

B.Tech. (PHYSICS) – SHIFT IV

1. Vectors A and B have same magnitude. In addition, the magnitude of their resultant is also equal to the magnitude of either of them. Then A and B are at an angle
 - (A) 120°
 - (B) 60°
 - (C) 90°
 - (D) 45°

2. A stone is released from an elevator going up with acceleration a . The acceleration of the stone after the release is
 - (A) a upwards
 - (B) $(g - a)$ upwards
 - (C) $(g - a)$ downwards
 - (D) g downwards

3. The linear momentum of a system of particles is equal to
 - (A) total mass \times acceleration
 - (B) total mass \times velocity
 - (C) total mass \times velocity of center of mass of the particles
 - (D) total mass \times acceleration of center of mass of the particles

4. A jar has a mixture of Hydrogen and Oxygen gases in the ratio 1 : 5. The ratio of mean kinetic energies of the molecules of the Hydrogen and Oxygen gas is
 - (A) 1 : 16
 - (B) 5 : 1
 - (C) 1 : 1
 - (D) 1 : 5

5. A black body at a temperature $T = 3\text{ K}$ emits radiation of maximum intensity at a wavelength of
 - (A) 10^7 \AA
 - (B) 1 \AA
 - (C) 1 cm
 - (D) 10^{-7} \AA

6. A fraction f_1 of a radioactive sample decays in one mean life and a fraction f_2 decays in one half life. Then

- (A) $f_1 > f_2$
- (B) $f_1 < f_2$
- (C) $f_1 = f_2$
- (D) relative fraction of f_1 and f_2 depends on initial amount of the sample

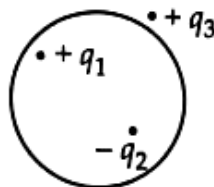
7. Reciprocal of the bulk modulus is called

- (A) modulus of rigidity
- (B) volume stress
- (C) volume strain
- (D) compressibility

8. For steady flow of a fluid, the Reynold's number must be

- (A) less than 2000
- (B) greater than 2000 but less than 3000
- (C) negative
- (D) greater than 3000

9. The figure below shows a spherical Gaussian surface and a charge distribution. The electric field at any point over the surface will be due to the charge



- (A) $+q_3$ alone
- (B) $+q_1$ and $+q_3$
- (C) $+q_1$, $+q_3$ and $-q_2$
- (D) $+q_1$ and $-q_2$

10. If E and B represent the electric and magnetic field component of the electromagnetic waves, then the direction of propagation of the wave will be

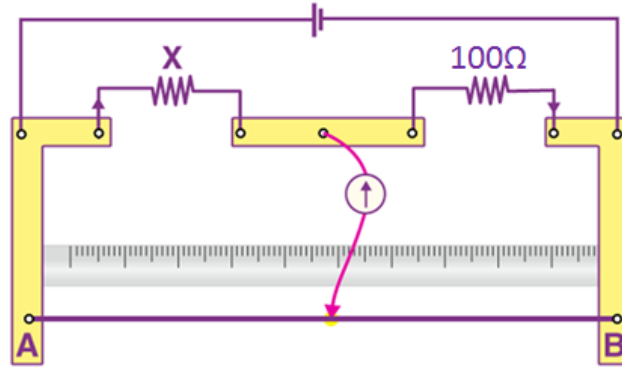
- (A) parallel to E direction
- (B) parallel to B direction
- (C) in a direction given by $E \times B$
- (D) in a direction given by $B \times E$

11. If the frequency of the AC is made four times of its initial value, then the inductive reactance will
- (A) be 4 times
 - (B) be 2 times
 - (C) remain same
 - (D) be half
12. If the particles listed below all have same kinetic energy, which one of them have the shortest de-Broglie wavelength?
- (A) Electron
 - (B) Proton
 - (C) Deuteron
 - (D) α -particle
13. Circularly polarized light is passed through a quarter wave plate. Then the general state of polarization state of the outgoing radiation is
- (A) Unpolarized
 - (B) Elliptical polarized
 - (C) Circular polarized
 - (D) Linearly polarized
14. Three stars A , B and C have temperatures T_A , T_B and T_C . A appears bluish, B appears reddish and C appears yellowish. Then we can conclude that
- (A) $T_A > T_C > T_B$
 - (B) $T_A > T_B > T_C$
 - (C) $T_B > T_C > T_A$
 - (D) $T_A > T_B > T_A$
15. An AND gate with inverters on each of its input is equivalent to
- (A) NAND gate
 - (B) NOR gate
 - (C) XOR gate
 - (D) OR gate

16. The dimensional formula for modulus of rigidity is
- (A) $[ML^2T^{-2}]$
 - (B) $[ML^{-1}T^{-2}]$
 - (C) $[ML^{-1}T^{-3}]$
 - (D) $[ML^{-2}T^{-2}]$
17. In a good conductor, the energy gap between the conduction band and the valence band is
- (A) Infinity
 - (B) Wide
 - (C) Narrow
 - (D) Zero
18. Pieces of copper and germanium are cooled from room temperature to 80 K. The resistance of
- (A) Copper increases and germanium increases
 - (B) Copper increases and germanium decreases
 - (C) Copper decreases and germanium decreases
 - (D) Copper decreases and germanium increases
19. A photodiode is essentially a
- (A) P-type semiconductor
 - (B) N-type semiconductor
 - (C) P-N junction
 - (D) Metal-Insulator-Semiconductor
20. For which of the following does the centre of mass lie outside the body?
- (A) A pencil
 - (B) A shot put
 - (C) A dice
 - (D) A bangle
21. At what rate the earth should rotate so that the weight of a body at the equator of the earth becomes zero?
- (A) 17 time the present speed
 - (B) 8 times the present speed
 - (C) 170 times the present speed
 - (D) 80 times the present speed

