EAMCET

ENGINEERING ENTRANCE EXAM

SOLVED PAPER–2002

PHYSICS

1. Tanks A and B open at the top contain two different liquids upto certain height in them. A hole is made to the wall of each tank at a depth h from the surface of the liquid. The area of the hole in B is twice that of in A. If the liquid mass flux through each hole is equal , then the ratio of the densities of the liquids respectively, is :
(a) 1 (b) $\frac{3}{2}$ (c) $\frac{2}{3}$ (d) $\frac{1}{2}$

2. A water barrel having water upto a depth d is placed on a table of height h. A small hole is made on the wall of the barrel at its bottom. If the stream of water coming out of the hole falls on the ground at a horizontal distance R from the barrel, then the value of d is :
(a) $\frac{4h}{R^2}$ (b) $4hR^2$ (c) $\frac{R^2}{4h}$ (d) $\frac{h}{4R^2}$

3. A glass capillary tube of inner diameter 0.28 mm is lowered vertically into water in a vessel. The pressure to be applied on the water in the capillary tube so that water level in the tube is same as that in the vessel (in N/m^2) is :
Surface tension of water = 0.07 N/m
Atmospheric pressure = 10^5 N/m^2
(a) 10^3 (b) 99×10^3
(c) 100×10^3 (d) 101×10^3

4. The Poisson's ratio of a material is 0.4. If a force is applied to a wire of this material, there is a decrease of cross- sectional area by 2%. The percentage increase in its length is :
(a) 3% (b) 2.5%
(c) 1% (d) 0.5%

5. If the displacement (x) and velocity (v) of a particle executing simple harmonic motion are related through the expression $4v^2 = 25 - x^2$, then time period is :
(a) π (b) 2π
(c) 4π (d) 6π

6. A body executes simple harmonic motion under the action of a force F_1 with a time period $\frac{4}{5}$ s. If the force is changed to F_2 it executes SHM with time period $\frac{3}{5}$ s. If both the forces F_1 and F_2 act simultaneously in the same direction on the body, its time period in seconds is :
(a) $\frac{12}{25}$ (b) $\frac{24}{25}$ (c) $\frac{35}{24}$ (d) $\frac{25}{12}$

7. A body is projected up with a velocity equal to $\frac{3}{4}$ th of the escape velocity from the surface of the earth. The height it reaches is : (Radius of the earth = R)
(a) $\frac{10R}{9}$ (b) $\frac{9R}{7}$ (c) $\frac{9R}{8}$ (d) $\frac{10R}{3}$

8. If A is the areal velocity of a planet of mass M, its angular momentum is :
(a) $\frac{M}{A}$ (b) $2MA$ (c) A^2M (d) AM^2

9. A body of mass M kg is on the top point of a smooth hemisphere of radius 5 m. It is released to slide down the surface of the hemisphere. It leaves the surface when velocity is 5 m/s. At this instant the angle made by the radius vector of the body with the vertical is : (Acceleration due to gravity = 10 ms^{-2})
(a) 30° (b) 45° (c) 60° (d) 90°

10. Moment of inertia of a uniform horizontal solid cylinder of mass M about an axis passing thorugh its edge and perpendicular to the axis of the cylinder when its length is 6 times its radius R is :

(a) $\frac{39MR^2}{4}$ (b) $\frac{30MR^2}{4}$

(c) $\frac{49MR}{4}$ (d) $\frac{49MR^2}{4}$

11. Consider the following statements A and B. Identify the correct choice in the given answers :

A. The refractive index of the extra-ordinary ray depends on the angle of incidence in double refraction.

B. The vibrations of light waves acquire one sidedness for both ordinary and extraordinary rays in double refraction.

(a) A and B are wrong
(b) A and B are correct
(c) A is correct and B is wrong
(d) A is wrong and B is correct

12. A thin magnetic iron rod of length 30 cm is suspended in a uniform magnetic field. Its time period of oscillation is 4s. It is broken into three equal parts. The time period in seconds of oscillation of one part when suspended in the same magnetic field is :

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

13. Consider the following two statements A and B and identify the correct choice in the given answers :

A. Paramagnetism is explained by domain theory.

B. Susceptibility of a diamagnetic substance is independent of temperature.

(a) Both A and B are correct
(b) Both A and B are worng
(c) A is correct and B is wrong
(d) A is wrong and B is correct

14. A body of mass 1g and carrying a charge 10^{-8}C passes from two points P and Q. P and Q are at electric potentials. 600 V and 0 V respectively. The velocity of the body at Q is 20 cms^{-1}. It velocity in ms^{-1} at P is :

(a) $\sqrt{0.028}$ (b) $\sqrt{0.056}$ (c) $\sqrt{0.56}$ (d) $\sqrt{5.6}$

15. A parallel plate capacitor of capacity 100 μF is charged by a battery of 50 volts. The battery remains connected and if the plates of the capacitor are separated so that the distance between them becomes double the original distance, the additional energy given by the battery to the capacitor in joules is :

(a) $\frac{125}{2}\times10^{-3}$ (b) 12.5×10^{-3}

(c) 1.25×10^{-3} (d) 0.125×10^{-3}

16. The time in seconds required to produce a potential difference of 20 V across a capacitor of 1000 μF when it is charged at the steady rate of 200 μC/s is :

(a) 50 (b) 100 (c) 150 (d) 200

17. The balancing length for a cell is 560 cm in a potentiometer experiment. When an external resistance of 10 Ω is connected in parallel to the cell, the balancing length changes by 60 cm. The internal resistance of the cell in ohms, is :

(a) 1.6 (b) 1.4
(c) 1.2 (d) 0.12

18. A conductor of resistance 3 Ω is stretched uniformly till its length is doubled. The wire is now bent in the form of an equilateral triangle. The effective resistance between the ends of any side of the triangle in ohms is :

(a) $\frac{9}{2}$ (b) $\frac{8}{3}$ (c) 2 (d) 1

19. A uniform conductor of resistance R is cut into 20 equal pieces. Half of them are joined in series and the remaining half of them are connected in parallel. If the two combinations are joined in series, the effective resistance of all the pieces is :

(a) R (b) $\frac{R}{2}$ (c) $\frac{101R}{200}$ (d) $\frac{201R}{200}$

20. The cold junction of a thermocouple is at 0°C. The thermo e.m.f. produced in the thermocouple is given by an equation $E = 16T - 0.04T^2$, where T is the temperature of the hot junction. The temperature of inversion and neutral temperature of the thermocouple are :

(a) 200°C; 400°C (b) 400°C; 200°C
(c) 200° C; 300°C (d) 300°C; 200°C

21. A conducting rod of length L rotates with angular speed ω in a uniform magnetic field of induction B which is perpendi- cular to its motion. The induced emf developed between the two ends of the rod is :

(a) $\frac{BL^2\omega}{4}$ (b) $\frac{BL^2\omega}{2}$ (c) $BL^2\omega$ (d) $2BL^2\omega$

22. A moving coil galvanometer of resistance 100 Ω shows full scale deflection when a current of 100 micro-amperes passes through it. If it is intended to show full scale deflection when a current of 1 milli-ampere passes through it, the value of shunt resistance in ohms to be connected to the galvanometer is :

(a) $\frac{9}{4}$ (b) $\frac{10}{3}$ (c) $\frac{100}{9}$ (d) $\frac{900}{7}$

23. An electron revolves in a circle of radius 0.4 Å with a speed of 10^6 m/s in a hydrogen atom. The magnetic field produced at the centre of the orbit due to the motion of the electron (in Tesla) is : [$\mu_0 = 4\pi \times 10^{-7}$ H/m, charge on the electron $= 1.6 \times 10^{-19}$ C]

