entropy of the system decreases and the internal energy decreases
(c) the entropy of the system decreases and the internal energy increases
(d) the entropy of the system increases and the internal energy decreases

15. In Focault's method of determining the velocity of light, the distance between the rotating mirror and the concave mirror is made to pass along a tube of water ($\mu = 1.33$) instead of air, the displacement is :

(a) $\dfrac{t}{1.33}$ (b) $1.33\,t$ (c) $(1.33)^2\,t$ (d) $1.33\,t^2$

16. Emission of electrons in photoelectric effect is possible if :
(a) metal surface is lightly polished
(b) the incident light is of sufficiently high intensity
(c) the light is incident at right angles to surface of the metal
(d) the incident light is of sufficiently low wavelength

17. A plastic tube containing few stones is floating in a tank of water. If the stones are unloaded, the water level :
(a) remains same   (b) rises
(c) falls
(d) rises or falls depending on the number of stones unloaded

18. A force is experienced by cathode rays when they pass through uniform electric field :
(a) in the direction of electric field
(b) in the direction opposite to that of electric field
(c) perpendicular to electric field
(d) zero, because the cathode rays do not have the charge

19. If a bar magnet of moment μ is suspended in a uniform magnetic field B and it is given an angular deflection θ w.r.t. its equillibrium position, the restoring torque on magnet is :
(a) $\mu B \sin\theta$ (b) $\mu B \cos\theta$
(c) $\mu B \tan\theta$ (d) $\mu^2 B^2 \sin\theta \cos\theta$

20. On heating, the length of the side of cube changes by 2%. The volume of the cube changes by :
   (a) 1%   (b) 6%   (c) 0.5%   (d) 3%

Fill in the Blanks

1. Photoelectrons are emitted from a metal surface when photons of energy 3.1 eV or more impinge on it. In an experiment with this metal using a monochromatic radiation the stopping potential was found to be 2.5 volt. The energy of the photons used in the experiment is ....

2. The closest distance of approach of an α-particle travelling with a velocity V to a certain nucleus is x. The distance of closest approach of α-particles travelling with a velocity $3V$ to the same nucleus is ....

3. In two isotopes of an element, the number of protons in their nuclei will be .... and number of neutrons in their nuclei will be ....

4. In an intrinsic semiconductor the charge carriers responsible for electrical conduction are ....

5. A semiconductor device which is used for detecting light intensity is called a ....

6. It is assumed that nuclear mass is of the order of 10^{-27} kg and nuclear radius is of the order of 10^{-15} m. The nuclear density is of the order of ....

7. A horizontal stream of H_2O leaves an opening in the side of a tank. If the opening is h metres above the ground, and the stream hits the ground D meters away and the acceleration due to gravity is g the speed of H_2O as it leaves the tank in terms of g, h and D is ....

8. A 2 m long Al pipe at 27°C is heated until it is 2.0024 m, at 77°C. The coefficient of linear expansion of Al is ....

9. If two elements have their atomic numbers as z_1 and z_2. The ratio of the wavelengths λ_1 and λ_2 corresponding to their k_α lines is ....

10. In an astronomical telescope the distance between the eye-piece and the objective is .... as the sum of the focal lengths of the objective and the eye-piece.

11. The dimensional formula of the universal constant of gravitation is ....

12. The resultant of the vectors A and B depends also on the angle θ between them. The magnitude of the resultant is always given by ....

13. μ_s, μ_k and μ_r are the coefficients of static, kinetic and rolling friction between two surfaces. In their increasing order of magnitude one can write ....

14. The work done on a particle moving round a horizontal circular path of radius 'r' with uniform speed 'v' under a centripetal force F is equal to ....

15. A particle is projected with an initial velocity of 200 m/s, in a direction which makes an angle of 30° with the vertical the horizontal distance travelled by the particle in 3 seconds is ....

