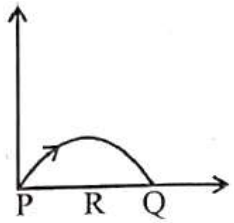
Physics

1. **Among the following the least unit for length is**
   (a) parsec (b) nanometer
   (c) fermi (d) angstrom
2. **The time of flight of a vertically projected stone is 8 s . The position of the stone after 6 s from the ground is (Acceleration due to gravity = $10\ ms^{-2}$)**
   (a) 20 m (b) 60 m
   (c) 75 m (d) 40 m
3. **A stone thrown with velocity ' u ' at angles ' θ ' and $(90^\circ - \theta)$ with the horizontal reaches to maximum heights H_1 and H_2 respectively. Its horizontal range is**
   (a) $4\sqrt{H_1H_2}$ (b) $2H_1H_2$
   (c) $2\sqrt{H_1H_2}$ (d) $\sqrt[4]{\frac{H_1}{H_2}}$
4. **Two vectors of same magnitude act at a point. Twice the product of the magnitudes of two vectors is equal to the square of the magnitude of their resultant. The angle between the two vectors is**
   (a) 60° (b) 30° (c) 90° (d) 120°
5. **Acar of mass 1500 kg is moving with $20\ ms^{-1}$ velocity. If the breaks are applied it comes to rest in 5 seconds, then the retarding force is**
   (a) 9000 N (b) 6000 N
   (c) 12000 N (d) 3000 N
6. **A body is made to move up along an inclined plane of inclination 30° and the coefficient of friction is 0.5 , then its retardation is (g - acceleration due to gravity)**
   (a) $\left(\frac{2+\sqrt{3}}{4}\right)g$ (b) $\left(\frac{2-\sqrt{3}}{4}\right)g$
   (c) $\left(\frac{2-\sqrt{3}}{2}\right)g$ (d) $\left(\frac{2+\sqrt{3}}{2}\right)g$
7. **A machine gun fires 300 bullets per minute each with a velocity of $500\ ms^{-1}$. If the mass of each bullet is 4 g , the power of the machine gun is**
   (a) 3.6 kW (b) 3 kW
   (c) 5.4 kW (d) 2.5 kW
8. **A body falls freely from a height of 100 m on to the ground and rebounds to a maximum height of 36 m after collision. The coefficient of restitution between ground and the body is**
   (a) 0.4 (d) 0.36
   (c) 0.6 (d) 0.5
9. **A force of $(2\hat{i} + 3\hat{j} + 4\hat{k})$N acts on a particle whose position vector with respect to the origin of the coordinate system is $(6\hat{i} + b\hat{j} + 12\hat{k})$m. If the angular momentum of the body is constant, the value of ' b ' is**
   (a) 6 (b) 9 (c) 12 (d) 3
10. **The range of a projectile of weight W is R . The average torque on the projectile between the initial and final positions P and Q about the point of projection is**



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

11. **Two springs A and B fixed at the top and are stretched by 8 cm and 16 cm respectively, when loads of 20 N and 10 N are suspended at the lower ends. The ratio of the spring constants of the springs A and B is**
(a) 1: 1 (b) 2: 1
(c) 3: 1 (d) 4: 1

12. **The amplitudes of a damped harmonic oscillator after 2 and 4 seconds are A_1 and A_2 respectively. If the initial amplitude of the oscillator is A_0, then**
(a) $A_1 = \sqrt{A_0 A_2}$ (b) $A_2 = \sqrt{A_0 A_1}$
(c) $A_0 = \sqrt{A_1 A_2}$ (d) $A_1 = \frac{A_0 + A_2}{2}$

13. **The value of acceleration due to gravity at a height of $4R_E$ from surface of earth is (R_E is radius of earth and acceleration due to gravity on the surface of the earth = $10\ ms^{-2}$)**
(a) 0.2 ms^{-2} (b) 0.3 ms^{-2}
(c) 0.4 ms^{-2} (d) 3 ms^{-2}

14. **The maximum possible height of a mountain on earth is approximately (elastic limit of mountain rock = $30 \times 10^7 Nm^{-2}$, average density of mountain rock = $3 \times 10^3 kgm^{-3}$, g = $10\ ms^{-2}$),**
(a) 9 km (b) 10 km
(c) 12 km (d) 8.8 km

15. **A person of height 1.65 m is standing upright. The additional external force required by blood vessel of length 1 cm , diameter 1 mm at feet to balance the pressure compared to similar blood vessel in head is (Density of blood = $1.1 \times 10^3\ kg\ m^{-3}$, $g = 10\ ms^{-2}$)**
(a) 0.57 N (b) 5.7 N
(c) 1.85 N (d) 3.14 N

16. **The specific heat capacity of a copper block of mass M is ' s '. If the mass of the copper block is doubled, the specific heat capacity will be**
(a) 2 s (b) $\frac{5}{2}$. (c) s (d) $\sqrt{\frac{3}{2}}$ s

17. **2 moles of a monatomic gas requires heat energy Q to be. heated from $30°C$ to $40°C$ at constant volume. The heat energy required to raise the temperature of 4 moles of a diatomic gas from $28°C$ to $33°C$ at constant volume is**
(a) 2 Q (b) $\frac{7Q}{2}$ (c) $\frac{4Q}{3}$ (d) $\frac{5Q}{3}$

18. **A block of steel of mass 2 kg slides down a rough inclined plane of inclination of $\sin^{-1}\left(\frac{3}{5}\right)$ at a constant speed. The temperature of the block as it slides through .80 cm , assuming that the mechanical energy lost is used to increase the temperature of the block is nearly (Specific heat capacity of steel = $420 Jkg^{-1}\ K^{-1}$ and Acceleration due to gravity = $10\ ms^{-2}$)**
(a) 0.0190°C (b) 0.0114°C
(c) 0.0152°C (d) 0.0952 °C

19. **Isothermal bulk modulus of a gas at a pressure P is (γ - ratio of specific heat capacities of the gas)**
(a) γ (b) γP (c) P (d) $\frac{\gamma}{P}$

20. **A vessel of volume 10 liters is filled with H_2 gas. The total average translational kinetic energy of its molecules is 4.5×10^5 J. The pressure of hydrogen in the vessel is**
(a) $3 \times 10^6 Nm^{-2}$ (b) $30 \times 10^6 Nm^{-2}$
(c) $30 \times 10^4 Nm^{-2}$ (d) $3 \times 10^4 Nm^{-2}$

21. **Small amplitude progressive wave in a stretched string has a speed of $100 cms^{-1}$, and frequency 100 Hz . The phase difference between two points 2.75 cm apart on the string, in radians, is**
(a) 0 (b) $11\frac{\pi}{2}$ (c) $\frac{\pi}{4}$ (d) $\frac{3\pi}{8}$

