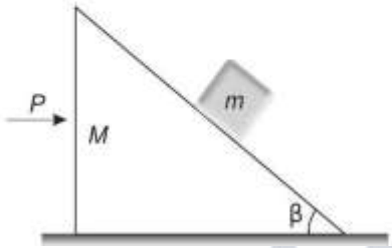
Physics

1. **If E, M, J and G respectively denote energy, mass, angular momentum and universal gravitational constant, the quantity, which has the same dimensions as the dimensions of $\frac{EJ^2}{M^5G^2}$**
(a) time (b) angle
(c) mass (d) length

2. **The work done in moving an object from origin to a point whose position vector is $\mathbf{r} = 3\hat{\imath} + 2\hat{\jmath} - 5\hat{k}$ by a force $\mathbf{F} = 2\hat{\imath} - \hat{\jmath} - \hat{k}$ is**
(a) 1 unit (b) 9 units
(c) 13 units (d) 60 units

3. **A particle is projected from the ground with an initial speed of v at an angle of projection θ. The average velocity of the particle between its time of projection and time it reaches highest point of trajectory is**
(a) $\frac{v}{2}\sqrt{1+2\cos^2\theta}$
(b) $\frac{v}{2}\sqrt{1+2\sin^2\theta}$
(c) $\frac{v}{2}\sqrt{1+3\cos^2\theta}$
(d) $v\cos\theta$

4. **Two wooden blocks of masses M and m are placed on a smooth horizontal surface as shown in figure. If a force P is applied to the system as shown in figure such that the mass m remains stationary with respect to block of mass M, then the magnitude of the force P is**



(a) $(M+m)g\tan\beta$ (b) $g\tan\beta$
(c) $mg\cos\beta$ (d) $(M+m)g\,\mathrm{cosec}\,\beta$

5. **A ball at rest is dropped from a height of 12. It losses 25% of its kinetic energy on striking the ground and bounces back to a height ' h '. Then value of ' h ' is**
(a) 3 m (b) 6 m
(c) 9 m (d) 12 m

6. **Two bodies of mass 4 kg and 5 kg are moving along east and north directions with velocities 5 m/s and 3 m/s respectively. Magnitude of the velocity of centre of mass of the system is**
(a) $\frac{25}{9}$ m/s (b) $\frac{9}{25}$ m/s
(c) $\frac{41}{9}$ m/s (d) $\frac{16}{9}$ m/s

7. **A mass of 2.9 kg is suspended from a string of length 50 cm and is at rest. Another body of mass 100 g, which is moving horizontally with a velocity of 150 m/s strikes and sticks to it. Subsequently when the string makes an angle of 60° with the vertical, the tension in the string is $(g = 10\ m/s^2)$**
(a) 140 N (b) 135 N
(c) 125 N (d) 90 N

8. **The upper half of an inclined plane with an angle of inclination ϕ, is smooth while the lower half is rough. A body starting from rest at the top of the inclined plane comes to rest at the bottom of the inclined plane. Then the coefficient of friction for the lower half is**
(a) $2\tan\phi$ (b) $\tan\phi$
(c) $2\sin\phi$ (d) $2\cos\phi$

9. **Moment of inertia of a body about an axis is $4\ kg - m^2$. The body is initially at rest and a torque of 8 N -m starts acting on it along the same axis. Work done by the torque in 20 s, in joules, is**
(a) 40 (b) 640
(c) 2560 (d) 3200

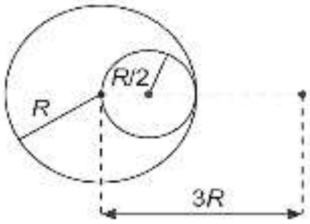
10. **A uniform circular disc of radius R, lying on a frictionless horizontal plane is rotating with an angular velocity ' ω ' about is its own axis. Another identical circular disc is gently placed on the top of the first disc coaxially. The loss in rotational kinetic energy due to friction between the two discs, as they acquire**

common angular velocity is (I is moment of inertia of the disc)

(a) $\frac{1}{8}/\omega^2$ (b) $\frac{1}{4}/\omega^2$

(c) $\frac{1}{2}/\omega^2$ (d) $/\omega^2$

11. **The gravitational force acting on a particle, due to a solid sphere of uniform density and radius R, at a distance of 3R from the centre of the sphere is F_1. A spherical hole of radius $(R/2)$ is now made in the sphere as shown in the figure. The sphere with hole now exerts a force F_2 on the same particle. Ratio of F_1 and F_2 is**



(a) $\frac{50}{41}$ (b) $\frac{41}{50}$ (c) $\frac{41}{42}$ (d) $\frac{25}{41}$

12. **Two particles A and B of masses ' m ' and ' 2m ' are suspended from massless springs of force constants K_1 and K_2. During their oscillation, if their maximum velocities are equal, then the ratio of amplitudes of A and B is**

(a) $\sqrt{\frac{K_1}{K_2}}$ (b) $\sqrt{\frac{K_2}{2K_1}}$

(c) $\sqrt{\frac{K_2}{K_1}}$ (d) $\sqrt{\frac{2K_1}{K_2}}$

13. **A tension of 20 N is applied to a copper wire of cross- sectional area $0.01\ \mathrm{cm}^2$, Young's modulus of copper is $1.1 \times 10^{11}\ \mathrm{N/m}^2$ and Poisson's ratio is 0.32 . The decrease in cross sectional area of the wire is**

(a) $1.16 \times 10^{-6}\ \mathrm{cm}^2$

(b) $1.16 \times 10^{-5}\ \mathrm{m}^2$

(c) $1.16 \times 10^{-4}\ \mathrm{m}^2$

(d) $1.16 \times 10^{-3}\ \mathrm{cm}^2$

14. **A capillary tube of radius ' r ' is immersed in water and water rises to a height of ' h '. Mass of water in the capillary tube is 5×10^{-3} kg. The same capillary tube is now immersed in a liquid whose surface tension is $\sqrt{2}$ times the surface tension of water. The angle of contact between the capillary tube and this liquid is 45°. The mass of liquid which rises into the capillary tube now is, (in kg)**

(a) 5×10^{-3} (b) 2.5×10^{-3}

(c) $5\sqrt{2} \times 10^{-3}$ (d) 3.5×10^{-3}

15. **The terminal velocity of a liquid drop of radius ' r ' falling through air is v. If two such drops are combined to form a bigger drop, the terminal velocity with which the bigger drop falls through air is (ignore any buoyant force due to air)**

(a) $\sqrt{2}$V (b) 2v

(c) $\sqrt[3]{4}$V (d) $\sqrt[3]{2}$v

16. **A glass flask of volume one litre is filled completely with mercury at 0°C. The flask is now heated to 100°C. Coefficient of volume expansion of mercury is $1.82 \times 10^{-4}/^\circ$C and coefficient of linear expansion of glass is $0.1 \times 10^{-4}/^\circ$C. During this process, amount of mercury which overflows is**

