

Test in Physics Chemistry and Mathematics for B Tech (Second Shift)

1. Galvanometer is used to
 - (A) measure amount of current flowing
 - (B) measure direction of current flow
 - (C) check whether current is flowing or not
 - (D) measure potential difference

2. Which one is true for super conducting behavior?
 - (A) Large conductivity
 - (B) Paramagnetism
 - (C) Ferromagnetism
 - (D) Perfect conduction and perfect diamagnetism

3. What is the critical angle of incidence for water?
 - (A) 49.75°
 - (B) 47.75°
 - (C) 48.75°
 - (D) 46.75°

4. Sunlight incident on prism is split into several colours due to
 - (A) diffraction
 - (B) reflection
 - (C) incident
 - (D) dispersion

5. 10 cm is a wavelength corresponding to the spectrum of
 - (A) Radio waves
 - (B) Infrared waves
 - (C) Microwaves
 - (D) X-rays

6. The particle nature of light is proved by which of the following?
 - (A) Polarization
 - (B) Diffraction
 - (C) Photoelectric effect
 - (D) Interference

7. A doped semiconductor is also known as
- (A) intrinsic semiconductor
 - (B) extrinsic semiconductor
 - (C) diffused semiconductor
 - (D) compound semiconductor
8. Which one of the following has highest mobility?
- (A) Neutron
 - (B) Electron
 - (C) Positive ions
 - (D) Holes
9. Photoelectric effect is based on the law of conservation of
- (A) Mass
 - (B) Energy
 - (C) Momentum
 - (D) Angular velocity
10. The main origin of the magnetism is based on the
- (A) polar nature of the materials
 - (B) Pauli's exclusion principle
 - (C) intrinsic spin of the electron
 - (D) charge of the electron
11. Electromagnetic waves are produced due to
- (A) uniformly moving charge
 - (B) constantly circulating charge
 - (C) rest charge
 - (D) accelerated charge
12. An equivalent representation for the Boolean expression $A' + 1$ is
- (A) A
 - (B) A'
 - (C) 1
 - (D) 0

13. Ohms law says
- (A) $R = VI$
 - (B) $V = IR$
 - (C) $V = I^2R$
 - (D) $R = V^2I$
14. The reason why metals are so shiny is
- (A) their hardness makes them easy to polish
 - (B) the electric field of the photon is forced to go to zero at the surface of the metal, generating a wave in the opposite direction
 - (C) because metals are so hard, photons undergo completely elastic collisions which gives them an equal and opposite momentum
 - (D) metals carry a large static charge at their surface that repels the photons
15. Two identical objects having mass ' m ' are released from rest and they move towards each other under the influence of mutual gravitational force. Gravitational potential energy of the two particle system
- (A) is zero
 - (B) is constant ($\neq 0$)
 - (C) decreases as the separation decreases
 - (D) increases as the separation decreases
16. Expression of Brewster's law is
- (A) $\mu = \tan i_p$
 - (B) $\mu = \tan r$
 - (C) $\mu = \cos r$
 - (D) $\mu = \sin r$
17. What is the focal length of the combination of the two lens having power $+14D$ and $-4D$ respectively are placed in contact coaxially?
- (A) 100 cm
 - (B) 10 cm
 - (C) 10 m
 - (D) 100 m

18. Two electric bulbs having resistance in the ratio of 1 : 3 are connected in parallel to a constant voltage source. The power dissipated in them has the ratio of
- (A) 1 : 6
 - (B) 1 : 3
 - (C) 3 : 1
 - (D) 6 : 1
19. The value of Young's modulus for a perfect rigid body is
- (A) zero
 - (B) infinity
 - (C) one
 - (D) less than one
20. A body of mass of 10 kg is placed at the centre of the earth. Now, the weight of the body will be
- (A) Infinite
 - (B) 10 kg
 - (C) Zero
 - (D) 20 kg
21. At a given temperature, the pressure of an ideal gas is
- (A) directly proportional to its density
 - (B) inversely proportional to its density
 - (C) inversely proportional to square of its density
 - (D) independent of its density
22. Which one of the below given frequency is audible to human ears?
- (A) 2 Hz
 - (B) 25 kHz
 - (C) 2000 Hz
 - (D) 200 kHz
23. Which of these crystal defects occurs due to the interstitial position of atoms?
- (A) Schottky defect
 - (B) Frenkel defect
 - (C) Metal ion defect
 - (D) Screw dislocation

24. As the accelerating potential used in a Coolidge tube to produce X-rays is increased, the cut-off wavelength
- (A) increases
 - (B) decreases
 - (C) first increases, then decreases
 - (D) remain unchanged
25. For a P-N junction diode
- (A) forward current is in mA and reverse current is in μA
 - (B) forward current is in A and reverse current is in mA
 - (C) both forward and reverse currents are in μA
 - (D) both forward and reverse currents are in mA
26. When a light frequency n is shined on the metal surface, the maximum velocity of the photoelectrons emitted from the surface is v . If the incident frequency is increased to $4n$, the maximum velocity of the ejected photoelectrons will be
- (A) $4v$
 - (B) $2v$
 - (C) v
 - (D) $3v$
27. A time dependent force $F = 8t$ acts on a particle of mass 1 kg. If the particle starts from rest, the work done by the force during the first 2 second will be
- (A) 16 J
 - (B) 256 J
 - (C) 128 J
 - (D) 64 J
28. Copper of fixed volume V is drawn into wire of length l . When this wire is subjected to a constant force F , the extension produced in the wire is Δl . Which of the following graph is a straight line?
- (A) Δl versus $\frac{1}{l}$
 - (B) Δl versus l^2
 - (C) Δl versus $\frac{1}{l^2}$
 - (D) Δl versus l

29. Seven capacitors each of capacitance $4 \mu F$ are to be connected to obtain a capacitance of $\frac{20}{11} \mu F$, which of the following combination is possible?
- (A) 4 in parallel 3 in series
 - (B) 5 in parallel 2 in series
 - (C) 3 in parallel 4 in series
 - (D) 2 in parallel 5 in series
30. If the source of light used in a Young's double slit experiment is changed from red to violet,
- (A) the fringes will become brighter
 - (B) the intensity of minima will increase
 - (C) consecutive fringes will come closer
 - (D) the consecutive fringes moves apart
31. The SI unit of $\frac{1}{\sqrt{\epsilon_0 \mu_0}}$ is
- (A) F/m
 - (B) m/sec
 - (C) H-F
 - (D) m/HF
32. The permanent magnetic moment of the atoms of a material is zero. The material
- (A) must be paramagnetic
 - (B) must be diamagnetic
 - (C) must be ferromagnetic
 - (D) must be ferrimagnetic
33. A coil of inductance 300 mH and resistance 2Ω is connected to a 2 V voltage source. The current reaches half of its steady state value in
- (A) 0.05 sec
 - (B) 0.1 sec
 - (C) 0.15 sec
 - (D) 0.3 sec