22. **Blue colour of the sky is due to**

(a) reflection of light (b) refraction of light
(c) diffraction of light (d) scattering of light

23. The property of light which cannot be explained by Huygen's construction of wavefront is

(a) Refraction (b) Reflection
(c) Diffraction (d) Origin of spectra

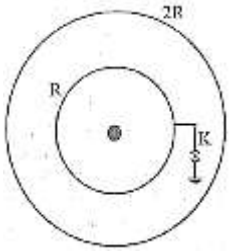
24. The electric field ($\vec{E}$ in NC^{-1}) in a region is given by $\vec{E} = 3\hat{i} + 5\hat{i}$. The net electric flux through a square area of side 2 m parallel to $y - z$ plane is

(a) $3NC^{-1}\ m^2$ (b) $6NC^{-1}\ m^2$
(c) $12NC^{-1}\ m^2$ (d) $24NC^{-1}\ m^2$

25. Two thin conducting concentric shells of radii R and 2 R are shown in the figure. The outer shell carries a charge $+Q$ and the inner shell is neutral. Then the correct statement/s is

(a) When the switch is closed, the potential on the inner shell becomes zero

(b) With the switch closed, the charge on the inner sphere is $\frac{Q}{2}$



(a) (a) and (b) are correct
(b) (a) is correct, (b) is wrong
(c) (a) is wrong, (b) is correct
(d) (a) and (b) are wrong

26. Two square - shaped metal plates of side 1 m, kept 0.01 m apart in air form a parallel plate capacitor. It is connected to a battery of 500 V . The plates of the capacitor are then immersed in an insulting oil by lowering the plates vertically with a speed of $0.001\ ms^{-1}$. If the dielectric constant of the oil is 11 , then current drawn from the battery during this process is

(a) 4.425×10^{-6} A (b) 4.425×10^{-5} A
(c) 4.425×10^{-9} A (d) 4.425×10^{-2} A

27. When a resistance R_1 is connected across a cell, the current is I_1 and if the resistance R_1 is replaced by R_2, the current is I_2. Then the internal resistance of the cell is

(a) $\frac{I_1R_1+I_2R_2}{I_1+I_2}$ (b) $\frac{I_1R_2-I_2R_1}{I_1-I_2}$
(c) $\frac{I_1R_2-I_2R_1}{I_1-I_2}$ (d) $\frac{I_2R_2-I_1R_1}{I_1-I_2}$

28. Charge passing through a conductor of cross-section $0.3\ m^2$ is given by $q = (3t^2 + 5t + 2)C$ where ' t ' is in seconds. The drift velocity at $t = 2$ s is (Concentration of electrons in the conductor $= 2 \times 10^{25}\ m^{-3}$)

(a) $0.77 \times 10^{-5}\ ms^{-1}$
(b) $0.93 \times 10^{-5}\ ms^{-1}$
(c) $1.77 \times 10^{-5}\ ms^{-1}$
(d) $2.08 \times 10^{-5}\ ms^{-1}$

29. A magnetic field intensity at the centre of a circular wire of radius 0.1 m carrying a current 0.2 A is

(a) $2\pi \times 10^{-5}$ T (b) $\pi \times 10^{-7}$ T
(c) 10^{-7} T (d) $4\pi \times 10^{-7}$ T

30. A wire is first bent in the form of a circular coil of 5 turns and the same wire is then bent in the form of another circular coil of 10 turns. If same current is passed in both the coils, then the ratio of the magnetic fields at their centres is

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

31. A solenoid has a core of a material with relative permeability 400 . The -windings of the solenoid are insulated from the core and carry a current of 4 A . If the number of turns is 500 per metre, then the magnetizing field is

(a) $2\pi \times 10^3 Am^{-1}$ (b) $1 \times 10^3 Am^{-1}$

(c) $4 \times 10^3 Am^{-1}$ (d) None of these

32. In an ac generator, if coil of N turns and area A is rotated at ∪ revolutions per second in a uniform magnetic field B, then the motional emf produced is equal to
(At $t = 0$ s, the coil is perpendicular to the field)

(a) NBA $(2\pi v)\sin(2\pi vt)$

(b) $NBA^2(2\pi v)\sin(2\pi v)$

(c) $N^2\ B^2\ A^2(2\pi v)\sin(2\pi t)$

(d) NBA $(4\pi v)\sin(2\pi vt)$

33. The frequency of ac at which 16μ F capacitor and $\frac{10}{\pi^2}$ mH inductor will have same reactance is

(a) 1 kHz (b) 1.25 kHz

(c) 1.5 kHz (d) 2 kHz

34. The average power output of a point source of an electromagnetic radiation is 1080 W . The maximum value of the rms value of the electric field at a distance of 3 m from the source is

(a) $20Vm^{-1}$(b) $40Vm^{-1}$

(c) $60Vm^{-1}$(d) $90Vm^{-1}$

35. The velocity of a particle A is 3 times the velocity of proton. If the ratio of the de Broglie wavelengths of the particle A and the proton is 3: 2, the mass of the particle A is (m_p − mass of proton)

(a) $\frac{2}{9}\ m_p$ (b) $\frac{2}{3}m_p$

(c) $\frac{2}{5}\ m_p$ (d) $\frac{2}{7}m_p$

36. The transition of an electron in hydrogen atom that emits a photon whose wavelength lies in the ultraviolet region of the electromagnetic spectrum is

(a) $5 \rightarrow 4$ (b) $4 \rightarrow 3$

(c) $3 \rightarrow 2$ (d) $2 \rightarrow 1$

37. The relation between the mean life - time τ and the half -life time $T_{1/2}$ of a radioactive substance is

(a) $T_{1/2} = \tau \log_e 2$ (b) $T_{1/2} = \tau \log_{10} 2$

(c) $T_{1/2} = \tau$ (d) $T_{1/2} = 2\tau \log_e 2$

38. A p-n junction diode is reverse biased with a voltage of 8 V . If the resistance of the diode is $4 \times 10^7 \Omega$, then the reverse saturation current is

(a) 32μ A (b) 2μ A

(c) 0.2μ A (d) 0.5μ A

39. In a p-n-p transistor

(a) emitter is heavily doped and collector is moderately doped.

(b) emitter is moderately doped and collector is heavily doped.

(c) both emitter and collector are heavily doped.

(d) both emitter and collector are moderately doped.

