Physics

1. **Regarding fundamental forces in nature, the correct statement is**
   (a) electromagnetic forces are always attractive
   (b) electromagnetic forces are always repulsive
   (c) gravitational forces are always attractive
   (d) strong nuclear forces are always repulsive

2. **The equation of motion of a damped oscillator is given by $m\frac{d^2x}{dt^2}+b\frac{dx}{dt}+kx=0$. The dimensional formula of $\frac{b}{\sqrt{km}}$ is**
   (a) $[M^0\ L^0\ T^0]$ (b) $[M^0\ L^1\ T^{-2}]$
   (c) $[M'L'T^{-2}]$ (d) $[M^1\ L^2\ T^{-2}]$

3. **A body is falling freely from the top of a tower of height 125 m . The distance covered by the body during the last second of its motion is x% of the height of the tower. Then x is**
   (Acceleration due to gravity $= 10\ ms^{-2}$)
   (a) 9 (b) 36
   (c) 25 (d) 49

4. **A body P is projected at an angle of 30° with the horizontal and another body Q is projected at angle of 30° with the vertical. If the ratio of the horizontal ranges of the bodies P and Q is $1:2$, then the ratio of the maximum heights reached by the bodies P and Q is**
   (a) $1:4$ (b) $1:6$
   (c) $2:3$ (d) $1:1$

5. **A car is moving on circular track banked at an angle of 45°. If the maximum permissible speed of the car to avoid slipping is twice the optimum speed of the car to avoid the wear and tear of the tyres, then the coefficient of static friction between the wheels of the car and the road is**
   (a) 0.3 (b) %0.5
   (c) 0.4 (d) 0.6

6. **A block of mass 0.5 kg is at rest on a horizontal table. The coefficient of kinetic friction between the table and the block is 0.2 . If a horizontal force of 5 N is applied on the block, the kinetic energy of the block in a time of 4 s is**
   (Acceleration due to gravity $= 10\ ms^{-2}$)
   (a) 64 J (b) 128 J
   (c) 256 J (d) 512 J

7. **The sphere A of mass m moving with a constant velocity hits another sphere B of mass 2 m at rest. If the coefficient of restitution is 0.4 , the ratio of the velocities of the spheres A and B after collision is**
   (a) $3:1$ (b) $1:5$
   (c) $1:7$ (d) $\%4:1$

8. **A solid sphere rolls down without slipping from the top of an inclined plane of height 28 m and angle of inclination 30°. The velocity of the sphere, when it reaches the bottom of the plane is**
   (Acceleration due to gravity $= 10\ ms^{-2}$)
   (a) $20\ ms^{-1}$ (b) $28\ ms^{-1}$
   (c) $\%10\ ms^{-1}$ (d) $14\ ms^{-1}$

9. **Four identical particles each of mass ' m ' are kept at the four corners of a square of side ' a '. If one of the particles is removed, the shift in the position of the centre of mass is**
   (a) $\sqrt{2}a$ (b) $\frac{3a}{\sqrt{2}}$
   (c) $\frac{a}{\sqrt{2}}$ (d) $\frac{a}{3\sqrt{2}}$

10. **In a time ' t ', the amplitude of vibrations of a damped oscillator becomes half of its initial value, then the mechanical energy of the oscillator decreases by**
    (a) 40% (b) 20%
    (c) 75% (d) 50%

11. **The energy required to take a body from the surface of the earth to a height equal to the radius of the earth is 'W'. The energy required to take this body from the surface of the earth to a height equal to twice the radius of the earth is**
(a) $\frac{W}{3}$ (b) $\frac{2W}{3}$
(c) W (d) $\frac{4W}{3}$

12. **A steel wire of length 3 m and a copper wire of length 2.2 m are connected end to end. When the combination is stretched by a force, the net elongation is 1.05 mm . If the area of cross-section of each wire is $6\ mm^2$, then the load applied is (Young's moduli of steel and copper are respectively $2 \times 10^{11} Nm^{-2}$ and $1.1 \times 10^{11} Nm^{-2}$)**
(a) 180 N (b) 90 N
(c) 135 N (d) 120 N

13. **The height of water level in a tank of uniform cross-section is 5 m . The volume of the water leaked in 5 s through a hole of area $2.4\ mm^2$ made at the bottom of the tank is (Assume the level of the water in the tank remains constant and acceleration due to gravity $= 10\ ms^{-2}$)**
(a) $90 \times 10^{-6}\ m^3$ (b) $120 \times 10^{-6}\ m^3$
(c) $80 \times 10^{-6}\ m^3$ (d) $40 \times 10^{-6}\ m^3$

14. **The work done in increasing the diameter of a soap bubble from 2 cm to 4 cm is (Surface tension of soap solution $= 3.5 \times 10^{-2} Nm^{-1}$)**
(a) 528×10^{-6} J (b) 264×10^{-6} J
(c) 132×10^{-6} J (d) 178×10^{-6} J

15. **The temperature on a Fahrenheit temperature scale that is twice the temperature on a Celsius temperature scale is**
(a) 160°F (b) 240°F
(c) 320°F (d) 480°F

16. **The temperatures of equal masses of three different liquids A, B and C are 15°C, 24°C and 30°C respectively. The resultant temperature when liquids A and B are mixed is 20°C and when liquids B and C are mixed is 26°C. Then the ratio of specific heat capacities of the liquids A, B and C is**
(a) 5:8:10 (b) 8:10:5
(c) 5:10:8 (d) 8:5:10

17. **The efficiency of a reversible heat engine working between two temperatures is 50%. The coefficient of performance of a refrigerator working between the same two temperatures but in reverse direction is**
(a) 1 (b) 2
(c) 3 (d) 4

18. **The total internal energy of 4 moles of a diatomic gas at a temperature of 27°C is (Universal gas constant $= 8.31\ J\ mol^{-1}\ K^{-1}$)**
(a) 13.47 kJ (b) 4.98 kJ
(c) 24.93 kJ (d) 14.96 kJ

19. **A car travelling at a speed of 54 kmph towards a wall sounds horn of frequency 400 Hz . The difference in the frequencies of two sounds, one received directly from the car and other reflected from the wall noticed by a person standing between the car and the wall is (speed of sound in air is $335\ ms^{-1}$)**
(a) 35.9 Hz (b) 20 Hz
(c) 70 Hz (d) Zero

20. **The speed of a transverse wave in a stretched string ' *A* ' is ' *V* '. Another string ' *B* ' of same length and same radius is subjected to same tension. If the density of the material of the string ' B ' is 2% more than that of ' A ', then the speed of the transverse wave in string ' *B* ' is**
(a) $\sqrt{1.04}v$ (b) $\sqrt{1.02}v$
(c) $\frac{v}{\sqrt{1.04}}$ (d) $\frac{v}{\sqrt{1.02}}$

21. **For a combination of two convex lenses of focal lengths ' f_1 ' and ' f_2 ' to act as a glass slab, the distance of separation between them is**