(a) 0.1 (b) 1.0 (c) 10 (d) 100

24. Two photons of energies twice and thrice the work function of a metal are incident on the metal surface. Then the ratio of maximum velocities of the photoelectrons emitted in the two cases respectively, is :

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

25. In compton scattering process, the incident X-radiation is scattered at an angle 60°. The wavelength of the scattered radiation is 0.22 Å. The wavelength of the incident X-radiation in Å units is :

(a) 0.508 (b) 0.408 (c) 0.232 (d) 0.208

26. If λ_0 is the de-Broglie wavelength for a proton accelerated through a potential difference of 100 V, the de-Broglie wavelength for α-particle accelerated through the same potential difference is :

(a) $2\sqrt{2\lambda_0}$ (b) $\frac{\lambda_0}{2}$ (c) $\frac{\lambda_0}{2\sqrt{2}}$ (d) $\frac{\lambda_0}{\sqrt{2}}$

27. Consider the following statements A and B. Indentify the correct choice in the given answer.

A. p-n, p-p and n-n forces between nucleons are not equal and charge dependent
B. In nuclear reactor the fission reaction will be in accelerating state if the value of neutron reproduction factor $A > 1$

(a) Both A and B are correct
(b) Both A and B are wrong
(c) A is wrong and B is correct
(d) A is correct and B is wrong

28. The masses of neutron, proton and deutron in amu are 1.00893, 1.00813 and 2.01473 respectively. The packing fraction of the deutron in amu is :

(a) 11.65×10^{-4} (b) 23.5×10^{-4}
(c) 33.5×10^{-4} (d) 47.15×10^{-4}

29. In a transistor circuit, when the base current is increased by 50 micro-amperes keeping the collector voltage fixed at 2 volts, the collector current increases by 1 mA.The current gain of the transistor is :

(a) 20 (b) 40
(c) 60 (d) 80

30. A common emitter transistor amplifier has a current gain of 50. If the load resistance is 4 kΩ and input resistance is 500 Ω, the voltage gain of the amplifier is :

(a) 100 (b) 200 (c) 300 (d) 400

31. The van der Waals' equation for a gas is :

$$\left(P + \frac{a}{V^2}\right)(V - b) = nRT$$

where P, V, R, T and n represent the pressure, volume, universal gas constant, absolute temperature and number of moles of a gas respectively. a and b are constants. The ratio $\frac{b}{a}$ will have the following dimensional formula :

(a) $[M^{-1}L^{-2}T^2]$ (b) $[M^{-1}L^{-1}T^{-1}]$
(c) $[ML^2T^2]$ (d) $[MLT^{-2}]$

32. In the measurement of a physical quantity $X = \frac{A^2B}{C^{1/3}D^3}$. The percentage errors introduced in the measurements of the quantities A, B, C, and D are 2%, 2%, 4% and 5% respectively. Then the minimum amount of percentage error in the measurement of X is contributed by :

(a) A (b) B (c) C (d) D

33. A proton of velocity $(3\hat{i}+2\hat{j})\ ms^{-1}$ enters a field of magnetic induction $(2\hat{j}+3\hat{k})$ tesla, the acceleration produced in the proton in ms^{-2} is : (Specific charge of proton $=0.96\times10^8\ Ckg^{-1}$)
(a) $2.8\times10^8\ (2\hat{i}-3\hat{j})$
(b) $2.88\times10^8\ (2\hat{i}-3\hat{j}+2\hat{k})$
(c) $2.8\times10^8\ (2\hat{i}+3\hat{k})$
(d) $2.88\times10^8\ (\hat{i}-3\hat{j}+2\hat{k})$

34. The horizontal and vertical displace- ments of a projectile at time t are $x=36\,t$ and $y=48\,t-4.9t^2$ respectively. Initial velocity of the projectile in m/s is :
(a) 15 (b) 30 (c) 45 (d) 60

35. A body of mass 4 kg is moving with momentum of 8 kg ms^{-1}. A force of 0.2N acts on it in the direction of motion of the body for 10 seconds. The increase in kinetic energy in joules is :
(a) 10 (b) 8.5 (c) 4.5 (d) 4

36. A body is moving up an inclined plane of angle θ with an initial kinetic energy E. The coefficient of friction between the plane and the body is μ. The work done against friction before the body comes to rest is :
(a) $\frac{\mu\cos\theta}{E\cos\theta+\sin\theta}$ (b) E
(c) $\frac{\mu E\cos\theta}{\mu\cos\theta-\sin\theta}$ (d) $\frac{\mu E\cos\theta}{\mu\cos\theta+\sin\theta}$

37. A body of mass 2 kg starts from rest and moves with unifrom acceleration. It acquires a velocity 20 ms^{-1} in 4s. The power exerted on the body in 2s in watts is :
(a) 50 (b) 100 (c) 150 (d) 200

38. A body is sliding down a rough inclined plane. The coefficient of friction between the body and the plane is 0.5. The ratio of the net force required for the body to slide down and the normal reaction on the body is 1 : 2. Then the angle of the inclined plane is :
(a) 15° (b) 30° (c) 45° (d) 60°

39. Particles of masses m, $2m$, $3m$ ... nm grams are placed on the same line at distance $l, 2\,l, 3\,l$ ..... nl cm from a fixed point. The distance of centre of mass of the particles from the fixed point in centimetre is :
(a) $\frac{(2n+1)l}{3}$ (b) $\frac{l}{n+1}$
(c) $\frac{n(n^2+1)l}{2}$ (d) $\frac{2l}{n(n^2+1)}$

40. The diameter of a flywheel is 1m. It has a mass of 20 kg. It is rotating about its axis with a speed of 120 rotations in one minute. Its angular momentum in kg - m^2/s is :
(a) 13.4 (b) 31.4 (c) 41.4 (d) 43.4

41. The coefficients of apparent expansion of a liquid when determined using two different vessels A and B are γ_1 and γ_2 respectively. If the coefficient of linear expansion of the vessel A is α, the coefficient of linear expansion of the vessel B is :
(a) $\frac{a\gamma_1\gamma_2}{\gamma_1+\gamma_2}$ (b) $\frac{\gamma_1-\gamma_2}{2\alpha}$
(c) $\frac{\gamma_1-\gamma_2+\alpha}{3}$ (d) $\frac{\gamma_1-\gamma_2}{3}+\alpha$

42. The mass of oxygen gas occupying a volume of 11.2 litres at a temperature 27°C and a pressure of 760 nm of mercury in kilograms is :
[Molecular weight of oxygen = 32]
(a) 0.001456 (b) 0.01456
(c) 0.1456 (d) 1.1456

43. A mental sphere of radius r and specific heat S is rotated about an axis passing through its centre at a speed of n rotations per second. It is suddenly stopped and 50% of its energy is used in increasing its temperature. Then the raise in temperature of the sphere is :
(a) $\frac{2\pi^2n^2r^2}{5\,S}$ (b) $\frac{1\,\pi^2n^2}{10\,r^2S}$
(c) $\frac{7}{8}\pi r^2n^2S$ (d) $\frac{5\,(\pi rn)^2}{14\,S}$

44. 5 moles of Hydrogen $\left(\gamma=\frac{7}{5}\right)$ initially at S.T.P. are compressed adiabatically so that its temperature becomes 400°C. The increase in the Internal Energy of the gas in kilo-joules is :
($R=8.30\ J\ mol^{-1}K^{-1}$)
(a) 21.56 (b) 41.55 (c) 65.55 (d) 80.55

45. When the temperature of a black body increases, it is observed that the wavelength corresponding to maximum energy changes from 0.26 μm to 0.13 μm. The ratio of the emissive powers of the body at the respective temperature is :
(a) $\frac{16}{1}$ (b) $\frac{4}{1}$ (c) $\frac{1}{4}$ (d) $\frac{1}{16}$