40. A carrier wave of peak voltage 15 V is used to transmit a message signal. If the modulation index is 60%, then the peak voltage of the modulating signal is

(a) 3 V (b) 6 V

(c) 9 V (d) 12 V

Chemistry

41. Vijayawada FM radio station broadcasts at frequency of 103.4 MHz . The wavelength of the corresponding radio waves (in m) is

(a) 2.90 (b) 29.0

(c) 9.20 (d) 92.0

42. The minimum number of quantum numbers required to specify an orbital in an atom is
(a) 1 (b) 4 (c) 2 (d) 3

43. Consider the following two statements
Statement I: Among Mg, Al, Mg^{2+}, Al^{3+} the one having smallest size is Al^{3+}
Statement II: Eu is having exceptionally high atomic radii among lanthanide elements
The correct answer is
(a) Both statements I and II are correct
(b) Both statements I and II are not correct
(c) Statement I is correct but statement II not correct
(d) Statement I is not correct but statement II is correct

44. Identify the pair of elements with the highest and lowest electronegativity respectively
(a) K and Rb (b) I and F
(c) F and Fr (d) Fr and Li

45. If the bond order in C_2 is ' x ' then the bond order in B_2 and O_2, respectively are
(a) $\frac{1}{2}x, 2x$ (b) x, x
(c) $\frac{1}{2}x, x$ (d) $x, 2x$

46. Identify incorrectly matched set from the following
(a) Molecules with incomplete octet- BeH_2, BCl_3
(b) Polar molecules- BF_3, CCl_4
(c) Molecules with expanded octet- PCl_5, SF_6
(d) Odd electron molecules- NO, NO_2

47. An ideal gas (X) present in a vessel of volume VL exerted a pressure of 16.4 atm at 200 K . What is its concentration in $molL^{-1}$? (Given $R = 0.082\ L\ atm\ mol^{-1}\ K^{-1}$)
(a) 0.50 (b) 0.25
(c) 1.00 (d) 1.50

48. A 100 L cylinder containing H_2 exerted a pressure of 4 atm at 300 K . It was accidentally opened and some H_2 was escaped. When it was closed, it exerted a pressure of 3 atm at 300 K The number of moles of H_2 remaining in the cylinder is equal to (Assume H_2 as an ideal gas; R = gas constant)
(a) $\frac{1}{2R}$ (b) R (c) $\frac{1}{R}$ (d) 2 R

49. Observe the following reaction
$$Cl_2(g) + 2OH^-(aq) \rightarrow ClO^-(aq) + Cl^-(aq) + H_2O(l)$$
Identify the correct statements about this reaction
(I) $Cl_2(g)$ is oxidized to $ClO^-(aq)$
(II) $Cl_2(g)$ is oxidized to $Cl^-(aq)$
(III) $Cl_2(g)$ is reduced to $ClO^-(aq)$
(IV) $Cl_2(g)$ is reduced to $Cl^-(aq)$
The correct answer is
(a) I, IV only (b) I, III only
(c) I, II, IV only (d) II, III only

50. If the standard enthalpy change $(\Delta_r H^\theta)$ for a certain reaction at 298 K and constant pressure is -1860 kJ mol $^{-1}$, the standard entropy change $(\Delta_{sys} S^\theta)$ of the same reaction is $-550\ J\ K^{-1}\ mol^{-1}$, which one of the following statements is correct?
(a) $(\Delta_{sys} S^\theta) + \Delta_{surr} S^\theta = -7692\ J\ mol^{-1}\ K^{-1}$, the reaction is spontaneous
(b) $(\Delta_{sys} S^\theta) + \Delta_{surr} S^\theta = -5692\ J\ mol^{-1}\ K^{-1}$, the reaction is non-spontaneous
(c) $(\Delta_{sys} S^\theta) + \Delta_{surr} S^\theta = +5692\ J\ mol^{-1}\ K^{-1}$, the reaction is spontaneous
(d) $(\Delta_{sys} S^\theta) + \Delta_{surr} S^\theta = +7692\ J\ mol^{-1}\ K^{-1}$, the reaction is non-spontaneous

51. If the standard enthalpy change $(\Delta_r H^\theta)$ for reaction $H_2(g) + Br_2(l) \rightarrow 2HBr(g)$ is -72.8 kJ , the standard enthalpy of formation $(\Delta_f H^\theta)$ of $HBr(g)(in kJ mol^{-1})$ is

(a) -36.4 (b) +36.4
(c) -18.2 (d) -18.2

52. At T(K), the equilibrium constant for $A(g) \rightleftharpoons B(g)$ is 10^{-2}. If rate of forward reaction is $0.025\ mol\ L^{-1}\ s^{-1}$. The rate of backward reaction (in $molL^{-1}\ s^{-1}$) is

(a) 4×10^{1} (b) 2.5×10^{-4}
(c) 2.5×10^{-2} (d) 5×10^{-2}

53. One mole $H_2O(g)$ and one mole $CO(g)$ are taken in 1 L flask and heated to 725 K . At equilibrium, 40% (by mass) of water reacted with $CO(g)$ as follows

$$H_2O(g) + CO(g) \rightleftharpoons H_2(g) + CO_2(g)$$

Its K_c value is

(a) 0.444 (b) 2.220
(c) 0.222 (d) 4.440

54. The $O-H$ bond length in H_2O in gas phase is

(a) 95.7 pm (b) 90.2 pm
(c) 104.5 pm (d) 115.5 pm

55. Which of the following alloys are correctly matched with their uses?

(i) Li/Mg armour plates
(ii) Cu/Be high strength springs
(iii) Mg/Al aircraft construction

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

56. Match the following

List I		**List II**	
(Group 13 element)		**(metallic radius, pm)**	
(A)	AI	(I)	135
(B)	Ga	(II)	143
(C)	In	(III)	170
(D)	TI	(IV)	167

The correct answer is

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

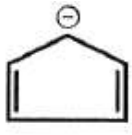
57. Choose the acidic oxide from the following

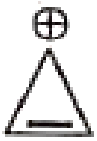
(a) CO (b) GeO
(c) SnO (d) PbO

58. In the Kolbe electrolysis of sodium propanoate, the products X and Y are formed at respected electrodes. What are X and Y ?

(a) $X = CH_3 - CH_2 - CH_2 - CH_3$ at Cathode; $Y = H_2$ at Anode
(b) $X = CH_3 - CH_2 - CH_3$ at Cathode; $Y = H_2$ at Anode
(c) $X = CH_3 - CH_2 - CH_2 - CH_3$ at Anode; $Y = H_2$ at Cathode
(d) $X = CH_3 - CH_3$ at Anode; $Y = H_2$ at Cathode

59. Which of the following molecule is not aromatic?

(a)  (b) 




(c) (d)

60. An example for network solid is

(a) SiO_2 (b) MgO

(c) CaF_2 (d) ZnS

61. 20 mL of 0.1 M HCl is added to the 30 mL of 0.1 M NaOH . To this solution extra 50 mL of water was added. What is the molarity of the final solution formed?