(a) $f_1 + f_2$ (b) $f_1 \sim f_2$
(c) $\frac{f_1+f_2}{2}$ (d) $\frac{f_1 \sim f_2}{2}$

22. If a ray of light passes through an equilateral prism such that the angle of incidence and the angle of emergence are both equal to 70% of the angle of the prism, then the angle of minimum deviation is
(a) 36° (b) 18°
(c) 42° (d) 24°

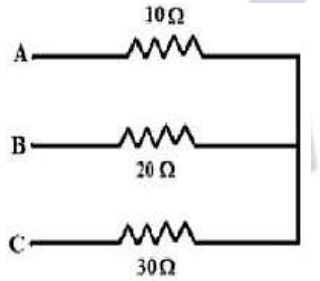
23. Young's double slit experiment is performed with monochromatic light of wavelength 6000Å. If the intensity of light at a point on the screen where path difference of 2000Å is I_1 and the intensity of light at a point on the screen where the path difference is 1000Å is I_2, then $I_1 : I_2 =$
(a) 1:3 (b) 2:1
(c) 1:1 (d) 4:5

24. Two positive point charges are separated by a distance of 4 m in air. If the sum of the two charges is 36μC and the electrostatic force between them is 0.18 N , then the bigger charge is
(a) 30μC (b) 18μC
(c) 20μC (d) 16μC

25. Three capacitors of capacitances 10μ F, 5μ F and 20μ F are connected in series with a 14 V dc supply. The charge on 5μ F capacitor is
(a) 20μC (b) 40μC
(c) 70μC (d) 2.8μC

26. When the temperature of a wire is increased from 303 K to 356 K , the resistance of the wire increases by 10%. The temperature coefficient of resistance of the material of the wire is
(a) $2 \times 10^{-3}\ ^\circ C^{-1}$ (b) $2 \times 10^{-4}\ ^\circ C^{-1}$
(c) $1.1 \times 10^{-3}\ ^\circ C^{-1}$ (d) $1.1 \times 10^{-4}\ ^\circ C^{-1}$

27. Three resistors of resistances 10Ω, 20Ω and 30Ω are connected as shown in the figure. If the points A, B and C are at potentials 10 V, 6 V and 5 V respectively, then the ratio of the magnitudes of the currents through 10Ω and 30Ω resistors is



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

28. A particle of charge 2 C is moving with a velocity of $(3\hat{i} + 4\hat{j})ms^{-1}$ in the presence of magnetic and electric fields. If the magnetic field is $(\hat{i} + 2\hat{j} + 3\hat{k})$T and the electric field is $(-2\hat{k})NC^{-1}$, then the Lorentz force on the particle is
(a) 50 N (b) 20 N
(c) 30 N (d) 40 N

29. A rectangular coil of 400 turns and 10^{-2} m^2 area, carrying a current of 0.5 A is placed in a uniform magnetic field of 1 T such that the plane of the coil makes an angle of 60° with the direction of the magnetic field. The initial moment of force acting on the coil in Nm is
(a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$
(c) 1 (d) $\frac{\sqrt{3}}{2}$

30. The most exotic diamagnetic materials are
(a) Superconductors (b) Semiconductors
(c) Conductors (d) Resistors

31. Two circular coils of radii r_1 and $r_2 (r_1 \ll r_2)$ are placed coaxially with their centers coinciding. The mutual inductance of the arrangement is

(a) $\frac{\mu_0 \pi r_2^2}{2r_1}$ (b) $\frac{\mu_0 \pi r_1 r_2}{2(r_1+r_2)}$

(c) $\frac{\mu_0 \pi r_1^2}{2r_2}$ (d) $\frac{\mu_0 \pi (r_1+r_2)}{2r_1 r_2}$

32. In a series LCR circuit, if the current leads the source voltage, then

(a) $X_C > X_L$ (b) $X_L > X_C$

(c) $X_L = X_C \neq 0$ (d) $X_L = X_C = 0$

33. If the amplitude of the magnetic field part of a harmonic electromagnetic wave in vacuum is 270 nT , the amplitude of the electric field part of the wave is

(a) $90 NC^{-1}$ (b) $81 NC^{-1}$

(c) $9 NC^{-1}$ (d) $30 NC^{-1}$

34. If Planck's constant is 6.63×10^{-34}Js, then the slope of a graph drawn between cut off voltage and frequency of incident light in a photoelectric experiment is

(a) 4.14×10^{-15}Vs (b) 19.776×10^{-15}Vs

(c) 2.198×10^{-15}Vs (d) 1.337×10^{-15}Vs

35. At room temperature, gaseous hydrogen is bombarded with a beam of electrons of 13.6 eV energy. The series to which the emitted spectral line belongs to

(a) Lyman series (b) Balmer series

(c) Paschen series (d) Pfund series

36. The half-life of a radioactive substance is 12 minutes. The time gap between 28% decay and 82% decay of the radioactive substance is

(a) 6 minutes (b) 18 minutes

(c) 12 minutes (d) 24 minutes

37. An element consists of a mixture of three isotopes A, B and C of masses m_1, m_2 and m_3 respectively. If the relative abundances of the three isotopes A, B and C is in the ratio 2: 3: 5, the average mass of the element is

(a) $0.2m_1 + 0.3m_2 + 0.5m_3$

(b) $2m_1 + 3m_2 + 5m_3$

(c) $0.4m_1 + 0.6m_2 + m_3$

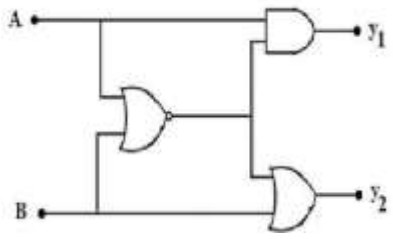
(d) $4m_1 + 6m_2 + 10m_3$

38. The concentration of electrons in an intrinsic semiconductor is 6×10^{15} m^{-3}. On doping with an impurity the electron concentration increases to 4×10^{22} m^{-3}. In thermal equilibrium, the concentration of the holes in the doped semiconductor is

(a) 18×10^{-8} m^{-3} (b) 1.5×10^{-7} m^{-3}

(c) 9×10^{8} m^{-3} (d) $\frac{2}{3} \times 10^{7}$ m^{-3}

39. Three logic gates are connected as shown in the figure. If the inputs are A = 1 and B = 1, then the values of y_1 and y_2 respectively are



(a) 0,0 (b) 0,1

(c) 1,0 (d) 1,1

40. The heights of the transmitting and receiving antennas are 33.8 m and 64.8 m respectively. The maximum distance between the antennas for satisfactory communication in line of sight mode is (Radius of the earth = 6400 km)

(a) 20.8 km (b) 28.8 km
(c) 49.6 km (d) 57.6 km

Chemistry

41. Identify the pair of species having same energy from the following (The number given in the bracket corresponds to principal quantum number (n) in which the electron is present)

(a) $H(n=1), Li^{2+}(n=1)$
(b) $Li^{2+}(n=3), Be^{3+}(n=4)$
(c) $He^{+}(n=1), Li^{2+}(n=3)$
(d) $H(n=3), Li^{2+}(n=2)$