22. For hydrogen gas $C_p - C_v = a$ and for oxygen gas $C_p - C_v = b$, so the relation between a and b is given by
- (A) $a = 16b$
 - (B) $4a = b$
 - (C) $a = 4b$
 - (D) $a = b$
23. The fuse is made from a wire of
- (A) low resistance and high melting point
 - (B) high resistance and high melting point
 - (C) high resistance and low melting point
 - (D) low resistance and low melting point
24. When n-type semiconductor is heated
- (A) number of electrons increases while number of holes decreases
 - (B) number of holes increases while number of electrons decreases
 - (C) number electrons and holes remains the same
 - (D) number of electrons and holes increases equally
25. The dimensions $ML^{-1}T^{-2}$ may correspond to
- (A) Work done by a force
 - (B) Linear momentum
 - (C) Pressure
 - (D) Frequency

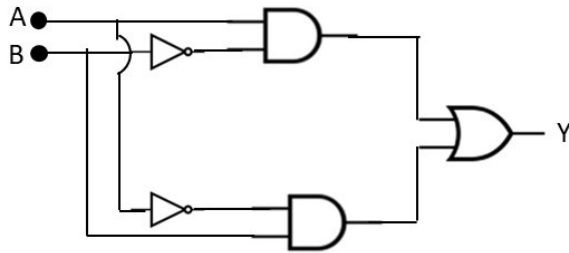
26. A meter bridge is set up as shown, to determine an unknown resistance 'X' using a standard 100 ohm resistor. The galvanometer shows null point when the tapping-key is at 52 cm mark. The end-corrections are 3 cm and 2 cm respectively for ends A and B. The determined value of 'X' is



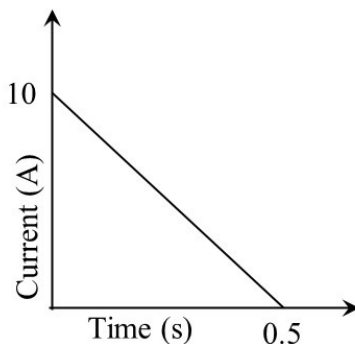
- (A) 100 ohm
 (B) 106 ohm
 (C) 108 ohm
 (D) 110 ohm
27. When a pendulum clock keeping correct time is taken to high altitudes, then
- (A) It will keep correct time
 (B) Its length should be decreased to keep correct time
 (C) Its length should be increased to keep correct time
 (D) It cannot keep correct time even if the length is changed
28. A particle is moving with speed $v = b\sqrt{x}$ along positive x axis. If the particle is at origin when $t = 0$ sec, the speed of the particle at $t = \tau$ is
- (A) $b^2\tau$
 (B) $\frac{b^2\tau}{2}$
 (C) $\frac{b^2\tau}{\sqrt{2}}$
 (D) $\frac{b^2\tau}{4}$

29. When a drop of oil is spread on a water surface, it displays beautiful colours in daylight because of
- (A) dispersion of light
 - (B) interference of light
 - (C) reflection of light
 - (D) scattering of light
30. An astronomical telescope having an objective of focal length 150 cm and eyepiece of focal length 5 cm, is focused to see an object 10 km from the objective. If the final image is formed at infinity, the angular magnification produced by the telescope is
- (A) -30
 - (B) 750
 - (C) -0.033
 - (D) -750
31. A transmitting antenna of height 20 m and the receiving antenna of height h are separated by a distance of 40 km for satisfactory communication in line-of-sight mode. If the radius of earth is 6400 km, the value of h is
- (A) 40 m
 - (B) 45 m
 - (C) 30 m
 - (D) 25 m
32. To double the covering range of a TV transmission tower, its height should be multiplied by
- (A) $\frac{1}{\sqrt{2}}$
 - (B) 2
 - (C) 4
 - (D) $\sqrt{2}$

33. In the combination of the following gates, the output Y can be written in terms of inputs A and B as



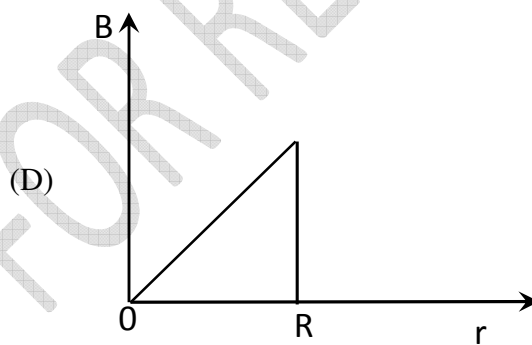
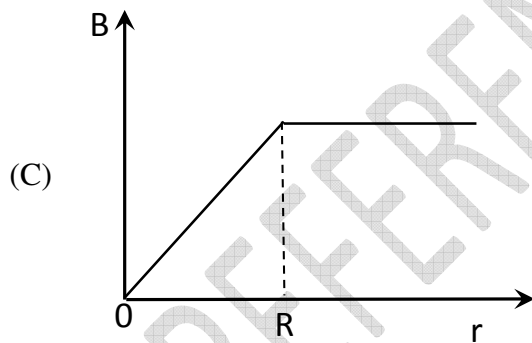
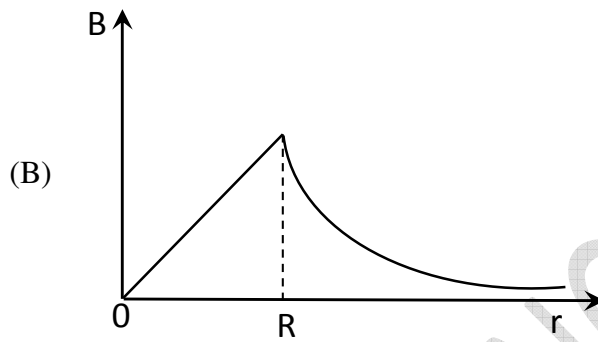
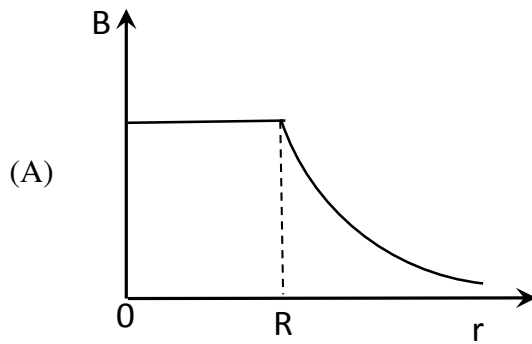
- (A) $\overline{A.B}$
 (B) $A.\overline{B} + \overline{A}.B$
 (C) $\overline{A.B} + A.B$
 (D) $\overline{A + B}$
34. In photoelectric effect, the photocurrent
- (A) depends both on intensity and frequency of the incident light
 (B) does not depend on the frequency of the incident light but depends on the intensity of the incident light.
 (C) decreases with increase in frequency of incident light.
 (D) increases with increase in frequency of incident light.
35. In a coil of resistance 100Ω , a current is induced by changing the magnetic flux through it as shown in the figure.