(a) 0.1 M (b) 0.01 M

(c) 0.5 M (d) 0.05 M

62. The molarity of one molal glucose solution having density of $1.2\ g/mL$ is

(a) 0.101 M (b) 1.01 M

(c) 2.01 M (d) 0.001 M

63. The conductivity of a solution containing 2.08 g of anhydrous barium chloride in 200 mL solution is 6×10^{-3} ohm $^{-1}$ cm^{-1}. The molar conductivity of the solution (in ohm-1 cm^2 mol^{-1}) is $\underline{x} \times 10^2$. The value of $\underline{x}$ is (Atomic mass of $Ba = 137, Cl = 35.5$)

(a) 1.2 (b) 2.4

(c) 3.6 (d) 3.0

64. For the reaction $A + B \rightarrow C$, the following data were obtained

Exp	Initial concentration [A] M	[B] M	Initial rate (M min - 1)
1.	0.1	0.1	1.0×10^{-4}
2.	0.1	0.3	9.0×10^{-4}
3.	0.3	0.3	2.7×10^{-3}

The order of reaction with respect to A and B are respectively

(a) 1,2 (b) 2,1

(c) 1.5,1.5 (d) 0,3

65. The correct statements about Zeolites are

(I). They are good shape selective catalysts

(II) They contain Al-O-Si framework

(III) They are not found in nature

(IV) They are used as catalysts for cracking hydrocarbons, in petrochemical industry

(a) I & II only (b) II & III only

(c) III & IV only (d) I, II & IV only

66. Which of the following is not the application of adsorption?

(a) Use of SiO_2 gel for removing the moisture

(b) Use of coconut charcoal to separate inert gases

(c) Use of Al_2O_3 to separate the components of organic mixture in chromatography

(d) Use of $CaCl_2$ for removing the moisture

67. How many of the following can be purified by using zone refining method?

Ni, B, Ti, In, Ge, Mn, Ag, Si, Ga

(a) 4 (b) 5 (c) 6 (d) 7

68. For ozone molecule consider the following

(A) It is a linear molecule with bond angle $180°$

(B) It is an angular molecule with bond angle $117°$

(C) The bond lengths of both $O - O$ bonds are same

(D) With respect to oxygen it is thermodynamically more stable

The correct options are

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

69. From the list given below, the number of lanthanides which exhibit +4 state in their oxides is Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy

(a) 5 (b) 4 (c) 6 (d) 2

70. Given below are two statements

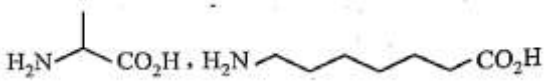
Assertion (A): All Cu (II) halides are known except the iodide

Reason (R): Cu^{2+} oxidizes I^- to I_2

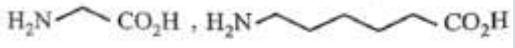
The correct answer is

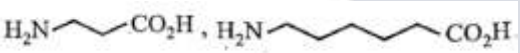
(a) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(b) Both (A) and (R) are correct and (R) is the correct but (R) is not the correct explanation of (A)
(c) (A) is correct but (R) is not correct
(d) (A) is not correct but (R) is correct

71. Monomers of nylon 2-nylon 6 are

(a) 

(b) 

(c) 

(d) 

72. Given below are two statements

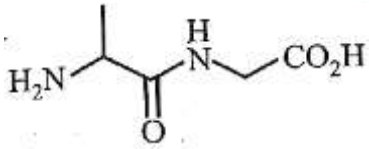
Assertion (A): Hydrolysis of DNA does not form equal number of A and T; G and C

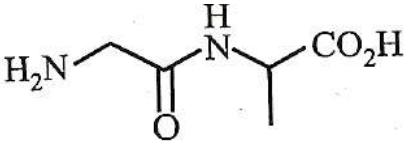
Reason (R): In DNA adenine forms hydrogen bonds with thymine and cytosine forms hydrogen bonds with guanine

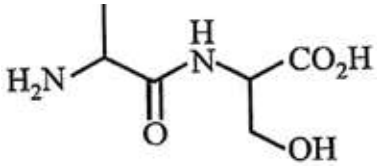
The correct answer is

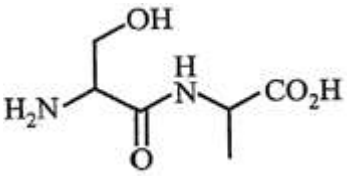
(a) Both A and R are correct and R is the correct explanation of A
(b) Both A and R are correct but R is not the correct explanation of A
(c) A is correct but R is incorrect
(d) A is incorrect but R is correct

73. The structure of Gly-Ala is

(a) 

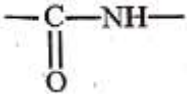
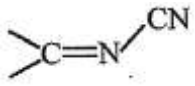
(b) 

(c) 

(d) 

74. The group present in prontosil is

(a) $-N=N-$ (b) $-As=As-$

(c)  (d) 

75. The optically inactive compound from the following is

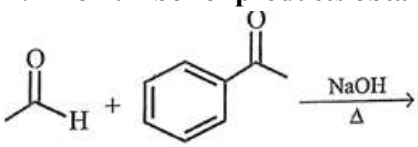
(a) 2-Bromopropanal
(b) 3-Bromopropanal
(c) 3-Bromo 2-iodopropanal
(d) 2-Bromo 3-iodopropanal

76. Which of the correct option for the following reaction?

$\mathbf{2CH_3CH_2Br \xrightarrow[\text{Dry ether}]{\text{2 Na /}} ?}$

(a) Wurtz reaction; $CH_3CH_2CH_2CH_3$
(b) Wurtz-Fittig reaction; $CH_3CH_2CH_2CH_3$
(c) Wurtz reaction; $CH_3CH_2CH_2CH_2CH_3$
(d) Wurtz-Fittig reaction; $CH_3CH_2CH_2CH_2CH_3$

77. The number of products obtained in the following reaction is



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

78. What are ' X ' and ' Y ' respectively in the following reactions?

$\mathbf{C_6H_5CHO + C_6H_5COCH_3 \xrightarrow[293\ K]{OH^-} \underset{major}{X} \xrightarrow{NaBH_4} Y}$

(a) $C_6H_5COCH = C(CH_3)C_6H_5, C_6H_5CH_2CH_2COC_6H_5$
(b) $C_6H_5COCH = C(CH_3)C_6H_5, C_6H_5 = CHCH(OH)\ C_6H_5$
(c) $C_6H_5CH = CHCOC_6H_5, C_6H_5CH = CHCH(OH)\ C_6H_5.$
(d) $C_6H_5CH = CHCOC_6H_5, C_6H_5CH_2CH_2COC_6H_5$

79. Which of the following is used in perfumery?

(a) Esters of benzoic acid
(b) Ethanoic acid
(c) Methanoic acid
(d) Sodium benzoate