42. Which one of the following corresponds to the wavelength of line spectrum of H atom in its Balmer series? (R = Rydberg constant)

(a) $\frac{9}{8R}$ (b) $\frac{100}{21R}$
(c) $\frac{25}{24R}$ (d) $\frac{16}{15R}$

43. Identify the pair of elements in which the number of s-electrons to p-electrons ratio is 2: 3

(a) P, Mg (b) P, Ca
(c) O, Mg (d) O, S

44. Which of the following has the least electron gain enthalpy?

(a) Chlorine (b) Iodine
(c) Oxygen (d) Sulphur

45. According to Fajan's rules, which of the following is not correct about covalent character?

(a) $KF < KI$ (b) $LiF < KF$
(c) $SnCl_2 < SnCl_4$ (d) $NaCl < CuCl$

46. Consider the following pairs

Order	Property
A) $NO_2 > O_3 > H_2O$	Bond angle
B) $HF > H_2O > NH_3$	Dipole moment
C) $I_2 > F_2 > N_2$	Bond length

Which of the above pairs are correctly matched?

(a) A, B & C (b) B & C only
(c) A & C only (d) A & B only

47. An open vessel containing air was heated from 27°C to 727°C. Some air was expelled. What is the fraction of air remaining in the vessel?
(Assume air as an ideal gas)

(a) $\frac{1}{10}$ (b) $\frac{7}{10}$
(c) $\frac{3}{10}$ (d) $\frac{9}{10}$

48. 12 g of an element reacts with 32 g of oxygen. What is the equivalent weight of the element?

(a) 12 (b) 6
(c) 4 (d) 3

49. The standard enthalpy of formation $(\Delta_f H^{\ominus})$ of ammonia is -46.2 kJ mol^{-1}. What is the $\Delta_r H^{\ominus}$ of the following reaction?

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

(a) -46.2 kJ (b) $+46.2$ kJ
(c) -92.4 kJ (d) -184.8 kJ

50. At $T(K)$, K_c for the reaction $AO_2(g) + BO_2(g) \rightleftharpoons AO_3(g) + BO(g)$ is 16. One mole each of reactants and products are taken in a IL flask and heated to $T(K)$, and equilibrium is established. What is the equilibrium concentration of $BO(\text{in mol}L^{-1})$?

(a) 1.6 (b) 0.4
(c) 1.2 (d) 0.8

51. Observe the following reactions

I. $H_2O(l) + 2Na(s) \rightarrow 2NaOH(aq) + H_2(g)$

II. $2H_2O(l) + 2F_2(g) \rightarrow 4H^+(aq) + 4F^-(aq) + O_2(g)$

Identify the correct statement from the following

(a) In both reaction I and reaction II, water is oxidized
(b) In both reaction I and reaction II, water is reduced
(c) In reaction I water is reduced and in reaction II water is oxidized
(d) In reaction I water is oxidized and in reaction II water is reduced

52. What is the correct stability order of KO_2, RbO_2, CsO_2 ?

(a) $KO_2 < CsO_2 < RbO_2$
(b) $CsO_2 < KO_2 < RbO_2$
(c) $CsO_2 < RbO_2 < KO_2$
(d) $KO_2 < RbO_2 < CsO_2$

53. Assertion (A): MgO, CaO, SrO and BaO are insoluble in water

Reason (R): In aqueous medium the basic strength of MgO, CaO, SrO and BaO increases with **increase in the atomic number of metal**

(a) (A) and (R) are correct. (R) is the correct explanation of (A)
(b) (A) and (R) are correct, but (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

54. Identify the element for which +1 oxidation state is more stable than +3 oxidation state

(a) Ga (b) Sn
(c) Tl (d) Ge

55. Observe the oxides $CO, B_2O_3, SiO_2, CO_2, Al_2O_3, PbO_2, Tl_2O_3$

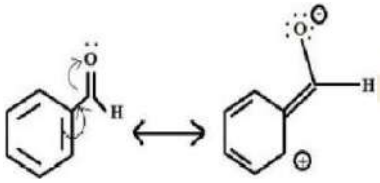
The number of acidic oxides in the list is

(a) 3 (b) 4
(c) 5 (d) 2

56. The common components of photochemical smog are

(a) O_3, CH_4, CO_2 (b) O_3, CO_2, CO
(c) O_2, SO_3, PAN (d) O_3, NO, PAN

57. The electron displacement effect observed in the given structures is known as



(a) $+R$ effect (b) R effect
(c) Electromeric effect (d) -I effect

58. An alkene $X(C_4H_8)$ exhibits geometrical isomerism. Oxidation of A with $KMnO_4 \mid H^+$ gave Y . On heating sodium salt of Y with a mixture of NaOH and CaO gave Z . What is Z?

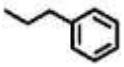
(a) CH_3CH_3 (b) $CH_3CH_2CH_3$
(c) $CH_3CH_2CH_2CH_3$ (d) CH_4

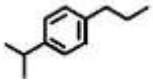
59. The number of activating and deactivating groups of the following are respectively

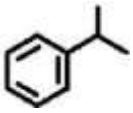
(a) 2,3 (b) 3,2
(c) 1, 4 (d) 4,1

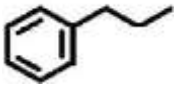
60. X and Z respectively in the following reaction sequence are

$C_3H_6 \xrightarrow{X} Y \xrightarrow[AlCl_3]{C_6H_6} Z$ (major product)

(a) HBr , 

(b) HBr , 

(c) HBr/ROOR , 

(d) HBr/ROOR , 

61. The molecular formula of a compound is AB_2O_4. Atoms of O form ccp lattice. Atoms of A (cation) occupy $\frac{1}{8}$ th of tetrahedral voids. Atoms of B (cation) occupy a fraction of octahedral voids. What is the fraction of vacant octahedral voids?

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

62. Distilled water boils at 373.15 K and freezes at 273.15 K . A solution of glucose in distilled water boils at 373.202 K . What is the freezing point (in K) of the same solution?
(For water, $K_b = 0.52\ K\ kg\ mol^{-1}$, $K_f = 1.86\ K\ kg\ mol^{-1}$)

(a) 273.15 (b) 273.0
(c) 272.964 (d) 273.336

63. Identify the correct statements from the following
(A) At 298 K , the potential of hydrogen electrode placed in a solution of pH = 10, is -0.59 V
(B) The limiting molar conductivity of Ca^{2+} and $Cl^-$is 119 and 76 S cm^2 mol^{-1} respectively. The limiting molar conductivity of $CaCl_2$ is 195 S cm^2 mol^{-1}
(C) The correct relationship between K_c and $E^{\ominus}_{cell}$ is $E^{\ominus}_{cell} = \frac{2.303RT}{nF} \log K_c$

(a) A, B, C (b) A, B only
(c) A, C only (d) B, C only

64. For a first order reaction, a plot of $\ln k$ (y-axis) and $\frac{1}{T}$ (x-axis) gave the straight line with slope equal to $-10^3 k$ and intercept equal to 2.303 (on y-axis). What is the activation energy (E_a in $kJmol^{-1}$) of the reaction?
(Given $R = 8.314 Jmol^{-1}\ K^{-1}$)

(a) 8.314 (b)2.303
(c) 2303 (d) 83.14

65. Adsorption of a gas (A) on an adsorbent follows Freundlich adsorption isotherm. The slope and intercept (on y-axis) of the isotherm are 0.5 and 1.0 respectively. What is the value of $\frac{x}{m}$, when the pressure of the gas (A) is 100 atm ?