(a) 21.2 cc (b) 15.2 cc

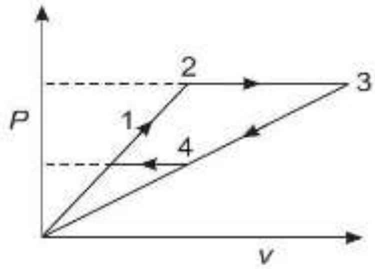
(c) 2.12 cc (d) 18.2 cc

17. **On a temperature scale Y, water freezes at -160°Y and boils at -50°Y. On this Y scale, a temperature of 340 K is**

(a) -160.3°Y (b) -96.3°Y

(c) -86.3°Y (d) -76.3°Y

18. **Three moles of an ideal monoatomic gas undergoes a cyclic process as shown in the figure. The temperature of the gas in different states marked as $1, 2, 3$ and 4 are 400 K, 700 K, 2500 K and 1100 K respectively. The work done by the gas during the process 1-2-3-4-1 is (universal gas constant is R)**



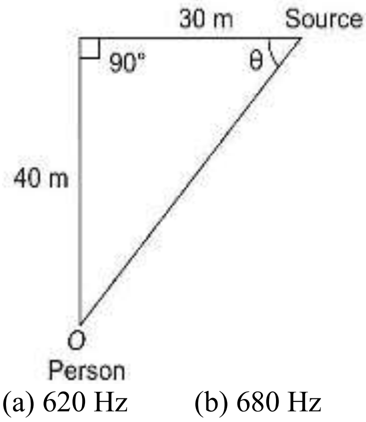
(a) 1650R (b) 550R
(c) 1100R (d) 2200R

19. Efficiency of a heat engine whose sink is at temperature of 300 K is 40%. To increase the efficiency to 60%, keeping the sink temperature constant, the source temperature must be increased by
(a) 750 K (b) 500 K
(c) 250 K (d) 1000 K

20. Two bodies A and B of equal surface area have thermal emissivities of 0.01 and 0.81 respectively. The two bodies are radiating energy at the same rate. Maximum energy is radiated from the two bodies A and B at wavelengths λ_A and λ_B respectively. Difference in these two wavelengths is 1μ m. If the temperature of the body A is 5802 K , then value of λ_B is
(a) $\frac{1}{2}$ μm (b) 1μ m
(c) 2μ m (d) $\frac{3}{2}$ μ m

21. An air column in a tube 32 cm long, closed at one end, is in resonance with a tuning fork. The air column in another tube, open at both ends, of length 66 cm is in resonance with another tuning fork. When these two tuning forks are sounded together, they produce 8 beats per second. Then the frequencies of the two tuning forks are, (Consider fundamental frequencies only)
(a) 250 Hz, 258 Hz (b) 240 Hz, 248 Hz
(c) 264 Hz, 256 Hz (d) 280 Hz, 272 Hz

22. A source of sound of frequency 640 Hz is moving at a velocity of $\frac{100}{3}$ m/s along a road, and is at an instant 30 m away from a point A on the road (as shown in figure). A person standing at O, 40 m away from the road hears sound of apparent frequency v'. The value of v' is (velocity of sound = 340 m/s)



(a) 620 Hz (b) 680 Hz
(c) 720 Hz (d) 840 Hz

23. The two surfaces of a concave lens made of glass of refractive index 1.5 have the same radii of curvature R. It is now immersed in a medium of refractive index 1.75 , then the lens
(a) becomes a convergent lens of focal length 3.5R
(b) becomes a convergent lens of focal length 3.0R
(c) changes as a divergent lens of focal length 3.5R
(d) changes as a divergent lens of focal length 3.0R

24. A microscope consists of an objective of focal length 1.9 cm and eye piece of focal length 5 cm . The two lenses are kept at a distance of 10.5 cm . If the image is to be formed at the least distance of distinct vision, the distance at which the object is to be placed before the objective is (least distance of distinct vision is 25 cm)
(a) 6.2 cm (b) 2.7 cm
(c) 21.0 cm (d) 4.17 cm

25. Fresnel diffraction is produced due to light rays falling on a small obstacle. The intensity of light at a point on a screen beyond an obstacle depends on

(a) the focal length of lens used for observation
(b) the number of half-period zones that superpose at the point
(c) the square of the sum of the number of half period zones
(d) the thickness of the obstacle

26. A short bar magnet having magnetic moment $4 \mathrm{Am}^2$, placed in a vibrating magnetometer, vibrates with a time period of 8 s . Another short bar magnet having a magnetic moment $8 \mathrm{Am}^2$ vibrates with a time period of 6 s . If the moment of inertia of the second magnet is 9×10^{-2} kg $-\mathrm{m}^2$, the moment of inertia of the first magnet is (assume that both magnets are kept in the same uniform magnetic induction field.)

(a) 9×10^{-2} kg $-\mathrm{m}^2$
(b) 8×10^{-2} kg $-\mathrm{m}^2$
(c) 5.33×10^{-2} kg $-\mathrm{m}^2$
(d) 12.2×10^{-2} kg $-\mathrm{m}^2$

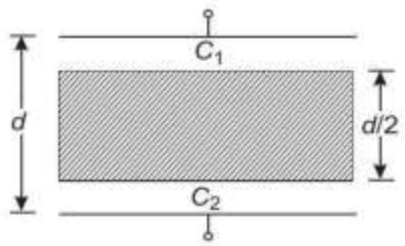
27. Two short bar magnets have their magnetic moments $1.2 \mathrm{Am}^2$ and $1.0 \mathrm{Am}^2$. They are placed on a horizontal table parallel to each other at a distance of 20 cm between their centres, such that their north poles pointing towards geographic south. They have common magnetic equatorial line. Horizontal component of earth's field is 3.6×10^{-5} T. Then, the resultant horizontal magnetic induction at mid point of the line joining their centers is $\frac{\mu_0}{4\pi} = 10^{-7}$ N/m

(a) 3.6×10^{-5} T (b) 1.84×10^{-4} T
(c) 2.56×10^{-4} T (d) 5.8×10^{-5} T

28. A deflection magnetometer is adjusted and a magnet of magnetic moment M is placed on it in the usual manner and the observed deflection is θ. The period of oscillation of the needle before settling of the deflection is T. When the magnet is removed, the period of oscillation of the needle is T_0 before settling to $0^\circ - 0^\circ$. If the earth's induced magnetic field is B_H, the relation between T and T_0 is

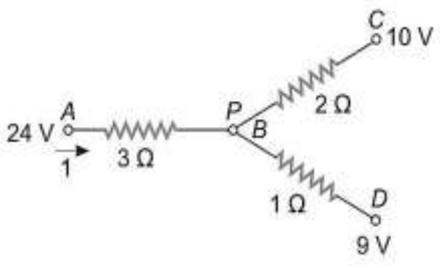
(a) $T^2 = T_0^2 \cos\theta$ (b) $T^2 = \frac{T_0^2}{\cos\theta}$
(c) $T = T_0 \cos\theta$ (d) $T = \frac{T_0}{\cos\theta}$

