EAMCET

ENGINEERING ENTRANCE EXAM

SOLVED PAPER–1997

PHYSICS

1. The mass of a planet is 1/9 of the mass of the earth and its radius is half that of the earth. If a body weighs 9 N on the earth, its weight on the planet would be :
(a) 6 N (b) 4 N (c) 2 N (d) 1 N

2. A thin metal disc of radius 0.25 m and mass 2 kg starts from rest and rolls down an inclined plane. If its rotational kinetic energy is 4 J at the foot of the inclined plane, then its linear velocity at the same point is :
(a) 1.2 m/s (b) $2\sqrt{2}$ m/s
(c) 20 m/s (d) 2 m/s

3. A constant torque of 1000 N-m, turns a wheel of moment of inertia 200 kg-m^2 about an axis through its centre. Its angular velocity after 3 second is, (in rad/sec) :
(a) 1 (b) 5 (c) 15 (d) 10

4. A body of mass 10 kg lies on a rough horizontal surface. When a horizontal force of F newton acts on it, it gets an acceleration of 5 m/s^2 and when the horizontal force is doubled, it gets an acceleration of 18 m/s^2. Then the coefficient of friction between the body and the horizontal surface is : (assume $g = 10\ ms^{-2}$)
(a) 0.2 (b) 0.8 (c) 0.4 (d) 0.6

5. A mass of 12 kg at rest explodes into two pieces of masses 4 kg and 8 kg which move in opposite directions. If the velocity of 8 kg piece is 6 m/s, then the kinetic energy of the other piece is (in joule) :
(a) 64 (b) 128
(c) 144 (d) 288

6. The weight of a man in a lift moving upwards is 608 N while the weight of the same man in the lift moving downwards, with the same acceleration is 368 N. His normal weight in N is :
(a) 498 (b) 588
(c) 480 (d) 240

7. A particle is moving east wards with a velocity of 15 m/s. In a time of 10 second, the velocity changes to 15 m/s northwards. Average acceleration during this time is (in m/s^2) :
(a) $\frac{3}{\sqrt{2}}$ north-east (b) $3\sqrt{2}$ north-east
(c) $\frac{3}{\sqrt{2}}$ north-west (d) $3\sqrt{2}$ north-west

8. The reaction time for a car driver is 0.9 sec. If the car travelling initially with 36 km/h is stopped by the driver after observing a signal by the deaceleration of 5 m/s^2, the total distance travelled by the car before coming to rest is :
(a) 19 m (b) 9 m
(c) 10 m (d) 28 m

9. If M,L,T, and I stand for mass, length time and electric current respectively, the dimensional formula for capacitance is :
(a) $[M^{-1}L^2T^{-4}I^2]$ (b) $[M^{-1}L^{-2}T^4I^2]$
(c) $[ML^2T^4I^2]$ (d) $[ML^2T^{-4}I^{-2}]$

10. A force $\vec{F} = 3\hat{i} + c\hat{j} + 2\hat{k}$ acting on a particle causes a displacement $\vec{s} = -4\hat{i} + 2\hat{j} + 3\hat{k}$ in its own direction. If the work done is 6 J, the value of c is:
(a) zero (b) 1
(c) 12 (d) 6

11. The angular velocity of the second's-hand of a watch is :
(a) 0.053 rad/sec (b) 0.210 rad/sec
(c) 0.105 rad/sec (d) 0.42 rad/sec

12. A copper solid cube of 60 mm side is subjected to a pressure of 2.5×10^7 Pa. If the bulk modulus of copper is 1.25×10^{11} N/m^2, the change in the volume of cube is :
(a) -43.2 m^3 (b) -43.2 mm^3
(c) -43.2 cm^3 (d) -432 mm^3

13. The coefficient of real expansion of mercury is 18×10^{-5}/°C. The thermometer bulb has a volume of 10^{-6} m^3 and the cross-section of the stem is 0.002 cm^2. Assuming that the bulb is filled with mercury at 0°C, the length of the mercury column at 100°C will be :
(a) 9 cm (b) 18 cm
(c) 9 mm (d) 18 mm

14. A clock with an iron pendulum keeps correct time at 15°C. If the room temperature rises to 20°C, the error in second per day will be : (coefficient of linear expansion of iron is 0.000012/°C)
(a) 2.5 s (b) 2.6 s (c) 2.4 s (d) 2.2 s

15. A gas at temperature 27°C and pressure 30 atm is allowed to expand to atmospheric pressure. If the volume becomes 10 times its initial volume, the final temperature becomes :
(a) 100°C (b) 373°K
(c) 373°C (d) -173°C

16. Certain amount of heat supplied to an ideal gas under isothermal conditions will result in :
(a) a rise in temperature
(b) doing external work and a change in temperature
(c) doing external work
(d) an increase in the internal energy of the gas

17. 30g of water at 300°C is in a beaker. Which of the following, when added to water, will have greater cooling effect? (specific heat of copper = 0.1 cal/g°C)
(a) 100 g of water at 10°C
(b) 15 g of water at 0°C
(c) 3 g of ice at 0°C
(d) 18 g of copper at 0°C

18. Two cylindrical conductors A and B of same metallic material have their diameters in the ratio 1 : 2 and lengths in the ratio 2 : 1. If the temperature difference between their ends is same, the ratio of heats conducted respectively by A and B per sec is :
(a) 1 : 2 (b) 1 : 4
(c) 1 : 16 (d) 1 : 8

19. An organ pipe P_1 closed at one end vibrating in its first overtone and another pipe P_2, open at both ends vibrating in its third overtone are in resonance with a given tuning fork. Then the ratio of lengths of P_1 and P_2 respectively are given by :
(a) 1 : 2 (b) 1 : 3
(c) 3 : 8 (d) 3 : 4