16. Assume that heat capacity of H_2O to be 4.2 $\times 10^3$ J kg^{-1} K^{-1} and the latent heat of vaporisation of H_2O to be 22.5×10^5 J kg^{-1}. The amount of heat in joules required to heat one kg of water from 50°C to 100°C and then to convert into steam at 100°C is ....

17. In a moving coil galvanometer the deflection is proportional to the ....

18. A radio station operates at a frequency of 10 MHz with a power output of 265.2 kW. Given that the Planck's constant $h = 6.63 \times 10^{-34}$ J-s. The rate of emission of photon from the station is ....

19. A radio active nucleus with mass number A splits into the nuclei whose mass numbers are in the ratio 3 : 2, the ratio of their radii is ....

20. A charge +2 μC is placed at $x = 0$ and a charge of -32 μC at $x = 60$ cm where must a third charge $+Q$ be placed on the x-axis such that it experiences no force? The distance of the point is ....

21. If 3 capacitors of values 1,2 and 3 µF are aviable, the maximum and minimum values of capacitances one can obtain by different combinations of the 3 capacitors together are respectively ....

22. D-line in a solar spectrum as named by Fraunhofer is actually found to be due to absorption of light of this wavelength by .... vapour.

23. Three spherical identical mercury drops on a thermally isolated system merge into a single drop. The temperature of this drop will be .... than the original temperature of any of the small drops.

24. Four $2\,\Omega$ resistors are connected together along the edges of a square. A 10 V battery of negligible internal resistance is connected across a pair of the diagonally opposite corners of the square. The power dissipated in the circuit is ....

25. A 2 µF condenser is charged to 500 V and then the plates are joined through a resistance. The heat produced in the resistance (in joules) is ....

26. Let A be the area swept out by the line joining the earth and the sun during Feb, 1991. The area swept out by the line during a typical week in Feb 1992 is ....

27. The banking angle for a curved road of radius 490 m for a vehicle moving at 35 m/s is equal to $\tan^{-1}$ ....

28. A ball of mass 100 g is moving with a velocity of 10 m/s. on being hit with bat rebounds with a velocity of 10 m/s. The force of the ball by the bat acts for 0.01 sec, then the force exerted on the ball by the bat is ....

29. Two identical tumblers are filled with H_2O at a certain temperature. One of them is warmed up and the other is cooled down. But it is observed that H_2O overflows from both the tumblers. The temperature at which they are fully filled is .... K.

30. A vessel is filled with an ideal gas at a pressure of 20 atm and is at a temperature of 27°C. One-half of the mass is removed from the vessel and the temperature of the remaining gas is increased to 87°C. At this temperature the pressure of the gas will be ....

CHEMISTRY

1. At 27°C the ratio of root mean square velocities of ozone to oxygen is :
(a) $\sqrt{3/5}$ (b) $\sqrt{4/3}$ (c) $\sqrt{2/3}$ (d) 0.25

2. Given the bond energies of $N \equiv N, H—H$ and $N—H$ bonds as 945, 436 and 391 kJ/mol respectively, the enthalpy of the reaction $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$ is :
(a) – 93 kJ   (b) 102 kJ
(c) 90 kJ   (d) 105 kJ

3. A catalyst increases the rate of reaction because it :
(a) increases the activation energy
(b) decreases the energy barrier for reaction
(c) decreases the collision diameter
(d) increases the temperature coefficient

4. In nuclear reactor, heavy water is used as a :
(a) fuel   (b) projectile
(c) moderator   (d) arrestor

5. In the reaction $H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$:
(a) $K_p = K_c$ (b) $K_p \ne K_c$
(c) $K_p \ge K_c$ (d) $K_p < K_c$

6. When 9.65 Coulombs of electricity is passed through a solution of $AgNO_3$ (atomic weight of silver 108), the amount of silver deposited is :
(a) 10.8 mg   (b) 5.4 mg
(c) 16.2 mg   (d) 21.2 mg