The magnitude of change in flux through the coil is

- (A) 200 Wb
 (B) 225 Wb
 (C) 250 Wb
 (D) 275 Wb

36. The correct plot of the magnitude of magnetic field \vec{B} vs distance r from the centre of the wire, if the radius of the wire is R

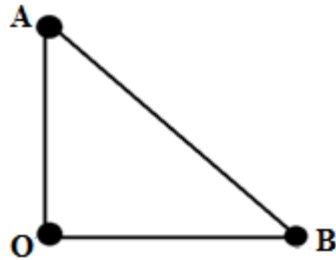


37. Two rain drops reach the earth with the terminal velocities in the ratio of 4 : 9. The ratio of their masses is
- (A) $4\sqrt{2} : 9\sqrt{2}$
 - (B) 2 : 3
 - (C) 4 : 9
 - (D) 8 : 27
38. An oscillator is nothing but an amplifier with
- (A) larger gain
 - (B) no feed back
 - (C) positive feed back
 - (D) negative feed back
39. A free neutron decays to a proton but a free proton does not decay to a neutron. This is because
- (A) Neutron is a composite particle made of a proton and an electron where as proton is a fundamental particle
 - (B) Neutron is a uncharged particle where as proton is a charged particle
 - (C) Neutron has a larger rest mass than the proton
 - (D) Weak forces can operate in a neutron but not in a proton
40. Planck's constant explains
- (A) the Quantum nature of light
 - (B) the Particle nature of light
 - (C) the Wave nature of light
 - (D) both the Quantum nature and Wave nature of light
41. The motion of a car on a straight road can be called as
- (A) Rectilinear
 - (B) Circular
 - (C) Periodic
 - (D) Harmonic
42. The coefficient of restitution for a perfectly elastic collision is
- (A) 1
 - (B) 0
 - (C) -1
 - (D) ∞

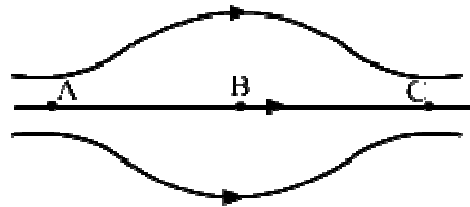
43. The wettability of a surface by a liquid primarily depends on
- (A) Surface tension
 - (B) Density
 - (C) Angle of contact between the surface and liquid
 - (D) Viscosity
44. The SI unit of specific heat capacity is
- (A) $\text{J kg}^{-1}\text{K}^{-1}$
 - (B) $\text{J kg}^{-1}\text{K}^{-2}$
 - (C) $\text{J kg}^{-2}\text{K}^{-1}$
 - (D) $\text{J}^{-1}\text{kgK}^{-1}$
45. If the length of the simple pendulum is increased, then the time period will
- (A) increase
 - (B) decrease
 - (C) remain constant
 - (D) can't predict
46. The potential energy of a test charge will when moved from lower potential point to a higher potential point.
- (A) remain the same
 - (B) increase
 - (C) decrease
 - (D) become zero
47. Two resistors of resistance 5 ohms and 15 ohms are connected in series. If the voltage drop across 5 ohms resistor is 2.5 V, the current across 15 ohms resistor is
- (A) 0.5 A
 - (B) 1 A
 - (C) 5 A
 - (D) insufficient data
48. Materials with susceptibility χ in the range $-1 \leq \chi < 0$ are called
- (A) Ferromagnetic
 - (B) Paramagnetic
 - (C) Antiferromagnetic
 - (D) Diamagnetic

49. The coils in resistance boxes are made from doubled insulated wire to nullify the effect of
- (A) heating
 - (B) magnetism
 - (C) pressure
 - (D) self induced e.m.f.
50. The reason for transmitting A.C. power at high voltages from the power house is
- (A) as the rate of transmission is faster
 - (B) as it is more economic due to less power loss
 - (C) as power cannot be transmitted at low voltages
 - (D) as a precaution against theft of transmission lines
51. When a high energy UV photon beam enters an electric field, it will be
- (A) Accelerated
 - (B) Deflected
 - (C) Retarded
 - (D) Undeflected
52. Beta rays emitted by radioactive material are
- (A) neutral particles
 - (B) electrons orbiting around the nucleus
 - (C) electromagnetic radiation
 - (D) charged particles emitted by the nucleus
53. In a common base amplifier the phase difference between input and output voltage is
- (A) 45°
 - (B) 0
 - (C) 90°
 - (D) 180°
54. A monkey is sitting at a spring balance that reads 60 kilograms. What effect will the monkey having jumped off the balance have on the reading?
- (A) Decrease
 - (B) Increase
 - (C) No change in reading
 - (D) First increase and then becomes zero

55. Three objects of mass 1 kg each are placed at corners of a right-angled triangle AOB as shown in the figure. Consider 'O' as the origin and $OA = OB = 1$ m. Determine the position of the centre of mass of this system



- (A) $\frac{1}{3}(i - j)m$
- (B) $\frac{2}{3}(i + j)m$
- (C) $\frac{1}{3}(i + j)m$
- (D) $(i - j)m$
56. In a thermodynamic process, pressure of a fixed mass of the gas is changed in such a manner that the gas molecules give out 30 J of heat. Also, 10 J of work is done on the gas. If the internal energy of the gas was 40 J, what will be the final internal energy ?
- (A) 20 J
- (B) -20 J
- (C) 80 J
- (D) zero
57. The figure below shows the electric field lines due to two positive charges. The magnitudes E_A , E_B and E_C of the electric fields at point A, B and C respectively are related as