20. A source and an observer move away from each other , each with a velocity of 10 m/s, with respect to ground. If the observer find the frequency of sound coming from the source as 1950 Hz, the original frequency of the source is : (assume velocity of sound in air = 340 m/s)
(a) 1950 Hz (b) 2068 Hz
(c) 1832 Hz (d) 2186 Hz

21. Which of the following statements is not true in the case of Huygen's eye piece ?
(a) It is achromatic
(b) It satisfies condition for minimum spherical aberration
(c) It has cross wires
(d) It cannot be used for measurement

22. The dark lines in the solar spectrum are due to :
(a) absorption of certain wavelengths by elements present in the outer layer
(b) absence of certain elements in the sun
(c) black body radiation from the sun
(d) scattering of light

23. A bar magnet of pole strength 2 A-m is kept in a magnetic field of induction 4×10^{-5} Wb/m^2 such that the axis of the magnet makes an angle 30° with the direction of the field. The couple acting on the magnet is found to be 80×10^{-7}N-m. Then the distance between the poles of the magnet is :
(a) 20 cm (b) 2 m
(c) 3 cm (d) 20 cm

24. In a deflection magnetometer experiment in tan A position, a short bar magnet placed at 18 cm from the centre of the compass needle produces a deflection of 30°. If another magnet of same length but 16 times pole strength as that of first magnet is placed in tan B position at 36 cm, the deflection will be :
(a) 0° (b) 30° (c) 45° (d) 60°

25. A charge q is placed at the centre of the line joining two equal charges Q to establish equilibrium. The system of three charges will be in equilibrium if q is equal to :
(a) $+Q/4$ (b) $+Q/2$ (c) $-Q/2$ (d) $-Q/4$

26. The capacity of a parallel plate capacitor with no dielectric but with a separation 0.4 cm is 2 μF. The separation is reduced to half and it is filled with a dielelctric of value 2.8. The final capacity of the capacitor is :
(a) 11.2 μF (b) 5.6 μF
(c) 4.0 μF (d) 22.4 μF

27. Two parallel wires of length 9 m each, are separated by a distance of 0.15 m. If they carry equal current in the same direction and exert a total force of 30×10^{-7} N on each other, the value of the current must be :
(a) 1.5 A (b) 2.25 A (c) 0.5 A (d) 0.25 A

28. The emf of a daniel cell is 1.08 V. When the terminals of the cell are connected to resistance of 3 Ω, the potential difference across the terminals is found to be 0.6 V. Then the internal resistance of the cell is:
(a) 1.8 Ω (b) 2.4 Ω (c) 3.24 Ω (d) 0.2 Ω

29. A sensitive galvanometer like a moving coil galvanometer can be converted into an ammeter or into a voltmeter by connecting a proper resistance to it. Then which of the following statements is not true?
(a) An ammeter is connected in series in a circuit and the potential difference across it is small
(b) An ammeter is connected in series in a circuit and the current through it is negligible
(c) A voltmeter is connected in parallel in a circuit and the current through it is negligible
(d) A voltmeter is connected in parallel in a circuit the potential difference across it is maximum

30. When the electron in hydrogen atom is excited from the 4th stationary orbit to the 5th stationary orbit, the change in the angular momentum of the electron in J-s is : (Planck's constant $h = 6.64 \times 10^{-34}$ J-s)
(a) 4.16×10^{-34} (b) 3.32×10^{-34}
(c) 1.05×10^{-34} (d) 2.08×10^{-34}

31. An electron beam is allowed to pass normally through magnetic and electric fields which are mutually perpendicular. When the magnetic field induction and electric field strength are 0.0004 Wb/m^2 and 3000 V/m respectively, the beam suffers no deflection. Then the velocity of electron is :
(a) 7.5×10^6 m/s (b) 7.5×10^4 m/s
(c) 7.5×10^2 m/s (d) 1.2×10^6 m/s

32. When a slow neutron is captured by U^{235} nucleus nuclear fission takes place, each fission releases an energy of 200 MeV. The number of fissions required to occur (per sec) to produce a power of 1 MW is :
(a) 6.2×10^{16} (b) 6.2×10^{15}
(c) 1.56×10^{16} (d) 3.125×10^{16}

33. In the following reaction, the energy released is :
$4\,{}_1H^1 \rightarrow 2\,He^4 + 2e^+ + \text{energy}$
(Given : Mass of ${}_1H^2 = 4.031300$ amu,
Mass of ${}_2He^4 = 4.0026603$ amu
Mass of $2\,{}_1e^0 = 0.001098$ amu.)
(a) 12.33 MeV
(b) 24.67 MeV
(c) 25.6 MeV
(d) 49.34 MeV

34. The value indicated by Fermi energy level in an intrinsic semiconductor is :
(a) the average energy of electrons and holes
(b) the energy of electrons in conduction band
(c) the energy of holes in valence band
(d) the energy of forbidden region

35. The two diodes A and B are biased as shown, then :

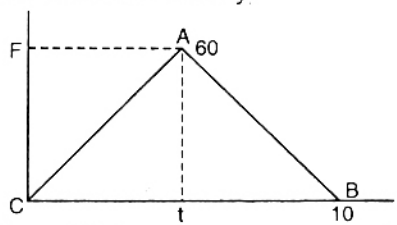
-5 V A -9 V

-3 V B -6 V

(a) the diodes A and B are reverse biased
(b) the diode A is forward biased and B is reverse biased
(c) the diode B is forward biased and diode A is reverse biased
(d) the diodes A and B are forward biased

PART – B : ANALYTICAL QUESTIONS

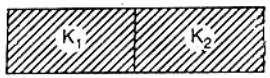
1. Velocity of a wave is directly proportional to modulus of elasticity E and density d of medium, find the expression of v using dimensional analysis.
2. An athlete starts running from the bottom of a tower at the same movement, a ball is thrown horizonatlly with a velocity v from the top of the same tower. What should be the speed of the athlete to catch the ball, assuming that there is no air resistance ?
3. The variation of force with respect to time of action on a body of mass 2 g as shown in figure. If the final velocity is 10 ms^{-1}. What is the initial velocity?