46. An auditorium has volume of $10^5 m^3$ and surface area of absorption $2 \times 10^4 m^2$. Its average absorption coefficient is 0.2. The reverberation time of the auditorium in seconds is :
(a) 6.5 (b) 5.5 (c) 4.25 (d) 3.25

47. A metallic were with tension T and at temperature 30°C vibrates with its fundamental frequency of 1 kHz. The same wire with the same tension but at 10°C temperature vibrates with a fundamental frequency of 1.001 kHz. The coefficient of linear expansion of the wire is :
(a) $2 \times 10^{-4}/°C$ (b) $1.5 \times 10^{-4}/°C$
(c) $1 \times 10^{-4}/°C$ (d) $0.5 \times 10^{-4}/°C$

48. A convex lens of focal length 0.15 m is made of a material of refractive index $\frac{3}{2}$. When it is placed in a liquid, its focal length is increased by 0.225 m. The refractive index of the liquid is :
(a) $\frac{7}{4}$ (b) $\frac{5}{4}$ (c) $\frac{9}{4}$ (d) $\frac{3}{2}$

49. A prism is made up of material of refractive index $\sqrt{3}$. The angle of the prism is Å. If the angle of minimum deviation is equal to the angle of the prism, then the value of A is :
(a) 30° (b) 45° (c) 60° (d) 75°

50. In Young's double slit interference experiment the wavelength of light used is 6000 Å. If the path difference between waves reaching a point P on the screen is 1.5 microns, then at that point P :
(a) Second bright band occurs
(b) Second dark band occurs
(c) Third dark band occurs
(d) Third bright band occurs

CHEMISTRY

1. X litre of carbon monoxide is present at STP. It is completely oxidized to CO_2. The volume of CO_2 formed is 11.207 litres. What is the value of X in litres ?
(a) 22.414 (b) 11.207
(c) 5.6035 (d) 44.828

2. The bond energies (in kJ mol^{-1}) of P—H, As—H and N—H are respectively :
(a) 247, 389 and 318
(b) 247, 389 and 318
(c) 318, 389 and 247
(d) 318, 247 and 389

3. Which one of the following represents the correct order of electronegativity ?
(a) P > O > N (b) N > P > O
(c) O > N > P (d) N > O > P

4. In the following reaction, X and Y are respectively :

$$CH_3COOH + NH_3 \longrightarrow X \xrightarrow{\Delta} Y + H_2O$$

(a) CH_3CONH_2, CH_4
(b) CH_3COONH_4, CH_3CONH_2
(c) CH_3CONH_2, CH_3COOH
(d) CH_3NH_2, CH_3CONH_2

5. Which one of the following is the molecular formula of a tertiary amine ?
(a) C_2H_7N (b) C_3H_9N (c) CH_5N (d) CH_3N

6. 4 g of an ideal gas occupies 5.6035 L of volume at 546K and 2 atmosphere pressure. What is its molecular weight ?
(a) 4 (b) 16 (c) 32 (d) 64

7. Which one of the following statements is correct with respect to basic character ?
(a) $PH_3 > P(CH_3)_3$ (b) $PH_3 = NH_3$
(c) $PH_3 > NH_3$ (d) $P(CH_3)_3 > PH_3$

8. The calculated magnetic moment (in Bohr magnetons of Cu^{2+} ion is :
(a) 1.73 (b) zero (c) 2.6 (d) 3.4

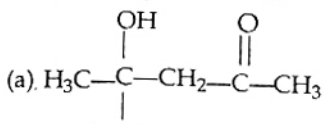
9. What is the catalyst used in the conversion of acetaldehyde to acetic acid ?
(a) Manganese acetate
(b) $LiAlH_4$
(c) H_2/Ni (d) Na/NH_3

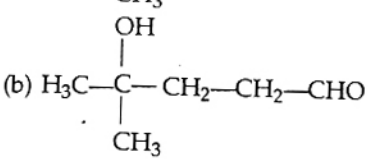
10. 75 mL of 0.2 M HCl is mixed with 25 mL of 1M HCl. To this solution, 300 mL of distilled water is added. What is the pH of the resultant solution ?
(a) 1 (b) 2
(c) 4 (d) 0.2

11. What are the products formed when ammonia reacts with excess chlorine ?
(a) N_2 and NCl_3 (b) NCl_3 and HCl
(c) N_2 and NH_4Cl (d) N_2 and HCl

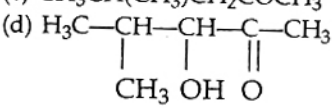
12. What is X in the following reaction ?

$$2CH_3COCH_3 \xrightarrow{Ba(OH)_2} X$$

(a) 

(b) 

(c) $CH_3CH(CH_3)CH_2COCH_3$

(d) 

13. Consider the following reaction :
$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$
The rate of this reaction in terms of N_2 at T K is
$\frac{-d[N_2]}{dt} = 0.02$ mol L^{-1} s^{-1}. What is the value of $-d[H_2]/dt$ (in units of mol L^{-1} s^{-1}) at the same temperature :
(a) 0.02 (b) 50 (c) 0.06 (d) 0.04

14. The concentration of a 100 mL solution containing X g of Na_2CO_3 (molecular wt. = 106) is Y M. The values of X and Y are respectively :
(a) 2.12, 0.05 (b) 1.06, 0.2
(c) 1.06, 0.1 (d) 2.12, 0.1

15. One mole of fluorine is reacted with two moles of hot concentrated KOH. The products formed are KF, H_2O and O_2. The molar ratio of KF, H_2O and O_2 respectively is :
(a) 1 : 1 : 2 (b) 2 : 1 : 0.5
(c) 1 : 2 : 1 (d) 2 : 1 : 2

16. In chloroethane, the carbon bearing halogen is bonded to ..... hydrogen (*s*). It is called ..... alkyl halide :
(a) two, primary (b) three, primary
(c) two, secondary (d) one, tertiary

17. What is the reduction electrode potential (in volts) of copper electrode when $[Cu^{2+}] = 0.01$M is in a solution at 25°C ? ($E°$ of Cu^{2+}/Cu electrode is + 0.34 V)
(a) 0.3991 (b) 0.2809
(c) 0.3105 (d) 0.3695

18. Which one of the following molecules contain both ionic and covalent bonds ?
(a) CH_2Cl_2 (b) K_2SO_4
(c) $BeCl_2$ (d) SO_2

19. 4 g of a hydrocarbon on complete combustion gave 12.571 g of CO_2 and 5.143 g of water. What is the empirical formula of the hydrocarbon ?
(a) CH (b) CH_2
(c) CH_3 (d) C_2H_3

20. What is the reaction occurring at the anode in Down's process for the extraction of sodium ?
(a) $4OH^- \longrightarrow 2H_2O + O_2 + 4e^-$
(b) $Na^+ + e^- \longrightarrow Na$
(c) $2Cl^- \longrightarrow Cl_2 + 2e^-$
(d) $NaOH \longrightarrow Na^+ + OH^-$

21. What is the minimum quantity (in grams) of methyl iodide required for preparing one mole of ethane by Wurtz reaction ?
(Atomic weight of iodine = 127)
(a) 142 (b) 568
(c) 326 (d) 284

22. Which one of the following statements is not correct ?
(a) Physical adsorption decreases with increase in the temperature
(b) Physical adsorption is multilayered
(c) Activation energy of physical adsorption is very high
(d) Enthalpy change of physical adsorption is about 20 kJ mol^{-1}

23. The products formed when diethyl ether is reacted with cold HI are :
(a) $C_2H_5I + C_2H_5OH$
(b) $2C_2H_5I + H_2O$ (c) $2C_2H_5OH$
(d) $C_2H_5—O—O—C_2H_5 + H_2O$