- (A) $E_A > E_B > E_C$
- (B) $E_B > E_A > E_C$
- (C) $E_A = E_C > E_B$
- (D) $E_A > E_B = E_C$

58. Pick out the correct increasing order of energy of electromagnetic waves from the following

- (A) $E_{\text{gamma}} < E_{\text{ultraviolet}} < E_{\text{visible}} < E_{\text{infrared}} < E_{\text{micro}}$
- (B) $E_{\text{micro}} < E_{\text{infrared}} < E_{\text{ultraviolet}} < E_{\text{visible}} < E_{\text{gamma}}$
- (C) $E_{\text{micro}} < E_{\text{infrared}} < E_{\text{visible}} < E_{\text{gamma}} < E_{\text{ultraviolet}}$
- (D) $E_{\text{micro}} < E_{\text{infrared}} < E_{\text{visible}} < E_{\text{ultraviolet}} < E_{\text{gamma}}$

59. Which of the following is a correct statement?

- (A) Beta rays are the same as cathode rays
- (B) Gamma rays are high energy neutrons
- (C) Alpha particles are singly ionized helium atoms
- (D) Protons and neutrons have the same mass

60. Match the following:

- | Column A | Column B |
|--------------------|--|
| (i) Attenuation | (P) mixing of unwanted signal with the informational signal during propagation |
| (ii) Amplification | (Q) converts one form of energy into another |
| (iii) Noise | (R) the process of increasing the amplitude |
| (iv) Transducer | (S) is the loss of strength of a signal during the propagation |

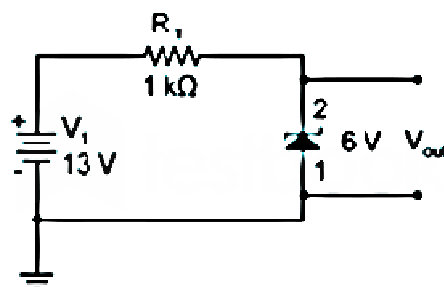
- (A) (i) - (S), (ii) - (R), (iii) - (P), (iv) - (Q)
- (B) (i) - (R), (ii) - (S), (iii) - (P), (iv) - (Q)
- (C) (i) - (S), (ii) - (R), (iii) - (Q), (iv) - (P)
- (D) (i) - (P), (ii) - (R), (iii) - (S), (iv) - (Q)

61. A particle is initially moving with a velocity of 10 m/s. If it undergoes a constant acceleration of 2 m/s^2 , what is its velocity after 4 seconds?

- (A) 12 m/s
- (B) 14 m/s
- (C) 16 m/s
- (D) 18 m/s

62. A force of 20 N is applied to an object of mass 5 kg. What is the acceleration of the object?
- (A) 2 m/s^2
 - (B) 4 m/s^2
 - (C) 10 m/s^2
 - (D) 100 m/s^2
63. A force of 15 N acts on an object, causing it to move a distance of 5 m in the direction of the force. What is the work done by the force?
- (A) 3 J
 - (B) 5 J
 - (C) 15 J
 - (D) 75 J
64. Which of the following statements is **true** regarding a rigid body?
- (A) Its shape changes under the action of external forces
 - (B) It cannot rotate about its center of mass
 - (C) The distance between any two particles remains constant
 - (D) Its center of mass changes position over time
65. A Carnot engine operates between two temperatures, T_1 and T_2 , with $T_1 > T_2$. The efficiency of the engine is given by
- (A) $1 - \frac{T_2}{T_1}$
 - (B) $T_1 - \frac{T_2}{T_1}$
 - (C) $\frac{T_2}{T_1} - 1$
 - (D) $1 - \frac{T_1}{T_2}$
66. The frequency of oscillation of a simple pendulum is independent of
- (A) Amplitude
 - (B) Acceleration due to gravity
 - (C) Length of the pendulum
 - (D) Mass of the pendulum bob

67. A light beam of wavelength 600 nm from a distant source falls on a single slit of 1 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. The distance between the first dark fringes on either side of the central bright fringe is
- (A) 2.4 mm
 (B) 1.2 mm
 (C) 1.2 cm
 (D) 2.4 cm
68. Identify the correct equation based on the three equations of motion.
- (A) $s = \frac{ut}{2} + \frac{at^2}{2}$
 (B) $s = \frac{ut}{2} + at^2$
 (C) $s = \frac{2ut}{2} + \frac{at^2}{2}$
 (D) $s = 2ut + \frac{at^2}{2}$
69. The property of breaking of material with little permanent distortion is called
- (A) Ductility
 (B) Malleability
 (C) Rigidity
 (D) Brittleness
70. Which one of the following statements holds good when the light is refracted into a medium?
- (A) Both frequency and wavelength of the light increase
 (B) Both wavelength and frequency decrease
 (C) The wavelength decreases but the frequency remains constant
 (D) The wavelength increases but the frequency remains unchanged
71. Calculate the current flow through the Zener diode based on the circuit below



- (A) 6 mA
- (B) 0 mA
- (C) 7 mA
- (D) 5.3 mA

72. For turbulent flow, the velocity at the centre is times the mean velocity.

- (A) 1.2
- (B) 2.2
- (C) 2.0
- (D) 1.5

73. Negative feedback in an amplifier

- (A) reduces the voltage gain
- (B) increases the voltage gain
- (C) does not affect the voltage gain
- (D) converts the amplifier into an oscillator

74. Two isotopes of an element have

- (A) the same number of nucleons in their nuclei
- (B) the same number of protons as well as neutrons
- (C) the same number of protons but a different number of neutrons
- (D) different number of protons but the same number of neutrons

75. The colour of light that travels with maximum speed in glass is

- (A) red
- (B) blue
- (C) violet
- (D) green

**CHEMISTRY UG
(SHIFT IV - FINAL)**

76. Plants and living beings are the examples of

- (A) Isolated system
- (B) Adiabatic system
- (C) Open system
- (D) Closed system