(a) 10 (b) 1
(c) 100 (d) 1000

66. A low boiling point metal contains high boiling point metal as impurity. The correct refining method is

(a) Liquation (b) Distillation
(c) Poling (d) Vapour phase refining

67. Which of the following when subjected to thermal decomposition will liberate dinitrogen?
(i) sodium nitrate
(ii) ammonium dichromate
(iii) barium azide

(a) i, ii only (b) ii, iii only
(c) i, iii only (d) i, ii, iii

68. Observe the following reaction. This reaction represents

$$4HCl + O_2 \xrightarrow[723\ K]{CuCl_2} 2Cl_2 + 2H_2O$$

(a) van Arkel process
(b) Hall - Heroult process
(c) Serpeck's process
(d) Deacon's process

69. Identify the set which is not correctly matched in the following

(a) PH_3, colourless gas, rotten fish smell
(b) Cl_2, greenish yellow gas, pungent smell
(c) Ne, fluorescent green gas, rotten egg smell
(d) SO_2, colourless gas, pungent smell

70. Identify the correct statements from the following

(i) Ti (IV) is more stable than Ti (III) and Ti (II)

(ii) Among 3d-series elements (from Z=22 to 29) only copper has positive reduction potential (M^{2+}/M)

(iii) Both Sc and Zn exhibit +1 oxidation state

(a) i, ii only (b) i, iii only
(c) ii, iii only (d) i, ii, iii

71. The molecular formula of a coordinate complex is $CoH_{12}O_6Cl_3$. When one mole of this aqueous solution of complex is reacted with excess of aqueous $AgNO_3$ solution, three moles of AgCl was formed. What is the correct formula of the complex?

(a) $[Co(H_2O)_6]Cl_3$ (b) $[Co(H_2O)_5Cl_2]Cl_2H_2O$
(c) $[Co(H_2O)_4Cl_2]Cl(H_2O)_2$ (d) $[Co(H_2O)_3Cl_3](H_2O)_3$

72. Match the following

List - I (Monomer/s)		**List - II (Name of the polymer)**	
A	$CF_2 = CF_2$	**I**	Neoprene
B	$NH_2(CH_2)_6NH_2$, $HO_2C(CH_2)_4CO_2H$	**II**	Bakelite
C	$C_6H_5OH, HCHO$	**III**	Teflon
D	$CH_2 = CH(Cl) - CH = CH_2$	**IV**	Nylon 6,6

The correct answer is

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

73. The functional groups involved in the conversion of glucose to gluconic acid and gluconic acid to saccharic acid respectively are

(a) $-CHO, -CHOH$ (b) $-CHO, -CH_2OH$
(c) $-CH_2OH, -CHO$ (d) $-CH_2OH, -CHOH$

74. Among the following the incorrect statement about chloramphenicol is

(a) It is a bacteriostatic drug
(b) It is a broad spectrum antibiotic
(c) It is a bactericidal drug
(d) It is used to treat typhoid

75. A halogen compound $X(C_4H_9Br)$ on hydrolysis gave alcohol Y . The alcohol Y undergoes dehydration with $20\%H_3PO_4$ at 358 K . What is X ?

(a) $(CH_3)_3CBr$ (b) $(CH_3)_2CHCH_2Br$
(c) $CH_3CH_2CH_2CH_2Br$ (d) $CH_3CH(Br)CH_2CH_3$

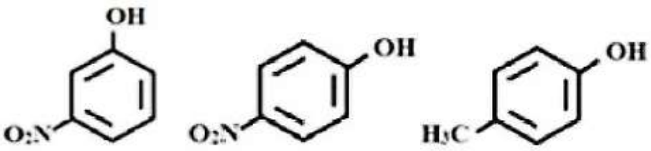
76. An alcohol $X(C_5H_{12}O)$ when reacted with conc. HCl and anhydrous $ZnCl_2$ produces turbidity instantly. The alcohol *X* can be prepared from which of the following reactions?

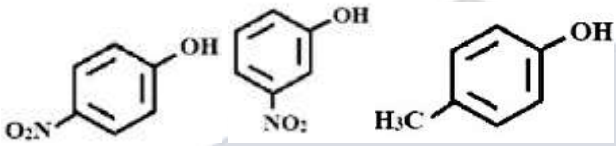
(a) Reduction of 2-pentanone with $NaBH_4$
(b) Reaction of isopropyl magnesium bromide with ethanal
(c) Reaction of ethyl magnesium bromide with propanal
(d) Acid catalysed hydration of 2-methyl-1-butene

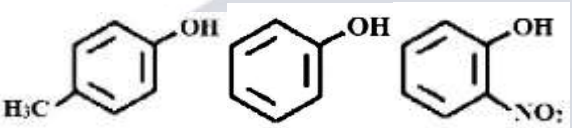
77. Assertion (A) : Chlorobenzene is not formed in the reaction of phenol with thionyl chloride
Reason (R) : In phenol, carbon - oxygen bond has partial double bond character

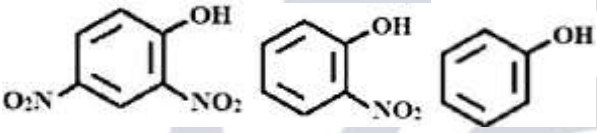
(A) and (R) are correct. (R) is the correct explanation of (A)
(A) and (R) are correct, but (R) is not the correct explanation of (A)
(A) is correct but (R) is not correct
(A) is not correct but (R) is correct

78. The pK_a values of X, Y, Z respectively are 8.3, 7.1, 10.2. What are X, Y, Z ?

(a) 

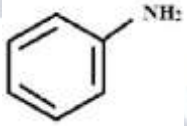
(b) 

(c) 

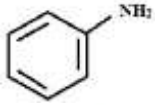
(d) 

79. The reagents / chemicals X and Y that convert cyanobenzene to schiff's base are

(a) (i) DIBAL-H , NH_2OH (ii) H_2O



(b) DIBAL $-H, H_2O$,
(c) LAH , CH_3OH



(d) H_3O^+,

80. The correct statements of the following are

(A) Aniline forms a stable benzene diazonium chloride at 285 K
(B) N - Phenylethanamide is less reactive towards nitration than aniline
(C) $p-CH_3C_6H_4COCl$ is Hinsberg reagent