34. A stone of mass m tied to a string of length l is rotated in a circle with the other end of the string as the centre. The speed of the stone is v . If the string breaks, the stone will
- (A) move towards the centre
 - (B) move away from the centre
 - (C) move along the tangent
 - (D) stop
35. A sphere, a cube and a thin circular plate all of same material having same mass are initially heated to 200°C . Which of these will cool faster?
- (A) Circular plate
 - (B) Sphere
 - (C) Cube
 - (D) Both the circular plate and sphere
36. The image formed by an objective of a compound microscope is
- (A) Virtual and diminished
 - (B) Real and diminished
 - (C) Real and enlarged
 - (D) Virtual and enlarged
37. The shortest height of a vertical mirror required to see the entire image of a man will be
- (A) one third of man's height
 - (B) half of the man's height
 - (C) two third of man's height
 - (D) one fourth of the man's height
38. A cell supplies a current of 0.9 A through a $2\ \Omega$ resistor and a current of 0.3 A through a $7\ \Omega$ resistor. What is the internal resistance of the cell?
- (A) $0.5\ \Omega$
 - (B) $1\ \Omega$
 - (C) $1.2\ \Omega$
 - (D) $2\ \Omega$

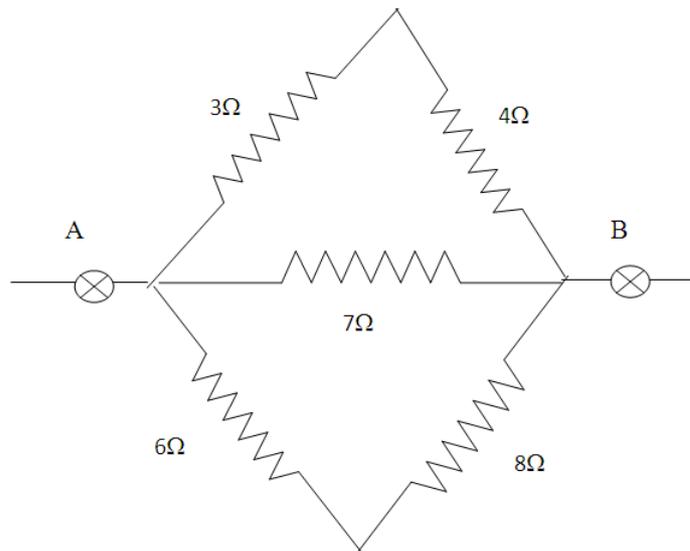
39. A spring of force constant k is cut into two pieces such that one piece is double the length of the other. Then the longer piece will have a force constant of
- (A) $2k/3$
 - (B) $3k/2$
 - (C) $3k$
 - (D) $6k$
40. A body of mass 10 kg is moving on a horizontal surface by applying a force of 10 N in forward direction. If body moves with constant velocity, the work done by applied force for a displacement of 2 m is
- (A) 20 J
 - (B) 10 J
 - (C) 30 J
 - (D) 40 J
41. Out of gravitational, electromagnetic, van der Waal's, electrostatic and nuclear forces, which of the following provides an attractive force between neutrons?
- (A) gravitational and van der Waal's
 - (B) electrostatic and gravitational
 - (C) electrostatic and nuclear
 - (D) nuclear
42. A condenser of capacity $10 \mu\text{F}$ is charged to a potential difference of 100 V. It is now connected in parallel to another uncharged condenser. The common potential now is 40 V. The capacitance of the other condenser is
- (A) $25 \mu\text{F}$
 - (B) $20 \mu\text{F}$
 - (C) $15 \mu\text{F}$
 - (D) $10 \mu\text{F}$
43. For ferromagnetic substances the permeability is and susceptibility is
- (A) very large; positive and large
 - (B) very large; negative and small
 - (C) very small; positive and large
 - (D) very low; negative and small

44. The magnetic flux linked with a coil changes from 1 Weber to 0.1 Weber in 0.1 sec. The induced e.m.f is
- (A) 9 Volts
 - (B) 10 Volts
 - (C) 0.009 Volts
 - (D) 0.1 Volts
45. A step down transformer transforms supply line voltage of 2200 V into 220 V. The primary coil has 5000 turns. The efficiency and power transmitted by the transformer are 90% and 8 kW respectively. Then the number of turns in the secondary and the power supplied are
- (A) 50 turns, 9.89 kW
 - (B) 500 turns, 9.89 kW
 - (C) 500 turns, 8.89 kW
 - (D) 100 turns, 8.89 kW
46. On a glass plate a light ray is incident at an angle of 60° . If the reflected and refracted rays are mutually perpendicular, the refractive index of the material is
- (A) $\sqrt{3}/2$
 - (B) $\sqrt{3}$
 - (C) $3/2$
 - (D) $1/\sqrt{3}$
47. If the least distance for clear vision is 25 cm, power of objective and the eyepiece are 25 dioptre and 5 dioptre lenses respectively, with separation between them is 30 cm, the maximum magnifying power of the compound microscope is
- (A) 8.4
 - (B) 7.4
 - (C) 9.4
 - (D) 10.4
48. A proton and an α particle are accelerated by the same potential difference. Their ratio of the de Broglie wavelengths ($\lambda_p, \lambda_\alpha$) is
- (A) 1
 - (B) 2
 - (C) $\sqrt{8}$
 - (D) $1/\sqrt{8}$

49. A photon and an electron have same kinetic energy. If λ_p and λ_e are the wavelengths of them respectively, then
- (A) $\lambda_p < \lambda_e$
 - (B) $\lambda_p > \lambda_e$
 - (C) $\lambda_p = \lambda_e$
 - (D) $\lambda_p = \lambda_e = 0$
50. Ratio of wavelengths of first line of Lyman series and the first line of Balmer series is
- (A) 1 : 3
 - (B) 27 : 5
 - (C) 5 : 27
 - (D) 4 : 9
51. If Avogadro's number is 6×10^{23} then the number of protons, neutrons and electrons in 14 gm of ${}_6\text{C}^{14}$ are respectively
- (A) 36×10^{23} , 48×10^{23} , 36×10^{23}
 - (B) 36×10^{23} , 36×10^{23} , 36×10^{23}
 - (C) 48×10^{23} , 36×10^{23} , 48×10^{23}
 - (D) 48×10^{23} , 48×10^{23} , 36×10^{23}
52. The binding energy per nucleus of deuteron (${}_1\text{H}^2$) and helium nucleus (${}_2\text{He}^4$) is 1.1 MeV and 7 MeV respectively. If two deuteron nuclei react to form a single helium nucleus, then the energy released is
- (A) 13.9 MeV
 - (B) 25.8 MeV
 - (C) 23.6 MeV
 - (D) 19.2 MeV

53. An aluminium rod of length 3.14 m is of square cross-section $3.14 \times 3.14 \text{ mm}^2$. What should be the radius of 1 m length of another rod of same material to have equal (same) resistance?
- (A) 2 mm
 (B) 4 mm
 (C) 1 mm
 (D) 6 mm

54. The resistance across AB in the circuit is



- (A) 2.8Ω
 (B) $14/3 \Omega$
 (C) $3/14 \Omega$
 (D) $5/14 \Omega$
55. The energy band gap in conductors, semiconductors and insulators are EG_1 , EG_2 and EG_3 respectively. Then the relation among them is
- (A) $EG_1 = EG_2 = EG_3$
 (B) $EG_1 > EG_2 > EG_3$
 (C) $EG_1 < EG_2 < EG_3$
 (D) $EG_1 < EG_2 > EG_3$