4. A 2 kg and 3 kg masses are moving in a straight line. At a certain instant, 2 kg mass is at 1 m from origin with a velocity of 3 ms^{-1} and 3 kg mass is at 2 m from origin with a velocity of 1 ms^{-1}. Find the position and velocity of centre of mass of two body system.
5. A circular platform of mass 100 kg rotates at an angular velocity of 12 rpm about an axis through its centre. When a boy stands on its edge, the mass of the boy is 40 kg and can be regarded as a point of mass here. What will be angular velocity of platform when the boy moves to centre of platform ?
6. A stone of 2 kg mass tied to the end of 1 m long string is whirled in a vertical circle at constant speed. The speed of stone is 4 ms^{-1}. Find tension in the string when the stone is at (i) bottom of the circle (ii) top of the circle.
7. A capillary tube is immersed vertically in water such that the height of liquid column in it is x, this arrangment is taken into a mine of depth d and height of liquid column is found to be y. If R is the radius of the earth, find d in terms of x, y and R.
8. At 25°C, length of a metal rod is 10 m and its cross-section is 50 cm^2. Calculate the temperature at which it can have the same length as the length obtained by a longitudinal force of 4×10^5 N.
($\alpha = 12 \times 10^{-6}$, $°C^{-1}$, $Y = 2 \times 10^{11}$ Nm^{-2})
9. 5 kg of water in vessel is rotated through a motor of power 300 kW. Assuming frictional losses, how long it will take to rise the temperature of water by 6°C ? ($J = 4.2$ J/cal)
10. 1 g of ice at 0°C is mixed with 1 g of steam at 100°C. Find the mass of water formed.
11. Water is poured in a cylindrical vessel of length 100 cm. A tuning fork of frequency 480 Hz is held above the mouth of vessel by exciting it. Find the minimum length of water column for resonance. (velocity of sound in air 360 ms^{-1}).
12. A ray is incident on an equilateral prism of $\mu = 2$ such that ray inside the prism goes parallel to the base.
    (i) Find the angle of minimum deviation.
    (ii) Draw the figure showing incident, emergent and refracted rays and also deviation for the same situation.
13. Magnetic materials Zn, Fe, Mn, Al, Cd Bi, Sb, Co, Ni, Mn.
    (i) Categorise them according to theory of magnetism.
    (ii) Arrange them in descending order of magnetic strength.

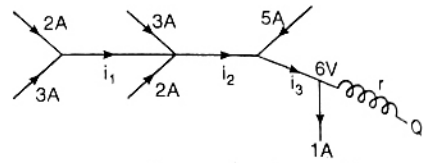
14. An electron in ground state of H-atom absorbs an energy of 12.75 eV. Calculate the number of all possible spectral lines that can be transmitted during its transition to all possible low energy levels.

15. Calculate capacitance C, if C_0 is the capacitance without dielectric, in terms of C_0, K_1, K_2.



16. Two circular coils of equal radii $2\sqrt{2} \times 10^{-2}$ m and having number of turns 2 each are arranged in perpendicular plane such that their centres coincide. Find (i) intensity or magnetic field at the centre due to each coil. (ii) resultant magnetic field at centre. They are carrying current of 20mA each.

17. Find current and r



18. $X + \alpha \rightarrow Y + {}_0n^1 : Y \rightarrow + {}_1e^0 + {}_{14}Si^{30}$
(i) Name X and Y
(ii) Name the process of first,

19. Of the following identify moderators and controller.
D_2O, Graphite, B, Cd, H_2O, Be, Li, CO_2

20. The stopping potential of surface when it is excited with a light of wavelength 5890 Å is 0.37 V. Find (i) threshold wavelength (ii) the maximum kinetic energy of photoelectrons if the metal is illuminated by light of wavelength 5000 Å. [h = 6.65×10^{-34} J-s]

CHEMISTRY

1. Hydrolysis of an ester gives a carboxylic acid which on Kolbe's electrolysis yields ethane. The ester is :
(a) methyl ethanoate
(b) methyl methanoate
(c) ethyl methanoate
(d) methyl propanoate

2. The strongest conjugate base results from :
(a) formic acid (b) benzoic acid
(c) acetic acid (d) acetylene

3. The ΔH value for the reaction
$$H_2 + Cl_2 \rightleftharpoons 2HCl$$
is –44.12 kcal.
If E_1 is the activation energy of the reactants and E_2 is the activation energy of the products, then for the above reaction :
(a) $E_1 > E_2$ (b) $E_1 < E_2$
(c) $E_1 = E_2$
(d) ΔH is not related to E_1 or E_2

4. The value of K_p for the reaction $2H_2S\,(g) \rightleftharpoons 2H_2\,(g) + S_2\,(g)$ is 1.2×10^{-2} at 1065°C. The value of K_c for this reaction :
(a) 1.2×10^{-2} (b) $< 1.2 \times 10^{-2}$
(c) 83 (d) $> 1.2 \times 10^{-2}$

5. Which one of the following metals will not reduce H_2O ?
(a) Ca (b) Fe (c) Cu (d) Li

6. In the Bohr hydrogen atom, the electronic transition emitting light of longest wavelength is :
(a) $n = 2$ to $n = 3$ (b) $n = 4$ to $n = 3$
(c) $n = 3$ to $n = 2$ (d) $n = 2$ to $n = 1$

7. Which one of the following halogens does not exhibit positive oxidation state in its compounds ?
(a) I (b) Br
(c) Cl (d) F