7. When aniline is treated with $CHCl_3$ and KOH, the product is :
(a) benzene diazonium chloride
(b) benzanilide
(c) a Schiff's base
(d) phenyl isocyanide

8. 0.84 g of metal carbonate reacts exactly with 40 mL of N/2 H_2SO_4. The equivalent weight of the metal carbonate is :
(a) 84 g   (b) 64 g
(c) 42 g   (d) 38 g

9. Cuprous ion is colourless while cupric ion is coloured because :
   (a) both have unpaired electrons in the 'd' orbital
   (b) cuprous ion has completed d-orbital and cupric ion has incomplete d-orbital
   (c) both have half-filled p and d orbitals.
   (d) cuprous ion has incompleted d-orbitals and cupric ion has a completed d-orbital

10. Atoms of different elements having identical mass are known as :
    (a) isotopes   (b) isobars
    (c) isotones   (d) isomers

11. In the long form of periodic table, the elements having lowest ionisation potential are present in :
    (a) I group   (b) IV group
    (c) VII group   (d) zero group

12. If 20 mL of 0.4 N NaOH solution completely neutralised 40 mL of a dibasic acid, the molarity of the acid solution is :
    (a) 0.1 M   (b) 0.2 M
    (c) 0.3 M   (d) 0.4 M

13. A sample of gas has a volume of 0.2 L measured at 1 atmosphere pressure and 0°C. At the same pressure but at 273°C its volume becomes :
    (a) 0.1 L   (b) 0.4 L   (c) 0.8 L   (d) 0.6 L

14. If in a 100 mL of an aqueous HCl of pH 1.00, 900 mL of more distilled water is added, the pH of the resultant solution will be :
    (a) 1.0   (b) 2.0   (c) 4.0   (d) 7.0

15. The degree of dissociation of an acid HA in 0.1 M solution is 0.1%. Its dissociation constant is :
    (a) 1×10^{-3} (b) 1×10^{-7}
    (c) 1×10^{-10} (d) 1×10^{-14}

16. Al^{3+} ion has a lower ionic radius than Mg^{2+} ion because :
    (a) Mg atom has less number of neutrons than Al.
    (b) Al^{3+} has a higher nuclear charge than Mg^{2+}
    (c) their electronegativities are different
    (d) Al has a lower ionisation potential than Mg atom

17. When ethyl alcohol reacts with bromine in the presence of alkali the compound formed is :
    (a) C_2H_6 (b) C_2H_5Br
    (c) CH_3Br (d) $CHBr_3$

18. The half-life period of a radio-active element is 140 days. After 560 days 1g of the element will be reduced to :
    (a) 1/2 g   (b) 1/4 g
    (c) 1/8 g   (d) 1/16 g

19. Bauxite is a mineral for the extraction of :
    (a) Ca   (b) Cu   (c) Al   (d) Fe

20. For an ideal gas, the relation between the enthalpy change and internal energy change at constant temperature is given by :
    (a) $H = E + PV$ (b) $\Delta H = E + \Delta nRT$
    (c) $\Delta H = \Delta E + P\Delta V$ (d) $\Delta H = \Delta G + T\Delta S$

Fill in the Blanks

1. The most electronegative element is ....
2. The nuclei which has same number of neutrons, but different number of protons are called ....
3. The pH of 10^{-2}M NaOH solution is ....
4. The oxidation number of Mn in $KMnO_4$ is ....
5. At constant temperature and pressure if $\Delta G < 0$ the process is ....
6. The solution that is made by mixing appropriate amount of a weak acid and salt is called ....
7. Chloroform slowly reacts with oxygen of the air in the presence of light to give ....
8. When NH_4NO_3 is heated, the gas formed is ....
9. Ammoniacal solution of $AgNO_3$ is called ....
10. 3.5 g of CO at 0°C and 760 mm pressure contains .... molecules.
11. The rate of reaction is generally doubled for a .... rise in temperature.
12. A radioactive element has a decay constant $6.93 \times 10^{-3} \sec^{-1}$. Its half-life is .... minutes.