(a) A & B only (b) A & C only
(c) B only (d) C only

Mathematics

81. If $f(x)=\frac{2x-3}{3x-2}$ and $f_n(x)=$ (fo fo fo..... ntimes)(x), then $f_{32}(x)=$

(a) $\frac{2x-3}{3x-2}$ (b) x
(c) $\frac{3x+2}{2x+3}$ (d) $f_{23}(x)$

82. The domain of the real valued function $f(x)=\sqrt{\cos(\sin x)}+\cos^{-1}\left(\frac{1+x^2}{2x}\right)$ is

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

83. For $n \in$ N, the largest positive integer that divides $81^n + 20n - 1$ is k . If S is the sum of all positive divisors of k then $S - k =$
(a) 117 (b) 130
(c) 115 (d) 127

84. A, B, C, D are square matrices such that $A + B$ is symmetric, $A - B$ is skewsymmetric and D is the transpose of C .
If $A = \begin{bmatrix} -1 & 2 & 3 \\ 4 & 3 & -2 \\ 3 & -4 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} 0 & 1 & -2 \\ 2 & -1 & 0 \\ 0 & 2 & 1 \end{bmatrix}$, then the matrix $B + D =$
(a) $\begin{bmatrix} -1 & 6 & 3 \\ 6 & 2 & -2 \\ 3 & -2 & 6 \end{bmatrix}$ (b) $\begin{bmatrix} -1 & 6 & 3 \\ 3 & 2 & -2 \\ 1 & -2 & 6 \end{bmatrix}$
(c) $\begin{bmatrix} 3 & 2 & -2 \\ 2 & 6 & 3 \\ -2 & 3 & 2 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & -2 & 6 \\ -2 & 3 & 2 \\ 6 & 2 & 1 \end{bmatrix}$

85. If A is square matrix and $A^2 + I = 2A$, then $A^9 =$
(a) $8A^2 - 7I$ (b) $9A + 8I$
(c) $9A - 8I$ (d) $8A^2 + 7I$

86. $\det \begin{bmatrix} \frac{a^2+b^2}{c} & c & c \\ a & \frac{b^2+c^2}{a} & a \\ b & b & \frac{c^2+a^2}{b} \end{bmatrix} =$
(a) $(a-b)(b-c)(c-a)$
(b) $(a+b)(b+c)(c+a)$
(c) $2abc$
(d) $4abc$

87. The system of simultaneous linear equations $x - 2y + 3z = 4, 3x + y - 2z = 7, 2x + 3y + z = 6$ has
(a) infinitely many solutions
(b) no solution
(c) unique solution having $z = 2$
(d) unique solution having $z = 1/2$

88. If $\sqrt{5} - i\sqrt{15} = r(\cos\theta + i\sin\theta), -\pi < \theta < \pi$, then $r^2(\sec\theta + 3\text{cosec}^2\theta) =$
(a) 40 (b)60
(c) 120 (d) 180

89. The point P denotes the complex number $z = x + iy$ in the Argand plane. If $\frac{2z-i}{z-2}$ is a purely real number, then the equation of the locus of P is
(a) $2x^2 + 2y^2 - 4x - y = 0$
(b) $x + 4y - 2 = 0 \& (x, y) \neq (2,0)$
(c) $x - 4y - 2 = 0 \& (x, y) \neq (2,0)$
(d) $x^2 + y^2 - 4x - 2y = 0$

90. x and y are two complex numbers such that $|x| = |y| = 1$. If $\text{Arg}(x) = 2\alpha, \text{Arg}(y) = 3\beta$ and $\alpha + \beta = \frac{\pi}{36}$, then $x^6y^4 + \frac{1}{x^6y^4} =$
(a) 0 (b) -1
(c) 1 (d) $\frac{1}{2}$

91. One of the roots of the equation $x^{14} + x^9 - x^5 - 1 = 0$ is
(a) $\frac{1+\sqrt{3}i}{2}$ (b) $\frac{\sqrt{5}-1}{4} + i\frac{\sqrt{10-2\sqrt{5}}}{4}$
(c) $\frac{1-\sqrt{3}i}{2}$ (d) $\frac{\sqrt{5}+1}{4} + i\frac{\sqrt{10-2\sqrt{5}}}{4}$

92. If the quadratic equation $3x^2 + (2k+1)x - 5k = 0$ has real and equal roots, then the value of k such that $-\frac{1}{2} < k < 0$ is

(a) $\frac{-16+\sqrt{255}}{2}$ (b) $\frac{-16-\sqrt{255}}{2}$

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

93. The equations $2x^2 + ax - 2 = 0$ and $x^2 + x + 2a = 0$ have exactly one common root. If $a \neq 0$, then one of the roots of the equation $ax^2 - 4x - 2a = 0$ is

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

(c) $\frac{-4+\sqrt{22}}{3}$ (d) $\frac{-2+\sqrt{22}}{3}$

94. If α, β, γ are the roots of the equation $2x^3 - 3x^2 + 5x - 7 = 0$, then $\sum\alpha^2\beta^2 =$

(a) $-\frac{17}{4}$ (b) $\frac{17}{4}$

(c) $-\frac{13}{4}$ (d) $\frac{13}{4}$

95. The sum of two roots of the equation $x^4 - x^3 - 16x^2 + 4x + 48 = 0$ is zero. If $\alpha, \beta, \gamma, \delta$ are the roots of this equation, then $\alpha^4 + \beta^4 + \gamma^4 + \delta^4 =$

(a) 123 (b)369

(c) 132 (d) 396

96. The sum of all the 4-digit numbers formed by taking all the digits from 2, 3, 5, 7 without repetition, is

(a) 331122 (b) 123312

(c) 113322 (d) 132132

97. The number of ways in which 15 identical gold coins can be distributed among 3 persons such that each one gets atleast 3 gold coins is

(a) 27 (b) 28

(c) 22 (d) 25

98. The number of all possible combinations of 4 letters which are taken from the letters of the word ACCOMMODATION is

(a) 167 (b) 161

(c) 160 (d) 157

99. If ${}^nC_r = C_r$ and $2\frac{C_1}{C_0} + 4\frac{C_2}{C_1} + 6\frac{C_3}{C_2} + \cdots + 2n\frac{C_n}{C_{n-1}} = 650$, then ${}^nC_2 =$

(a) 25 (b) 300

(c) 225 (d) 625

100. When $|x| < 2$ coefficient of x^2 in the power series expansion of $\frac{x}{(x-2)(x-3)}$ is

(a) $\frac{1}{6}$ (b) $\frac{5}{36}$

(c) $\frac{25}{216}$ (d) $\frac{5}{18}$

101. If $\frac{x^4}{(x^2+1)(x-2)} = f(x) + \frac{Ax+B}{x^2+1} + \frac{C}{x-2}$, then $f(14) + 2A - B =$

(a) 5 C (b) 4C

(c) 6C (d) 7C

102. If the period of the function $f(x) = 2\cos(3x+4) - 3\tan(2x-3) + 5\sin(5x) - 7$ is k, then

(a) $\sin\frac{k}{8} = \frac{1}{2}$ (b) $\cos\frac{k}{6} = \frac{1}{\sqrt{2}}$

(c) $\tan\frac{k}{3} = -\sqrt{3}$ (d) $\sec\frac{k}{2} = 2$

103. If $\tan A < 0$ and $\tan 2A = -\frac{4}{3}$, then $\cos 6A =$

(a) $\frac{117}{125}$ (b) $-\frac{117}{125}$

(c) $\frac{120}{169}$ (d) $-\frac{120}{169}$

104. If $m\cos(\alpha+\beta) - n\cos(\alpha-\beta) = m\cos(\alpha-\beta) + n\cos(\alpha+\beta)$, then $\tan\alpha\tan\beta =$