8. Which one of the following ores is chloride ?
(a) Horn silver (b) Zincite
(c) Bauxite (d) Felspar

9. In the electrochemical cell
$H_2\,(g)$ 1 atm. $1H^+\,(1M) \,||\, Cu^{2+}\,(1M)\,Cu\,(s)$
Which one of the following statements is true ?
(a) H_2 is cathode, Cu is anode
(b) Oxidation occurs at Cu electrode
(c) Reduction occurs at H_2 electrode
(d) H_2 is anode, Cu is cathode

10. On passing a current through a KCl solution, 19.5 g. of potassium is deposited. If the same quantity of electricity is passed through a solution of aluminium chloride, the amount of aluminium deposited is :
(a) 4.5 g (b) 9.0 g (c) 13.5 g (d) 27 g

11. The de-Broglie wavelength of a particle with mass 1 g and velocity 100 ms^{-1} is :
(a) 6.63×10^{-35} m (b) 6.63×10^{-34} m
(c) 6.625×10^{-33} m (d) 6.63×10^{-32} m

12. Which one of the following statements is true for ammonium ion ?
(a) All bonds are ionic
(b) All bonds are co-ordinate covalent
(c) H-atoms are situated at the corners of a square
(d) H-atoms are situated at the corners of tertrahedron

13. Which one of the following is not a base ?
(a) N_2H_4 (b) NH_2OH
(c) $(CH_3)_3N$ (d) HN_3

14. Which one of the following is reduced by hydrogen peroxide in acid medium ?
(a) Potassium permanganate
(b) Potassium iodide
(c) $FeSO_4$
(d) Potassium ferrocyanide

15. The electronic configuration of chromium (Z= 24) is :
(a) [Ar] $4d^4 4s^2$ (b) [Ar] $3d^5 4s^1$
(c) [Ar] $3d^4 3s^2$ (d) [Ar] $4d^5 4s^1$

16. Which one of the following compounds in aqueous solution gives a white precipitate with perchloric acid ?
(a) NaCl (b) KCl
(c) $MgCl_2$ (d) $FeCl_3$

17. Which of the following sequence is correct with reference to the oxidation number of iodine ?
(a) $I_2 < ICl < HI < HIO_4$
(b) $HIO_4 < ICl < I_2 < HI$
(c) $I_2 < HI < ICl < HIO_4$
(d) $HI < I_2 < ICl < HIO_4$

18. The root mean square velocity of a gas is doubled when the temperature is :
(a) reduced to half
(b) reduced to one-fourth
(c) increased four times
(d) increased two times

19. Quartz is a crystalline variety of :
(a) sodium silicate (b) silicon carbide
(c) silicon (d) silica

20. Which of the following compounds does not form an ozonide ?
(a) Ethene (b) Propyne
(c) Propene (d) Propane

21. The pH of the aqueous solution containing 0.49 g of H_2SO_4 in one litre is :
(a) 2 (b) 1 (c) 1.7 (d) 0.3

22. The conjugate acid of NH_2^- ion is :
(a) NH_3 (b) NH_4^+
(c) N_2H_4 (d) NH_2OH

23. Which one of the following compounds liberates CO_2 from aqueous $NaHCO_3$?
(a) Aluminium chloride
(b) $CHCl_3$
(c) CCl_4
(d) CH_3Cl

24. In which one of the following conversions phosphorus pentachloride is used as the reagent ?
(a) $H_2C{=}CH_2 \longrightarrow CH_3CH_2Cl$
(b) $H_3C{-}O{-}CH_3 \longrightarrow CH_3Cl$
(c) $CH_3CH_2OH \longrightarrow CH_3CH_2Cl$
(d) $CH{\equiv}CH \longrightarrow CH_2{=}CHCl$

25. Which one of the following elements has the highest-first ionisation potential ?
(a) Boron (b) Carbon
(c) Nitrogen (d) Oxygen

26. Of the following, the one with largest size is :
(a) Cl^- (b) Ar (c) K^+ (d) Ca^{2+}

27. The reagent that gives an orange coloured precipitate with acetaldehyde :
(a) NH_2OH (b) $NaHSO_3$
(c) iodine (d) 2,4-DNP

28. The hybridization state of carbon atoms in the product formed by the reaction of ethyl chloride with aqueous KOH is :
(a) sp (b) sp^2
(c) sp^3 (d) sp^3d

29. The atomic number of a radioactive element increases by one unit in :
(a) alpha emission
(b) beta emission
(c) gamma emission
(d) electron capture

30. Which one of the following compounds is Lewis acid ?
(a) PCl_3 (b) BCl_3
(c) NCl_3 (d) $CHCl_3$

31. The alkane that yields two isomeric monobromo derivatives :
(a) neo pentane (b) ethane
(c) methane (d) propane

32. The alcohol that produces turbidity immediately with $ZnCl_2$/conc. HCl at room temperature :
(a) 1-hydroxybutane
(b) 2-hydroxybutane
(c) 2-hydroxy-2-methyl propane
(d) 1-hydroxy-2-methyl propane

33. Ethyl chloride on heating with silver cyanide forms a compound X. The functional isomer of X is :
(a) C_2H_5NC
(b) C_2H_5CN
(c) $H_3C—NH—CH_3$
(d) $C_2H_5NH_2$

34. The number of π bonds in the product formed by passing acetylene through dil. H_2SO_4 containing mercuric sulphate is :
(a) zero (b) one
(c) two (d) three

35. In the complete combustion of butanol C_4H_9OH (I) if ΔH is enthalpy of combustion and ΔE is the heat of combustion at constant volume, then :
(a) $\Delta H < \Delta E$
(b) $\Delta H = \Delta E$
(c) $\Delta H > \Delta E$
(d) ΔH, ΔE relation cannot be predicted

MATHEMATICS

1. If $f : R \to R$ is defined by $f(x) = 2x + |x|$ then $f(3x) - f(-x) - 4x$ is equal to :
(a) $-f(x)$ (b) $f(x)$ (c) $f(-x)$ (d) $2f(x)$