29. Two metal plates each of area ' A ' form a parallel plate capacitor with air in between the plates. The distance between the plates is ' d '. A metal plate of thickness $\frac{d}{2}$ and of same area A is inserted between the plates to form two capacitors of capacitances C_1 and C_2 as shown in the figure. If the effective capacitance of the two capacitors is C' and the capacitance of the capacitor initially is C, then $\frac{C'}{C}$ is



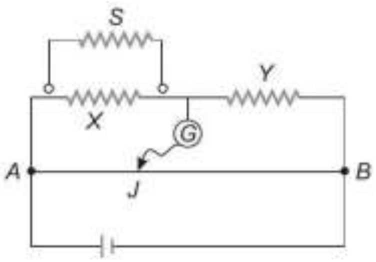
(a) 4 (b) 2 (c) 6 (d) 1

30. In the circuit shown in the figure, the current ' T ' is



(a) 6 A (b) 2 A (c) 4 A (d) 7 A

31. In the meter bridge experiment, the length AB of the wire is 1 m . The resistors X and Y have values 5Ω and 2Ω respectively. When a shunt resistance S is connected to X, the balancing point is found to be 0.625 m from A. Then, the resistance of the shunt is



(a) 5Ω (b) 10Ω
(c) 7.5Ω (d) 12.5Ω

32. The ends of an element of zinc wire are kept at a small temperature difference ΔT and a small current (I) is passed through the wire. Then, the heat developed per unit time
(a) is proportional to ΔT and l
(b) is proportional to I^3 and ΔT
(c) is proportional to Thomson coefficient of the metal
(d) is proportional to ΔT only

33. A series LCR circuit is connected across a source of alternating emf of changing frequency and resonates at frequency f_0. Keeping capacitance constant, if the inductance (L) is increased by $\sqrt{3}$ times and resistance is increased (R) by 1.4 times, the resonant frequency now is
(a) $3^{1/4} f_0$ (b) $\sqrt{3} f_0$
(c) $(\sqrt{3}-1)^{1/4} f_0$ (d) $\left(\frac{1}{3}\right)^{1/4} f_0$

34. The sensitivity of a galvanometer that measures current is decreased by $\frac{1}{40}$ times by using shunt resistance of 10Ω. Then, the value of the resistance of the galvanometer is
(a) 400Ω (b) 410Ω
(c) 30Ω (d) 390Ω

35. Initially a photon of wavelength λ_1 falls on photocathode and emits an electron of maximum energy E_1. If the wavelength of the incident photon is changed to λ_2, the maximum energy of the electron emitted becomes E_2. Then value of hc ($h=$ Planck's constant, $c=$ velocity of light) is
(a) $hc=\frac{(E_1+E_2)\lambda_1\lambda_2}{\lambda_2-\lambda_1}$
(b) $hc=\frac{E_1-E_2}{\lambda_2-\lambda_1}\cdot(\lambda_1\lambda_2)$
(c) $hc=\frac{(E_1-E_2)(\lambda_2-\lambda_1)}{\lambda_1\lambda_2}$
(d) $hc=\frac{\lambda_2-\lambda_1}{\lambda_1\lambda_2 E_2}\cdot E_1$

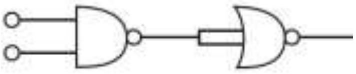
36. The work function of a metal is 2 eV . If a radiation of wavelength 3000Å is incident on it, the maximum kinetic energy of the emitted photoelectrons is (Planck's constant $h=6.6\times10^{-34}$ Js; velocity of light $c=3\times10^{8}$ m/s; $1\text{eV}=1.6\times10^{-19}$ J)
(a) 4.4×10^{-19} J (b) 5.6×10^{-19} J
(c) 3.4×10^{-19} J (d) 2.5×10^{-19} J

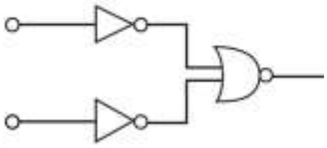
37. The radius of $_{72}Te^{125}$ nucleus is 6 fermi. The radius of $_{13}Al^{27}$ nucleus in meters is
(a) 3.6×10^{-12} m (b) 3.6×10^{-15} m
(c) 7.2×10^{-8} m (d) 7.2×10^{-15} m

38. AU^{235} nuclear reactor generates energy at a rate of 3.70×10^{7} J/s. Each fission liberates 185 MeV useful energy. If the reactor has to operate for 144×10^{4} s, then, the mass of the fuel needed is (Assume Avogadro's number $=6\times10^{23}\text{ mol}^{-1}$, $1\text{eV}=1.6\times10^{-19}$ J)
(a) 70.5 kg (b) 0.705 kg
(c) 13.1 kg (d) 1.31 kg

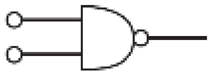
39. The base current in a transistor circuit changes from 45μ A to 140μ A. Accordingly, the collector current changes from 0.2 mA to 0.400 mA . The gain in current is
(a) 9.5 (b) 1
(c) 40 (d) 20

40. Of the following, NAND gate is

(a) 

(b) 

(c) 

(d) 

Chemistry

41. The number of radial nodes of 3s and 2p orbitals respectively are

(a) 0,2 (b) 2,0
(c) 1,2 (d) 2,1

42. The basis of quantum mechanical model of an atom is

(a) angular momentum of electron
(b) quantum numbers
(c) dual nature of electron
(d) black body radiation

43. The number of elements present in the fourth period is

(a) 32 (b) 8 (c) 18 (d) 2

44. Identify the correct set.

	Molecule	Hybridisation of central atom	Shape
(a)	PCl_5	dsp^3	square pyramidal
(b)	$[Ni(CN)_4]^{2-}$	sp^3	tetrahedral
(c)	SF_6	sp^3d^2	octahedral
(d)	IF_3	dsp^3	pyramidal

45. Which one of the following statements is correct?

(a) Hybrid orbitals do not form σ bonds
(b) Lateral overlap of p-orbitals or p - and d-orbitals produces π-bonds
(c) The strength of bonds follows the order
$\sigma_{p-p} < \sigma_{s-s} < \pi_{p-p}$
(d) s-orbitals do not form σ bonds

46. Which one of the following is an example of disproportionation reaction?

(a) $3Cl_2(g) + 6OH^-(aq) \rightarrow ClO_3^-(aq) + 5Cl^-(aq) + 3H_2O(I)$
(b) $Ag^{2+}(aq) + Ag(s) \rightarrow 2Ag^+(aq)$
(c) $Zn(s) + CuSO_4(aq) \rightarrow Cu(s) + ZnSO_4(aq)$
(d) $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$