56. The magnitude of average velocity is equal to the average speed when a particle moves
- (A) on a curved path
 - (B) in a straight line
 - (C) with the constant acceleration
 - (D) with constant retardation
57. If F is the force between two point charges submerged in a medium of dielectric constant K , then on withdrawing the medium, the force between the charges becomes
- (A) $F\sqrt{K}$
 - (B) FK
 - (C) F/\sqrt{K}
 - (D) F/K
58. Resistances n , each of r ohm, when connected in parallel give an equivalent resistance of R ohm. If these resistances were connected in series, the combination would have resistance in ohm, equal to
- (A) R/n^2
 - (B) R/n
 - (C) nR
 - (D) n^2R
59. A stationary particle explodes into two particles of masses m_1 and m_2 which move in opposite directions with velocities v_1 and v_2 . The ratio of their kinetic energies E_1/E_2 is
- (A) m_2/m_1
 - (B) m_1/m_2
 - (C) 1
 - (D) m_1v_2/m_2v_1

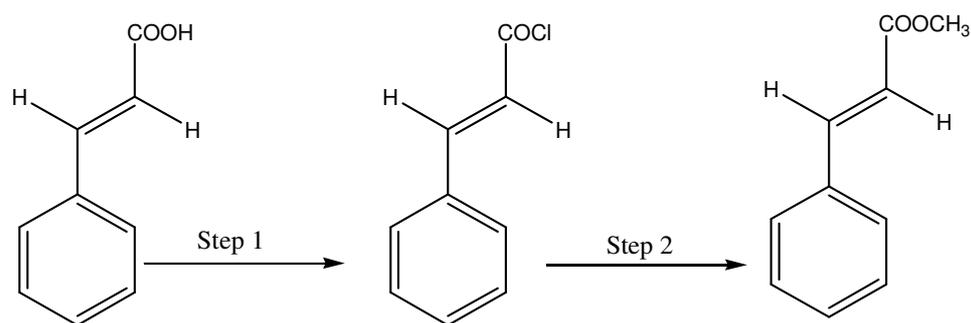
60. A ray of light is incident normally on one of the faces of a prism of angle 30° and refractive index $\sqrt{2}$. The angle of deviation of the ray is
- (A) 0°
 - (B) 12.5°
 - (C) 15°
 - (D) 22.5°
61. Matter wave duality is associated with
- (A) Pauli's principle
 - (B) De Broglie relation
 - (C) Schrodinger wave equation
 - (D) Plank's equation
62. If energy of a photon of 3 eV strikes a metal surface and resulting work function on the metal is 2 eV, calculate the kinetic energy of the emitted photon.
- (A) 5 eV
 - (B) 2.5 eV
 - (C) 1.5 eV
 - (D) 1 eV
63. According to Graham's law of diffusion, the rate of diffusion of a gas at constant pressure is
- (A) directly proportional to density of the gas
 - (B) inversely proportional to density of the gas
 - (C) directly proportional to square root of density of the gas
 - (D) inversely proportional to square root of density of the gas
64. In a cyclic process
- (A) work done is zero
 - (B) work done by the system is equal to the quantity of heat given to the system
 - (C) work done does not depend on the quantity of heat given to the system
 - (D) the internal energy of the system increases

65. If solute-solvent interaction are weaker than those between solute-solute and solvent-solvent interactions, then
- (A) $\Delta H_{\text{mix}} = 0$
 - (B) $\Delta H_{\text{mix}} = +\text{ve}$
 - (C) $\Delta H_{\text{mix}} = -\text{ve}$
 - (D) $\Delta H_{\text{mix}} = T\Delta S$
66. When a catalyst is added to a reversible reaction in equilibrium state, the value of the equilibrium constant
- (A) increases
 - (B) decreases
 - (C) does not change
 - (D) becomes zero
67. What is the relation between K_p and K_c ?
- (A) $K_p = \Delta n K_c RT$
 - (B) $K_p = -\Delta n K_c RT$
 - (C) $K_p = K_c (RT)^{\Delta n}$
 - (D) $K_p = K_c (RT)^{-\Delta n}$
68. Henderson–Hasselbalch equation for a buffer solution is
- (A) $\text{pH} = \text{pK}_a + \log \left(\frac{[\text{Salt}]}{[\text{Acid}]} \right)$
 - (B) $\text{pH} = \text{pK}_a - \log \left(\frac{[\text{Salt}]}{[\text{Acid}]} \right)$
 - (C) $\text{pH} = \text{pK}_b + \log \left(\frac{[\text{Salt}]}{[\text{Acid}]} \right)$
 - (D) $\text{pH} = \text{pK}_b - \log \left(\frac{[\text{Salt}]}{[\text{Acid}]} \right)$

69. Solubility product for a M_2S salt having solubility 's' mol lit⁻¹ is
- (A) $K_{sp} = 2s^2$
 - (B) $K_{sp} = 4s^2$
 - (C) $K_{sp} = 2s^3$
 - (D) $K_{sp} = 4s^3$
70. If half life time of a reaction is independent of initial concentration of reactant, what is the order of reaction?
- (A) Zero order
 - (B) $\frac{1}{2}$ order
 - (C) First order
 - (D) Second order
71. For the reaction, $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
- (A) Rate = $0.25 \frac{d[NH_3]}{dt}$
 - (B) Rate = $-0.25 \frac{d[NH_3]}{dt}$
 - (C) Rate = $4 \frac{d[NH_3]}{dt}$
 - (D) Rate = $-4 \frac{d[NH_3]}{dt}$
72. The reaction $Zn^{2+} + Cu \rightarrow Zn + Cu^{2+}$ is
- (The reduction potentials of Zn and Cu are -0.76 V and $+0.34$ V respectively)
- (A) non-spontaneous process
 - (B) spontaneous process
 - (C) spontaneous at high temperature
 - (D) spontaneous at lower temperature

73. Considering the formation, breaking and strength of hydrogen bond, predict which of the following mixtures will show a negative deviation from Raoult's law?
- (A) Methanol and acetone
 - (B) Chloroform and acetone
 - (C) Nitric acid and water
 - (D) Phenol and aniline
74. The physical adsorption of gases on the solid is due to
- (A) Covalent bond
 - (B) Hydrogen bond
 - (C) Ionic bond
 - (D) van der Waal's forces
75. Which among the following is **NOT** a facile reaction for primary amides (RCONH_2)?
- (A) Dehydration to give the corresponding nitriles
 - (B) Reaction with bromine in the presence of sodium hydroxide to give primary amines with one carbon less
 - (C) Reaction with alkyl halides to give the corresponding secondary and tertiary amides
 - (D) Reaction with lithium aluminum hydride to give primary amines having the same number of carbon atoms
76. In amylopectin, branching occurs by
- (A) C1-C4 glycosidic linkage
 - (B) C6-C6 linkage
 - (C) C1-C3 glycosidic linkage
 - (D) C1-C6 glycosidic linkage
77. Which among the following name reactions is suitable for the conversion of ethanoic acid to 2-bromoethanoic acid?
- (A) Hell-Volhard-Zelinsky reaction
 - (B) Hunsdiecker reaction
 - (C) Reformatsky reaction
 - (D) Favorskii reaction

78. Methyl cinnamate can be prepared as shown



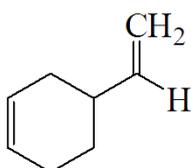
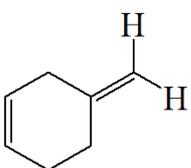
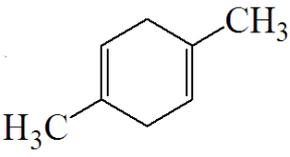
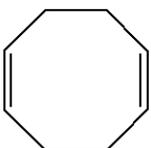
Which reagents should be used?