(a) $m+n$ (b) $m-n$

(c) $-\frac{n}{m}$ (d) $\frac{m}{n}$

105. The number of solutions of the equation $\sin 7\theta - \sin 3\theta = \sin 4\theta$ that lie in the interval $(0, \pi)$ is

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

106. $\mathbf{Cos}^{-1}\frac{3}{5} + \mathbf{Sin}^{-1}\frac{5}{13} + \mathbf{Tan}^{-1}\frac{16}{63} =$

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

107. If $\mathbf{Cosh}^{-1}\left(\frac{5}{3}\right) + \mathbf{Sinh}^{-1}\left(\frac{3}{4}\right) = k$, then $e^k =$

(a) $\frac{2}{3}$ (b) $\frac{3}{2}$
(c) 6 (d) 5

108. In a triangle ABC , if $(a-b)^2\cos^2\frac{C}{2} + (a+b)^2\sin^2\frac{C}{2} = a^2 + b^2$, then $\cos A =$

(a) $\cos B$ (b) $\sin C$
(c) $\sin B$ (d) $-\cos C$

109. In a triangle ABC , if $r_1r_2 + rr_3 = 35, r_2r_3 + rr_1 = 63$ and $r_3r_1 + rr_2 = 45$, then $2s =$

(a) 28 (b) 25
(c) 21 (d) 36

110. $\bar{\imath} - 2\bar{\jmath} + \bar{k}, 2\bar{\imath} + \bar{\jmath} - \bar{k}, \bar{\imath} - \bar{\jmath} - 2\bar{k}$ are the position vectors of the vertices A, B, C of a triangle ABC respectively. If D and E are the mid points of BC and CA respectively, then the unit vector along $\overline{DE}$ is

(a) $\frac{1}{7}(3\bar{\imath} - 2\bar{\jmath} + 6\bar{k})$ (b) $\frac{1}{\sqrt{14}}(-\bar{\imath} - 3\bar{\jmath} + 2\bar{k})$
(c) $\frac{1}{\sqrt{3}}(\bar{\imath} - \bar{\jmath} - \bar{k})$ (d) $\frac{1}{13}(12\bar{\imath} + 3\bar{\jmath} + 4\bar{k})$

111. A vector of magnitude $\sqrt{2}$ units along the internal bisector of the angle between the vectors $2\bar{\imath} - 2\bar{\jmath} + \bar{k}$ and $\bar{\imath} + 2\bar{\jmath} + 2\bar{k}$ is

(a) $\bar{\jmath} + \bar{k}$ (b) $\bar{\imath} - \bar{\jmath}$
(c) $\bar{\imath} - \bar{k}$ (d) $\sqrt{\bar{\imath} + \bar{k}}$

112. If θ is the angle between the vectors $4\bar{\imath} - \bar{\jmath} + 2\bar{k}$ and $\bar{\imath} + 3\bar{\jmath} - 2\bar{k}$ then $\sin 2\theta =$

(a) $\sqrt{\frac{3}{95}}$ (b) $-\sqrt{\frac{3}{95}}$
(c) $-\frac{\sqrt{285}}{49}$ (d) $\frac{\sqrt{258}}{49}$

113. $\bar{a}, \bar{b}, \bar{c}$ are three vectors such that $|\bar{a}| = 3, |\bar{b}| = 2\sqrt{2}, |\bar{c}| = 5$ and $\bar{c}$ is perpendicular to the plane of $\bar{a}$ and $\bar{b}$. If the angle between the vectors $\bar{a}$ and $\bar{b}$ is $\frac{\pi}{4}$ then $|\bar{a} + \bar{b} + \bar{c}| =$

(a) $5\sqrt{3}$ (b) $2\sqrt{5}$
(c) 10 (d) $3\sqrt{6}$

114. If $\bar{a}, \bar{b}, \bar{c}$ are non-coplanar vectors and the points $\lambda\bar{a} + 3\bar{b} - \bar{c}, \bar{a} - \lambda\bar{b} + 3\bar{c}, 3\bar{a} + 4\bar{b} - \lambda\bar{c}, \bar{a} - 6\bar{b} + 6\bar{c}$ are coplanar, then one of the values of λ is

(a) 87 (b) 5
(c) 2 (d) 1

115. The mean deviation about the mean for the following data is

Class interval	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10
Frequency	1	3	5	3	1

(a) 2 (b) $\frac{15}{13}$
(c) $\frac{22}{13}$ (d) $\frac{20}{13}$

116. When 2 dice are thrown, it is observed that the sum of the numbers appeared on the top faces of both the dice is a prime number. Then the probability of having a multiple of 3 among the pair of numbers thus

obtained is

(a) $\frac{8}{15}$ (b) $\frac{11}{36}$

(c) $\frac{5}{9}$ (d) $\frac{5}{12}$

117. If 2 cards drawn at random from a well shuffled pack of 52 playing cards are from the same suit, then the probability of getting a face card and a card having a prime number is

(a) $\frac{8}{13}$ (b) $\frac{2}{13}$

(c) $\frac{8}{221}$ (d) $\frac{32}{221}$

118. A dealer gets refrigerators from 3 different manufacturing companies C_1, C_2 and C_3. 25% of his stock is from C_1, 35% from C_2 and 40% from C_3. The percentages of receiving defective refrigerators from C_1, C_2 and C_3 are 3%, 2%, 1% respectively. If a refrigerator sold at random is found to be defective by a customer, then the probability that it is from C_2 is

(a) $\frac{29}{37}$ (b) $\frac{8}{37}$

(c) $\frac{14}{37}$ (d) $\frac{15}{37}$

119. If the probability that a student selected at random from a particular college is good at mathematics is 0.6 , then the probability of having two students who are good at mathematics in a group of 8 students of that college standing in front of the college is

(a) $\frac{2^6\times3^2\times7}{5^8}$ (b) $\frac{2^6\times3^2\times7}{5^6}$

(c) $x\frac{2^8\times3^2\times7}{5^6}$ (d) $\frac{2^8\times3^2\times7}{5^8}$

120. If on an average 4 customers visit a shop in an hour, then the probability that more than 2 customers visit the shop in a specific hour is