24. Which one of the following is a correct pair with respect to molecular formula of xenon compound and hybridization state of xenon in it ?
(a) XeF_4, sp^3 (b) XeF_2, sp
(c) XeF_2, sp^3d (d) XeF_4, sp^2

25. Which one of the following statements is not correct ?
(a) Rydberg's constant and wave number have same units
(b) Lyman series of hydrogen spectrum occurs in the ultraviolet region
(c) The angular momentum of the electron in the ground state hydrogen atom is equal to $h/2\pi$
(d) The radius of first Bohr orbit of hydrogen atom is 2.116×10^{-8} cm

26. When bauxite powder is mixed with coke and reacted with nitrogen at 2075K, carbon monoxide and X are formed. What is the gas formed when X is reacted with water ?
(a) NH_3 (b) N_2
(c) N_2O (d) O_2

27. What is the gas liberated when alkaline formaldehyde solution is treated with H_2O_2 ?
(a) CO_2 (b) O_2
(c) CH_4 (d) H_2

28. The chemicals used for preparing acetophenone are :
(A) C_6H_6
(B) CH_3COCH_3
(C) CH_3COCl
(D) Anhydrous $AlCl_3$
(a) A, B, C (b) B, C, D
(c) A, C, D (d) A, B, D

29. Which one of the following statements is correct ?
(a) Bronsted-Lowery theory could not explain the acidic nature of BCl_3
(b) The pH of 0.01 M NaOH solution is 2
(c) The ionic product of water at 25°C is $10^{-10} mol^2 L^{-2}$
(d) The pH of a solution can be calculated using the equation $pH = \log [H^+]$

30. Fluorosis disease is caused due to the reaction of ..... with excess of fluoride in the body :
(a) Ca (b) Mg (c) Fe (d) K

31. One mole of $A(g)$ is heated to 200°C in a one litre closed flask, till the following equilibrium is reached.
$A(g)$ $B(g)$
The rate of forward reaction at equilibrium is 0.02 mol L^{-1} min^{-1}. What is the rate (in mol L^{-1} min^{-1}) of the backward reaction at equilibrium ?
(a) 0.04 (b) 0.01 (c) 0.02 (d) 1

32. The energy of an electromagnetic radiation is 19.875×10^{-13} ergs. What is its wave number in cm^{-1} ? ($h = 6.625 \times 10^{-27}$ erg sec; $c = 3 \times 10^{10}$ cm sec^{-1}) :
(a) 1000 (b) 10^6 (c) 100 (d) 10,000

33. The products formed when heavy water is reacted with magnesium nitride, are :
(a) NH_3, $Mg(OH)_2$
(b) NH_3, $Mg(OD)_2$
(c) ND_3, $Mg(OH)_2$
(d) ND_3, $Mg(OD)_2$

34. The reagent used in the preparation of aspirin from salicylic acid is :
(a) $SOCl_2$/pyridine
(b) CH_3COOH/HCl
(c) $(CH_3CO)_2O$/Conc. H_2SO_4
(d) $CH_3Cl/AlCl_3$

35. In the following reaction, X and Y respectively are

$$C_2H_5OH \xrightarrow{KMnO_4/H^+} X \xrightarrow[H_2SO_4/\Delta]{Y} CH_3COOC_2H_5$$

(a) CH_3OH, C_2H_5OH
(b) CH_3CHO, CH_3OH
(c) $CH_2= CH_2$, CH_3COOH
(d) CH_3COOH, C_2H_5OH

36. At 27°C, a closed vessel contains a mixture of equal weights of helium (mol. wt. = 4), methane (mol, wt. = 16) and sulphur dioxide (mol. wt. = 64). The pressure exerted by the mixture is 210 mm. If the partial pressures of helium, methane and sulphur dioxide are p_1, p_2 and p_3 respectively, which one of the following is correct ?

(a) $p_3 > p_2 > p_1$ (b) $p_1 > p_2 > p_3$
(c) $p_1 > p_3 > p_2$ (d) $p_2 > p_3 > p_1$

37. The compound formed when gypsum is dissolved in aqueous ammonium sulphate solution, is :

(a) $CaSO_4.NH_4Cl.H_2O$
(b) $CaCl_2.(NH_4)_2SO_4.H_2O$
(c) $CaSO_4(NH_4)_2SO_4.2H_2O$
(d) $CaCl_2.NH_4Cl.2H_2O$

38. In the following reaction, A and B respectively are :

$$A \xrightarrow{HBr} C_2H_5Br \xrightarrow{B} A$$

(a) C_2H_4 and alcoholic KOH/Δ
(b) C_2H_5Cl and aqueous KOH/Δ
(c) C_2H_5OH and aqueous KOH/Δ
(d) C_2H_2 and PBr_3

39. 0.066 g of metal was deposited when a current of 2 ampere is passed through a metal ion solution for 100 seconds. What is the electrochemical equivalent (in gram coulomb^{-1}) of the metal ?

(a) 3.3×10^{-6} (b) 3.3×10^{-4}
(c) 0.033 (d) 3.3

40. What is the hybridization state of the central atom in the conjugate base of NH_4^+ ion ?

(a) sp (b) sp^3
(c) sp^2 (d) dsp^2

41. 10 g of a radioactive element is disintegrated to 1 g in 2.303 minutes. What is the half-life (in minutes) of that radioactive element ?

(a) 1/0.693 (b) 6.93
(c) 1 (d) 0.693

42. Iron sulphide is heated in air to form A an oxide of sulphur. A is dissolved in water to give an acid. The basicity of this acid is :

(a) 2 (b) 3
(c) 1 (d) zero

43. The reaction conditions used for converting 1, 2-dibromo ethane to ethy- lene are :

(a) Zn, alcohol, Δ
(b) KOH, alcohol, Δ
(c) KOH, water, Δ
(d) Na, alcohol, Δ

44. Calculate the heat of combustion (in kJ) of methane from the following data :

(i) $C_{(graphite)} + 2H_2(g) \longrightarrow CH_4(g)$
$\Delta H = -74.8$ kJ

(ii) $C_{(graphite)} + O_2(g) \longrightarrow CO_2(g)$
$\Delta H = -393.5$ kJ

(iii) $H_2(g) + 1/2O_2(g) \longrightarrow H_2O(l)$
$\Delta H = -286.2$ kJ

(a) –891.1 (b) –816.3
(c) –965.9 (d) –1040.7

45. Oxalic acid reacts with concentrated H_2SO_4 to give a mixture of two gases. When this mixture is passed through caustic potash, one of the gases is absorbed. What is the product formed by the absorbed gas with caustic potash ?