47. At T(K), the ratio of kinetic energies of 4 g of $H_2(g)$ and 8 g of $O_2(g)$ is

(a) 1: 4 (b) 4: 1
(c) 2: 1 (d) 8: 1

48. Which one of the following is an isotonic pair of solutions?

(a) 0.15 M NaCl and $0.1 M Na_2SO_4$
(b) 0.2 M Urea and 0.1 M Sugar

(c) $0.1 M BaCl_2$ and 0.2 M Urea
(d) $0.4 M MgSO_4$ and $0.1 M NH_4Cl$

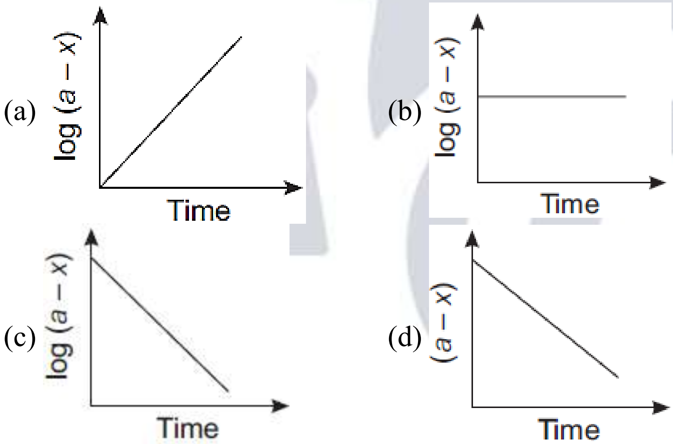
49. The vapour pressure in mm of Hg , of an aqueous solution obtained by adding 18 g of glucose $(C_6H_{12}O_6)$ to 180 g of water at $100^\circ C$ is
(a) 7.60 (b) 76.0
(c) 759 (d) 752.4

50. During the electrolysis of copper sulphate aqueous solution using copper electrode, the reaction takine place at the cathode is
(a) $Cu \rightarrow Cu^{2+}(aq) + 2e^-$
(b) $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$
(c) $H^+(aq) + e^- \rightarrow \frac{1}{2}H_2(g)$
(d) $SO_4^{2-}(aq) \rightarrow SO_3(g) + \frac{1}{2}O_2(g) + 2e^-$

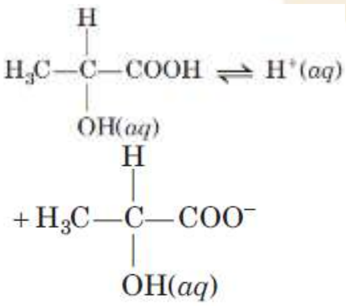
51. The extent of charge of lead accumulator is determined by
(a) amount of $PbSO_4$ in the battery
(b) amount of PbO_2 in the battery
(c) specific gravity of H_2SO_4 of the battery
(d) amount of Pb in the battery

52. The number of octahedral and tetrahedral holes respectively present in a hexagonal close packed (hcp) crystal of ' X ' atoms are
(a) X, 2X (b) X, X
(c) 2X, X (d) 2X, 2X

53. Which one of the following plots is correct for a first order reaction?



54. The degree of ionization of 0.10 M lactic acid is 4.0%



The value of K_c is
(a) 1.66×10^{-5} (b) 1.66×10^{-4}
(c) 1.66×10^{-3} (d) 1.66×10^{-2}

55. The pH of a buffer solution made by mixing 25 mL of $0.02 M NH_4OH$ and 25 mL of 0.2 M NH_4Cl at 25° is (pK_b of $NH_4OH = 4.8$)

(a) 5.8 (b) 8.2
(c) 4.8 (d) 3.8

56. For which one of the following reactions, the entropy change is positive?

(a) $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$
(b) $Na^+(g) + Cl^-(g) \rightarrow NaCl(s)$
(c) $NaCl(I) \rightarrow NaCl(s)$
(d) $H_2O(l) \rightarrow H_2O(g)$

57. Match the following.

	List I		List II
(A)	Solid dispersed in liquid	(I)	Emulsion
(B)	Liquid dispersed in liquid	(II)	Foam
(C)	Gas dispersed in liquid	(III)	Gel
(D)	Liquid dispersed in solid	(IV)	Sol
		(V)	Aerosol

The correct match is

	(A)	(B)	(C)	(D)
(a)	(IV)	(I)	(II)	(III)
(b)	(III)	(I)	(V)	(II)
(c)	(III)	(I)	(II)	(IV)
(d)	(IV)	(I)	(V)	(III)

58. Observe the following statements
(1) Heavy water is harmful for the growth of animals.
(2) Heavy water reacts with Al_4C_3 and forms deuterated acetylene.
(3) $BaCl_2 \cdot 2D_2O$ is an example of interstitial deuterate.
The correct statements are

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

59. Solution " X " contains Na_2CO_3 and $NaHCO_3$. 20 mL of X when titrated using methyl orange indicator consumed 60 mL of 0.1 M HCl solution. In another experiment, 20 mL of X solution when titrated using phenolphthalein consumed 20 mL of 0.1 M HCl solution. The concentrations (in mol^{-1}) of Na_2CO_3 and $NaHCO_3$ in X are respectively

(a) 0.01,0.02 (b) 0.1,0.1
(c) 0.01,0.01 (d) 0.1,0.01

60. Diborane reacts with HCl in the presence of $AlCl_3$ and liberates

(a) H_2 (b) Cl_2
(c) BCl_3 (d) Cl_2 and BCl_3

61. How many corners of SiO_4 units are shared in the formation of three -dimensional silicates?

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

62. Which one of the following is not correct?

(a) Pyrophosphoric acid is a tetrabasic acid
(b) Pyrophosphoric acid contains $P-O-P$ linkage
(c) Pyrophosphoric acid contains two $P-H$ bonds
(d) Orthophosphoric acid can be prepared by dissolving P_4O_{10} in water

63. $Na_2S_2O_3$ reacts with moist Cl_2 to form Na_2SO_4, HCl and X. Which one of the following is X ?
(a) H_2S (b) SO_2
(c) SO_3 (d) S

64. The role of copper diaphragm in Whytlaw-Gray's method is
(a) preventing the corrosion of electrolytic cell
(b) preventing the mixing of H_2 and F_2
(c) as anode
(d) as cathode

65. Liquid X is used in bubble chamber to detect neutral mesons and gamma photons. Then, X is
(a) He (b) Ne (c) Kr (d) Xe

66. A compound absorbs light in the wavelength region $490-500$ nm. Its complementary colour is
(a) red (b) blue
(c) orange (d) blue- green

67. Which of the following is not added during the extraction of silver by cyanide process?
(a) NaCN (b) Air
(c) Zn (d) $Na_2S_2O_3$

68. Cataract and skin cancer are caused by
(a) depletion of nitric oxide
(b) depletion of ozone layer
(c) increase in methane
(d) depletion of nitrous oxide

69. Which one of the following gives Prussian blue colour?
(a) $Fe_2[Fe(CN)_6]$ (b) $Na_4[Fe(CN)_6]$
(c) $Fe_3[Fe(CN)_6]_3$ (d) $Fe_4[Fe(CN)_6]_3$

70. $C_2H_6 \xrightarrow{450^\circ C} C_2H_4 + H_2$
Above reaction is called as
(a) combustion (b) rearrangement
(c) pyrolysis (d) cleavage