80. Arrange the following in increasing order of their boiling points

N – Ethylethan amine	Butan amine	N,N – dimethyl Ethanamine
I	II	III

(a) III > II > I (b) III > I > II
(c) II > III > I (d) II > I > III

Mathematics

81. If $f(x) = x^3 - x$ and $g(x) = \sin 2x$, then $f\left(g\left(\frac{\pi}{12}\right)\right) =$

(a) 0 (b) 1 (c) $-\frac{3}{8}$ (d) 2

82. For $x \in \mathbb{R}$ if $f(x) = \sqrt{\log_{10}\left(\frac{3-x}{x}\right)}$, then the domain of f is

(a) $\left[0, \frac{3}{2}\right]$ (b) $\left(0, \frac{3}{2}\right]$
(c) [0,1] (d) (0,1]

83. Let $A=\begin{pmatrix}0\\-6\\8\end{pmatrix}$, $B=\begin{pmatrix}3&5&-7\\0&-1&8\\6&-1&0\end{pmatrix}$ and $X=\begin{pmatrix}x\\y\\z\end{pmatrix}$.

If $D=[\alpha\beta\gamma]^T$ is the solution of $X^TB^T=A^T$, then $D^TA=$

(a) 0 (b) 4 (c) -2 (d) 6

84. If $S=\begin{bmatrix}0&1&1\\1&0&1\\1&1&0\end{bmatrix}$ and $A=\frac{1}{2}\begin{bmatrix}b+c&c-a&b-a\\c-b&c+a&a-b\\b-c&a-c&a+b\end{bmatrix}$, then $SAS^{-1}=$

(a) $\begin{bmatrix}a&0&0\\0&b&0\\0&0&c\end{bmatrix}$ (b) $\frac{1}{2}\begin{bmatrix}a&0&0\\0&b&0\\0&0&c\end{bmatrix}$

(c) $2\begin{bmatrix}a&0&0\\0&b&0\\0&0&c\end{bmatrix}$ (d) $\begin{bmatrix}a&b&c\\b&c&a\\c&a&b\end{bmatrix}$

85. If $A=\begin{bmatrix}i&0\\0&-i\end{bmatrix}$, $B=\begin{bmatrix}0&-1\\1&0\end{bmatrix}$ and $C=\begin{bmatrix}0&i\\i&0\end{bmatrix}$, then

(a) $A^2+B^2+C^2=3\,A^2\,B^2C^2$

(b) $A^2+B^2+C^2=3ABC$

(c) $A^2+B^2+C^2=3I$

(d) $A^2+B^2+C^2=2ABC$

86. If $z_1=(2,-1)$ and $z_2=(6,3)$, then amp $\left(\frac{z_1-z_2}{z_1+z_2}\right)=$

(a) $-\frac{3\pi}{4}-\tan^{-1}\left(\frac{1}{4}\right)$ (b) $\frac{\pi}{4}\tan^{-1}\left(\frac{1}{4}\right)$

(c) $\frac{3\pi}{4}+\tan^{-1}\left(\frac{1}{4}\right)$ (d) $\frac{\pi}{4}+\tan^{-1}\left(\frac{1}{4}\right)$

87. The number of all possible solutions of the equation $z^3+\bar{z}=0$ is

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

88. $\left[\sqrt{2}(\cos 56°15'+i\sin 56°15')\right]^8=$

(a) 1 (b) i

(c) 16 (d) 16 i

89. $(1+i)^{2024}+(1-i)^{2024}=$

(a) -2^{1012} (b) 2^{1013}

(c) $2^{2024}I$ (d) $-2^{1012}i$

90. If the values of k for which the equation $x^2+2(k+2)x+6k+7=0$ has equal roots are k_1 and k_2, then $k_1^2+k_2^2=$

(a) 8 (b) 9 (c) 10 (d) 12

91. If $(3+2\sqrt{2})^{x^2-4}+(3-2\sqrt{2})^{x^2-4}=6$, then $x^4+x^2+5=$

(a) -30 (b) -35 (c) 30 (d) 35

92. If the equation $x^4+ax^3+bx^2+cx+d=0$ has three equal roots, then that root is

(a) $\frac{6c-ab}{8b-3a^2}$ (b) $\frac{ab-6c}{8b+3a^2}$

(c) $\frac{6c-ab}{3a^2-4b}$ (d) $\frac{6c-ab}{3a^2-8b}$

93. If -1 is a twice repeated root of the equation $a(x^3+x^2)+bx+c=0$, then $a:b:c=$

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

(c) $1:1:-1$ (d) $1:1:1$

94. If C_j stands for ${}^nC_j$, then

$$\frac{C_1}{C_0}+\frac{2\times C_2}{C_1}+\frac{3\times C_3}{C_2}+\cdots+\frac{n\times C_n}{C_{n-1}}=$$

(a) $\sum_{k=1}^{n}k^2$ (b) $\sum_{k=1}^{n}\frac{k}{2}$

(c) $\sum_{k=1}^{n}2k$ (d) $\sum_{k=1}^{n}k$

95. If the number of diagonals of a regular polygon of n sides is 104 , then $n =$

(a) 19 (b) 16 (c) 13 (d) 11

96. If $(2-5x)^{\frac{-1}{5}} = a_0 + a_1x + a_2x^2 + \cdots$, then $\frac{a_1}{a_2} =$

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

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

97. The number of natural numbers less than 10000 which are divisible by 5 and that no digit is repeated in the same number, is

(a) 802 (b) 602

(c) 702 (d) 1106

98. A team of 5 students is to be selected from 12 students. If two particular students are to be included in that team, then the number of ways that such team can be selected is

(a) 792 (b) 180 (c) 120 (d) 90

99. $\sin 21^\circ \cos 9^\circ - \cos 84^\circ \cos 6^\circ =$

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

100. If $1+\sqrt{1+a} = (1+\sqrt{1-a})\cot\alpha$ and $0 < a < 1$, then $\sin 4\alpha =$

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

101. If $A = \frac{\pi}{24}$, then $\frac{\cos A+\cos 3A+\cos 5A+\cos 7A}{\sin A+\sin 3A+\sin 5A+\sin 7A} =$

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

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

102. If $\sec(\theta+\alpha)$, $\sec\theta$ and $\sec(\theta-\alpha)$ are arithmetic progression, then $\sin^2\theta =$

(a). $\cos\alpha$ (b) $2\cos\alpha$

(c) $-2\cos\alpha$ (d) $-\cos\alpha$

103. If $\cos\alpha + \cos\beta = a$ and $\sin\alpha + \sin\beta = b$, then match the items given in List - A with those of their values in List-B