77. Which of the following statement is **false**?
- (A) Temperature is a state function
 - (B) Work is a state function
 - (C) Change in the state is completely defined when the initial and final states are specified
 - (D) Work appears at the boundary of the system
78. The compound that is **not** a Lewis acid is
- (A) BF_3
 - (B) AlCl_3
 - (C) ZnCl_2
 - (D) NI_3
79. Addition of Ag^+ , Pb^{2+} , Fe^{3+} and Si^{4+} causes coagulation of negatively charged colloidal sol in the following order
- (A) $\text{Fe}^{3+} > \text{Si}^{4+} > \text{Pb}^{2+} > \text{Ag}^+$
 - (B) $\text{Ag}^+ < \text{Pb}^{2+} < \text{Fe}^{3+} < \text{Si}^{4+}$
 - (C) $\text{Ag}^+ > \text{Pb}^{2+} > \text{Fe}^{3+} > \text{Si}^{4+}$
 - (D) $\text{Ag}^+ = \text{Pb}^{2+} = \text{Fe}^{3+} = \text{Si}^{4+}$
80. When a solution of a weak electrolyte is diluted
- (A) specific conductance increases
 - (B) specific conductance increases but equivalent conductance decreases
 - (C) both specific conductance and equivalent conductance decreases
 - (D) specific conductance decreases and equivalent conductance increases
81. Which of the following is **not** a reference electrode?
- (A) Saturated calomel electrode
 - (B) Platinum electrode
 - (C) Silver-Silver chloride electrode
 - (D) Standard hydrogen electrode
82. The unit of the rate and rate constant are the same for a reaction of order
- (A) 0
 - (B) 1
 - (C) $\frac{1}{2}$
 - (D) 2

83. The activation energy for a chemical reaction depends upon

- (A) temperature
- (B) nature of reactants
- (C) concentration of reactants
- (D) collision frequency

84. The example of emulsion is

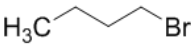
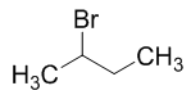
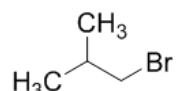
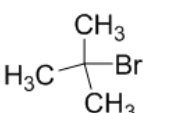
- (A) Soap
- (B) Butter
- (C) Cheese
- (D) Starch

85. Match Column I with Column II and select the correct answer using the codes given below.

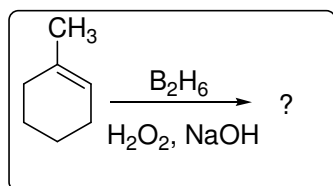
Column I		Column II	
a.	Isothermal process	1.	No heat exchange
b.	Adiabatic process	2.	Constant temperature
c.	Isochoric process	3.	Constant pressure
d.	Joule Thomson process	4.	Constant volume
		5.	Constant enthalpy

- (A) a-2, b-1, c-4, d-5
- (B) a-1, b-2, c-3, d-5
- (C) a-2, b-1, c-4, d-3
- (D) a-1, b-2, c-4, d-3

86. For a zero order reaction where the concentration of the reactants do not affect the rate of the reaction, the plot of concentration of reactant vs time will be
- (A) linearly decreasing
 - (B) linearly increasing
 - (C) exponentially decreasing
 - (D) exponentially increasing
87. The adsorption isotherm is defined as the dependence of
- (A) surface coverage on the temperature at fixed pressure
 - (B) surface coverage on the pressure at fixed temperature
 - (C) surface coverage on the oxidation state of the surface material
 - (D) rate of surface reaction at a fixed temperature
88. The gas which is commonly employed in the study of adsorption is
- (A) O_2
 - (B) Cl_2
 - (C) CO_2
 - (D) N_2
89. Which of the following decreases with increase in concentration?
- (A) Conductance
 - (B) Specific conductance
 - (C) Cell constant
 - (D) Molar conductance
90. 3 M 1.5 L of KOH solution is mixed with another 1 M 650 mL KOH solution. What is the molarity of the resultant solution?
- (A) 2.00 M
 - (B) 2.40 M
 - (C) 2.66 M
 - (D) 1.50 M
91. The polar molecular solids are held by
- (A) Hydrogen bonding
 - (B) London forces
 - (C) Dipole - Dipole interaction
 - (D) Ionic interaction

92. A solution will boil when its vapor pressure equals
- (A) standard state pressure of solvent
 - (B) enthalpy of vaporization
 - (C) external pressure
 - (D) enthalpy of fusion
93. One of the methods of purifying a colloidal solution is
- (A) Coagulation
 - (B) Peptization
 - (C) Dialysis
 - (D) Electro-osmosis
94. When constituent particles are present only on the corner positions of a unit cell, it is said to be
- (A) face centered unit cell
 - (B) primitive unit cell
 - (C) body centered unit cell
 - (D) end-centered unit cell
95. Calculate the P^H at the equivalence point when a solution of 0.01 M CH_3COOH is treated with a solution of 0.01 M $NaOH$. pK_a of CH_3COOH is 4.74.
- (A) 2.11
 - (B) 4.22
 - (C) 6.22
 - (D) 8.22
96. Compound **M** (C_4H_9Br) was treated with alcoholic KOH and the product formed was ozonolyzed and subsequently reduced to yield ethanol as the only product. What is the structure of compound **M**?
- (A) 
 - (B) 
 - (C) 
 - (D) 

97. Hydroboration-oxidation is a method to prepare alcohols from olefins. The product alcohol is an anti-Markovnikov product. Predict the product formed from the following hydroboration-oxidation reaction.