- (A) Step 1 - HCl, Step 2 - CH₃OH
(B) Step 1 - HCl, Step 2 - CH₃CO₂H
(C) Step 1 - PCl₅, Step 2 - CH₃OH
(D) Step 1 - PCl₅, Step 2 - CH₃CO₂H
79. C₆₀ (Fullerene) also known as buckminsterfullerene has
- (A) 14 pentagons and 18 hexagons
(B) 12 pentagons and 20 hexagons
(C) 10 pentagons and 20 hexagons
(D) 20 pentagons and 12 hexagons
80. Among formaldehyde, trichloroacetaldehyde (CCl₃CHO) and benzaldehyde, the aldehydes that undergo Cannizzaro reaction are
- (A) all the three aldehydes
(B) formaldehyde and trichloroacetaldehyde
(C) trichloroacetaldehyde and benzaldehyde
(D) formaldehyde and benzaldehyde
81. Which nitrogenous base is **NOT** present in Ribonucleic Acids (RNA)?
- (A) Adenine
(B) Thymine
(C) Guanine
(D) Cytosine

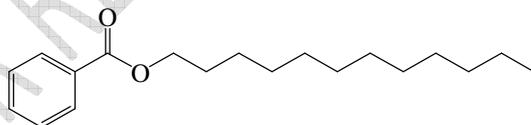
82. Which among the following is **NOT** a reducing sugar?

- (A) 2-deoxyribose
- (B) fructose
- (C) glucose
- (D) sucrose

83. Which of the following is formed by the dimerization of 1,3-butadiene by Diels-Alder reaction?

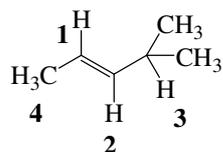
- (A) 
- (B) 
- (C) 
- (D) 

84. IUPAC name of the following compound is



- (A) Dodecyl benzoate
- (B) Benzyl dodeconate
- (C) Benzoyl oxy dodecane
- (D) Phenyl dodeconate

85. Which hydrogen is most easily abstracted from the below mentioned compound to give the corresponding radical intermediate?



- (A) 1
(B) 2
(C) 3
(D) 4
86. Which among the following aromatic compounds is most reactive towards sulfonation reaction?
- (A) Benzene
(B) Toluene
(C) Ethylbenzene
(D) *t*-Butylbenzene
87. Pick the statement that is **NOT** true for S_N1 substitutions.
- (A) Carbocation intermediate is involved
(B) E1 elimination is a possible side reaction
(C) Reaction rate is doubled when the concentration of nucleophile is doubled
(D) Primary alkyl halides seldom undergo S_N1 substitutions
88. Arrange the elements in the order of increase in ionization energy?
- (A) H, Li, Na, K, Rb, Cs
(B) K, Rb, Cs, H, Li, Na
(C) Cs, H, Li, K, Rb, Na
(D) Cs, Rb, K, Na, Li, H
89. Cobalt and Nickel are
- (A) diamagnetic
(B) paramagnetic
(C) ferromagnetic
(D) antiferromagnetic

90. Chlorine exists in two isotopic forms Cl-37 and Cl-35, but its atomic mass is 35.5. What would be the approximate ratio of Cl-37 and Cl-35?
- (A) 1 : 2
(B) 1 : 1
(C) 3 : 1
(D) 1 : 3
91. Which one is the example for linkage isomerism?
- (A) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]^{2+}$
(B) $[\text{Pd}(\text{NH}_3)_4]$
(C) $[\text{Co}(\text{NH}_3)_4\text{ClBr}]\text{Br}$
(D) $[\text{Cr}(\text{NH}_3)_5\text{CN}]$
92. The packing fraction (%) of simple cubic unit cell is
- (A) 74
(B) 68
(C) 52
(D) 39
93. Calculate de Broglie wavelength for an electron moving at the speed of 6.0×10^6 m/s. ($m = 9.1 \times 10^{-31}$ Kg, $h = 6.627 \times 10^{-34}$ Js)
- (A) 1.46×10^{-10} m
(B) 1.21×10^{-9} m
(C) 1.46×10^{-9} m
(D) 1.21×10^{-10} m
94. Physical properties of the elements in the periodic table depends upon the
- (A) size of atom
(B) size of proton
(C) number of electrons
(D) size of neutron

95. is a polar molecule.
- (A) BF_6
 (B) XeF_4
 (C) SF_4
 (D) SiF_4
96. Which type of radioactive decay causes the atomic number of a nucleus to increase by one unit?
- (A) Electron capture
 (B) α -particle emission
 (C) β -particle emission
 (D) γ -ray emission
97. The maximum temperature that can be achieved in blast furnace is
- (A) up to 1200 K
 (B) up to 2200 K
 (C) up to 1900 K
 (D) up to 5000 K
98. The structures of beryllium chloride in solid state and vapour phase are
- (A) chain and dimer, respectively
 (B) linear in both phases
 (C) dimer and linear, respectively
 (D) chain in both phases
99. Match the following.

List I		List II	
(a)	PCl_5	(i)	Square pyramidal
(b)	SF_6	(ii)	Trigonal planar
(c)	BrF_5	(iii)	Octahedral
(d)	BF_3	(iv)	Trigonal bipyramidal

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

100. What is the correct electronic configuration of the central atom in $K_4[Fe(CN)_6]$ based on crystal field theory?
- (A) $t_{2g}^4 e_g^2$
(B) $t_{2g}^6 e_g^0$
(C) $t_{2g}^3 e_g^3$
(D) $e^4 t_2^2$
101. If the non-zero numbers x, y, z are in A.P, and $\tan^{-1} x, \tan^{-1} y, \tan^{-1} z$ are also in A.P, then
- (A) $x = y = z$
(B) $xy = yz$
(C) $x^2 = yz$
(D) $z^2 = xy$
102. Let $f(x)$ be a polynomial of second degree. If $f(1) = f(-1)$ and a, b, c are in A.P, then $f'(a), f'(b)$ and $f'(c)$ are
- (A) in A.P
(B) in G.P
(C) in H.P
(D) equal
103. How many 5 letter words, with or without meaning can be formed out of the letters of the word 'EQUATIONS' if repetition of letters is not allowed?
- (A) 126
(B) 5^9
(C) 9^5
(D) 15120