71. Assertion (A) $-NH_2$ group of aniline is ortho, para directing in electrophilic substitutions.
Reason (R) $-NH_2$ group stabilises the arenium ion formed by the ortho, para attack of the electrophile.
The correct answer is
(a) Both (A) and (R) are correct, (R) is the correct explanation of (A)
(b) Both (A) and (R) are correct, (R) is not the correct explanation of (A)
(c) (A) is correct, but (R) is not correct
(d) (A) is not correct, but (R) is correct

72. In which of the following properties, the two enantiomers of lactic acid differ from each other?
(a) Sign of specific rotation (b) Density
(c) Melting point (d) Refractive index

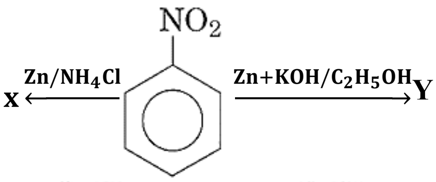
73. Heating chloroform with aqueous sodium hydroxide solution forms
(a) sodium acetate (b) sodium oxalate
(c) sodium formate (d) chloral

74. The products formed in the reaction of phenol with Br_2 dissolved in CS_2 at $0^\circ C$ are
(a) o-bromo, m-bromo and p-bromophenols
(b) o-bromo and p-bromophenols
(c) 2,4,6-tribromo and 2,3,6-tribromophenols
(d) 2,4-dibromo and 2,6-dibromophenols

75. The structure of PCC is
(a) $C_6H_5\overset{\oplus}{N}HCrO_2Cl^{\ominus}$ (b) $C_6H_5\overset{\oplus}{N}HCrO_3Cl^{\ominus}$
(c) $C_5H_5\overset{\oplus}{N}HCrO_2Cl^{\ominus}$ (d) $C_5H_5\overset{\oplus}{N}HCrO_3Cl^{\ominus}$

76. The pK_a values of four carboxylic acids are given below. Identify the weakest carboxylic acid.
(a) 4.89 (b) 1.28
(c) 4.76 (d) 2.56

77. Identify X and Y in the following reactions



(a) 

(b) 

(c) 

(d) 

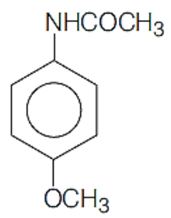
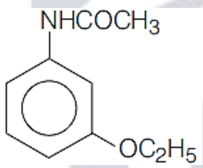
78. Example of a biodegradable polymer pair is

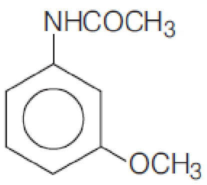
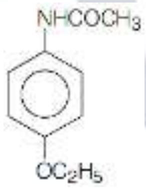
(a) nylon-6,6 and terylene
(b) PHBV and dextron
(c) bakelite and PVC
(d) PET and polyethylene

79. The number of hydrogen bonds between guanine and cytosine; and between adenine and thymine in DNA is

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

80. Identify phenacetin from the following.

(a) 
(b) 

(c) 
(d) 

Mathematics

81. If $f(x) = (p - x^n)^{1/n}$, $p > 0$ and n is a positive integer, then $f[f(x)]$ is equal to

(a) x (b) x^n
(c) $p^{1/n}$ (d) $p - x^n$

82. The value of $x \in \mathbb{R}$ $\left[\log(1.6)^{1-x^2} - (0.625)^{6(1+x)}\right] \in \mathbb{R}$ is

(a) $(-\infty, -1) \cup (7, \infty)$ (b) $(-1,5)$
(c) $(1,7)$ (d) $(-1,7)$

83. If I is the identity matrix of order 2 and $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$,, then for $n \geq 1$, mathematical induction gives

(a) $A^n = nA - (n-1)I$
(b) $A^n = nA + (n-1)I$
(c) $A^n = 2^nA - (n+1)I$
(d) $A^n = 2^{n-1}A - (n-1)I$

84. If ${}^nC_{r-1} = 330$, ${}^nC_r = 462$, and ${}^nC_{r+1} = 462$, then r is equal to

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

85. 10 men and 6 women are to be seated in a row so that no two women sit together. The number of ways they can be seated, is

(a) $11!\,10!$ (b) $\frac{11!}{6!5!}$

(c) $\frac{10!9!}{5!}$ (d) $\frac{11!10!}{5!}$

86. If t_n denotes the number of triangles formed with n points in a plane, no three of which are collinear and if $t_{n+1} - t_n = 36$, then n is equal to

(a) 7 (b) 8 (c) 9 (d) 10

87. The term independent of $x(x > 0, x \neq 1)$ in the expansion of $\left[\frac{(x+1)}{(x^{2/3}-x^{1/3}+1)} - \frac{(x-1)}{(x-\sqrt{x})}\right]^{10}$ is

(a) 105 (b) 210

(c) 315 (d) 420

88. If x is small, so that x^2 and higher powers can be neglected, then the approximate value for $\frac{(1-2x)^{-1}(1-3x)^{-2}}{(1-4x)^{-3}}$ is

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

(c) $1-4x$ (d) $1-5x$

89. If $\frac{1}{x^4+x^2+1} = \frac{Ax+B}{x^2+x+1} + \frac{Cx+D}{x^2-x+1}$, then C + D is equal to

(a) -1 (b) 1 (c) 2 (d) 0

90. $\frac{1}{2\cdot 3} + \frac{1}{4\cdot 5} + \frac{1}{6\cdot 7} + \frac{1}{8\cdot 9} + \cdots$ is equal to

(a) $\log\left(\frac{2}{e}\right)$ (b) $\log\left(\frac{e}{2}\right)$

(c) $\log(2e)$ (d) $e-1$

91. If the harmonic mean between the roots of $(5+\sqrt{2})x^2 - bx + (8+2\sqrt{5}) = 0$ is 4 , then the value of b is

(a) 2 (b) 3

(c) $4-\sqrt{5}$ (d) $4+\sqrt{5}$

92. The set of solutions satisfying both $x^2+5x+6 \geq 0$ and $x^2+3x-4 < 0$ is

(a) $(-4,1)$

(b) $(-4,-3] \cup [-2,1)$

(c) $(-4,-3) \cup (-2,1)$

(d) $[-4,-3] \cup [-2,1]$

93. If the roots of $x^3 - 42x^2 + 336x - 512 = 0$, are in increasing geometric progression, then its common ratio is

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

(c) 4: 1 (d) 6: 1

94. If α and β are the roots of the equation $x^2 - 2x + 4 = 0$, then $\alpha^9 + \beta^9$ is equal to

(a) -2^8 (b) 2^9

(c) -2^{10} (d) 2^{10}

95. If $A = \begin{bmatrix} -8 & 5 \\ 2 & 4 \end{bmatrix}$ satisfies the equation $x^2 + 4x - p = 0$, then p is equal to

(a) 64 (b) 42

(c) 36 (d) 24

96. $\begin{vmatrix} x+2 & x+3 & x+5 \\ x+4 & x+6 & x+9 \\ x+8 & x+11 & x+15 \end{vmatrix}$ is equal to