13. The IUPAC name of the compound
$$CH_3 \\ | \\ CH_3—CH_2—C{=}CH_2 \text{ is } ....$$

14. Dilute $KMnO_4$ oxidises acetylene to ....

15. Ionisation potential of $1s$ electron is .... than that of $2s$ electron in the same atom.

16. Kr nucleus has a .... radius than that of Ba.

17. A magic number of nucleide contains .... number of protons .... number of neutrons.

18. The mole fraction of solute in 20% aqueous H_2O_2 solution is ....

19. The correct electronic configuration of potassium is ....

20. The formula of plaster of paris is ....

21. Mg is mainly extracted from ....

22. $^{235}_{92}U + ^1_0n \longrightarrow 3^1_0n + ^{90}_{36}Kr + ...$

23. Ethyl alcohol when passed over copper at 300°C is dehydrogenated to give ......

24. $C_6H_5NO_2 \xrightarrow{Sn/HCl} ....$

25. C_2H_5Br on boiling with alcoholic solution of NaOH forms ....
$$CH_3—CH_2Br \xrightarrow{alc. NaOH} CH_2{=}CH_2 + HBr.$$

26. In diborane, boron atom undergoes .... hybridisation.

27. The energy of red stars is due to nuclear ....

28. EN of an atom is given by the average of EA and ....

29. d^2sp^3 hybridisation represents .... configuration.

30. The rate of diffusion of a gas in a diffusion tube is $1/2\sqrt{7}$. Molecular weight of the gas is .... $g \, mol^{-1}$.

MATHEMATICS

1. Set A has 3 elements and set B has 4 elements. The number of injections that can be defined from A to B is :
(a) 144   (b) 12   (c) 24   (d) 64

2. The function $f(x) = \dfrac{x}{\sqrt{1-x^2}}$ and
$g(x) = \dfrac{x}{\sqrt{1+x^2}}$, find $fog(x)$.
(a) x^2 (b) x
(c) $\dfrac{x}{\sqrt{1-x^2}}$ (d) none of these

3. If $\begin{vmatrix} a+b & b+c & c+a \\ b+c & c+a & a+b \\ c+a & a+b & b+c \end{vmatrix} = k \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$, then k is equal to :
(a) 1   (b) 2   (c) 4   (d) 8

4. If G is the centroid of triangle ABC and D, E, F are the mid points of the sides BC, CA and AB of a triangle respectively, then $\dfrac{AG^2 + BG^2 + CG^2}{AD^2 + BE^2 + CF^2}$ is equal to :
(a) $\dfrac{1}{3}$ (b) $\dfrac{2}{3}$ (c) $\dfrac{1}{4}$ (d) $\dfrac{4}{9}$

5. If the mean of a binomial distribution is 25, then the standard deviation lies in the interval :
(a) (0, 5)   (b) (0, 0.25)
(c) (0, 0.5)   (d) (0, 25)

6. The value of
$\tan 15° + \tan 30° + \tan 15° \tan 30°$ is :
(a) 1   (b) – 1   (c) 0   (d) $\sqrt{2}$

7. A box contains 10 mangoes out of which 4 are rotten. Two mangoes are taken out together at random. If one of them is found to be good, the probability that the other is also good, is :
(a) $\dfrac{5}{18}$ (b) $\dfrac{8}{15}$ (c) $\dfrac{1}{3}$ (d) $\dfrac{2}{3}$

8. Two tangents are drawn from the point $(-2, -1)$ to the parabola $y^2 = 4x$. If α is the angle between them, then $\tan \alpha$ is equal to :
(a) $\dfrac{1}{3}$ (b) $\dfrac{1}{2}$ (c) 2   (d) 3