List-A	List-B
(I) $\tan\left(\frac{\alpha+\beta}{2}\right) =$	(a) $\frac{b}{a}$
(II) $\cos(\alpha+\beta) =$	(b) $\frac{2ab}{a^2+b^2}$
(III) $\sin(\alpha+\beta) =$	(c) $\frac{2ab}{a^2-b^2}$
(IV) $\tan(\alpha+\beta) =$	(d) $\frac{a^2-b^2}{a^2+b^2}$
	(e) $\frac{a^2+b^2}{a^2-b^2}$

(a) (I) → (a), (II) → (e), (III) → (d), (IV) → (c)
(b) (I) → (a), (II) → (c), (III) → (b), (IV) → (e)
(c) (I) → (a), (II) → (d), (III) → (c), (IV) → (b)
(d) (I) → (a), (II) → (d), (III) → (b), (IV) → (c)

104. If $\alpha = \log_e(2+\sqrt{3})$, then

$$\frac{\cosh\alpha}{1-\tanh\alpha} + \frac{\sinh\alpha}{1-\coth\alpha} =$$

(a) $4+2\sqrt{3}$ (b) $7+4\sqrt{3}$

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

105. In $\triangle ABC$, if $\cot\frac{A}{2} : \cot\frac{B}{2} : \cot\frac{C}{2} = 3:7:9$, then $a:b:c =$

(a) 8: 6: 5 (b) 5: 6: 8

(c) 10: 8: 5 (d) 5: 8: 10

106. In $\triangle ABC$, if $\frac{1}{r_1}, \frac{1}{r_2}$ and $\frac{1}{r_3}$ are in arithmetic progression, then $r_2 : r =$

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

107. If P_1, P_2 and P_3 are the lengths of the altitudes drawn. from the vertices A, B and C of $\triangle ABC$ respectively, then $\frac{\cos A}{P_1} + \frac{\cos B}{P_2} + \frac{\cos C}{P_3} =$

(a) $\frac{1}{R}$ (b) R (c) $\frac{\Delta}{R}$ (d) $\frac{r}{R}$

108. If $\frac{2x^2+5x+6}{(x+2)^3} = \frac{a}{x+2} + \frac{b}{(x+2)^2} + \frac{c}{(x+2)^3}$, then $a \cdot b + b \cdot c + c \cdot a =$

(a) 28 (b) 14 (c) -10 (d) -8

109. $\vec{a}$ and $\vec{b}$ are two vectors such that $\vec{a}$ is not parallel to $\vec{b}$. If $\vec{p} = (x + 2y + 3)\vec{a} + (5x - y + 2)\vec{b}$ and $\vec{q} = (2x + 3y + 5)\vec{a} + (x - 5y - 2)\vec{b}$ are two vectors such that $\vec{p} = 2\vec{q}$, then $x - 2y =$

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

110. $3\hat{i} - 2\hat{j} - \hat{k}, -2\hat{i} - \hat{j} + 3\hat{k}$ and $-\hat{i} + 3\hat{j} - 2\hat{k}$ are the position vectors of the vertices A, B and C of a $\triangle$ ABC respectively. If H is its ortho center, then $\overrightarrow{HA} + \overrightarrow{HB} + \overrightarrow{HC} =$.

(a) $2\overrightarrow{SA}$ (b) $\vec{0}$
(c) $2\overrightarrow{AB}$ (d) $\hat{i} + \hat{j} + \hat{k}$

111. Let π_1 be the plane determined by the vectors $\hat{i} + 2\hat{j}$ and $3\hat{j} - 2\hat{k}$. Let π_2 be the plane determined by the vectors $\hat{j} + 2\hat{k}$ and $3\hat{k} - 2\hat{i}$. If θ is the angle between π_1 and π_2, then $\cos\theta =$

(a) $\frac{7}{26}$ (b) $-\frac{14}{29}$
(c) $-\frac{32}{5\sqrt{2}}$ (d) $\frac{23}{38}$

112. If $\vec{a} = 2\hat{i} + 3\hat{j}, \vec{b} = 3\hat{j} + 4\hat{k}$ and $\vec{c} = 5\hat{i} + 4\hat{k}$ are three vectors, then a vector which is perpendicular to $\vec{a}$ and $\vec{b} \times \vec{c}$ is

(a) $45\hat{i} - 30\hat{j} + 15\hat{k}$
(b) $3\hat{i} - 2\hat{j} + \hat{k}$
(c) $-30\hat{i} + 20\hat{j} + 4\hat{k}$
(d) $-45\hat{i} + 30\hat{j} + 4\hat{k}$

113. Let $\overrightarrow{OA} = 2\hat{i} - 3\hat{j} + \hat{k}, \overrightarrow{OB} = \hat{i} - 4\hat{j} - 3\hat{k}$ and $\overrightarrow{OC} = -3\hat{i} + \hat{j} + 2\hat{k}$ be the position vectors of three points, A, B, C respectively. If G is the centroid of triangle ABC , then $BC^2 + CA^2 + AB^2 + 9(OG)^2 =$

(a) 162 (b) 156
(c) 144 (d) 132

114. The variance of 20 observations is 5 . If each one of the observations is multiplied by 2 , then the variance of the resulting observations is

(a) 40 (b) 80 (c) 20 (d) 10

115. If two subsets A and B are selected at random from a set S containing n elements, then the probability that $A \cap B = \phi$ and $A \cup B = S$, is

(a) $\frac{1}{2^n}$ (b) 2^n
(c) $\frac{1}{2^{n+1}}$ (d) $\frac{1}{2^n \times 2^n}$

116. In a game, a pair of dice is rolled 24 times. If a person wins the game by not getting 6 on both the dice in any one of the 24 rolls, then the probability that a person wins the game is

(a) $\left(\frac{35}{36}\right)^{24}$ (b) $\left(\frac{17}{18}\right)^{24}$
(c) $\left(\frac{11}{12}\right)^{24}$ (d) $\left(\frac{5}{6}\right)^{24}$

117. Bag B_1 contains 4 white and 2 black balls. Bag B_2 contains 3 white and 4 black balls. A bag is chosen at random and a ball is drawn from it at random, then the probability that the ball drawn is white, is

(a) $\frac{1}{42}$ (b) $\frac{42}{32}$ (c) $\frac{33}{42}$ (d) $\frac{23}{42}$

118. If four dice are thrown simultaneously, then the probability that none of the dice shows the number 1 on its face, is

(a) $\frac{625}{1296}$ (b) $\frac{125}{648}$

(c) $\frac{1250}{1296}$ (d) $\frac{625}{2592}$

119. The range of a random variable X is $\{0,1,2\}$. If $P(X=0)=3C^3, P(X=1)=4C-10C^2$ and $P(X=2)=5C-1$, then the value of C is