(a) $3x^2+4x+5$

(b) x^3+8x+2

(c) 0

(d) -2

97. The system of equations $3x+2y+z=6$, $3x+4y+3z=14$ and $6x+10y+8z=a$, has infinite number of solutions, if a is equal to

(a) 8 (b) 12 (c) 24 (d) 36

98. The number of real values of t such that the system of homogeneous equations

$\mathbf{tx+(t+1)y+(t-1)z=0}$
$\mathbf{(t+1)x+ty+(t+2)z=0}$
$\mathbf{(t-1)x+(t+2)y+tz=0}$
has non-trivial solutions is
(a) 3 (b) 2 (c) 1 (d) 4

99. $\left(\frac{1+i}{1-i}\right)^4+\left(\frac{1-i}{1+i}\right)^4$ **is equal to**
(a) 0 (b) 1 (c) 2 (d) 4

100. If a complex number z satisfies $|z^2-1|=|z|^2+1$**, then z lies on**
(a) the real axis (b) the imaginary axis
(c) $y=x$ (d) a circle

101. If $\frac{(1+i)x-i}{2+i}+\frac{(1+2i)y+i}{2-i}=1$**, then (x, y) is equal to**
(a) $\left(\frac{7}{3},\frac{-7}{15}\right)$ (b) $\left(\frac{7}{3},\frac{7}{15}\right)$
(c) $\left(\frac{7}{5},\frac{-7}{15}\right)$ (d) $\left(\frac{7}{5},\frac{7}{15}\right)$

102. The period of $f(x)=\cos\left(\frac{x}{3}\right)+\sin\left(\frac{x}{2}\right)$ **is**
(a) 2π (b) 4π
(c) 8π (d) 12π

103. If $\sin\theta+\cos\theta=p$ **and** $\sin^3\theta+\cos^3\theta=q$**, then** $p(p^2-3)$ **is equal to**
(a) q (b) 2q
(c) −q (d) −2q

104. If $\tan(\pi\cos\theta)=\cot(\pi\sin\theta)$**, then a value of** $\cos\theta-\frac{\pi}{4}$ **among the following is**
(a) $\frac{1}{2\sqrt{2}}$ (b) $\frac{1}{\sqrt{2}}$
(c) $\frac{1}{2}$ (d) $\frac{1}{4}$

105. The set of solutions of the system of equations

$$x+y=\frac{2\pi}{3}$$

and $\cos x+\cos y=\frac{3}{2}$
where x, y are real, is
(a) $\left\{(x,y):\cos\left(\frac{x-y}{2}\right)=\frac{1}{2}\right\}$
(b) $\left\{(x,y):\sin\left(\frac{x-y}{2}\right)=\frac{1}{2}\right\}$
(c) $\left\{(x,y):\cos(x-y)=\frac{1}{2}\right\}$
(d) Empty set

106. If $\cos^{-1}\left(\frac{5}{13}\right)+\cos^{-1}\left(\frac{3}{5}\right)=\cos^{-1}x$**, then x is equal to**
(a) $\frac{3}{65}$ (b) $\frac{-36}{65}$
(c) $\frac{-33}{65}$ (d) -1

107. $\tanh^{-1}\left(\frac{1}{2}\right)+\coth^{-1}(2)$ **is equal to**
(a) $\frac{1}{2}\log 3$ (b) $\frac{1}{2}\log 6$
(c) $\frac{1}{2}\log 12$ (d) $\log 3$

108. In any $\triangle ABC$**,** $r_1r_2+r_2r_3+r_3r_1$ **is equal to**
(a) $\frac{\Delta^2}{r^2}$ (b) $\frac{\Delta}{r}$ (c) $\frac{2\Delta}{r}$ (d) Δ^2

109. If in a $\triangle$ ABC, $\frac{1}{a+c}+\frac{1}{b+c}=\frac{3}{a+b+c}$, then $\angle C$ is equal to
(a) 30° (b) 45°
(c) 60° (d) 90°

110. A person observes the top of a tower from a point A on the ground. The elevation of the tower from this point is 60°. He moves 60 m in the direction perpendicular to the line joining A and base of the tower. The angle of elevation of the tower from this point is 45°. Then, the height of the tower (in metres) is
(a) $60\sqrt{\frac{3}{2}}$ (b) $60\sqrt{2}$
(c) $60\sqrt{3}$ (d) $60\sqrt{\frac{2}{3}}$

111. The points whose position vectors are $2i+3j+4k$, $3i+4j+2k$ and $4i+2j+3k$ are the vertices of
(a) an isosceles triangle
(b) right angled triangle
(c) equilateral triangle
(d) right angled isosceles triangle

112. P, Q, R and S are four points with the position vectors $3i-4j+5k$, $-4i+5j+k$ and $-3i+4j+3k$, respectively. Then, the line PQ meets the line RS at the point
(a) $3i+4j+3k$ (b) $-3i+4j+3k$
(c) $-i+4j+k$ (d) $i+j+k$

113. If $a\neq 0, b\neq 0, c\neq 0, a\times b=0$ and $b\times c=0$, then $a\times c$ is equal to
(a) b (b) a (c) 0 (d) $i+j+k$

114. The shortest distance between the lines $r=3i+5j+7k+\lambda(i+2j+k)$ and $r=-i-j-k+\mu(7i-6j+k)$ is
(a) $\frac{16}{5\sqrt{5}}$ (b) $\frac{26}{5\sqrt{5}}$
(c) $\frac{36}{5\sqrt{5}}$ (d) $\frac{46}{5\sqrt{5}}$

115. A unit vector coplanar with $i+j+3k$ and $i+3j+k$ and perpendicular to $i+j+k$ is
(a) $\frac{1}{\sqrt{2}}(j+k)$ (b) $\frac{1}{\sqrt{3}}(i-j+k)$
(c) $\frac{1}{\sqrt{2}}(j-k)$ (d) $\frac{1}{\sqrt{3}}(i+j-k)$

116. If a and b are two non-zero perpendicular vectors, then a vector y satisfying equations $a\cdot y=c$ (where, c is scalar) and $a\times y=b$ is
(a) $|a|^2[ca-(a\times b)]$
(b) $|a|^2\cdot[ca+(a\times b)]$
(c) $\frac{1}{|a|^2}[ca-(a\times b)]$
(d) $\frac{1}{|a|^2}[a+(a\times b)]$

117. Two numbers are chosen at random from $\{1,2,3,4,5,6,7,8\}$ at a time. The probability that smaller of the two numbers is less than 4 is
(a) $\frac{7}{14}$ (b) $\frac{8}{14}$ (c) $\frac{9}{14}$ (d) $\frac{10}{14}$

118. Two fair dice are rolled. The probability of the sum of digits on their faces to be greater than or equal to 10 is
(a) $\frac{1}{5}$ (b) $\frac{1}{4}$ (c) $\frac{1}{8}$ (d) $\frac{1}{6}$

119. A bag contains $2n+1$ coins. It is known that n of these coins have a head on both sides, whereas the remaining $n+1$ coins are fair. A coin is picked up at random from the bag and tossed. If the probability that the toss results in a head is $\frac{31}{42}$, then n is equal to
(a) 10 (b) 11 (c) 12 (d) 13

120. The random variable takes the values $1, 2, 3, \dots, m$. If $P(X = n) = \frac{1}{m}$ to each n, then the variance of X is

(a) $\frac{(m+1)(2m+1)}{6}$ (b) $\frac{m^2-1}{12}$

(c) $\frac{m+1}{2}$ (d) $\frac{m^2+1}{12}$

121. If X is a poisson variate $P(X = 1) = 2P(X = 2)$, then $P(X = 3)$ is equal to

(a) $\frac{e^{-1}}{6}$ (b) $\frac{e^{-2}}{2}$ (c) $\frac{e^{-1}}{2}$ (d) $\frac{e^{-1}}{3}$

122. The origin is translated to $(1, 2)$. The point $(7, 5)$ in the old system undergoes the following transformations successively.