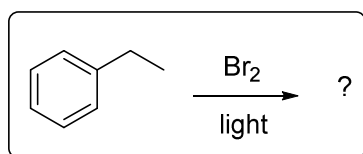


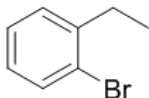
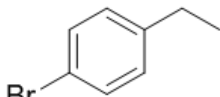
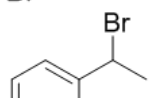
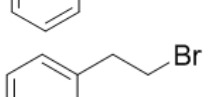
- (A)
- (B)
- (C)
- (D)

98. Which among the following compounds will give positive iodoform and Tollen's silver mirror tests?

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

99. Predict the major product formed in the reaction given below



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

100. Which among the elements given below is present in the hormone thyroxine?

- (A) Cl
(B) I
(C) Ca
(D) Mg

101. Chemically coconut oil is a/an

- (A) Alcohol
(B) Acid
(C) Ester
(D) Ketone

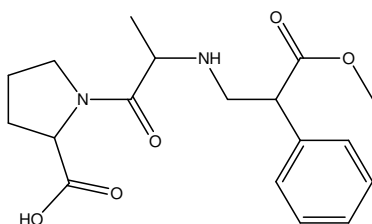
102. Stratospheric ozone layer depletion is primarily initiated by

- (A) Chlorine and bromine atoms
(B) Hydroxyl radical
(C) NO_2
(D) SO_2

103. An additive used in LPG cylinders to aid gas leak detection is:

- (A) diphenyl sulphide
- (B) 4-Methyl-4-sulfanylpentan-2-one
- (C) methyl isothiocyanate
- (D) Ethanethiol

104. Identify functional groups present in the following molecule

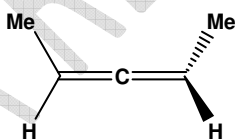


- (A) Acid, Amide, Amine, Ester, Aromatic ring
- (B) Alcohol, Ether, Amide, Amine, Aromatic ring
- (C) Acid, Nitro, Aromatic ring, Amide
- (D) Acid, Ester

105. What type of reaction is the addition of HBr to an alkene in the absence of light and radical initiators?

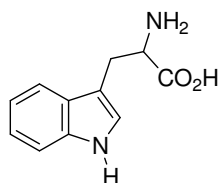
- (A) Electrophilic addition
- (B) Nucleophilic addition
- (C) Concerted addition
- (D) None of the above

106. The allene shown here exhibits



- (A) optical isomerism
- (B) geometrical isomerism
- (C) both optical and geometrical isomerism
- (D) neither optical nor geometrical isomerism

107. Name the following amino acid



- (A) Glycine
(B) Aspartic Acid
(C) Tryptophan
(D) Tyrosine
108. Triphenyl carbinol may be prepared by the reaction of 2 equivalents of phenylmagnesium chloride with
- (A) CH₃CHO
(B) HCHO
(C) Methyl benzoate (PhCO₂CH₃)
(D) PhCHO
109. Primary alcohols having two additional carbons can be prepared from Grignard reagents by the reaction with
- (A) ethylene oxide
(B) acetaldehyde
(C) Acetylene
(D) Two equivalents of Formaldehyde
110. Geometry and hybridization of carbon in benzene are
- (A) Angular and sp^3
(B) Planar and sp^2
(C) Linear and sp
(D) Tetrahedral and sp^3
111. Among the following compounds, under identical conditions, which will dissolve fastest in conc. H₂SO₄?
- (A) Benzene
(B) Nitrobenzene
(C) Toluene
(D) Chlorobenzene

112. Which among the following is not a chlorine containing compound?
- (A) DDT
 - (B) ABS Rubber
 - (C) Neoprene
 - (D) PVC
113. Simple aliphatic alcohols have higher boiling point than isomeric ethers due to difference in
- (A) Intermolecular hydrogen bonding
 - (B) Intramolecular hydrogen bonding
 - (C) van der Waals forces of attraction
 - (D) Polarizability
114. Kjeldahl's method is a
- (A) Quantitative method for determining nitrogen in an organic compound
 - (B) Qualitative method for detecting the presence of nitrogen and halogens in an organic compound
 - (C) Quantitative method for determining sulphur in pesticides
 - (D) Method for determining iodine number of oils and fats
115. Which among the following set of species have a carbon atom with a vacant orbital?
- (A) carbocation and triplet carbene
 - (B) carbocation and singlet carbene
 - (C) free radical and triplet carbene
 - (D) carbanion and singlet carbene
116. Among the alkali metals (Group 1) and alkaline earth metals (Group 2), which individual element in each group tends to deviate from the general trend in ionization energy, and what specific factor or anomaly contributes to this deviation?
1. Lithium (Li) in Group 1; Anomalous electron configuration.
 2. Cesium (Cs) in Group 1; Increased atomic size and electronic configuration.
 3. Beryllium (Be) in Group 2; Unique electron configuration and higher effective nuclear charge
 4. Strontium (Sr) in Group 2; Screening effect and increased atomic size.
- (A) 1, 2
 - (B) 1, 3
 - (C) 2, 3
 - (D) 2, 4

117. Which of the following statements is **incorrect** with respect to Beryllium?
- (A) It is rendered passive by nitric acid
 - (B) It forms Be_2C
 - (C) Its salt rarely hydrolyze
 - (D) Its hydride is electron deficient and polymeric
118. Which one shows a unique reactivity with hydrogen, forming a stable compound under normal conditions?
- (A) Sodium (Na); Forms stable compound NaH
 - (B) Potassium (K); Forms stable compound KH
 - (C) Rubidium (Rb); Forms stable compound RbH
 - (D) Cesium (Cs); Forms stable compound CsH
119. In the extraction processes of zinc, aluminium, copper, and iron; which metal is predominantly extracted using the electrolytic method?
- (A) Zinc; High melting point of the metal
 - (B) Aluminium; Low energy consumption and high purity
 - (C) Copper; Efficient separation of impurities
 - (D) Iron; Cost-effectiveness and simplicity
120. Which one exhibits anomalous behavior in terms of its chemical reactivity, particularly forming stable compounds with a higher oxidation state than expected, and what is the primary reason for this anomaly?
- (A) Nitrogen (N); Small atomic size and high electronegativity
 - (B) Phosphorus (P); Ability to exhibit various oxidation states
 - (C) Arsenic (As); Exceptionally stable As^{5+} oxidation state
 - (D) Bismuth (Bi); High atomic mass and low electronegativity
121. Among the allotropes of carbon, which one exhibits a unique property of superconductivity at relatively high temperatures compared to other known superconductors?
- (A) Graphite
 - (B) Diamond
 - (C) Amorphous carbon
 - (D) Fullerene (specifically C_{60})