104. If $\lim_{x \rightarrow 0} (\cos x + a \sin bx)^{\frac{1}{x}} = e^2$, then

(A) $a = 1, b = -2$

(B) $a = 2\sqrt{2}, b = \sqrt{2}$

(C) $a = 2\sqrt{2}, b = \frac{1}{\sqrt{2}}$

(D) $a = -2, b = 1$

105. If the point $(a, -a)$ lies inside the circle

$x^2 + y^2 - 4x + 2y - 8 = 0$, then 'a' lies in the interval

(A) $(-1, 4)$

(B) $(-\infty, -1)$

(C) $(4, \infty)$

(D) $[-1, 4]$

106. If $(n-1)C_r = (k^2 - 3)nC_{r+1}$, then k lies in the interval

(A) $[-\sqrt{3}, \sqrt{3}]$

(B) $(-\infty, -2)$

(C) $(2, \infty)$

(D) $(\sqrt{3}, 2]$

107. The remainder when $1! + 2! + 3! + \dots + 100!$ is divided by 240, is

(A) 187

(B) 33

(C) 73

(D) 153

108. The solution set of $f'(x) > g'(x)$ where $f(x) = \frac{1}{2}5^{2x+1}$ and

$g(x) = 5^x + 4x \log_e 5$ is

(A) $(1, \infty)$

(B) $(0, 1)$

(C) $(-1, \infty)$

(D) $(0, \infty)$

109. Let f be the greatest integer function defined by $f(x) = [x]$ and g be the modulus function defined by $g(x) = |x|$. Then the value of $(g \circ f)\left(\frac{-1}{3}\right)$ is
- (A) 1
 - (B) -1
 - (C) 0
 - (D) $\frac{1}{3}$
110. The probability of obtaining an even prime number on each die, when a pair of dice is rolled, is
- (A) 0
 - (B) $\frac{1}{6}$
 - (C) $\frac{1}{12}$
 - (D) $\frac{1}{36}$
111. The product of three consecutive numbers is always divisible by
- (A) 6
 - (B) 10
 - (C) 15
 - (D) 8
112. In the group of quaternions $Q_8 = \{\pm 1, \pm i, \pm j, \pm k\}$, the order of $-j$ is
- (A) 2
 - (B) 4
 - (C) 8
 - (D) 6

113. If $P + \frac{1}{Q} = 1$ and $Q + \frac{1}{R} = 1$, then the product of P , Q and R is
- (A) -1
 - (B) 2
 - (C) -2
 - (D) 3
114. The sum of mean and variance of a binomial distribution of 5 trials is 4.8. Then the probability of success is
- (A) 0.2
 - (B) 1.2
 - (C) 0.8
 - (D) 0.5
115. The set of all points of discontinuity of the greatest integer function $f(x) = [x]$ is
- (A) the set of all integers
 - (B) the set of all real numbers
 - (C) the set of all natural numbers
 - (D) the set of all rational numbers
116. If \vec{a} and \vec{b} are two non-zero vectors such that $|\vec{a} \times \vec{b}| = \vec{a} \cdot \vec{b}$, then the angle between \vec{a} and \vec{b} is
- (A) $\frac{\pi}{3}$
 - (B) $\frac{\pi}{4}$
 - (C) $\frac{\pi}{6}$
 - (D) $\frac{\pi}{2}$
117. Let the roots of $bt^2 + ct + a = 0$ be imaginary. For all real values of t , the expression $3b^2t^2 + 6bct + 2c^2$ is
- (A) less than $-4ab$
 - (B) greater than $-4ab$
 - (C) less than $4ab$
 - (D) greater than $4ab$

118. In a triangle ABC , if $\sin A \sin B = \frac{ab}{c^2}$, then the triangle is

- (A) equilateral
- (B) isosceles
- (C) right angled
- (D) obtuse angled

119. Let $f(t) = 2t^2 + 5t + 1$. If $f(t) = a(t+1)(t-2) + b(t-2)(t-1) + c(t-1)(t+1)$ for real numbers a, b, c , then

- (A) there are infinite number of choices for a, b, c
- (B) only one choice for a but infinite number of choices for b and c
- (C) exactly one choice for each of a, b, c
- (D) more than one but finite number of choices for a, b, c

120. Let $M = \begin{pmatrix} \cos \frac{\pi}{4} & -\sin \frac{\pi}{4} \\ \sin \frac{\pi}{4} & \cos \frac{\pi}{4} \end{pmatrix}$ and $Y = \begin{pmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{pmatrix}$. Then $M^3 Y =$

(A) $\begin{pmatrix} -1 \\ 0 \end{pmatrix}$

(B) $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$

(C) $\begin{pmatrix} -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{pmatrix}$

(D) $\begin{pmatrix} -\frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} \end{pmatrix}$

121. The number of real solutions of the equation $x^7 + 14x^5 + 16x^3 + 30x - 560 = 0$ is

- (A) 7
- (B) 1
- (C) 3
- (D) 5

122. The vector $\vec{a} = \alpha\vec{i} + 2\vec{j} + \beta\vec{k}$ lies in the plane of the vectors $\vec{b} = \vec{i} + \vec{j}$ and $\vec{c} = \vec{j} + \vec{k}$ and bisects the angle between \vec{b} and \vec{c} . Then

- (A) $\alpha = 1, \beta = 1$
- (B) $\alpha = 2, \beta = 2$
- (C) $\alpha = 1, \beta = 2$
- (D) $\alpha = 2, \beta = 1$

123. Which of the following function is not one to one?

- (A) $g: \mathbb{R} \rightarrow \mathbb{R}, g(x) = 2x + 5$
- (B) $g: [0, \pi] \rightarrow [-1, 1], g(x) = \cos x$
- (C) $g: \left[\frac{-\pi}{2}, \frac{\pi}{2} \right] \rightarrow [1, 7], g(x) = 3 \sin x + 4$
- (D) $g: \mathbb{R} \rightarrow [-1, 1], g(x) = \sin x$

124. The number of real solutions of the equation $\frac{6-x}{x^2-4} = 2 + \frac{x}{x+2}$ is

- (A) 0
- (B) 1
- (C) 2
- (D) 4

125. If $x_n > x_{n-1} > \dots > x_2 > x_1$, then the value of $\log_{x_1} \log_{x_2} \log_{x_3} \dots \log_{x_n} x_n^{x_{n-1}}$ is equal to

- (A) 0
- (B) 1
- (C) 2
- (D) n

126. If $\tan x = \frac{3}{4}$ and $\tan y = \frac{1}{7}$, then $x + y$ is equal to

- (A) π
- (B) 2π
- (C) $\frac{\pi}{4}$
- (D) $\frac{\pi}{2}$

127. If α and β are roots of both the equations $\cos^2 x + a \cos x + b = 0$ and $\sin^2 x + p \sin x + q = 0$, then

- (A) $1 + b + a^2 = p^2 - q$
- (B) $a^2 + b^2 = p^2 + q^2$
- (C) $b + q = a^2 + p^2 - 2$
- (D) $b + q = a^2 + p^2 + 2$

128. If z_1 and z_2 are complex numbers satisfying $\left| \frac{z_1}{z_2} \right| = 1$ and $\arg(z_1 z_2) = 0$, then

- (A) $z_1 = z_2$
- (B) $|z_2^2| = z_1 z_2$
- (C) $z_1 z_2 = 1$
- (D) $z_1 \cdot z_2 = 1$

129. $\sqrt{2 + \sqrt{2 + \sqrt{2 + \dots \infty}}}$ is equal to

- (A) $2i$
- (B) i
- (C) $-i$
- (D) -1

130. The complex numbers $\sin x + i \cos 2x$ and $\cos x - i \sin 2x$ are conjugate to each other for

(A) $x = n\pi$

(B) $x = \left(n + \frac{1}{2}\right)\pi$

(C) all values of x

(D) no value of x

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131. Let a, b, c be in Harmonic Progression. Then $\frac{a}{b+c}, \frac{b}{a+c}, \frac{c}{a+b}$ are