9. The equation $x^2 - 3xy + \lambda y^2 + 3x - 5y + 2 = 0$, where λ is a real number, represents a pair of lines. If θ is the angle between them, then $cosec^2 \theta$ is equal to :
(a) 3   (b) 9   (c) 10   (d) 100

10. $\lim\limits_{n \to \infty} \dfrac{1}{n^2} \cdot \sum\limits_{r=1}^{n} r\, e^{r/n}$ is equal to :

    (a) 0   (b) 1   (c) e (d) $2e$

11. S and T are the focii of an ellipse and B is an end of the minor axis. If STB is an equilateral triangle, then e is :

    (a) $\dfrac{1}{2}$ (b) $\dfrac{1}{3}$ (c) $\dfrac{1}{4}$ (d) $\dfrac{2}{3}$

12. The maxima and minima of the function $2x^3 - 15x^2 - 36x + 18$ are :

    (a) $(-1, 37), (6, -306)$
    (b) $(1, -37), (-6, 306)$
    (c) $(-1, -37), (-6, -306)$
    (d) $(1, 37), (6, 306)$

13. The angle between the lines joining the origin to the points of intersection of the line $y = 3x + 2$ with the curve $x^2 + 2xy + 3y^2 + 4x + 8y = 11$ is :

    (a) $\tan^{-1}\left(\dfrac{\sqrt{2}}{3}\right)$ (b) $\tan^{-1}\left(\dfrac{2\sqrt{2}}{3}\right)$

    (c) $\tan^{-1}\left(\dfrac{2}{\sqrt{3}}\right)$ (d) $\tan^{-1}\left(\dfrac{\sqrt{3}}{2}\right)$

14. If $x = a\cos^3\theta$, $y = a\sin^3\theta$, then $\sqrt{1 + \left(\dfrac{dy}{dx}\right)^2}$ is equal to :

    (a) $\sec\theta$ (b) $|\sec\theta|$
    (c) $\sec^2\theta$ (d) $\tan^2\theta$

15. If a, b, c, d are positive, then $\lim\limits_{n \to \infty} \left(1 + \dfrac{1}{a + bn}\right)^{c + dn}$ is equal to :

    (a) e (b) $e^{d/b}$
    (c) $e^{c/n}$ (d) $e^{c + d/n + b}$

16. $\displaystyle\int_0^1 \dfrac{xe^x\, dx}{(x+1)^2} = \ldots$

    (a) $\dfrac{e}{2}$ (b) $\dfrac{e}{2} - 1$

    (c) $\dfrac{e-1}{2}$ (d) none of these

17. $\displaystyle\int_{-\pi/2}^{\pi/2} \sin^2 x \cos^2 x\,(\sin x + \cos x)\, dx = ?$

    (a) $\dfrac{2}{15}$ (b) $\dfrac{4}{15}$ (c) $\dfrac{2}{5}$ (d) $\dfrac{6}{5}$

18. In the set Q of all rationals $f : Q \to Q$ and is defined by $f(x) = 2x + 3, x \in Q$. Formula that define the inverse function f^{-1} is :

    (a) $f^{-1} : f \to Q$ (b) $f^{-1} : Q \to f$
    (c) $f^{-1} : Q \to Q$ (d) none of these

19. Matrix A is such that $A = \begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$, then $(A - 2I)\,(A - 3I)$ is equal to :

    (a) $2I$ (b) $3I$ (c) $4I$ (d) O

20. $\tan^{-1}\dfrac{x}{y} - \tan^{-1}\dfrac{x-y}{x+y}$ is equal to :

    (a) $\dfrac{\pi}{2}$ (b) $\dfrac{\pi}{3}$

    (c) $\dfrac{\pi}{4}$ or $\dfrac{-3\pi}{4}$ (d) $\dfrac{\pi}{4}$

Fill in the Blanks

1. If n is a positive integer, then $\sum\limits_{r=1}^{n} (^nC_r)^2 = \ldots\ldots\ldots$

2. The real roots of the equation $a\,(b-c)\,x^2 + b\,(c-a)x + c\,(a-b) = 0$ are ...

3. The real value(s) of x which satisfy $(5 + 2\sqrt{6})^{x^2-3} + (5 - 2\sqrt{6})^{x^2-3} = 10$ is/are ....

4. A flag staff stand on the top of a tower 80 m high, subtends an angle $\tan^{-1}\left(\dfrac{1}{9}\right)$ at a point 100 m from foot of the tower. The height of flag staff is ....