(a) K_2SO_4 (b) K_2HCO_3
(c) K_2CO_3 (d) KOH

46. Which one of the following statements is correct ?

(a) The radius (R) of a nuclide of mass number A is given by the equation $R = R_0(A)^{1/2}$ (R_0 = constant)
(b) $_7N^{15}$ and $_8O^{16}$ are isobars
(c) The end product nuclide in thorium ($4n$) series is $_{83}Bi^{209}$
(d) $_{20}Ca^{40}$ has magic number of protons and magic number of neutrons

47. Thermite is a mixture of X parts of ferric oxide and Y parts of aluminium powder. X, Y respectively are :

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

48. Which one of the following is not an iso-electronic pair ?

(a) Mg^{2+}, C^{4-} (b) N^{3-}, O^{2-}
(c) N^{2-}, O^{2-} (d) F^-, Al^{3+}

49. The reagent used for converting acetylene to oxalic acid is :
(a) $HgSO_4$/aqueous H_2SO_4
(b) $HgSO_4/CH_3COOH$
(c) $KMnO_4/KOH$, 25°C
(d) Cr_2O_3/H_2SO_4

50. Which one of the following is a secondary alcohol ?
(a) 2-methyl-2-propanol
(b) 1-propanol
(c) 1-butanol
(d) 2-pentanol

MATHEMATICS

1. From a point on the level ground, the angle of elevation of the top of a pole is 30° on moving 20 metres nearer, the angle of elevation is 45°. Then the height of the pole (in metres), is :
(a) $10(\sqrt{3}-1)$ (b) $10(\sqrt{3}+1)$
(c) 15 (d) 20

2. If $\vec{a}.\hat{i} = \vec{a}.(\hat{i}+\hat{j}) = \vec{a}.(\hat{i}+\hat{j}+\hat{k})$, then $\vec{a}$ is equal to :
(a) $\hat{i}$ (b) $\hat{j}$
(c) $\hat{k}$ (d) $\hat{i}+\hat{j}+\hat{k}$

3. If three points A, B and C have position vectors $(1, x, 3), (3, 4, 7)$ and $(y, -2, -5)$ respectively and if they are collinear, then (x, y) is :
(a) $(2, -3)$ (b) $(-2, 3)$
(c) $(-2, -3)$ (d) $(2, -3)$

4. The orthogonal projection of $\vec{a}$ on $\vec{b}$ is :
(a) $\frac{(\vec{a}.\vec{b})\vec{a}}{|\vec{a}|^2}$ (b) $\frac{(\vec{a}.\vec{b})\vec{b}}{|\vec{b}|^2}$
(c) $\frac{\vec{a}}{|\vec{a}|^2}$ (d) $\frac{\vec{b}}{|\vec{b}|}$

5. If the position vectors of the vertices of a triangle are $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}-3\hat{j}-5\hat{k}$ and $3\hat{i}-4\hat{j}-4\hat{k}$, then the triangle is :.
(a) equilateral
(b) isosceles
(c) right angled isosceles
(d) right angled

6. If $[\vec{a}\,\vec{b}\,\vec{c}]=3$, then the volume (in cubic units) of the parallelopiped with $2\vec{a}+\vec{b}$, $2\vec{b}+\vec{c}$ and $2\vec{c}+\vec{a}$ as edges, is :
(a) 15 (b) 22
(c) 25 (d) 27

7. $(\vec{a}+\vec{b})\cdot(\vec{b}+\vec{c})\times(\vec{a}+\vec{b}+\vec{c})$ is equal to :
(a) 0 (b) $-[\vec{a}\,\vec{b}\,\vec{c}]$
(c) $2[\vec{a}\,\vec{b}\,\vec{c}]$ (d) $[\vec{a}\,\vec{b}\,\vec{c}]$

8. A bag contains 5 black balls, 4 white balls and 3 red balls. If a ball is selected at random, the probability that it is a black or a red ball, is :
(a) $\frac{1}{3}$ (b) $\frac{1}{4}$
(c) $\frac{5}{12}$ (d) $\frac{2}{3}$

9. The probability of getting qualified in IITJEE and EAMCET by a student are respectively $\frac{1}{5}$ and $\frac{3}{5}$. The probability that the student gets qualified for at least one of these test, is :
(a) $\frac{3}{25}$ (b) $\frac{8}{25}$ (c) $\frac{17}{25}$ (d) $\frac{22}{25}$

10. One die and a coin (both unbiased) are tossed simultaneously. The probability of getting 5 on the top of the die and tail on the coin is :
(a) $\frac{1}{2}$ (b) $\frac{1}{12}$ (c) $\frac{1}{6}$ (d) $\frac{1}{8}$

11. In a binomial distribution the probability of getting success is $\frac{1}{4}$ and the standard deviation is 3. Then its mean is :
(a) 6 (b) 8 (c) 10 (d) 12

12. If the mean of a poisson distribution is $\frac{1}{2}$, then the ratio of $P(X=3)$ to $P(X=2)$ is :
(a) 1 : 2 (b) 1 : 4 (c) 1 : 6 (d) 1 : 8

13. A random variable X takes the values 0, 1 and 2. If $P(X=1)=P(X=2)$ and $P(X=0)=0.4$, then the mean of the random variable X is :
(a) 0.2 (b) 0.7 (c) 0.5 (d) 0.9

14. If the axes are rotated through an angle 45° in the positive direction without changing the origin, then the co-ordinates of the point $(\sqrt{2}, 4)$ in the old system are :
(a) $(1-2\sqrt{2}, 1+2\sqrt{2})$
(b) $(1+2\sqrt{2}, 1-2\sqrt{2})$
(c) $(2\sqrt{2}, \sqrt{2})$
(d) $(\sqrt{2}, 2)$

15. If a straight line perpendicular to $2x-3y+7=0$ forms a triangle with the co-ordinate axes whose area is 3 sq. units, then the equation of the straight line is :
(a) $3x+2y=\pm 2$ (b) $3x+2y=\pm 6$
(c) $3x+2y=\pm 4$ (d) $3x+2y=\pm 8$

16. If a point $(x, y) = (\tan\theta + \sin\theta, \tan\theta - \sin\theta)$, then the locus of (x, y) is :
(a) $(x^2 y)^{2/3} + (xy^2)^{2/3} = 1$
(b) $x^2 - y^2 = 4xy$
(c) $x^2 - y^2 = 12xy$
(d) $(x^2 - y^2)^2 = 16xy$

17. If $(-2, 6)$ is the image of the point $(4, 2)$ with respect to the line $L=0$, then L is equal to :
(a) $6x-4y-7=0$ (b) $2x+3y-5=0$
(c) $3x-2y+5=0$ (d) $3x-2y+10=0$

18. If the co-ordinate axes are the bisectors of the angles between the pair of lines $ax^2+2hxy+by^2=0$ where $h^2 > ab$ and $a \neq b$, then :
(a) $a+b=0$ (b) $h=0$
(c) $h \neq 0, a+b=0$ (d) $a+b \neq 0$

19. If the angle 2θ is acute, then the acute angle between the pair of straight lines $x^2(\cos\theta - \sin\theta) + 2xy\cos\theta + y^2(\cos\theta + \sin\theta) = 0$, is :
(a) 2θ (b) $\frac{\theta}{2}$ (c) $\frac{\theta}{3}$ (d) θ

20. If the pair of straight lines $xy-x-y+1=0$ and the line $ax+2y-3a=0$ are concurrent, then a is equal to :
(a) 0 (b) 1 (c) -1 (d) 3

21. The acute angle between the two lines whose direction ratios are given by $l+m-n=0$ and $l^2+m^2-n^2=0$, is :
(a) 0 (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{3}$

22. The direction ratios of normal to the plane passing through $(0, 0, 1)$, $(0, 1, 2)$ and $(1, 0, 3)$, are :
(a) $(2, 1, -1)$ (b) $(1, 0, 1)$
(c) $(0, 0, -1)$ (d) $(1, 0, 0)$

23. If $P=(0, 1, 0)$, $Q=(0, 0, 1)$, then the projection of PQ on the plane $x+y+z=3$ is :
(a) 2 (b) $\sqrt{2}$
(c) 3 (d) $\sqrt{3}$

24. In the space the equation $by+cz+d=0$ represents a plane perpendicular to the :
(a) YOZ plane (b) ZOX plane
(c) XOY plane (d) none of these

25. A plane x passes through the point $(1, 1, 1)$. If b, c, a are the direction ratios of a normal to the plane, where a, b, c $(a<b<c)$ are the factors of 2001, then the equation of the plane is :
(a) $29x+31y+3z=63$
(b) $23x+29y-29z=23$
(c) $23x+29y+3z=55$
(d) $31x+37y+3z=71$