2. If $f : \{1, 2, 3, ...\} \to \{0, \pm 1, \pm 2, ...\}$ is defined by $y = f(x)$
$$= \begin{cases} \frac{x}{2} & \text{if } x \text{ is even} \\ -\frac{(x-1)}{2} & \text{if } x \text{ is odd} \end{cases}$$, then $f^{-1}(-100)$ is :
(a) 100 (b) 199 (c) 201 (d) 200

3. $\log_{3\sqrt{2}} 324$ is equal to :
(a) 4 (b) 6 (c) 8 (d) 3

4. If a polygon has 35 diagonals, then the number of sides of polygon are :
(a) 10 (b) 15 (c) 20 (d) 25

5. The number of lines that can be formed from 12 points in a plane of which 6 lie on a line are :
(a) 45 (b) 52 (c) 50 (d) 46

6. If $(1 + x + x^2)^n = \sum_{r=0}^{2n} a_r x^r$, then
$a_1 - 2a_2 + 3a_3 - ..... + (-1)^{2n-1} 2n\, a_{2n}$ is equal to :
(a) 0 (b) 1 (c) n (d) $-n$

7. The term independent of x in the expansion of $(3 + 2x)^{44}$, is
(a) 4th term (b) 5th term
(c) 1st term (d) 7th term

8. $1 + \frac{2}{x} + \frac{3}{x^2} + ... = \frac{1}{3}$, then x is equal to :
(a) $\frac{\sqrt{3}+1}{2}$ (b) $\frac{\sqrt{3}-1}{2}$
(c) $\frac{1}{3}$ (d) $-\frac{1}{3}$

9. If $\frac{(x+1)^2}{x^3+x} = \frac{A}{x} + \frac{Bx+C}{x^2+1}$, then $\sin^{-1}\left(\frac{A}{C}\right)$ is equal to :
(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

10. If $\frac{2+3i}{(7-i)(4+2i)} = A + iB$, then $A^2 + B^2$ is equal to :
(a) $\frac{13}{1000}$ (b) $\frac{13}{100}$
(c) $\frac{17}{100}$ (d) $\frac{17}{1000}$

11. If $|z-3+i|=4$, then the locus of $z=x+iy$ is :
(a) $x^2+y^2-6x+2y-6=0$
(b) $x^2+y^2-6=0$
(c) $x^2+y^2-3x+y-6=0$
(d) $x^2+y^2=0$

12. If $(1+i)^{100}=2^{49}(x+iy)$, then x^2+y^2 is equal to :
(a) 0 (b) 4 (c) 8 (d) 16

13. If $n>1$, then the product of all roots of unity is :
(a) 0 (b) 1
(c) $(-1)^{n-1}$ (d) -1

14. If α, β are the roots of equation $ax^2+bx+c=0$, then the quadratic equation whose roots are $\alpha+\beta, \alpha\beta$, is :
(a) $a^2x^2+a(b-c)x+bc=0$
(b) $a^2x^2+a(b-c)x-bc=0$
(c) $ax^2+(b+c)x+bc=0$
(d) $ax^2+(b+c)x-bc=0$

15. The minimum value of quadratic expression $x^2+2bx+c$ is :
(a) cb^2 (b) c^2b (c) $c+b^2$ (d) $c-b^2$

16. Sum of the series $1+\frac{k}{3}+\frac{k(k+1)}{3.6}+\frac{k(k+1)(k+2)}{3.6.9}+\ldots..$ is equal to :
(a) $\left(\frac{2}{3}\right)^k$ (b) $\left(\frac{3}{2}\right)^k$ (c) $\left(\frac{2}{3}\right)$ (d) $\left(\frac{3}{2}\right)$

17. If $A=\begin{bmatrix}\cos x & \sin x & 0\\ -\sin x & \cos x & 0\\ 0 & 0 & 1\end{bmatrix}=f(x)$, then $A^{-1}=$
(a) $f(-x)$ (b) $f(x)$ (c) $-f(x)$ (d) $-f(-x)$

18. If a, b, c are distinct and $\begin{vmatrix}a & a^2 & a^3-1\\ b & b^2 & b^3-1\\ c & c^2 & c^3-1\end{vmatrix}=0$, then :
(a) $a+b+c=1$ (b) $ab+bc+ca=0$
(c) $a+b+c=0$ (d) $abc=1$

19. If the system of equations $x+y+z=6$, $x+2y+\lambda z=0$, $x+2y+3z=10$ has no solution, then $\lambda=$
(a) 2 (b) 3 (c) 4 (d) 5

20. The set of matrics
$S=\left\{\begin{bmatrix}x & -x\\ -x & x\end{bmatrix}: x\in R, x\neq 0\right\}$
form a group with matrix multiplication as the binary operation, the identity element in it is :
(a) $\begin{bmatrix}\frac{1}{2} & -\frac{1}{2}\\ -\frac{1}{2} & \frac{1}{2}\end{bmatrix}$ (b) $\begin{bmatrix}2 & -2\\ -2 & 2\end{bmatrix}$
(c) $\begin{bmatrix}1 & -1\\ -1 & 1\end{bmatrix}$ (d) $\begin{bmatrix}-1 & 1\\ 1 & -1\end{bmatrix}$

21. If $\tan 35^\circ=K$, then the value of $\frac{\tan 145^\circ-\tan 125^\circ}{1+\tan 145^\circ \tan 125^\circ}=$
(a) $\frac{2K}{1-K^2}$ (b) $\frac{2K}{1+K^2}$
(c) $\frac{1-K^2}{2K}$ (d) $\frac{1-K^2}{1+K^2}$

22. If $x=a(\sec\theta+\tan\theta)^2$, $y=b(\sec\theta-\tan\theta)^4$, then $x^4y^2=$
(a) $ab\sec\theta$ (b) $a^2b^2+\tan^2\theta$
(c) a^2b^4 (d) a^4b^2