- (A) in Harmonic Progression
- (B) in Geometric Progression
- (C) in Arithmetic Progression
- (D) equal

132. The sum of all two digit odd numbers is

- (A) 2475
- (B) 2530
- (C) 4095
- (D) 5049

133. If $H_n = 1 + \frac{1}{2} + \dots + \frac{1}{n}$, then the value of $1 + \frac{3}{2} + \frac{5}{3} + \dots + \frac{2n-1}{n}$ is

- (A) $n + H_n$
- (B) $2n + H_n$
- (C) $2n - H_n$
- (D) $n - H_n$

134. A person read common difference of an Arithmetic Progression as -4 instead of 4 and obtained the sum of first eight terms as 48 . The correct sum of first eight terms is

- (A) 212
- (B) 272
- (C) 312
- (D) 342

135. Let $y = \left(1 + x^{\frac{1}{4}}\right) \left(1 + x^{\frac{1}{2}}\right) \left(1 - x^{\frac{1}{4}}\right)$. Then $\frac{dy}{dx}$ is equal to

- (A) 1
- (B) -1
- (C) x
- (D) \sqrt{x}

136. Let $f(x)$ be a polynomial in x . Then, the second order derivative of $f(e^x)$ with respect to x is

- (A) $f''(e^x).e^x + f'(e^x)$
- (B) $f''(e^x).e^{2x} + f'(e^{2x}).e^{2x}$
- (C) $f''(e^x).e^{2x}$
- (D) $f''(e^x).e^{2x} + f'(e^x).e^x$

137. Let $y = x^{\sin x}$. Then the value of $\frac{dy}{dx}$ at $x = \frac{\pi}{2}$ is

- (A) $1 + \frac{1}{\sqrt{2\pi}}$
- (B) 1
- (C) $\frac{1}{\sqrt{2\pi}}$
- (D) $-\frac{1}{\sqrt{2\pi}}$

138. If $f(x) = e^x \sin x$, then $f^{(6)}(x)$ is equal to

- (A) $e^{6x} \sin 6x$
- (B) $-8e^x \cos x$
- (C) $8e^x \sin x$
- (D) $8e^x \cos x$

139. Let $P(-1, 0)$, $Q(0, 0)$ and $R(3, 3\sqrt{3})$ be three points. Then the equation of the bisector of the $\angle PQR$ is

- (A) $\frac{\sqrt{3}}{2}x + y = 0$
- (B) $x - \sqrt{3}y = 0$
- (C) $\sqrt{3}x + y = 0$

(D) $x + \frac{\sqrt{3}}{2}y = 0$

140. The circles $x^2 + y^2 - 12x + 20 = 0$ and $x^2 + y^2 = k^2$ intersect at two distinct points, if

- (A) $k < 2$
- (B) $2 < k < 10$
- (C) $k > 8$
- (D) $k = 2$

141. Given $f_1(x) = x_1$, $f_2(x) = -x$, $f_3(x) = \frac{1}{x}$ and $f_4(x) = -\frac{1}{x}$ and \circ stands for composition of function. Then $(f_4 \circ f_2)(x)$ is

- (A) $f_1(x)$
- (B) $f_2(x)$
- (C) $f_3(x)$
- (D) $f_4(x)$

142. Locus of the midpoint of any focal chord of $y^2 = 4ax$ is

- (A) $y^2 = a(x - 2a)$
- (B) $y^2 = 2a(x - 2a)$
- (C) $y^2 = 2a(x - a)$
- (D) $y^2 = a(x - a)$

143. The latus rectum of the parabola $y^2 = 4ax$ whose focal chord is PSQ such that $SP = 3$ and $SQ = 2$ is given by

(A) $\frac{24}{5}$

(B) $\frac{12}{5}$

(C) $\frac{6}{5}$

(D) $\frac{1}{5}$

144. The number of values of c such that the line $y = 4x + c$ touches the curve $\frac{x^2}{4} + y^2 = 1$, is

(A) 1

(B) 2

(C) ∞

(D) 0

145. The diameter of $16x^2 - 9y^2 = 144$ which is conjugate to $x = 2y$, is

(A) $y = \frac{16x}{9}$

(B) $y = \frac{32x}{9}$

(C) $y = \frac{16y}{9}$

(D) $y = \frac{32y}{9}$

146. The value of $n \in I$, for which the function $f(x) = \frac{\sin nx}{\sin\left(\frac{x}{n}\right)}$ has 4π as its period,

is

(A) 2

(B) 3

(C) 4

(D) 5

147. $\lim_{x \rightarrow \infty} \left(\frac{x+6}{x+1} \right)^{x+4}$ is equal to

- (A) e^{-5}
- (B) e^5
- (C) 0
- (D) e^{-1}

148. The points of discontinuity of the function given below is/are

$$f(x) = \begin{cases} \frac{1}{5}(2x^2 + 3) & x \leq 1 \\ 6 - 5x & 1 < x < 3 \\ x - 3 & x \geq 3 \end{cases}$$

- (A) $x = 1$
- (B) $x = 3$
- (C) $x = 1, 3$
- (D) $x = 4$

149. If $f(x) = \sqrt{\frac{x - \sin x}{x + \cos^2 x}}$, then $\lim_{x \rightarrow \infty} f(x)$ is

- (A) 0
- (B) ∞
- (C) 1
- (D) -1

150. The point of the curve $y^2 = 2(x - 3)$ at which the normal is parallel to the line $y - 2x + 1 = 0$ is

- (A) (5, 2)
- (B) $\left(-\frac{1}{2}, -2\right)$
- (C) (5, -2)
- (D) $\left(\frac{3}{2}, 2\right)$

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

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

(B) $-e^x \cot\left(\frac{x}{2}\right) + c$

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

(D) $\frac{1}{2}e^x \cot\left(\frac{x}{2}\right) + c$

152. The differential equation $\frac{dy}{dx} = \frac{x(1+y^2)}{y(1+x^2)}$ represents a family of

- (A) parabola
- (B) hyperbola
- (C) circle
- (D) ellipse

153. The solution of $\frac{dy}{dx} + 1 = e^{x+y}$ is

(A) $e^{-(x+y)} + x + c = 0$

(B) $e^{-(x+y)} - x + c = 0$

(C) $e^{(x+y)} + x + c = 0$

(D) $e^{(x+y)} - x + c = 0$

154. The value of $\frac{(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2}{2\vec{a}^2 \cdot \vec{b}^2}$ is

(A) $\vec{a} \cdot \vec{b}$

(B) 1

(C) 0

(D) $\frac{1}{2}$

155. The points $(5, -4, 2)$, $(4, -3, 1)$, $(7, -6, 4)$ and $(8, -7, 5)$ are the vertices of a
- (A) rectangle
 - (B) square
 - (C) parallelogram
 - (D) trapezium

156. The inverse of the mapping $f : R \rightarrow R$ defined by $f(x) = 7x - 8$ for all $x \in R$, is

- (A) $g(y) = \frac{y-7}{8}$ for all $y \in R$
- (B) $g(y) = \frac{y+7}{8}$ for all $y \in R$
- (C) $g(y) = \frac{y+8}{7}$ for all $y \in R$
- (D) $g(y) = \frac{y-8}{7}$ for all $y \in R$

157. If $\begin{bmatrix} 2 & -2 & x \\ 2 & x & 2 \\ x & -2 & 2 \end{bmatrix}$ has no inverse, then the real value of x is

- (A) 0
- (B) 1
- (C) 2
- (D) 3

158. If the sum of two unit vectors is a unit vector then the magnitude of their difference is

- (A) $\sqrt{2}$
- (B) $\sqrt{3}$
- (C) $\frac{1}{2}$
- (D) 1

159. If $\frac{1-i}{1+i}$ is a root of the equation $ax^2 + bx + 1 = 0$, where a, b are real, then (a, b) is

- (A) (1, 1)
- (B) (1, -1)
- (C) (0, 1)
- (D) (1, 0)

160. Pipe A can fill a cistern in 36 minutes and pipe B in 48 minutes. If both the pipes are opened together, when should pipe B be closed so that the cistern may be just full in 24 minutes?