26. If the plane $7x+11y+13z=3003$ meets the co-ordinate axes in A, B, C, then the centroid of the ΔABC is :
(a) (143, 91, 77) (b) (143, 77, 91)
(c) (91, 143, 77) (d) (143, 66, 91)

27. The equation of the circle of radius 5 and touching the co-ordinate axes in third quadrant is :
(a) $(x-5)^2+(y+5)^2=25$
(b) $(x+5)^2+(y+5)^2=25$
(c) $(x+4)^2+(y+4)^2=25$
(d) $(x+6)^2+(y+6)^2=25$

28. The radius of the larger circle lying in the first quadrant and touching the line $4x+3y-12=0$ and the co-ordinate axes, is :
(a) 5 (b) 6
(c) 7 (d) 8

29. The four distinct points $(0, 0)$, $(2, 0)$, $(0, -2)$ and $(k, -2)$ are concyclic, if k is equal to :
(a) 3 (b) 1
(c) -2 (d) 2

30. A line is at a constant distance c from the origin and meets the co-ordinate axes in A and B. The locus of the centre of the circle passing through O, A, B is :
(a) $x^2+y^2=c^2$ (b) $x^2+y^2=2c^2$
(c) $x^2+y^2=3c^2$ (d) $x^2+y^2=4c^2$

31. The line $y=mx+c$ intercepts the circle $x^2+y^2=r^2$ in two distinct points, if :
(a) $-r\sqrt{1+m^2}<c<r\sqrt{1+m^2}$
(b) $c<-r\sqrt{1+m^2}$
(c) $c<r\sqrt{1+m^2}$
(d) none of these

32. The equation of the parabola with the focus (3, 0) and the directrix $x+3=0$, is :
(a) $y^2=3x$ (b) $y^2=6x$
(c) $y^2=12x$ (d) $y^2=2x$

33. If e and e' are the eccentricities of the ellipse $5x^2+9y^2=45$ and the hyperbola $5x^2-4y^2=45$ respectively, then ee' is equal to :
(a) 1 (b) 4 (c) 5 (d) 9

34. The pole of the straight line $x+4y=4$ with respect to the ellipse $x^2+4y^2=4$ is :
(a) (1, 1) (b) (1, 4)
(c) (4, 1) (d) (4, 4)

35. Locus of the poles of focal chord of a parabola is :
(a) the axis (b) a focal chord
(c) the directrix
(d) the tangent at the vertex

36. The equation $\frac{1}{r}=\frac{1}{8}+\frac{3}{8}\cos\theta$ represents :
(a) a parabola
(b) an ellipse
(c) a hyperbola
(d) a rectangular hyperbola

37. $\lim\limits_{x\to 0}\frac{4^x-9^x}{x(4^x+9^x)}$ is equal to :
(a) $\log\frac{2}{3}$ (b) $\log\frac{3}{2}$
(c) $\frac{1}{2}\log\frac{2}{3}$ (d) $\frac{1}{2}\log\frac{3}{2}$

38. The quadratic equation whose roots are l and m, where
$l=\lim\limits_{\theta\to 0}\left(\frac{3\sin\theta-4\sin^2\theta}{\theta}\right)$,
$m=\lim\limits_{\theta\to 0}\frac{2\tan\theta}{\theta(1-\tan^2\theta)}$, is :
(a) $x^2+5x+6=0$ (b) $x^2-5x+6=0$
(c) $x^2-5x-6=0$ (d) $x^2+5x-6=0$

39. If $f: R\to R$ is defined by $f(x)=x-[x]$, where $[x]$ is the greatest integer not exceeding x, then the set of discontinuous of f is :
(a) the empty set
(b) R
(c) Z
(d) N

40. If $f: R\to R$ defined by
$f(x)=\begin{cases}a^2\cos^2 x+b^2\sin^2 x & ,\ x\le 0\\ e^{ax+b} & ,\ x>0\end{cases}$
is a continuous function, then :
(a) $b=2\log|a|$ (b) $2b=\log|a|$
(c) $b=\log|2a|$ (d) $b^2=\log|a|$

41. Let $f(x)=e^x$, $g(x)=\sin^{-1}x$ and $h(x)=f(g(x))$, then $\frac{h'(x)}{h(x)}$ is equal to :
(a) $\sin^{-1}x$ (b) $\frac{1}{\sqrt{1-x^2}}$
(c) $-\frac{1}{\sqrt{1-x^2}}$ (d) $e^{\sin^{-1}x}$

42. If $f(x)=\sqrt{ax}+\frac{a^2}{\sqrt{ax}}$, then $f'(a)$ is equal to :
(a) 0 (b) -1 (c) 1 (d) a

43. If $y=ae^x+be^{-x}+c$, where a, b, c are parameters, then y''' is equal to :
(a) 0 (b) y (c) y' (d) y''

44. If $y=a\cos(\log x)+b\sin(\log x)$, where a, b are parameters, then $x^2y''+xy'$ is equal to :
(a) y (b) $-y$ (c) $2y$ (d) $-2y$

45. The two curves $x=y^2, xy=a^3$ cut orthogonally at a point, then a^2 is equal to :
(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) 1 (d) 2

46. If $\log(1+x)-\frac{2x}{2+x}$ is increasing, then :
(a) $0<x<\infty$ (b) $-\infty<x<0$
(c) $-\infty<x<\infty$ (d) $-1<x<2$

47. The functions $f(x) = xe^{-x}$, $\forall\ (x \in R)$ attains a maximum value at x is equal to :

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

48. The approximate value of $(1.0002)^{3000}$ is :

(a) 1.2 (b) 1.4 (c) 1.6 (d) 1.8

49. If $z = \frac{y}{x}\left[\sin\frac{x}{y} + \cos\left(1 + \frac{y}{x}\right)\right]$, then $x\frac{\partial z}{\partial x}$ is equal to :

(a) $y\frac{\partial z}{\partial y}$ (b) $-y\frac{\partial z}{\partial y}$

(c) $2y\frac{\partial z}{\partial y}$ (d) $2y\frac{\partial z}{\partial x}$

50. If $z = \sec(y - ax) + \tan(y + ax)$, then $\frac{\partial^2 z}{\partial x^2} - a^2\frac{\partial^2 z}{\partial y^2}$ is equal to :

(a) 0 (b) $-z$ (c) z (d) $2x$

51. $\int \frac{dx}{1 - \cos x - \sin x}$ is equal to :

(a) $\log\left|1 + \cot\frac{x}{2}\right| + c$

(b) $\log\left|1 - \tan\frac{x}{2}\right| + c$

(c) $\log\left|1 - \cot\frac{x}{2}\right| + c$

(d) $\log\left|1 + \tan\frac{x}{2}\right| + c$

52. $\int \frac{dx}{7 + 5\cos x}$ is equal to :

(a) $\frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{1}{\sqrt{3}}\tan\frac{x}{2}\right) + c$

(b) $\frac{1}{\sqrt{6}}\tan^{-1}\left(\frac{1}{\sqrt{6}}\tan\frac{x}{2}\right) + c$

(c) $\frac{1}{7}\tan^{-1}\left(\tan\frac{x}{2}\right) + c$

(d) $\frac{1}{4}\tan^{-1}\left(\tan\frac{x}{2}\right) + c$

53. $\int \frac{3^x\,dx}{\sqrt{9^x - 1}}$ is equal to :

(a) $\frac{1}{\log 3}\log\left|3^x + \sqrt{9^x - 1}\right| + c$

(b) $\frac{1}{\log 3}\log\left|3^x - \sqrt{9^x - 1}\right| + c$

(c) $\frac{1}{\log 9}\log\left|3^x + \sqrt{9^x - 1}\right| + c$

(d) $\frac{1}{\log 3}\log\left|9^x + \sqrt{9^x - 1}\right| + c$

54. $\int_2^3 \frac{dx}{x^2 - x}$ is equal to :