(a) $\frac{e^4-13}{e^4}$ (b) $\frac{8}{e^4}$

(c) $\frac{4}{e^4}$ (d) $\frac{e^4-21}{e^4}$

121. The centroid of a variable triangle ABC is at the distance of 5 units from the origin. If $A=(2,3)$ and $B=(3,2)$, then the locus of C is

(a) a circle of radius 225 units

(b) a rectangular hyperbola

(c) a circle of diameter 30 units

(d) an ellipse with eccentricity $\frac{4}{5}$

122. When the origin is shifted to the point $(2,b)$ by translation of axes, the coordinates of the point $(a,4)$ have changed to $(6,8)$. When the origin is shifted to (a,b) by translation of axes, if the transformed equation of $x^2+4xy+y^2=0$ is $X^2+2HXY+Y^2+2GX+2FY+C=0$, then $2H(G+F)=$

(a) C (b) $-2C$

(c) 2C (d) -C

123. The slope of a line L passing through the point $(-2,-3)$ is not defined. If the angle between the lines L and $ax-2y+3=0 (a>0)$ is 45°, then the angle made by the line $x+ay-4=0$ with positive X -axis in the anticlockwise direction is

(a) $\pi-\text{Tan}^{-1}\left(\frac{1}{2}\right)$ (b) $\frac{\pi}{3}$

(c) $\frac{2\pi}{3}$ (d) $\text{Tan}^{-1}\left(\frac{1}{2}\right)$

124. (a,b) is the point of concurrency of the lines $x-3y+3=0, kx+y+k=0$ and $2x+y-8=0$. If the perpendicular distance from the origin to the line $L\equiv ax-by+2k=0$ is p , then the perpendicular distance from the point $(2,3)$ to $L=0$ is

(a) $\frac{p}{2}$ (b) p

(c) $2p$ (d) $3p$

125. If $(4,3)$ and $(1,-2)$ are the end points of a diagonal of a square, then the equation of one of its sides is

(a) $4x+y-11=0$ (b) $2x+y=0$

(c) $2x-3y+1=0$ (d) $x-4y-9=0$

126. Area of the triangle bounded by the lines given by the equations $12x^2-20xy+7y^2=0$ and $x+y-1=0$ is

(a) $\frac{8}{29}$ (b) $\frac{8}{39}$

(c) $\frac{4}{29}$ (d) $\frac{4}{39}$

127. If $(1,1),(-2,2),(2,-2)$ are 3 points on a circle S, then the perpendicular distance from the centre of the circle S to the line $3x-4y+1=0$ is

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

(c) $\frac{23}{10}$ (d) 2

128. If the line $4x-3y+p=0(p+3>0)$ touches the circle $x^2+y^2-4x+6y+4=0$ at the point (h,k), then $h-2k=$

(a) $-\frac{8}{5}$ (b) 2

(c) $\frac{6}{5}$ (d) 3

129. If the inverse point of the point $P(3,3)$ with respect to the circle $x^2+y^2-4x+4y+4=0$ is $Q(a,b)$, then $a+5b=$

(a) 24 (b) 0

(c) -4 (d) 1

130. If the equation of the transverse common tangent of the circles $x^2+y^2-4x+6y+4=0$ and $x^2+y^2+2x-2y-2=0$ is $ax+by+c=0$, then $\frac{a}{c}=$

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

(c) 1 (d) -1

131. A circle $S\equiv x^2+y^2+2gx+2fy+6=0$ cuts another circle $x^2+y^2-6x-6y-6=0$ orthogonally. If the angle between the circles $S=0$ and $x^2+y^2+6x+6y+2=0$ is 60°, then the radius of the circle $S=0$ is

(a) 2 (b) 1

(c) 4 (d) 5

132. If m_1 and m_2 are the slopes of the direct common tangents drawn to the circles $x^2+y^2-2x-8y+8=0$ and $x^2+y^2-8x+15=0$, then $m_1+m_2=$

(a) $-\frac{24}{5}$ (b) $\frac{12}{5}$

(c) $\frac{24}{5}$ (d) $-\frac{12}{5}$

133. If $(2,3)$ is the focus and $x-y+3=0$ is the directrix of a parabola then the equation of the tangent drawn at the vertex of the parabola is

(a) $zx-y-2=0$ (b) $x-y+2=0$

(c) $x-y+5=0$ (d) $x-y-5=0$

134. The equation of the common tangent to the parabola $y^2=8x$ and the circle $x^2+y^2=2$ is $ax+by+2=0$. If $-\frac{a}{b}>0$, then $3a^2+2b+1=y^2=8x$

(a) 5 (b) 4

(c) 3 (d) 2

135. Consider the parabola $25\left[(x-2)^2+(y+5)^2\right]=(3x+4y-1)^2$, match the characteristic of this parabola given in List - I with its corresponding item in List-II

List - I		List - II	
I	Vertex	A	8

II	length of latus rectum	**B**	$\left(\frac{29}{10}, \frac{-38}{10}\right)$
III	Directrix	**C**	$3x + 4y - 1 = 0$
IV	One end of the latus rectum	**D**	$\left(\frac{-2}{5}, \frac{-16}{5}\right)$
		E	6

The correct answer is
(a) I-B, II-E, III-C, IV-D
(b) I-D, II-A, III-C, IV-B
(c) I-B, II-A, III-C, IV-D
(d) I-D, II-B, III-C, IV-A

136. **If $6x - 5y - 20 = 0$ is a normal to the ellipse $x^2 + 3y^2 = k$, then $k = x^2 + 3y^2 = k$**
(a) 9 (b) 17
(c) 25 (d) 37

137. **The point of intersection of two tangents drawn to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{4} = 1$ lie on the circle $x^2 + y^2 = 5$. If these tangents are perpendicular to each other, then $a =$**
(a) 25 (b) 5
(c) 9 (d) 3

138. **If the ratio of the perpendicular distances of a variable point $P(x, y, z)$ from the X axis and from the YZ -plane is $2:3$, then the equation of the locus of P is**
(a) $4x^2 - 9y^2 - 9z^2 = 0$ (b) $9x^2 - 4y^2 - 4z^2 = 0$
(c) $4x^2 - 4y^2 - 9z^2 = 0$ (d) $9x^2 - 9y^2 - 4z^2 = 0$

139. **The direction cosines of two lines are connected by the relations $l - m + n = 0$ and $2 \mid m - 3mn + nl = 0$. If θ is the angle between these two lines, then $\cos\theta =$**
(a) $\frac{1}{4}$ (b) $\frac{1}{\sqrt{19}}$
(c) $x^{\frac{1}{3}}$ (d) $\frac{1}{3\sqrt{2}}$

140. **A plane π passes through the points $(5, 1, 2)$, $(3, -4, 6)$ and $(7, 0, -1)$. If p is the perpendicular distance from the origin to the plane π and l, m, n are the direction cosines of a normal to the plane π, then $|3l + 2m + 5n| =$**
(a) 3p (b) $2p$
(c) p (d) $\frac{p}{2}$

141. $\lim_{x\to 0} \frac{3^{\sin x} - 2^{\tan x}}{\sin x} =$
(a) 0 (b) 1
(c) $\log_e 6$ (d) $\log_e \frac{3}{2}$