- (A) 8 minutes
- (B) 9 minutes
- (C) 12 minutes
- (D) 16 minutes

161. If $f : R \rightarrow R$ is defined by $f(x) = \cos x$ and $g : R \rightarrow R$ is defined by $g(x) = x^2$, then $f \circ g$ is

- (A) $x^2 \cos x$
- (B) $(\cos x)^2$
- (C) $\cos x^2$
- (D) $\frac{\cos x}{x^2}$

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

- (A) 2, 6
- (B) 2, 3
- (C) 3, 4
- (D) 4, 3

163. The value of $\int_e^{e^2} \log_e x \, dx$ is

- (A) $2e^2$
- (B) $2e^2 - e$
- (C) e
- (D) e^2

164. The values of x for which the graph of $f(x) = \frac{x^3}{3} - x^2 + 3$ has a horizontal tangent, are

- (A) 0
- (B) 0 and 2
- (C) 0 and 3
- (D) 3

165. The value of $\sum_{n=1}^{100} (i^n + i^{n+2})$ is

- (A) i
- (B) $1 + i$
- (C) 0
- (D) $-i$

166. If $Z = \sqrt[7]{-1}$ and Z is non-real, then $Z^{86} + Z^{175} + Z^{289}$ equals

- (A) Z
- (B) -1
- (C) Z^2
- (D) $(2Z - 3)^3$

167. The area of the region satisfying $\frac{1}{\sqrt{2}} < |(1+i)z+i| < \sqrt{2}$ is
- (A) 3π
 - (B) $\frac{3\pi}{2}$
 - (C) $\frac{3\pi}{4}$
 - (D) $-\frac{1}{\sqrt{3}}$
168. A man from the top of a 100 meter high tower sees a car moving towards the tower at an angle of depression of 30° . After some time, the angle of depression becomes 60° . The distance (in meters) travelled by the car during this time is
- (A) $\frac{200\sqrt{3}}{3}$
 - (B) $100\sqrt{3}$
 - (C) $\frac{100\sqrt{3}}{3}$
 - (D) $200\sqrt{3}$
169. On the interval $[0, 1]$, the function $x^{25}(1-x)^{75}$ takes its maximum value at the point
- (A) 0
 - (B) $\frac{1}{4}$
 - (C) $\frac{1}{2}$
 - (D) $\frac{1}{3}$
170. The solution set of $|x^2 - 5x| < 6$ is
- (A) $(-1, 2) \cup (3, 6)$
 - (B) $0 \leq x \leq 5$
 - (C) $x \geq 6$

- (D) $-5 \leq x \leq 5$
171. A balloon which always remains spherical is being inflated by pumping in 1000 cubic centimetres of gas per second. Then the rate at which the radius of the balloon is increasing when its radius is 5 cm, is
- (A) $\frac{10}{\pi}$ cm²/sec
- (B) $\frac{10}{3\pi}$ cm/sec
- (C) $\frac{\pi}{10}$ cm/sec
- (D) $\frac{10}{\pi}$ cm/sec
172. The function $f(x) = \frac{x^3 + x^2 - 16x + 20}{x - 2}$ is not defined at $x = 2$. In order to make $f(x)$ continuous at $x = 2$, $f(2)$ should be
- (A) 1
- (B) 4
- (C) 0
- (D) -4
173. Let $\frac{d}{dx} f(x) = \left(\frac{e^{\sin x}}{x} \right)$, $x > 0$. If $\int_1^4 \frac{3}{x} e^{\sin x^3} dx = f(k) - f(1)$, then one of the possible values of k , is
- (A) 15
- (B) 16
- (C) 63
- (D) 64
174. For a value of k , the area bounded by the curve $y = -x^5 + 8x^2$, the straight lines $x = 1$ and $x = k$ and the x -axis is equal to $\frac{16}{3}$. Such a value of k is
- (A) $\sqrt[3]{8 - \sqrt{17}}$
- (B) -1
- (C) 2
- (D) 3

175. The value of $\int 7^{7^{7^x}} 7^{7^x} 7^x dx$ is equal to

(A) $\frac{7^{7^{7^x}}}{(\log 7)^3} + c$

(B) $\frac{7^{7^{7^x}}}{(\log 7)^2} + c$

(C) $7^{7^{7^x}} (\log 7)^3 + c$

(D) $7^{7^{7^x}} + c$

176. If $*$ is a binary operation defined by $a * b = 3a + 4b - 2$, then $4 * 5$ is

(A) $\sqrt{48}$

(B) 31

(C) 29

(D) 30

177. If $R = \{(x, y) : x + 2y = 8\}$ is a relation on the set of all natural numbers N , then the range of R is

(A) $\{1, 2, 3\}$

(B) $\{1\}$

(C) $\{2, 5\}$

(D) $\{4, 3, 1\}$

178. If b, k are intercepts of a focal chord of the parabola $y^2 = 4ax$, then k is equal to

(A) $\frac{ab}{b-a}$

(B) $\frac{b}{b-a}$

(C) $\frac{a}{b-a}$

(D) $\frac{ab}{a-b}$

179. The equation of the tangent to the hyperbola $\frac{x^2}{4} - \frac{y^2}{3} = 1$, parallel to the line $y = x + 2$, is

- (A) $y = -x + 1$
- (B) $y = x + 1$
- (C) $y = -x - 1$
- (D) $y = x - 2$

180. If θ is the angle between the asymptotes of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ with eccentricity e , then $\sec\left(\frac{\theta}{2}\right)$ is

- (A) e
- (B) $\frac{e}{2}$
- (C) $\frac{e}{3}$
- (D) $\sqrt{3}$

181. If X follows binomial distribution with parameters $n = 8$ and $p = \frac{1}{2}$, then $P(|X - 4| \leq 2)$ is

- (A) $\frac{117}{128}$
- (B) $\frac{116}{128}$
- (C) $\frac{29}{128}$
- (D) $\frac{119}{128}$

182. A monoid becomes a group if it also satisfies the

- (A) closure axiom
- (B) associative axiom
- (C) identity axiom
- (D) inverse axiom

183. An example for a tautology is

- (A) $p \vee q$
- (B) $p \wedge q$
- (C) $p \vee \sim p$
- (D) $p \wedge \sim p$

184. The Arithmetic Mean of n observations is M . If the sum of $n - 4$ observations is a , then the mean of remaining 4 observations is