5. $\cot\left(\dfrac{\pi}{4} - 2\cot^{-1} 3\right) = \ldots\ldots\ldots$

6. Two dice are thrown simultaneously. The probability of getting total score of 7 is ...

7. Standard deviation of first n natural numbers is ....

8. $\displaystyle\int \dfrac{\cos 2x}{(\cos x + \sin x)^2}\, dx = \ldots\ldots\ldots$

9. If $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 0 & 2 \\ 2 & 1 & 2 \end{bmatrix}$, then $A^{-1} = \ldots\ldots\ldots$

10. The greatest value of $\sin^3 x + \cos^3 x = \ldots\ldots$

11. $x = \log \cot\left(\dfrac{\pi}{4} + \theta\right)$, then $\sinh x = \ldots\ldots$

12. The remainder obtained when the polynomial $x^{64} + x^{27} + 1$ is divided by $(x + 1)$, is $\ldots\ldots$

13. $\displaystyle\int_0^{\infty} \dfrac{dx}{(x + \sqrt{x^2 + 1})^3} = \ldots\ldots$

14. If $y = \cos(3 \cos^{-1} x)$, then $\dfrac{d^3 y}{dx^3} = \ldots\ldots$

15. The minimum value of $64 \sec\theta + 27 \operatorname{cosec}\theta$, when θ is in $\left(0, \dfrac{\pi}{2}\right)$, is $\ldots\ldots$

16. If the system of equations $3x - 2y + z = 0$, $\lambda x - 14y + 15z = 0$ and $x + 2y + 3z = 0$ has a non-trivial solutions, then $\lambda = \ldots\ldots$

17. The radius of any circle touching the lines $3x - 4y + 5 = 0$ and $6x - 8y - 9 = 0$ is $\ldots\ldots$

18. Equation $x^2 + 2ax - b^2 = 0$ has real roots α, β and equation $x^2 + 2px - q^2 = 0$ has real roots γ, δ. If circle 'C' is drawn with (α, γ) and (β, δ) as extremities of diameter, then its equation is $\ldots\ldots$

19. The maximum value of $f(x) = x^4 - 3x^3 + 2x^2 + x + 1$ is $\ldots\ldots$

20. $\displaystyle\int_0^{\pi} x \sin x \cos^4 x \, dx = \ldots\ldots$

21. $\displaystyle\int_0^1 \dfrac{x}{(1-x)^{3/4}} \, dx = \ldots\ldots$

22. Tangents are drawn through $(4, \sqrt{3})$ to the ellipse $\dfrac{x^2}{16} + \dfrac{y^2}{9} = 1$. The points at which these tangents touch the ellipse are $\ldots\ldots$

23. The position of vectors of A, B, C, D are $\hat{i} - \hat{k}, -\hat{i} - 2\hat{j}, 2\hat{i} - 3\hat{k}$ and $3\hat{i} - 2\hat{j} - \hat{k}$ are positive vectors, then projections of AB on CD is $\ldots\ldots$

24. If $(\hat{i}, \hat{j}, \hat{k})$ is an orthonormal system of vectors and $\hat{i}, \hat{i} + \hat{j}, \hat{i} + \hat{j} + \hat{k}$ are adjacent sides of parallelopiped, then its volume is $\ldots\ldots$