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

120. If eight coins are tossed simultaneously, then the probability of getting at least six heads is

(a) $\frac{37}{64}$ (b) $\frac{37}{512}$ (c) $\frac{37}{256}$ (d) $\frac{37}{128}$

121. The locus of a point which is at a distance of 2 units from the line $2x-3y+4=0$ and at a distance of $\sqrt{13}$ units from a point $(5,0)$ is

(a) $8x^2+12xy+56x-24y+84=0$

(b) $12xy-5y^2-56x+24y+84=0$

(c) $8x^2+12xy+y^2-56x+24y+84=0$

(d) $8x^2+12xy-7y^2-56x+24y+84=0$

122. The combined equation of the lines passing through the point $(3,4)$ and each making an angle 45° with the line $x+y+1=0$ is

(a) $xy-4x-3y+12=0$

(b) $(3x-2y-1)(x-2y+2)=0$

(c) $(3x+2y-17)(x+2y-11)=0$

(d) $xy-4x+3y+12=0$

123. The equal sides of an isosceles triangle are given by equations $7x-y+3=0$ and $x+y-3=0$. If the slope m of the third side is an integer, then $m=$

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

124. In $\triangle ABC$ the coordinates of the vertex A are $(-3,1)$. If the equation of the median through B is $2x+y-3=0$ and the equation of the bisector of angle C is $7x-4y-1=0$, then the equation of the side BC is

(a) $7x-3y=6$ (b) $18x-y=49$

(c) $15x+y=50$ (d) $4x-y=7$

125. If the lines given by $(x^2+y^2)\sin^2\alpha=(x\cos\alpha-y\sin\alpha)^2$ are perpendicular to each other, then $\sin^2\alpha+\tan^2\alpha=$

(a) $\frac{15}{4}$ (b) 0 (c) $\frac{3}{2}$ (d) $\frac{7}{12}$

126. If the area of the triangle formed by the lines $y-x+c$ and $2x^2+5xy+3y^2=0$ is $\frac{1}{20}$ sq. units, then $c=$

(a) ±1 (b) $\pm\sqrt{2}$

(c) ±3 (d) $\pm\sqrt{3}$

127. If the line passing through the points $(5,1,a)$ and $(3,b,1)$ crosses the YZ plane at the point $\left(0,\frac{17}{2},\frac{-13}{2}\right)$, then $a+b=a+b=$

(a) 12 (b) 10 (c) 8 (d) 4

128. $\triangle ABC$ is formed by $A(1,8,4), B(0,-11,4)$ and $C(2,-3,1)$. If D is the foot of the perpendicular drawn from A to BC , then the coordinates of D are

(a) $(-4,5,2)$ (b) $(4,-5,2)$

(c) $(4,-5,-2)$ (d) $(4,5,-2)$

129. The distance between two parallel planes $ax + by + cz + d_1 = 0, ax + by + cz + d_2 = 0$ is given by $\frac{|d_1 - d_2|}{\sqrt{a^2+b^2+c^2}}$. If the plane $2x - y + 2z + 3 = 0$ has the distances $\frac{1}{3}$ and $\frac{2}{3}$ units from the planes $4x - 2y + 4z + \lambda = 0$ and $2x - y + 2z + \mu = 0$ respectively, then the maximum value of $\lambda + \mu$ is

(a) 15 (b) 5 (c) 13 (d) 9

130. Let S be the circumcircle of the triangle formed by the line $x - 2y - 4 = 0$ with the coordinate axes. If $P(-2, -4)$ is a point in the plane of the circle S and Q is a point on S such that the distance between P and Q is the least, then $PQ =$

(a) $5\sqrt{5}$ (b) $5 + \sqrt{5}$

(c) $13 + \sqrt{5}$ (d) $13 - \sqrt{5}$

131. If the coordinates of point of contact of the circles $x^2 + y^2 - 4x + 8y + 4 = 0$ and $x^2 + y^2 + 2x = 0$ is (a, b), then $a + 2b =$

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

132. If the chord of contact of the point $P(h, k)$ with respect to the circle $x^2 + y^2 - 4x - 4y + 8 = 0$ meets the circle in two distinct points and it also makes an angle $45°$ with the positive X -axis in the positive direction, then (h, k) cannot be

(a) $\left(\frac{5}{2}, \frac{3}{2}\right)$ (b) $\left(\frac{5}{3}, \frac{7}{3}\right)$

(c) (3,1) (d) None of these

133. The equation of the pair of tangents drawn from the point $(1, 1)$ to the circle $x^2 + y^2 + 2x + 2y + 1 = 0$ is

(a) $3x^2 - 8xy + 3y^2 - 2x - 2y + 6 = 0$

(b) $11x^2 - 8xy + 11y^2 - 4x - 4y - 6 = 0$

(c) $3x^2 - 8xy + 3y^2 + 2x + 2y - 2 = 0$

(d) $x^2 - 4xy + y^2 + x + y = 0$

134. Let the circle $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ cut the circles $x^2 + y^2 - 2x + 2y - 2 = 0$ and $x^2 + y^2 + 4x - 6y + 9 = 0$ orthogonally. If the centre of the circle $S = 0$ lies on the line $2x + 3y - 2 = 0$, then $2g + f =$

(a) c (b) c + f

(c) 2 g − c (d) c − f

135. Let the equation of the tangent at a point P on the parabola $x^2 - 4x - 4y + 16 = 0$ be $2x - y - 5 = 0$. If the equation of the normal drawn at P to this parabola is $ax + y + c = 0$, then $ac =$

(a) -20 (b) 20 (c) 5 (d) -5

136. Let $x^2 + y^2 = 20$ be the director circle of an ellipse E whose major axis is X -axis and minor axis is Y -axis. If the length of the latus rectum of E is 2 , then the distance between its foci is

(a) $4\sqrt{5}$ (b) $4\sqrt{3}$

(c) $4\sqrt{2}$ (d) 3

137. If θ is the acute angle between the tangents drawn from the point $(2, 3)$ to the hyperbola $5x^2 - 6y^2 - 30 = 0$, then $\tan\theta =$

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

138. The difference between the focal distances of any point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is 6 . If $(\sqrt{13}, k)$ is an end point of a latus rectum of this hyperbola, then $k =$

(a) $\pm\frac{9}{2}$ (b) $\pm\frac{8}{3}$

(c) ± 9 (d) $\pm\frac{4}{3}$

139. If $f(x)=\begin{cases}1+6x-3x^2, & x\le 1\\ x+\log_2(b^2+7), & x>1\end{cases}$ is continuous at all real x , then $b=$