- (A) $\frac{nM - a}{4}$
- (B) $\frac{nM + a}{4}$
- (C) $nM - a$
- (D) $\frac{nM - a}{2}$

185. If the equation $hxy + gx + fy + c = 0$, $h \neq 0$ represents two straight lines, then

- (A) $2fgh = c^2$
- (B) $2fg = ch$
- (C) $fgh = c^2$
- (D) $fg = ch$

186. If the absolute term in the expansion of $\left(\sqrt{x} - \frac{k}{x^2}\right)^{10}$ is 405, then 'k' is equal to

- (A) ± 2
- (B) ± 1
- (C) ± 3
- (D) 0

187. The range of the function $f(x) = \log_e(3x^2 - 4x + 5)$ is

(A) $\left(-\infty, \log_e \frac{11}{3}\right]$

(B) $\left[\log_e \frac{11}{3}, \infty\right)$

(C) $\left[-\log_e \frac{11}{3}, \log_e \frac{11}{3}\right]$

(D) $\left(-\infty, -\log_e \frac{11}{3}\right]$

188. The value of the sum $\sum_{n=1}^{13} (i^n + i^{n+1})$, where $i = \sqrt{-1}$, equals

(A) $1 - i$

(B) $i - 1$

(C) $-i$

(D) 0

189. The locus represented by $|z - 1| = |z + i|$ is

(A) a circle of radius 1

(B) an ellipse with foci at 1 and $-i$

(C) a line through the origin

(D) a circle on the join of 1 and $-i$ as diameter

190. Let $A = \begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ be an orthogonal matrix. Then

(A) $b = \pm \frac{1}{\sqrt{6}}, c = \pm \frac{1}{\sqrt{3}}$

(B) $a = \pm \frac{1}{\sqrt{2}}, c = \pm \frac{1}{\sqrt{6}}$

(C) $a = \pm \frac{1}{\sqrt{2}}, b = \pm \frac{1}{\sqrt{6}}$

(D) $a = \pm \frac{1}{\sqrt{2}}, b = \pm \frac{1}{\sqrt{6}}, c = \pm \frac{1}{\sqrt{3}}$

191. If $\begin{vmatrix} \alpha & -\beta & 0 \\ 0 & \alpha & \beta \\ \beta & 0 & \alpha \end{vmatrix} = 0$ then

- (A) α/β is one of the cube roots of unity
- (B) α is one of the cube roots of unity
- (C) β is one of the cube roots of unity
- (D) $\alpha + \beta$ is one of the cube roots of unity

192. The value of λ for which the equations $x + y - 3 = 0$,
 $(1 + \lambda)x + (2 + \lambda)y - 8 = 0$, $x - (1 + \lambda)y + (2 + \lambda) = 0$ are consistent is

- (A) -1
- (B) $\frac{5}{3}$
- (C) $-\frac{5}{3}$
- (D) $\frac{3}{5}$

193. The sum to n terms of the sequence $\log a, \log ar, \log ar^2, \dots$ is

- (A) $\frac{n}{2} \log a^2 r^{n-1}$
- (B) $n \log a^2 r^{n-1}$
- (C) $\frac{3n}{2} \log a^2 r^{n-1}$
- (D) $3n \log ar^{n-1}$

194. If a, b, c are positive, then the minimum value of

$$a^{\log b - \log c} + b^{\log c - \log a} + c^{\log a - \log b} \text{ is}$$

- (A) 1
- (B) 3
- (C) 9
- (D) 16

195. Let $f(x)$ and $g(x)$ be two differentiable functions and $f(1) = g(1) = 2$. Then $\lim_{x \rightarrow 1} \frac{f(1)g(x) - f(x)g(1) - f(1) + g(1)}{g(x) - f(x)}$ is equal to
- (A) 0
(B) 1
(C) 2
(D) -1
196. If $g(x) = (x^2 + 2x + 3)f(x)$, $f(0) = 5$ and $\lim_{x \rightarrow 0} \frac{f(x) - 5}{x} = 4$, then $g'(0)$ is equal to
- (A) 22
(B) 20
(C) 18
(D) 12
197. If the sum of distances of a point from two perpendicular lines in a plane is 1, then its locus is
- (A) square
(B) circle
(C) straight line
(D) two intersecting lines
198. The distance between the planes $3x + 2y - 6z - 14 = 0$ and $3x + 2y - 6z + 21 = 0$ is
- (A) 1
(B) 5
(C) 7
(D) 35

199. If A and B are two events such that $P(A) = 0.7$, $P(B) = 0.3$ and $P\left(\frac{A}{B}\right) = 0.5$,

then $P\left(\frac{A'}{B'}\right)$ is

(A) $\frac{3}{8}$

(B) $\frac{3}{12}$

(C) $\frac{3}{14}$

(D) $\frac{3}{16}$

200. Two cards are drawn from a well shuffled pack of 52 cards with replacement. The probability that both cards are aces is

(A) $\frac{1}{13} \times \frac{1}{13}$

(B) $\frac{1}{13} + \frac{1}{13}$

(C) $\frac{1}{13} \times \frac{1}{17}$

(D) $\frac{1}{13} \times \frac{4}{51}$

FOR REFERENCE ONLY - CUSAT

KEY

SI No.	Key												
1	A	31	B	61	B	91	A	121	B	151	B	181	D
2	D	32	B	62	D	92	C	122	A	152	B	182	D
3	C	33	B	63	D	93	D	123	D	153	A	183	C
4	D	34	C	64	B	94	A	124	B	154	D	184	A
5	C	35	A	65	B	95	C	125	B	155	C	185	D
6	C	36	C	66	C	96	C	126	C	156	C	186	C
7	B	37	B	67	C	97	B	127	C	157	C	187	B
8	B	38	A	68	A	98	A	128	B	158	B	188	B
9	B	39	B	69	D	99	A	129	D	159	D	189	C
10	C	40	A	70	C	100	B	130	D	160	D	190	D
11	D	41	D	71	B	101	A	131	A	161	C	191	A
12	C	42	C	72	A	102	A	132	A	162	C	192	C
13	B	43	A	73	B	103	D	133	C	163	D	193	A
14	B	44	A	74	D	104	C	134	B	164	B	194	B
15	C	45	C	75	C	105	A	135	B	165	C	195	C
16	B	46	B	76	D	106	D	136	D	166	B	196	A
17	B	47	C	77	A	107	D	137	B	167	C	197	A
18	C	48	C	78	C	108	D	138	B	168	A	198	B
19	B	49	A	79	B	109	A	139	C	169	B	199	C
20	C	50	C	80	D	110	D	140	B	170	A	200	A
21	A	51	A	81	B	111	A	141	C	171	D		
22	C	52	C	82	D	112	B	142	C	172	C		
23	B	53	C	83	A	113	A	143	A	173	D		
24	B	54	A	84	A	114	C	144	B	174	A		
25	A	55	C	85	C	115	A	145	B	175	A		
26	B	56	B	86	B	116	B	146	A	176	D		
27	C	57	B	87	C	117	B	147	B	177	A		
28	B	58	D	88	D	118	C	148	B	178	A		
29	B	59	A	89	C	119	C	149	C	179	B		
30	C	60	C	90	D	120	A	150	C	180	A		

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