25. The angle between any two diagonals of a cube is $\ldots\ldots$

26. The unit vector perpendicular to each of the vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 3\hat{i} + 4\hat{j} - \hat{k}$ is equal to $\ldots\ldots$

27. The derivative of the function $\tan^{-1}\left\{\dfrac{\cos x}{1 + \sin x}\right\} = \ldots\ldots$

28. All the values of $(-1)^{1/6}$ are $\ldots\ldots$

29. The equation of plane passing through three points (x_1, y_1, z_1), (x_2, y_2, z_2) and (x_3, y_3, z_3) is $\ldots\ldots$

30. $A = \{-1, -2, 0, 1, 2\}$ and $f : A \to R$ defined by $f(x) = x^2$, then the range of $f = \ldots\ldots$

Answers

Physics

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

Fill in the Blanks

1. $5.6 \, eV$

2. $\dfrac{x}{9}$

3. Same, different

4. Erectrons and holes

5. Photo diode

6. 10^{18}

7. $D\sqrt{\dfrac{g}{2h}}$

8. $2.4 \times 10^{-5}/°C$

5. Photo diode   6. 10^{18} 7. $D\sqrt{\dfrac{g}{2h}}$ 8. $2.4 \times 10^{-5}/°C$

9. $\dfrac{(z_2 - 1)^2}{(z_1 - 1)^2}$ 10. $f_o + f_e$ 11. $[M^{-1} L^3 T^{-2}]$ 12. $\sqrt{A^2 + B^2 + 2\,AB\cos\theta}$

13. $\mu_r < \mu_k < \mu_s$ 14. 0   15. 300 m   16. 24.6×10^5 J

17. Current   18. 4×10^{31} 19. $\left(\dfrac{3}{2}\right)^{1/3}$ 20. 20 cm, left to $+2\,\mu C$

21. $6\,\mu F, \dfrac{6}{11}\,\mu F$ 22. Sodium   23. More   24. 50 W

25. 0.25 J   26. A 27. 0.25   28. 200 N

29. 4°C or 277 K   30. 12 atm

Chemistry

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

Mathematics

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

Fill in the Blanks

1. $\dfrac{2n!}{(n!)^2} - 1$ 2. $1, \dfrac{c\,(a - b)}{a\,(b - c)}$ 3. $\pm 2, \pm \sqrt{2}$ 4. 20 m

5. 7   6. $\dfrac{1}{6}$ 7. $\sqrt{\dfrac{n^2 - 1}{12}}$ 8. $\log(\cos x + \sin x) + c$

9. $\begin{bmatrix} -2 & -3 & 4 \\ 2 & 2 & -3 \\ 1 & 2 & -2 \end{bmatrix}$ 10. $\dfrac{1}{\sqrt{2}}$ 11. $-\tan 2\theta$ 12. 1

13. $\dfrac{3}{8}$ 14. 24   15. 125   16. 29

17. $\dfrac{19}{10}$ 18. $x^2 + y^2 + 2ax + 2py - q^2 - b^2 = 0$ 19. 2

20. $\dfrac{\pi}{5}$ 21. $\dfrac{16}{5}$ 22. $\left(\pm 2, \pm \dfrac{3\sqrt{3}}{2}\right)$ 23. $\dfrac{4}{\sqrt{29}}$

24. 1 cu. units   25. $\cos^{-1}\left(\dfrac{1}{3}\right)$ 26. $\dfrac{1}{\sqrt{155}}\,(-3\hat{i} + 5\hat{j} + 11\hat{k})$

27. $-\dfrac{1}{2}$ 28. $e^{i\pi/6}, e^{i3\pi/6}, e^{i5\pi/6}, e^{i7\pi/6}, e^{i9\pi/6}, e^{i11\pi/6}$

29. $\sum \dfrac{(x - x_1)}{(y_2 - y_1)(z_3 - z_1) - (z_2 - z_1)(y_3 - y_1)} = 0$ 30. {0, 1, 4}