(I) Moves to the new point under the given translation of origin.

(II) Translated through 2 units along the negative direction of the new X-axis.

(III) Rotated through an angle $\frac{\pi}{4}$ about the origin of new system in the clockwise direction. The final position of the point $(7, 5)$ is

(a) $\left(\frac{9}{\sqrt{2}}, \frac{-1}{\sqrt{2}}\right)$ (b) $\left(\frac{7}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

(c) $\left(\frac{7}{\sqrt{2}}, \frac{-1}{\sqrt{2}}\right)$ (d) $\left(\frac{5}{\sqrt{2}}, \frac{-1}{\sqrt{2}}\right)$

123. If p and q are the perpendicular distances from the origin to the straight lines $x\sec\theta - y\operatorname{cosec}\theta = a$ and $x\cos\theta + y\sin\theta = a\cos 2\theta$, then

(a) $4p^2 + q^2 = a^2$ (b) $p^2 + q^2 = a^2$

(c) $p^2 + 2q^2 = a^2$ (d) $4p^2 + q^2 = 2a^2$

124. If $2x + 3y = 5$ is the perpendicular bisector of the line segment joining the points $A\left(1, \frac{1}{3}\right)$ and B, then B is equal to

(a) $\left(\frac{21}{13}, \frac{49}{39}\right)$ (b) $\left(\frac{17}{13}, \frac{31}{39}\right)$

(c) $\left(\frac{7}{13}, \frac{49}{39}\right)$ (d) $\left(\frac{21}{13}, \frac{31}{39}\right)$

125. If the points $(1, 2)$ and $(3, 4)$ lie on the same side of the straight line $3x - 5y + a = 0$, then a lies in the set

(a) $[7,11]$ (b) $\mathbb{R} - [7,11]$

(c) $[7, \infty)$ (d) $(-\infty, 11]$

126. The equation of the pair of lines passing through the origin whose sum and product of slopes are respectively the arithmetic mean and geometric mean of 4 and 9 is

(a) $12x^2 - 13xy + 2y^2 = 0$

(b) $12x^2 + 13xy + 2y^2 = 0$

(c) $12x^2 - 15xy + 2y^2 = 0$

(d) $12x^2 + 15xy - 2y^2 = 0$

127. The equation $x^2 - 5xy + py^2 + 3x - 8y + 2 = 0$ represents a pair of straight lines. If θ is the angle between them, then $\sin\theta$ is equal to

(a) $\frac{1}{\sqrt{50}}$ (b) $\frac{1}{7}$ (c) $\frac{1}{5}$ (d) $\frac{1}{\sqrt{10}}$

128. If the equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of straight lines, then the square of the distance of their point of intersection from the origin is

(a) $\frac{c(a+b)-af^2-bg^2}{ab-h^2}$ (b) $\frac{c(a+b)+f^2+g^2}{ab-h^2}$

(c) $\frac{c(a+b)-f^2-g^2}{ab-h^2}$ (d) $\frac{c(a+b)-f^2-g^2}{(ab-h^2)^2}$

129. The circle $4x^2 + 4y^2 - 12x - 12y + 9 = 0$

(a) touches both the axes

(b) touches the x-axis only

(c) touches the y-axis only

(d) does not touch the axes

130. For the circle C with the equation $x^2 + y^2 - 16x - 12y + 64 = 0$ match the List I with the List II given below.

	List I		List II

(i)	The equation of the polar of (-5,1) with respect to C	(A)	$y = 0$
(ii)	The equation of the tangent at (8,0) to C	(B)	$y = 6$
(iii)	The equation of the normal at (2,6) to C	(C)	$x + y = 7$
(iv)	The equation of the diameter of C through (8,12)	(D)	$13x + 5y = 98$
		(E)	X =8

The correct match is

	(i)	(ii)	(iii)	(iv)
(a)	(D)	(B)	(A)	(E)
(b)	(D)	(A)	(B)	(E)
(c)	(C)	(D)	(A)	(B)
(d)	(C)	(E)	(B)	(A)

131. If the length of the tangent from (h, k) to the circle $x^2 + y^2 = 16$ is twice the length of the tangent from the same point to the circle $x^2 + y^2 + 2x + 2y = 0$, then

(a) $h^2 + k^2 + 4h + 4k + 16 = 0$
(b) $h^2 + k^2 + 3h + 3k = 0$
(c) $3h^2 + 3k^2 + 8h + 8k + 16 = 0$
(d) $3h^2 + 3k^2 + 4h + 4k + 16 = 0$

132. $(a, 0)$ and $(b, 0)$ are centres of two circles belonging to a coaxial system of which y-axis is the radical axis. If radius of one of the circles is ' r ', then the radius of the other circle is

(a) $(r^2 + b^2 + a^2)^{1/2}$ (b) $(r^2 + b^2 - a^2)^{1/2}$
(c) $(r^2 + b^2 - a^2)^{1/3}$ (d) $(r^2 + b^2 + a^2)^{1/3}$

133. If the circle $x^2 + y^2 + 4x - 6y + c = 0$ bisects the circumference of the circle $x^2 + y^2 - 6x + 4y - 12 = 0$, then c is equal to

(a) 16 (b) 24
(c) -42 (d) -62

134. A circle of radius 4, drawn on a chord of the parabola $y^2 = 8x$ as diameter, touches the axis of the parabola. Then, the slope of the chord is

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

135. The mid-point of a chord of the ellipse $x^2 + 4y^2 - 2x + 20y = 0$ is $(2, -4)$. The equation of the chord is

(a) $x - 6y = 26$ (b) $x + 6y = 26$
(c) $6x - y = 26$ (d) $6x + y = 26$

136. If the focii of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ and the hyperbola $\frac{x^2}{4} - \frac{y^2}{b^2} = 1$ coincide, then b^2 is equal to

(a) 4 (b) 5 (c) 8 (d) 9

137. If $x = 9$ is a chord of contact of the hyperbola $x^2 - y^2 = 9$, then the equation of the tangent at one of the points of contact is