23. The period of the function $\tan(3x+5)$ is :
(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{3}$ (d) π

24. $\frac{\sin 3\theta}{1+2\cos 2\theta}=$
(a) $\cos\theta$ (b) $\sin\theta$ (c) $-\cos\theta$ (d) $-\sin\theta$

25. If $x=\sqrt{\frac{1-\cos\theta}{1+\cos\theta}}$, then $\frac{2x}{1-x^2}=$
(a) $\sin\theta$ (b) $\cos\theta$
(c) $\tan\theta$ (d) $\cot\theta$

26. If $\sin A+\sin B=l$, $\cos A-\cos B=m$, then the value of $\cos(A-B)=$
(a) $\frac{l^2-m^2}{l^2+m^2}$ (b) $\frac{l^2+m^2}{l^2-m^2}$
(c) $\frac{2lm}{l^2+m^2}$ (d) $\frac{2lm}{l^2-m^2}$

27. $\tan\left(\frac{1}{2}\cos^{-1}0\right)=$
(a) 0 (b) -1 (c) 1 (d) $\frac{1}{2}$

28. The value of θ satisfying $\sin 5\theta = \sin 3\theta - \sin\theta$ and $0 < \theta < \frac{\pi}{2}$ are :

(a) $\frac{\pi}{6}, \frac{\pi}{3}$ (b) $\frac{\pi}{6}, \frac{\pi}{4}$ (c) $\frac{\pi}{4}, \frac{\pi}{3}$ (d) $\frac{\pi}{4}, \frac{\pi}{2}$

29. The domain and range of $f(x) = \cot h\, x$ are respectively ..... .

(a) $R - \{0\}$, $R - [-1, 1]$
(b) $R - \{-1, 1\}$, $R - \{0\}$
(c) R, $R - \{0\}$
(d) $R - \{0\}$, R

30. If $\cos^{-1}\frac{3}{5} - \sin^{-1}\frac{4}{5} = \cos^{-1} x$, then $x =$

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

31. If in a ΔABC, $s = 2b$, $\cot\frac{A}{2}\cot\frac{C}{2}$ is equal to :

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

32. If the sides of a ΔABC are 6, 8, 10 unity, then the radius of its, circumcircle is :

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

33. From the top of a building 60 m high the angle of elevation of a top of a tower is found to be equal to the angle of depression of a foot of a tower, then the height of tower is (in metre) ..... .

(a) 90 (b) 105 (c) 100 (d) 120

34. A point moves such that $PA^2 - PB^2 = 4a^2$ where A and B are the points $(a, 0)$ and $(-a, 0)$ respectively, the locus of P is

(a) a straight line (b) a circle
(c) an ellipse (d) a parabola

35. A line passing through $A(1, -2)$ has slope 1. The points as the line at a distance of $4\sqrt{2}$ units from A, are

(a) $(3, -6), (5, 2)$ (b) $(-3, 6), (5, -2)$
(c) $(-3, -6), (5, 2)$ (d) $(3, 6), (-5, 2)$

36. If the point of intersection of $kx + 4y + 2 = 0$, $x - 3y + 5 = 0$ lies on $2x + 7y - 3 = 0$, then $k =$

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

37. The equation of the line which touches both the curve $y^2 = 4x$ and $3x^2 - 4y^2 = 12$ is :

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

38. If $2x + 3y + 4 = 0$ is the perpendicular bisector of the segment joining points $A(1, 2)$ and $B(\alpha, \beta)$ then the value of $(\alpha + \beta)$ is :

(a) $-\frac{81}{13}$ (b) $-\frac{136}{13}$ (c) $-\frac{135}{13}$ (d) $-\frac{134}{13}$

39. The point of intersection of straight lines represented by $6x^2 + xy - 40y^2 - 35x - 83y + 11 = 0$ is :

(a) (3, 1) (b) (3, -1)
(c) (-3, 1) (d) (-3, -1)

40. The difference of slope of pair of lines $y^2 - 2xy\sec^2\alpha + (3 + \tan^2\alpha)(-1 + \tan^2\alpha)x^2 = 0$ is :

(a) 2 (b) 4 (c) 6 (d) 8

41. If $\left(\frac{1}{2}, \frac{2}{5}\right)$ be the middle point of the chord of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$, then its length is :

(a) $\frac{7}{5}\sqrt{41}$ (b) $\frac{7}{4}\sqrt{41}$
(c) $\frac{7}{3}\sqrt{41}$ (d) none of these

42. Given that for the circle $x^2 + y^2 - 4x + 6y + 1 = 0$, the line with equation $3x - y = 1$ is a chord. The middle point of the chord is :

(a) $\left(\frac{2}{5}, \frac{11}{5}\right)$ (b) $\left(-\frac{2}{5}, \frac{11}{5}\right)$
(c) $\left(-\frac{2}{5}, -\frac{11}{5}\right)$ (d) $\left(\frac{2}{5}, -\frac{11}{5}\right)$

43. The radical axis of co-axial system of circle with the limiting points (1, 2) and (4, 3) is given by in equation

(a) $3x - y + 10 = 0$ (b) $3x + y - 10 = 0$
(c) $3x + y + 10 = 0$ (d) $x + 3y - 10 = 0$

44. The product of length of perpendiculars from any point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, to its asymptotes is :

(a) a^2b^2 (b) $a^2 + b^2$
(c) $\frac{a^2 + b^2}{a^2b^2}$ (d) $\frac{a^2b^2}{a^2 + b^2}$

45. If $x+y+1=0$, touches the parabola $y^2=kx$, then the value of k is :
(a) -3 (b) 3 (c) -4 (d) 4

46. The eccentricity of the ellipse $9x^2+16y^2=144$ is :
(a) $\frac{4}{\sqrt{7}}$ (b) $\frac{2}{\sqrt{7}}$ (c) $\frac{\sqrt{7}}{4}$ (d) $\frac{\sqrt{7}}{3}$