(a) ± 1 (b) 0

(c) ± 5 (d) ± 2

140. Let $f(x)$ be a real valued function. If $f'(x)$ is a constant for all $x\in\mathbb{R}, f(0)=2$ and $f'(0)=1$, then

(a) f(x) is not continuous on R

(b) f(x) is continuous at x = 0,1,2 and 3 only

(c) f(x) is continuous only on $[0,\infty)$

(d) f(x) is continuous on R

141. If $f:\mathbb{R}\to\mathbb{R}$ defined by $f(x)=\begin{cases}\frac{\sin x-\sin\frac{x}{2}}{x}, & x<0\\ \frac{\sqrt{x^2+x}-\sqrt{x}}{x^{3/2}}, & x>0\end{cases}$ is continuous on R, then $f(0)=$

(a) ½ (b) 3/2

(c) 1 (d) -1

142. If $f(x)$ is a differentiable function, $f'(x)\ge 5\forall x\in[2,6], f(2)=4$ and $f(3)=15$, then a possible value of $f(6)$

(a) $=24$ (b) lies between 4 and 15

(c) ≤ 15 (d) $=5$

143. If $f(x)=\sqrt{x+\sin x}$, then all the points of the set $\{(x,f(x))/f'(x)=0\}$ lie on

(a) a circle (b) a straight line

(c) an ellipse (d) a parabola

144. If $y=\frac{\log x}{x}$, then the value of $x^2\frac{d^2y}{dx^2}+3x\frac{dy}{dx}+y$ at the point $(\sqrt[3]{e},\sqrt{e})$ is

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

145. Let $f(x)$ be a differentiable function, $A(0,\alpha)$ and $B(8,\beta)$ be two points on the curve $y=f(x)$. Given $f(0)=2$ and $f'(4)=\frac{-3}{4}$. If the chord AB of the curve is parallel to the tangent drawn at the point $(4,f(4))$, then $\beta=$

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

146. If the tangent drawn to the curve $y=x^3-ax^2+x+1$ at each point $x\in\mathbb{R}$, is inclined at an acute angle with the positive direction of X - axis, then the set of all possible values of ' a ' is

(a) $\mathbb{R}-(-\sqrt{3},\sqrt{3})$ (b) $[-3,3]$

(c) $\mathbb{R}$ (d) $(-\sqrt{3},\sqrt{3})$

147. The number of points on the cure $y=2t^2+3t-5$ and $x=t^3-4t^2-3t$ such that the normals drawn at them on the curve are parallel to X -axis is

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

148. If $A=\{x/9x\ge x^2+20\}$ and $f:A\to R$ is defined by $f(x)=2x^3-15x^2+36x-48$, then the maximum value of $f(x)$ is

(a) -20 (b) 7 (c) 20 (d) -16

149. If $\int\left(\frac{4e^x+6e^{-x}}{9e^x-4e^{-x}}\right)dx=Ax+B\log\left|(9e^{2x}-4)\right|+C$, then $(A,B)=$

(a) $\left(\frac{3}{2},\frac{35}{36}\right)$ (b) $\left(\frac{-3}{2},\frac{-35}{36}\right)$

(c) $\left(\frac{-3}{2},\frac{35}{36}\right)$ (d) $\left(\frac{3}{2},\frac{-35}{36}\right)$

150. If $f(x)=\int\frac{dx}{(x^2+2)}$ and $f(\sqrt{2})=0$, then $f(0)=$

(a) $\frac{\pi}{2\sqrt{2}}$ (b) $\frac{-\pi}{2\sqrt{2}}$

(c) $\frac{-\pi}{4\sqrt{2}}$ (d) $\frac{\pi}{4\sqrt{2}}$

151. $\int e^x\left(\frac{2+\sin 2x}{1+\cos 2x}\right)dx=$

(a) $e^x \sec x + C$ (b) $e^x \tan x + C$
(c) $e^x \cot x + C$ (d) $e^x \operatorname{cosec} x + C$

152. **If $I = \int_{-a}^{a} (x^4 - 2x^2)dx$, then I is minimum at a =**

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

153. **Assertion (A): $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{(\sin x)^{\sqrt{2}}dx}{(\sin)^{\sqrt{2}}+(\cos x)^{\sqrt{2}}} = \frac{\pi}{12}$**

Reason (R): $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{f(x)+f\left(\frac{\pi}{2}-x\right)}{f(x)} = \frac{\pi}{12}$

(a) A is true, R is true and R is the correct explanation of A.
(b) A is true, R is true but R is not the correct explanation of A
(c) A is true, R is false
(d) A is false, R is true

154. **If [x] is the greatest integer not exceeding x, then**

$\int_{-0.5}^{1.5} x^2[x]dx =$

(a) $\frac{4.5}{4}$ (b) $\frac{3}{4}$ (c) $\frac{3.5}{4}$ (d) $\frac{2.375}{2}$

155. $\int_0^{50\pi} \sqrt{1 - \cos 2x}dx =$

(a) $-100\sqrt{2}$ (b) $100\sqrt{2}$
(c) $50\sqrt{2}$ (d) $-50\sqrt{2}$

156. **If $f(x) = \frac{x^3+5}{\sqrt{12+x}}$ and $\int_{-5}^{5} f(x)dx = \int_0^5 (f(x) + g(x))dx$, then $g(x) =$**

(a) $\frac{5-x^3}{\sqrt{12-x}}$ (b) $-\left(\frac{5+x^3}{\sqrt{12+x}}\right)$
(c) $\frac{-x^3+5}{\sqrt{12+x}}$ (d) $\frac{5+x^3}{\sqrt{12-x}}$

157. **The area (in sq. units) bounded by the curves $x^2 = 9y$, $(x-6)^2 = 9y$ and the X-axis is**

(a) 0 (b) 1 (c) 2 (d) 4

158. **The substitution $x = vy$ converts which one of the following differential equation to an equation solvable by variable separable method?**

(a) $(y^2 - 2x^2y)dx = (x^2 - 2x^2)dy$
(b) $x^2dy - ydx = \sqrt{x^2 + y^2}dx$
(c) $\frac{dy}{dx} = \frac{y^2}{x+\sqrt{xy}}$
(d) $\left(1 + 2e^{\frac{x}{y}}\right) + 2e^{\frac{x}{y}}\left(1 - \frac{x}{y}\right)\frac{dy}{dx} = 0$

159. **If $\frac{dy}{dx} = f(x, y)$ is a homogeneous differential equation, then the general form of $f(x, y)$ is**

(a) $x^n \phi\left(\frac{y}{x}\right), n \neq 1$ (b) $y^n \phi\left(\frac{x}{y}\right), n \neq 1$
(c) $\phi\left(\frac{y}{x}\right)$ (d) $K^n f(x, y), n \neq 1$

160. **The order and degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^{\frac{1}{2}} - 2\left(\frac{dy}{dx}\right)^{\frac{1}{4}} + xy = 0$ are respectively**

(a) 3 and 12 (b) 3 and 2
(c) 3 and 4 (d) 3 and 6