122. Which of the metal gives NH_4NO_3 with very dilute HNO_3 ?
- (A) Fe
 - (B) Ti
 - (C) Cu
 - (D) Hg
123. AlF_3 is soluble in HF only in the presence of KF. It is due to the formation of
- (A) $\text{K}_3[\text{AlF}_3\text{H}_3]$
 - (B) $\text{K}_3[\text{AlF}_6]$
 - (C) AlH_3
 - (D) $\text{K}[\text{AlF}_3\text{H}]$
124. Identify the following which cannot produce diborane.
- (A) $\text{Na}_2\text{B}_4\text{O}_7 + \text{HCl}$
 - (B) $\text{NaBH}_4 + \text{I}_2$
 - (C) $\text{BF}_3 + \text{LiAlH}_4$
 - (D) $\text{BF}_3 + \text{NaH}$
125. Select the **incorrect** statement.
- (A) Ag^+ forms complexes, Na^+ doesn't
 - (B) NaCl is water soluble AgCl is insoluble
 - (C) Na_2CO_3 is thermally stable while Ag_2CO_3 decompose into Ag, CO_2 and O_2
 - (D) NaCl and AgCl both give colour in flame when ignited
126. Be and Al show diagonal relationship hence both have
- (A) Same degree of electronegativity
 - (B) Approximately same charge /radius ratio
 - (C) Amphoteric nature of oxides
 - (D) All of the above
127. Boron nitride has the structure of the type
- (A) Graphite
 - (B) Diamond
 - (C) NaCl
 - (D) Both Graphite and Diamond

128. The composition of mica is
- (A) $\text{NaAlSiO}_4 \cdot 3\text{H}_2\text{O}$
 - (B) $\text{K}_2\text{O}_3 \cdot 3\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot 2\text{H}_2\text{O}$
 - (C) $\text{K}_2\text{HAl}(\text{SiO}_4)_3$
 - (D) $\text{Na.K.SiO}_4 \cdot 10\text{H}_2\text{O}$
129. In solid state PCl_5 exists as
- (A) PCl_3
 - (B) PCl_4^+
 - (C) PCl_6^-
 - (D) PCl_4^+ and PCl_6^-
130. Nitric oxide is paramagnetic in
- (A) Gaseous state
 - (B) Liquid state
 - (C) Solid state
 - (D) Polymeric state
131. The acid strength of oxo-acids of halogen is in order
- (A) $\text{HOI} > \text{HOBr} > \text{HOCl} > \text{HOF}$
 - (B) $\text{HOF} > \text{HOCl} > \text{HOBr} > \text{HOI}$
 - (C) $\text{HOCl} > \text{HOBr} > \text{HOI} > \text{HOF}$
 - (D) $\text{HOI} > \text{HOF} > \text{HOBr} > \text{HOCl}$
132. End product of the hydrolysis of XeF_6 is
- (A) XeO_3
 - (B) XeO_3^-
 - (C) XeOF_4
 - (D) XeO_2F_2
133. The common oxidation state of the elements of the lanthanide series is
- (A) +1
 - (B) +3
 - (C) +4
 - (D) +6

134. The correct ground state electronic configuration of chromium atom is
- (A) $[\text{Ar}] 3d^5 4s^1$
 - (B) $[\text{Ar}] 3d^5 4s^2$
 - (C) $[\text{Ar}] 3d^6 4s^0$
 - (D) $[\text{Ar}] 3d^4 4s^1 4p^1$
135. Which shows the maximum magnetic moment among the bivalent ions of the first transition series?
- (A) Mn^{+2}
 - (B) Fe^{+2}
 - (C) Co^{+2}
 - (D) Ni^{+2}

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136. The value of $\frac{1}{2.3} + \frac{1}{4.5} + \frac{1}{6.7} + \dots$ is
- (A) $1 - \log 2$
 - (B) $1 + \log 2$
 - (C) $\log 2$
 - (D) 1
137. If $u_n = \sqrt{n^4 + 1} - \sqrt{n^4 - 1}$, then the series $\sum u_n$ is
- (A) Divergent
 - (B) Convergent
 - (C) Constant
 - (D) Oscillatory
138. If $x = \sin t \sqrt{\cos 2t}$ and $y = \cos t \sqrt{\cos 2t}$ then $\frac{dy}{dx} =$
- (A) $\tan 3t$
 - (B) $-\tan 3t$
 - (C) $\tan 2t$
 - (D) $-\tan 2t$

139. $\int \frac{dx}{(x+2)\sqrt{x+3}} =$

(A) $\log\left(\frac{\sqrt{x+3}-1}{\sqrt{x+3}+1}\right)$

(B) $\log\left(\frac{\sqrt{x+3}+1}{\sqrt{x+3}-1}\right)$

(C) $\log\left(\frac{\sqrt{x+2}-1}{\sqrt{x+2}+1}\right)$

(D) $\log\left(\frac{\sqrt{x+2}+1}{\sqrt{x+2}-1}\right)$

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140. The curves $y^2 = 2x$ and $2xy = k$ cut the right angles if $k^2 =$
- (A) 4
 - (B) 6
 - (C) 8
 - (D) 2
141. From a pack of 52 cards, a card is drawn at random. The probability of drawing a black card or a queen card is
- (A) $\frac{5}{13}$
 - (B) $\frac{9}{13}$
 - (C) $\frac{7}{13}$
 - (D) $\frac{3}{13}$
142. The system of the equations $x - 4y + 7z = 14$, $3x + 8y - 2z = 13$ and $7x - 8y + 26z = 5$ has
- (A) one solution
 - (B) finite number of solutions
 - (C) infinitely many solutions
 - (D) no solution
143. The function $f(x) = \frac{\sin 2x}{x}$, when $x \neq 0$; $f(x) = 1$ when $x = 0$, is
- (A) continuous at $x = 0$
 - (B) not continuous at $x = 0$
 - (C) both continuous and differentiable at $x = 0$
 - (D) continuous but not differentiable at $x = 0$