142. **If the function $f(x) = \begin{cases} \frac{\cos ax - \cos 9x}{x^2} & , \text{if } x \neq 0 \\ 16 & , \text{if } x = 0 \end{cases}$ is continuous at $x = 0$, then $a =$**
(a) ± 8 (b) ± 7
(c) ± 6 (d) ± 5

143. **If $f(x) = \begin{cases} \frac{8}{x^3} - 6x & , \text{if } 0 < x \leq 1 \\ \frac{x-1}{\sqrt{x}-1} & , \text{if } x > 1 \end{cases}$ is a real valued function, then at $x = 1$, f is**
(a) continuous and differentiable
(b) continuous but not differentiable
(c) neither continuous nor differentiable

(d) differentiable but not continuous

144. If $2x^2 - 3xy + 4y^2 + 2x - 3y + 4 = 0$, then $\left(\frac{dy}{dx}\right)_{(3,2)} =$

(a) -5 (b) $\frac{5}{7}$

(c) -2 (d) $\frac{2}{7}$

145. If $x = \frac{9t^2}{1+t^4}$ and $y = \frac{16t^2}{1-t^4}$ then $\frac{dy}{dx} =$

(a) $\frac{16}{9}\left(\frac{1-t^4}{1+t^4}\right)^3$ (b) $\frac{16(1-t^4)}{9(1+t^4)}$

(c) $\frac{9(1-t^4)}{16(1+t^4)}$ (d) $\frac{16}{9}\left(\frac{1+t^4}{1-t^4}\right)^3$

146. If $y = \sin ax + \cos bx$ then $y'' + b^2y = y = \sin ax + \cos bx$

(a) $(b^2 - a^2)\sin ax$ (b) $(b^2 - a^2)\cos bx$

(c) $(a^2 - b^2)\tan ax$ (d) $(b^2 - a^2)\cot bx$

147. The radius of a sphere is 7 cm . If an error of 0.08sq. cm . is made in measuring it, then the approximate error (in cubic cm) found in its volume is)

(a) 0.28 (b) 0.32

(c) 0.96 (d) 0.098

148. The curve $y = x^3 - 2x^2 + 3x - 4$ intersects the horizontal line $y = -2$ at the point $P(h, k)$. If the tangent drawn to this curve at P meets the X $-$axis at (x_1, y_1) , then $x_1 =$

(a) 1 (b) 2

(c) 3 (d) -3

149. A particle moving from a fixed point on a straight line travels a distance S metres in $t$sec. If $S = t^3 - t^2 - t + 3$, then the distance (in mts) travelled by the particle when it comes to rest is

(a) 5 (b) 4

(c) 2 (d) 3

150. If $f(x) = (2x - 1)(3x + 2)(4x - 3)$ is a real valued function defined on $\left[\frac{1}{2}, \frac{3}{4}\right]$, then the value(s) of 'c' as defined in the statement of Rolle's theorem

(a) Does not exist (b) $\frac{7\pm\sqrt{247}}{36}$

(c) $\frac{7-\sqrt{247}}{36}$ (d) $\frac{7+\sqrt{247}}{36}$

151. If the interval in which the real valued function $f(x) = \log\left(\frac{1+x}{1-x}\right) - 2x - \frac{x^3}{1-x^2}$ is decreasing in (a, b), where $|b - a|$ is maximum, then $\frac{a}{b} =$

(a) -1 (b) 1

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

152. $\int \left(\sqrt{1 - \sin x} + \sqrt{1 + \sin x}\right)dx = f(x) + c$, where c is the constant of integration. If $\frac{5\pi}{2} < x < \frac{7\pi}{2}$ and $f\left(\frac{8\pi}{3}\right) = -2$, then $f'\left(\frac{8\pi}{3}\right) =$

(a) 1 (b) $\sqrt{3}$

(c) 0 (d) -1

153. If $f(x) = \int \frac{\sin 2x + 2\cos x}{4\sin^2 x + 5\sin x + 1}\,dx$ and $f(0) = 0$, then $f(\pi/6) =$

(a) $\log\frac{3}{4}$ (b) $2\log 2$

(c) $\frac{1}{2}\log 3$ (d) 1

154. $\int \frac{(1 - 4\sin^2 x)\cos x}{\cos(3x + 2)}\,dx =$

(a) $(\cos 2)x - \frac{1}{3}(\sin 2)\log|\sec(3x + 2)| + c$

(b) $(\sin 2)x - \frac{1}{3}(\cos 2)\log|\cos(3x + 2)| + c$

(c) $(\sin 2)x + \frac{1}{3}(\cos 2)\log|\cos(3x+2)| + c$

(d) $(\cos 2)x + \frac{1}{3}(\sin 2)\log|\sec(3x+2)| + c$

155. $\int \frac{x^5+x}{x^8+1}\,dx =$

(a) $\frac{1}{2\sqrt{2}}\text{Tan}^{-1}\left(\frac{x^4-1}{\sqrt{2}x^2}\right) + c$

(b) $\log(x^5+x^2) - \log(x^3+x) + \log(x+1) + c$

(c) $\frac{2}{9}x^8 - \frac{4}{9}x^6 + \frac{1}{9}x^4 - \frac{1}{3}x^2 + c$

(d) $^8\frac{1}{\sqrt{2}}\text{Tan}^{-1}\left(\frac{x^5-1}{\sqrt{2}x^3}\right) + c$

156. $\lim_{n\to\infty}\left[\left(1+\frac{1}{n^2}\right)\left(1+\frac{4}{n^2}\right)\left(1+\frac{9}{n^2}\right)\ldots(2)\right]^{\frac{1}{n}} =$

(a) $16e^{-1}$ (b) $2e^{\left(\frac{\pi-4}{2}\right)}$

(c) $2\log 2 - 1$ (d) $2 + e^{\left(\frac{\pi-4}{2}\right)}$

157. $\int_{-2}^{2} x^4(4-x^2)^{\frac{7}{2}}dx =$

(a) 4π (b) $\frac{\pi}{16}$

(c) 28π (d) $\frac{3\pi}{128}$

158. **Area of the region enclosed between the curves $y^2 = 4(x+7)$ and $y^2 = 5(2-x)$ is**

(a) $\frac{32\sqrt{2}}{3}$ (b) $\frac{8}{3}$

(c) $\frac{1}{6}$ (d) $24\sqrt{5}$

159. **If the slope of the tangent drawn at any point (x, y) on the curve $y = f(x)$ is $(6x^2+10x-9)$ and $f(2) = 0$, then $f(-2) =$ %**

(a) 0 (b) 4

(c) -6 (d) $x - 13$

160. **The general solution of the differential equation $(3x^2-2xy)dy + (y^2-2xy)dx = 0$ is**

(a) $x^2 - xy = cy^2$ (b) $xy^2 - xy = cx^3$

(c) $xy - x^2 = cy^3$ (d) $xy - y^2 = cy^3$