(a) $\log\frac{2}{3}$ (b) $\log\frac{4}{3}$ (c) $\log\frac{8}{3}$ (d) $\log\frac{1}{4}$

55. $\int_{-\pi/2}^{\pi/2} \sin^4 x\cos^6 x\,dx$ is equal to :

(a) $\frac{3\pi}{128}$ (b) $\frac{3\pi}{256}$ (c) $\frac{3\pi}{572}$ (d) $\frac{3\pi}{64}$

56. The approximate value of $\int_1^9 x^2\,dx$ by using trapezoidal rule with 4 equal intervals, is :

(a) 248 (b) 242.5

(c) 242.8 (d) 243

57. Order of the differential equation of the family of all concentric circles centered at (h, k), is :

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

58. The solution of $\frac{dy}{dx} + \frac{1}{3}y = 1$ is :

(a) $y = 3 + ce^{x/3}$ (b) $y = 3 + ce^{-x/3}$

(c) $3y = c + e^{x/3}$ (d) $y^2 + x + x^2 + 2 = ce^{2x}$

59. $y + x^2 = \frac{dy}{dx}$ has the solution :

(a) $y + x^2 + 2x + 2 = ce^x$

(b) $y + x + 2x^2 + 2 = ce^x$

(c) $y^2 + x + x^2 + 2 = ce^{2x}$

(d) $y + x + x^2 + 2 = ce^{2x}$

60. The solution of $\frac{dy}{dx} = \left(\frac{x}{y}\right)^{-1/3}$ is :

(a) $x^{2/3} + y^{2/3} = c$ (b) $y^{2/3} - x^{2/3} = c$

(c) $x^{1/3} + y^{1/3} = c$ (d) $y^{1/3} - x^{1/3} = c$

61. Let $A = \{x \in R, x \neq 0, -4 \le x \le 4\}$ and $f : A \to R$ defined by $f(x) = \frac{|x|}{x}$ for $x \in A$.

Then the range of f is :

(a) $\{1, -1\}$ (b) $\{x : 0 \le x \le 1\}$

(c) (1) (d) $\{x : -4 \le x \le 0\}$

62. If $f(x)=\frac{\cos^2 x+\sin^4 x}{\sin^2 x+\cos^4 x}$, for $x \in R$, then $f(2002)$ is equal to :
(a) 1 (b) 2 (c) 3 (d) 4

63. The function $f: R \to R$ is defined by $f(x)=\cos^2 x+\sin^4 x$ for $x \in R$, then $f(R)$ is equal to :
(a) $\left(\frac{3}{4}, 1\right]$ (b) $\left[\frac{3}{4}, 1\right)$
(c) $\left[\frac{3}{4}, 1\right]$ (d) $\left(\frac{3}{4}, 1\right)$

64. If the functions f and g are defined by $f(x)=3x-4$, $g(x)=2+3x$ for $x \in R$ respective, then $g^{-1}(f^{-1}(5))$ is equal to :
(a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{1}{4}$

65. The least number among $\sqrt[3]{4}$, $\sqrt[4]{5}$, $\sqrt[4]{7}$ and $\sqrt[3]{8}$ is :
(a) $\sqrt[3]{8}$ (b) $\sqrt[4]{7}$ (c) $\sqrt[3]{4}$ (d) $\sqrt[4]{5}$

66. If $\log 2=a$, $\log 3=b$, $\log 7=c$ and $6^x=7^{x+4}$, then x is equal to :
(a) $\frac{4b}{c+a-b}$ (b) $\frac{4c}{a+b-c}$
(c) $\frac{4b}{c-a-b}$ (d) $\frac{4a}{a+b-c}$

67. In the sequence, 1, (2, 3), (4, 5, 6), (7, 8, 9, 10) ... of sets, the sum of elements in the 50th set is :
(a) 62525 (b) 65225
(c) 56255 (d) 557625

68. The least value of the natural number n satisfying $C(n, 5)+C(n, 6)>C(n+1, 5)$ is :
(a) 10 (b) 11 (c) 12 (d) 13

69. The number of ways that 8 beads of different colours be strung as a necklace is :
(a) 2520 (b) 2880 (c) 4320 (d) 5040

70. The number of 5-digited number which are not divisible by 5 and which consists of different odd digits is :
(a) 24 (b) 32 (c) 96 (d) 120

71. If the coefficient of x in the expansion of $\left(x^2+\frac{k}{x}\right)^5$ is 270, then k is equal to :
(a) 1 (b) 2 (c) 3 (d) 4

72. The sum of the coefficients in the expansion of $(1+x+x^2)^n$ is :
(a) 2 (b) 2^n (c) 3^n (d) 4^n

73. In the expansion of $(1+x)^n$ the coefficients of pth and $(p+1)$th terms are respectively p and q, then $p+q$ is equal to :
(a) n (b) $n+1$ (c) $n+2$ (d) $n+3$

74. If $\frac{1-x+6x^2}{1-x^3}=\frac{A}{x}+\frac{B}{1+x}+\frac{C}{1+x}$, then A is equal to :
(a) 1 (b) 2 (c) 3 (d) 4

75. $1+x\log_e a+\frac{x^2}{2!}(\log_e a)^2+\frac{x^3}{3!}(\log_e a)^3$ $+\ldots.\ (a>0, x \in R)$ is equal to :
(a) a (b) a^x (c) $a^{\log_e x}$ (d) x

76. $1+\frac{1+2}{2!}+\frac{1+2+2^2}{3!}+\ldots$ is equal to :
(a) e^2+e (b) e^2 (c) e^2-1 (d) e^2-e

77. If the equations $x^2+ax+b=0$ and $x^2+bx+a=0$ $(a \neq b)$ have a common root, then $a+b$ is equal to :
(a) -1 (b) 1 (c) 3 (d) 4

78. If 3 is a root of $x^2+kx-24=0$. It is also a root of :
(a) $x^2+5x+k=0$ (b) $x^2+kx+24=0$
(c) $x^2-kx+6=0$ (d) $x^2-5x+k=0$

79. To remove the second term of the equation $x^4-8x^3+x^2-x+3=0$, diminish the roots of the equation by :
(a) 1 (b) 2 (c) 3 (d) 4

80. The maximum possible number of real roots of the equation $x^5-6x^2-4x+5=0$ is :
(a) 0 (b) 3 (c) 4 (d) 5

81. If α, β, γ are the roots of the equation $x^3+ax^2+bx+c=0$, then $\alpha^{-1}+\beta^{-1}+\gamma^{-1}$ is equal to :
(a) $\frac{a}{c}$ (b) $\frac{c}{a}$ (c) $-\frac{b}{c}$ (d) $\frac{b}{a}$

82. If $\frac{1+\sqrt{3}i}{2}$ is a root of the equation $x^4-x^2+x-1=0$. Then its real roots are :
(a) 1, 1 (b) $-1, -1$
(c) 1, 2 (d) $1, -1$

83. If α, β, γ are the roots of $2x^3 - 2x - 1 = 0$, then $(\Sigma \alpha \beta)^2$ is equal to :
(a) -1 (b) 1 (c) 2 (d) 3

84. If A, B are square matrices of order 3. A is non singular and $AB = O$, then B is a :
(a) null matrix
(b) non singular matrix
(c) singular matrix
(d) unit matrix

85. If $A = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$, then det A is equal to :
(a) 2 (b) 5 (c) 3 (d) 4

86. If $x^2 + y^2 + z^2 \neq 0$, $x = cy + bz$, $y = az + cx$ and $z = bx + ay$, then $a^2 + b^2 + c^2 + 2abc$ is equal to :
(a) 1 (b) 2
(c) $a + b + c$ (d) $ab + bc + ca$