47. An ellipse has one of the focus at (4, 0) and its eccentricity is $\frac{4}{5}$. The equation of ellipse is :
(a) $\frac{x^2}{25}+\frac{y^2}{9}=1$ (b) $\frac{x^2}{9}+\frac{y^2}{25}=1$
(c) $\frac{x^2}{5}+\frac{y^2}{4}=1$ (d) $\frac{x^2}{4}+\frac{y^2}{5}=25$

48. Radius of the director circle of hyperbola $\frac{x^2}{81}-\frac{y^2}{36}=1$ is :
(a) $2\sqrt{5}$ (b) $\sqrt{5}$ (c) $3\sqrt{5}$ (d) $\frac{\sqrt{5}}{2}$

49. $\lim_{x\to\infty}\frac{3x^2+1}{2x^2+1}=$
(a) $\frac{3}{2}$ (b) $\frac{2}{3}$ (c) $-\frac{3}{2}$ (d) $-\frac{2}{3}$

50. Given that the function 'f' defined by :
$$f(x)=\begin{cases}2x-1, & \text{if } x>2\\ k, & \text{if } x=2\\ x^2-1, & \text{if } x<2\end{cases}$$
is continuous, then the value of k is :
(a) 2 (b) 3 (c) 4 (d) -3

51. If $e^{x-y}=x^y$, then $\frac{dy}{dx}=$
(a) $\frac{\log x}{(1+\log x)^2}$ (b) $\frac{1-x}{(y+x\log y)}$
(c) $\frac{x-y}{x\log_e y}$ (d) $\frac{-\log x}{(1+\log x)^2}$

52. $\frac{d}{dx}\cos^{-1}\left(\frac{4x^3-27x}{27}\right)=$
(a) $\frac{3}{\sqrt{9-x^2}}$ (b) $\frac{1}{\sqrt{1-x^2}}$
(c) $-\frac{3}{\sqrt{9-x^2}}$ (d) $-\frac{1}{\sqrt{1-x^2}}$

53. The length of subnormal at $(-1, 4)$ on the curve $y=4x^2$, is :
(a) 4 (b) 8
(c) 16 (d) 32

54. The length of subtangent (if exist) at any point 'θ' on the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is :
(a) $a\,|\sin\theta|\sec^2\theta$ (b) $a\sin\theta|\sec\theta|$
(c) $a|\sin\theta\cos\theta|$ (d) $a\sin^2\theta|\sec\theta|$

55. The acute angle between the curves $xy=2$ and $y^2=4x$ is :
(a) $\tan^{-1}\left(\frac{1}{3}\right)$ (b) $\tan^{-1}(3)$
(c) $\tan^{-1}\left(\frac{1}{2}\right)$ (d) $\tan^{-1}\left(\frac{2}{3}\right)$

56. For a particle moving on a straight line it is observed that the distance 's' at the time 't' is given by $s=6t-\frac{1}{2}t^3$. The maximum velocity during the motion is :
(a) 3 (b) 6
(c) 9 (d) 12

57. If $x=\sin t, y=\sin pt$, then
$(1-x^2)\frac{d^2y}{dx^2}-x\frac{dy}{dx}+p^2y=$
(a) 0 (b) 1 (c) -1 (d) $\frac{1}{\sqrt{2}}$

58. If $y=(x^2-1)^n$, then
$(x^2-1)y_{n+2}+2xy_{n+1}=$
(a) $(n^2+1)y_n$ (b) $(n^2-1)y_n$
(c) $n(n^2-1)y_n$ (d) $n(n+1)y_n$

59. If $\int\frac{dx}{\sqrt{x}(x+9)}=f(x)+\text{constant}$, then $f(x)=$
(a) $\frac{2}{3}\tan^{-1}\sqrt{x}$ (b) $\frac{2}{3}\tan^{-1}\left(\frac{\sqrt{x}}{3}\right)$
(c) $\tan^{-1}\sqrt{x}$ (d) $\tan^{-1}\frac{\sqrt{x}}{3}$

60. $\lim_{n\to\infty}\left[\frac{n+1}{n^2+1^2}+\frac{n+2}{n^2+2^2}+\frac{n+3}{n^2+3^2}+\ldots..+\frac{1}{n}\right]=$
(a) $\frac{\pi}{4}+\frac{1}{2}\log 2$ (b) $\frac{\pi}{2}+\frac{1}{4}\log 2$
(c) $\frac{\pi}{4}+\frac{1}{4}\log 2$ (d) $\frac{\pi}{2}+\frac{1}{2}\log 2$

61. $\int_{-1}^{1} \tan^{-1} x \, dx =$

(a) 0 (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) $-\frac{\pi}{4}-1$

62. $I_n = \int \frac{\sin nx}{\sin x} dx$, where $n > 1$ then $I_n - I_{n-2} =$

(a) $\frac{2}{n-1}\cos(n-1)$ (b) $\frac{2}{n-1}\sin(n-1)x$

(c) $\frac{2}{n}\cos nx$ (d) $\frac{2}{n}\sin nx$

63. The area (in square units) bounded by the axis part of the curve $y = 1 + \frac{8}{x^2}$ and the lines $x = 2$ and $x = 4$ is :

(a) 2 (b) 3

(c) 4 (d) 5

64. Solution of differential equation $\frac{dy}{dx} = (1+y^2)(1+x^2)^{-1}$ is :

(a) $y - x = c(1 + xy)$ (b) $y + x = c(1 + xy)$

(c) $y + x = c(1 - xy)$ (d) $y - x = c(1 - xy)$

65. The ratio in which $\hat{i} + 2\hat{j} + 3\hat{k}$ divides the join of $-\hat{i} + 3\hat{j} + 5\hat{k}$ and $5\hat{i} - \hat{k}$ is :