(a) $x + \sqrt{3}y + 2 = 0$
(b) $3x + 2\sqrt{2}y - 3 = 0$
(c) $3x - \sqrt{2}y + 6 = 0$
(d) $x - \sqrt{3}y + 2 = 0$

138. **The perpendicular distance from the point $(1, \pi)$ to the line joining $(1, 0^\circ)$ and $1, \frac{\pi}{2}$, (in polar coordinates) is**

(a) 2 (b) $\sqrt{3}$

(c) 1 (d) $\sqrt{2}$

139. **If $D(2,1,0), E(2,0,0)$ and $F(0,1,0)$ are mid-points of the sides BC, CA and AB of $\triangle$ ABC, respectively. Then, the centroid of $\triangle$ ABC is**

(a) $\left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$ (b) $\left(\frac{4}{3}, \frac{2}{3}, 0\right)$

(c) $\left(-\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$ (d) $\left(\frac{2}{3}, \frac{1}{3}, \frac{1}{3}\right)$

140. **The direction ratios of the two lines AB and AC are $1, -1, -1$ and $2, -1, 1$. The direction ratios of the normal to the plane ABC are**

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

(c) $3,2,-1$ (d) $-1,2,3$

141. **A plane passing through $(-1,2,3)$ and whose normal makes equal angles with the coordinate axes is**

(a) $x + y + z + 4 = 0$

(b) $x - y + z + 4 = 0$

(c) $x + y + z - 4 = 0$

(d) $x + y + z = 0$

142. **A variable plane passes through a fixed point $(1,2,3)$. Then, the foot of the perpendicular from the origin to the plane lies on**

(a) a circle (b) a sphere

(c) an ellipse (d) a parabola

143. **Let f be a non-zero real valued continuous function satisfying $f(x+y) = f(x) \cdot f(y)$ for all $x, y \in \mathbb{R}$. If $f(2) = 9$, then $f(6)$ is equal to**

(a) 3^2 (b) 3^6

(c) 3^4 (d) 3^3

144. **$\lim_{x \to 0} \frac{\tan^3 x - \sin^3 x}{x^5}$ is equal to**

(a) $\frac{5}{2}$ (b) $\frac{3}{2}$ (c) $\frac{3}{5}$ (d) $\frac{2}{5}$

145. **If $f(x) = \frac{1}{1+\frac{1}{x}}$ and $g(x) = \frac{1}{1+\frac{1}{f(x)}}$, then $g'(2)$ is equal to**

(a) $\frac{1}{5}$ (b) $\frac{1}{25}$ (c) 5 (d) $\frac{1}{16}$

146. **If $\sqrt{\frac{y}{x}} + \sqrt{\frac{x}{y}} = 2$, then $\frac{dy}{dx}$ is equal to**

(a) $\frac{x^2+y^2}{x+y}$ (b) $\frac{x^2-y^2}{x+y}$

(c) 1 (d) 2

147. **If $\frac{d}{dx}[(x+1)(x^2+1)(x^4+1)(x^8+1)] = (15x^p - 16x^q + 1)(x-1)^{-2}$, then (p,q) is equal to**

(a) (12,11) (b) (15,14)

(c) (16,14) (d) (16,15)

148. **If $\cos^{-1}(\frac{y}{b}) = 2\log\frac{x}{2}$, where $x > 0$, then $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx}$ is equal to**

(a) $4y$ (b) $-4y$

(c) 0 (d) $-8y$

149. **The relation between pressure p and volume V is given by $pV^{1/4}$ = constant. If the percentage decrease in volume is $\frac{1}{2}$, then the percentage increase in pressure is**

(a) $-\frac{1}{8}$ (b) $\frac{1}{16}$

(c) $\frac{1}{8}$ (d) $\frac{1}{2}$

150. **If the curves $x^2 + py^2 = 1$ and $qx^2 + y^2 = 1$ are orthogonal to each other, then**

(a) $p - q = 2$ (b) $\frac{1}{p} - \frac{1}{q} = 2$

(c) $\frac{1}{p} + \frac{1}{q} = -2$ (d) $\frac{1}{p} + \frac{1}{q} = 2$

151. The focal length of a mirror is given by $\frac{2}{f}=\frac{1}{v}-\frac{1}{u}$. In finding the values of u and v, the errors are equal to ' p '. Then, the relative error in f is

(a) $\frac{p}{2}\left(\frac{1}{u}+\frac{1}{v}\right)$ (b) $p\left(\frac{1}{u}+\frac{1}{v}\right)$

(c) $\frac{p}{2}\left(\frac{1}{u}-\frac{1}{v}\right)$ (d) $p\left(\frac{1}{u}-\frac{1}{v}\right)$

152. If $u=\log\left(x^3+y^3+z^3-3xyz\right)$, then $(x+y+z)\left(u_x+u_y+u_z\right)$ is equal to

(a) 0 (b) $x-y+z$

(c) 2 (d) 3

153. $\int e^x\left(\frac{2+\sin 2x}{1+\cos 2x}\right)dx$ is equal to

(a) $e^x\cot x+C$ (b) $2e^x\sec^2 x+C$

(c) $e^x\cos 2x+C$ (d) $e^x\tan x+C$

154. If $\int \frac{x-\sin x}{1+\cos x}dx=x\tan\frac{x}{2}+p\log\sec\frac{x}{2}+C$, then p is equal to

(a) -4 (b) 4

(c) 2 (d) -2

155. If $\int \frac{dx}{x(\log x-2)(\log x-3)}=I+C$, then I is equal to

(a) $\frac{1}{x}\log\left|\frac{\log x-3}{\log x-2}\right|$

(b) $\log\left|\frac{\log x-3}{\log x-2}\right|$

(c) $\log\left|\frac{\log x-2}{\log x-3}\right|$

(d) $\log|(\log x-3)(\log x-2)|$

156. If $\int_0^b \frac{dx}{1+x^2}=\int_b^\infty \frac{dx}{1+x^2}$, then b is equal to

(a) $\tan^{-1}\frac{1}{3}$ (b) $\frac{\sqrt{3}}{2}$

(c) $\sqrt{2}$ (d) 1

157. The area (in sq units) bounded by the curves $x=-2y^2$ and $x=1-3y^2$ is

(a) $\frac{2}{3}$ (b) 1 (c) $\frac{4}{3}$ (d) $\frac{5}{3}$

158. The approximate value of $\int_1^3 \frac{dx}{2+3x}$ using Simpson's rule and dividing the interval [1, 3] into two equal parts is

(a) $\frac{1}{3}\log\frac{11}{5}$ (b) $\frac{107}{110}$

(c) $\frac{29}{110}$ (d) $\frac{119}{440}$

159. An integrating factor of the equation $\left(1+y+x^2y\right)dx+\left(x+x^3\right)dy=0$ is

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

160. The solution of the differential equation $\frac{dy}{dx}-2y\tan 2x=e^x\sec 2x$ is

(a) $y\sin 2x=e^x+C$

(b) $y\cos 2x=e^x+C$

(c) $y=e^x\cos 2x+C$

(d) $y\cos 2x+e^x=C$