87. If $z = x + iy$ is a complex number satisfying $\left|z + \frac{i}{2}\right|^2 = \left|z - \frac{i}{2}\right|^2$, then the locus of z is :
(a) x-axis (b) y-axis
(c) $y = x$ (d) $2y = x$

88. If $1 - i$ is a root of the equation $x^2 + ax + b = 0$, then b is equal to :
(a) 1 (b) -1 (c) -2 (d) 2

89. If $x_n = \cos\left(\frac{\pi}{4^n}\right) + i \sin\left(\frac{\pi}{4^n}\right)$, then $x_1 x_2 x_3 \ldots \infty$ is equal to :
(a) $\frac{1 + i\sqrt{3}}{2}$ (b) $\frac{-1 + i\sqrt{3}}{2}$
(c) $\frac{1 - i\sqrt{3}}{2}$ (d) $\frac{-1 - i\sqrt{3}}{2}$

90. If $z = 3 + 5i$, then $z^3 + \bar{z} + 198$ is equal to :
(a) $-3 - 5i$ (b) $-3 + 5i$
(c) $3 - 5i$ (d) $3 + 5i$

91. If $f(x) = \sin^2\left(\frac{\pi}{8} + \frac{x}{2}\right) - \sin^2\left(\frac{\pi}{8} - \frac{x}{2}\right)$, then the period of f is :
(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{2}$ (c) π (d) 2π

92. If $\cos(\alpha + \beta) = \frac{4}{5}$, $\sin(\alpha - \beta) = \frac{5}{13}$ and α, β between 0 and $\frac{\pi}{4}$, then $\tan 2\alpha$ is equal to :
(a) $\frac{56}{33}$ (b) $\frac{33}{56}$ (c) $\frac{16}{65}$ (d) $\frac{60}{61}$

93. $\cos^2 76° + \cos^2 16° - \cos 76° \cos 16°$ is equal to :
(a) 0 (b) $\frac{1}{2}$ (c) $-\frac{1}{4}$ (d) $\frac{3}{4}$

94. $\sum_{k=1}^{3} \cos^2\left((2k-1)\frac{\pi}{12}\right)$ is equal to :
(a) 0 (b) $\frac{1}{2}$ (c) $-\frac{1}{2}$ (d) $\frac{3}{2}$

95. If $\frac{3 + 2i \sin\theta}{1 - 2i \sin\theta}$ is a real number and $0 < \theta < 2\pi$, then θ is equal to :
(a) π (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

96. If $\sin^{-1} x - \cos^{-1} x = \frac{\pi}{6}$, then x is equal to :
(a) $\frac{1}{2}$ (b) $\frac{\sqrt{3}}{2}$ (c) $-\frac{1}{2}$ (d) $-\frac{\sqrt{3}}{2}$

97. $\sinh ix$ is equal to :
(a) $i \sin x$ (b) $\sin ix$
(c) $-i \sin x$ (d) $i \sin ix$

98. The perimeter of a triangle is 16 cm, one of the sides is of length 6 cm. If the area of the triangle is 12 sq cm. Then the triangle is :
(a) right angled (b) isosceles
(c) equilateral (d) scalene

99. If the altitude of a triangle are in arithmetic progression, then the sides of the triangles are in :
(a) AP (b) HP (c) GP (d) AGP

100. If ΔABC is right angled at A, then $r_2 + r_3$ is equal to :
(a) $r_1 - r$ (b) $r_1 + r$ (c) $r - r_1$ (d) R

Answers

Physics

1.	(a)	2.	(c)	3.	(d)	4.	(b)	5.	(a)	6.	(a)	7.	(b)	8.	(b)	9.	(c)	10.	(d)
11.	(b)	12.	(d)	13.	(d)	14.	(a)	15.	(a)	16.	(b)	17	(c)	18.	(b)	19.	(c)	20.	(b)
21.	(b)	22.	(c)	23.	(c)	24.	(d)	25.	(d)	26.	(c)	27.	(c)	28.	(a)	29.	(a)	30.	(d)
31.	(a)	32.	(c)	33.	(b)	34.	(d)	35.	(c)	36.	(b)	37.	(b)	38.	(c)	39.	(a)	40.	(b)
41.	(d)	42.	(b)	43.	(a)	44.	(b)	45.	(d)	46.	(c)	47.	(d)	48.	(b)	49.	(c)	50.	(c)

Chemistry

1.	(b)	2.	(d)	3.	(c)	4.	(b)	5.	(b)	6.	(b)	7.	(d)	8.	(a)	9.	(a)	10.	(a)
11.	(b)	12.	(a)	13.	(c)	14.	(c)	15.	(b)	16.	(a)	17	(b)	18.	(b)	19.	(b)	20.	(c)
21.	(d)	22.	(c)	23.	(a)	24.	(c)	25.	(d)	26.	(a)	27.	(d)	28.	(c)	29.	(a)	30.	(a)
31.	(c)	32.	(d)	33.	(d)	34.	(c)	35.	(d)	36.	(b)	37.	(c)	38.	(a,c)	39.	(b)	40.	(b)
41.	(d)	42.	(a)	43.	(a)	44.	(a)	45.	(c)	46.	(d)	47.	(a)	48.	(c)	49.	(c)	50.	(d)

Mathematics

1.	(b)	2.	(a)	3.	(a)	4.	(b)	5.	(d)	6.	(d)	7.	(d)	8.	(d)	9.	(c)	10.	(b)
11.	(d)	12.	(c)	13.	(d)	14.	(a)	15.	(b)	16.	(d)	17	(c)	18.	(b)	19.	(d)	20.	(b)
21.	(d)	22.	(a)	23.	(b)	24.	(a)	25.	(c)	26.	(a)	27.	(b)	28.	(b)	29.	(d)	30.	(d)
31.	(a)	32.	(c)	33.	(a)	34.	(a)	35.	(c)	36.	(c)	37.	(a)	38.	(b)	39.	(c)	40.	(a)
41.	(b)	42.	(a)	43.	(c)	44.	(b)	45.	(b)	46.	(c)	47.	(a)	48.	(c)	49.	(b)	50.	(a)
51.	(c)	52.	(b)	53.	(a)	54.	(b)	55.	(b)	56.	(a)	57.	(a)	58.	(b)	59.	(a)	60.	(b)
61.	(a)	62.	(a)	63.	(c)	64.	(c)	65.	(d)	66.	(b)	67.	(a)	68.	(b)	69.	(a)	70.	(c)
71.	(c)	72.	(c)	73.	(b)	74.	(a)	75.	(b)	76.	(d)	77.	(a)	78.	(c)	79.	(b)	80.	(b)
81.	(c)	82.	(d)	83.	(b)	84.	(a)	85.	(a)	86.	(a)	87.	(a)	88.	(d)	89.	(a)	90.	(d)
91.	(d)	92.	(a)	93.	(d)	94.	(d)	95.	(a)	96.	(b)	97.	(a)	98.	(b)	99.	(b)	100.	(a)

Hints & Solutions

PHYSICS

1. Let the velocity of liquid from hole in A is v_1 and velocity of liquid from hole in B is v_2, then from equation of continuity

$$A_1 v_1 = A_2 v_2$$

$$A v_1 = 2A v_2$$

$$v_2 = \frac{v_1}{2}$$

Volume of liquid coming out per second from hole in tank $A = A_1 v_1 = A v_1$

$\therefore$ Mass $m_1 = A v_1 \rho_1$

Similarly, $m_2 = A_2 v_2 \rho_2$

$$= 2A \cdot \frac{v_1}{2} \rho_2$$

$$= A v_1 \rho_2$$