(a) $-3 : 2$ (b) $1 : 2$

(c) $2 : 3$ (d) $-4 : 3$

66. If $\vec{a}$ and $\vec{b}$ are unit vectors. α is the angle between them, $\vec{a} - \vec{b}$ will be a unit vector, if $\alpha =$

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

(c) $\frac{2\pi}{3}$ (d) $\frac{\pi}{2}$

67. $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular unit vectors, then $|\vec{a} + \vec{b} + \vec{c}| =$

(a) $\sqrt{2}$ (b) 1

(c) $\sqrt{3}$ (d) 0

68. A unit vector perpendicular to $2\hat{i} + 3\hat{j} + 4\hat{k}$ and $4\hat{i} - 3\hat{j} + 2\hat{k}$ is :

(a) $\frac{3\hat{i} + 2\hat{j} - 3\hat{k}}{\sqrt{22}}$ (b) $\frac{3\hat{i} - 2\hat{j} - 3\hat{k}}{\sqrt{22}}$

(c) $\frac{3\hat{i} - 2\hat{j} + 3\hat{k}}{\sqrt{22}}$ (d) $\frac{-3\hat{i} + 2\hat{j} + 3\hat{k}}{\sqrt{22}}$

69. $\vec{a} = 2\hat{i} + 3\hat{j}$, $\vec{b} = \hat{i} + \hat{j} + \hat{k}$, $\vec{c} = \lambda\hat{i} + 4\hat{j} + 2\hat{k}$ are the continuous edges of parallelopiped of volume 2 cubic, then value of λ is :

(a) 1 (b) 2

(c) 3 (d) 4

70. $(\vec{b} \times \vec{c}) \cdot (\vec{c} \times \vec{a}) =$

(a) $[\vec{a}\ \vec{b}\ \vec{c}]\vec{c}$ (b) $[\vec{a}\ \vec{b}\ \vec{c}]$

(c) $[\vec{a}\ \vec{b}\ \vec{c}]\vec{a}$ (d) $\vec{a} \times (\vec{b} \times \vec{c})$

71. Two unbiased six faced dice are thrown. The probability that the sum of numbers of faces of them is a prime number greater than '5', is ..... .

(a) $\frac{1}{6}$ (b) $\frac{1}{4}$

(c) $\frac{2}{9}$ (d) $\frac{4}{9}$

72. If A and B are two events such that $P(A \cup B) = \frac{5}{6}$, $P(A \cap B) = \frac{1}{3}$, $P(A) = \frac{2}{3}$, then A and B are :

(a) dependent events

(b) independent events

(c) mutually exclusive events

(d) mutually exclusive and independent

73. The probability of choosing at randam a number which is divisible by 6 or 8 from among 1 to 90, is ..... .

(a) $\frac{1}{6}$ (b) $\frac{11}{90}$ (c) $\frac{1}{30}$ (d) $\frac{23}{90}$

74. If the mean and variance of a binomial variable X are respectively $\frac{35}{6}$ and $\frac{35}{36}$, then the probability of $X > 6$ is :

(a) $\frac{1}{2}$ (b) $\frac{5^7}{6^7}$

(c) $\frac{1}{7^6}$ (d) none of these

75. The parametric equation of the circle $x^2 + y^2 + x + \sqrt{3}y = 0$ is :

(a) $x = \cos\theta, y = \sin\theta$

(b) $x + \frac{1}{2} = \cos\theta, y + \frac{\sqrt{3}}{2} = \sin\theta$

(c) $x - \frac{1}{2} = \cos\theta, y - \frac{\sqrt{3}}{2}$

(d) none of these

Answers

Physics

1.	(b)	2.	(b)	3.	(c)	4.	(b)	5.	(d)	6.	(a)	7.	(a)	8.	(c)	9.	(b)	10.	(d)
11.	(c)	12.	(b)	13.	(a)	14.	(b)	15.	(d)	16.	(c)	17	(a)	18.	(d)	19.	(c)	20.	(b)
21.	(c)	22.	(a)	23.	(a)	24.	(b)	25.	(d)	26.	(a)	27.	(c)	28.	(b)	29.	(b)	30.	(c)
31.	(a)	32.	(d)	33.	(c)	34.	(a)	35.	(d)										

Part – B : Analytical Questions

1. $v = kE^{1/2} d^{-1/2}$ 2. v 3. 8.5 m/s

4. $r_{cm} = 1.6$ m, $v_{cm} = 1.8$ m/s 5. 0.70 rad/sec

6. At bottom, $T = 52$ N, At Top, $T = 12$ N 7. $d = \left(\frac{y-x}{y}\right)R$ 8. 58.3°C

9. 0.42 sec 10. 1.33 g 11. 6.25 cm 12. 120°

13. Ferromagnetic—Fe, Para magnetic—Mn, Al, Diamagnetic—Sb, bi
Correct order is—Fe, Mn, Al, Sb, bi

14. 6 15. $\frac{C_0}{2}(K_1 + K_2)$ 16. (i) $2\sqrt{2}\pi \times 10^{-7}$ T, (ii) $4\pi \times 10^{-7}$ T

17. 4 A, 1.5Ω 18. $_{13}Al^{27}$, $_{15}P^{30}$, Artificial radioactivity.

19. Moderators : Graphite & D_2O controller:B & Cd.

20. (i) 7143 Å, (ii) 0.75 eV

Chemistry

1.	(a)	2.	(d)	3.	(b)	4.	(b)	5.	(c)	6.	(b)	7.	(d)	8.	(a)	9.	(d)	10.	(a)
11.	(c)	12.	(d)	13.	(d)	14.	(a)	15.	(b)	16.	(b)	17	(d)	18.	(c)	19.	(d)	20.	(d)
21.	(a)	22.	(a)	23.	(a)	24.	(c)	25.	(c)	26.	(a)	27.	(d)	28.	(c)	29.	(b)	30.	(b)
31.	(d)	32.	(c)	33.	(b)	34.	(b)	35.	(c)										

Mathematics

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