144. The value of $\lim_{x \rightarrow 0} \frac{\sqrt{1+x}-1}{x}$ is

(A) 1

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

(C) $\frac{1}{3}$

(D) $\frac{1}{4}$

145. $\sin\left(\frac{\pi}{3} - \sin^{-1}\left(\frac{1}{2}\right)\right) =$

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

(B) $\frac{1}{3}$

(C) $\frac{1}{4}$

(D) 1

146. Let $f : Z \rightarrow Z$ defined by $f(x) = x^4$. Then

(A) f is neither one-one nor onto

(B) f is onto

(C) f is both one-one and onto

(D) f is one-one

147. Which of the following is true?

(A) Range of log function is the set of all real numbers

(B) The point (0, 1) is always on the graph of log function

(C) log function is ever increasing

(D) None of the above

148. The function $f(x) = \tan x$ is

- (A) increasing in $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
- (B) decreasing in $\left(0, \frac{\pi}{2}\right)$
- (C) decreasing in $\left(-\frac{\pi}{2}, 0\right)$
- (D) increasing in $(0, \pi)$

149. The directional cosines of z axis are

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

150. Two is 10% of x and 20% of y . Then $x - y$ is

- (A) 1
- (B) 5
- (C) 10
- (D) 20

151. Suppose $\sin a + \sin b = \sqrt{\frac{5}{3}}$, $\cos a + \cos b = 1$. Then $\cos(a - b)$ is

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

152. Angle between the line $\frac{x-1}{2} = \frac{y-3}{3} = \frac{z-4}{-1}$ and the plane $x-2y-4z+7=0$ is

- (A) 1
- (B) $\frac{\pi}{2}$
- (C) π
- (D) 0

153. If $A = \begin{pmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$ satisfies $A^2 - 4A - 5I = 0$, then A^{-1} is

(A) $\begin{pmatrix} \frac{-3}{5} & \frac{2}{5} & \frac{2}{5} \\ \frac{2}{5} & \frac{-3}{5} & \frac{2}{5} \\ \frac{2}{5} & \frac{2}{5} & \frac{-3}{5} \end{pmatrix}$

(B) $-\begin{pmatrix} \frac{3}{5} & \frac{2}{5} & \frac{2}{5} \\ \frac{2}{5} & \frac{3}{5} & \frac{2}{5} \\ \frac{2}{5} & \frac{2}{5} & \frac{3}{5} \end{pmatrix}$

(C) $\begin{pmatrix} \frac{1}{5} & 2 & 2 \\ 2 & \frac{1}{5} & 2 \\ 2 & 2 & \frac{1}{5} \end{pmatrix}$

(D) $\begin{pmatrix} \frac{3}{5} & \frac{2}{5} & \frac{2}{5} \\ \frac{2}{5} & \frac{3}{5} & \frac{2}{5} \\ \frac{2}{5} & \frac{2}{5} & \frac{3}{5} \end{pmatrix}$

154. The curve of equation $8x^2 + 4xy + 5y^2 - 24x - 24y = 0$ is

- (A) parabolic
- (B) elliptic
- (C) hyperbolic
- (D) a circle

155. If $y = e^{x+e^{x+e^{x+\dots\infty}}}$ then $\frac{dy}{dx}$ is
- (A) $\frac{y}{1-y}$
 - (B) e^{x+y}
 - (C) $2e^{x+y}$
 - (D) e^y
156. The value of c satisfied by Rolle's theorem for the function $f(x) = e^{\sin x}$ in $[4, 5]$ is
- (A) $\frac{\pi}{2}$
 - (B) $\frac{3\pi}{2}$
 - (C) $\frac{5\pi}{2}$
 - (D) $\frac{7\pi}{2}$
157. The two regression lines coincide if and only if
- (A) $r^2 = \pm 1$
 - (B) $b_{xx} \cdot b_{yy} = 1$
 - (C) $r = \pm 1$
 - (D) $b_{xy} = b_{yx}$
158. Which of the following point is farthest from the origin?
- (A) i
 - (B) 3
 - (C) $-2 + i$
 - (D) $4i$
159. The smallest value of $3 \sin \theta + 17$ is
- (A) 14
 - (B) 15
 - (C) 16
 - (D) 17

160. A traffic light runs repeatedly through the following cycle: green for 30 seconds, then yellow for 3 seconds and then red for 30 seconds. A man picks a random three-second time interval to watch the light. Then the probability that the colour changes while he is watching is

(A) $\frac{1}{63}$

(B) $\frac{1}{21}$

(C) $\frac{1}{10}$

(D) $\frac{1}{7}$

161. If $\sum_{n=0}^{\infty} \cos^{2n} \theta = 5$, then the value of $\cos 2\theta$ is

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

(B) $\frac{2}{5}$

(C) $\frac{3}{5}$

(D) $\frac{4}{5}$

162. Integers a, b, c, d , not necessarily distinct, are chosen independently and at random from 0 to 2007, inclusive. Then the probability that $ad - bc$ is even

(A) $\frac{7}{16}$

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

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

(D) $\frac{5}{8}$

163. Volume of the solid formed by revolving the region bounded by the parabola $y = x^2$, x -axis, $x = 0$, $x = 1$ about x -axis is

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

(B) $\frac{\pi}{4}$

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

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

164. Number of solutions of the equation $z^2 = \bar{z}$ is

(A) 1

(B) 2

(C) 3

(D) 4

165. If a matrix A is both symmetric and skew symmetric, then A is a

(A) diagonal matrix

(B) zero matrix

(C) square matrix

(D) rectangular matrix

166. Let $*$ be defined on \mathbb{Q} as $a * b = \frac{a+b}{2}$, $a, b \in \mathbb{Q}$. Then

(A) there exists $a_1, b_1 \in \mathbb{Q}$ such that $a_1 * a_2 \notin \mathbb{Q}$

(B) there exists $e \in \mathbb{Q}$ such that $a * e = a$ for all $a \in \mathbb{Q}$

(C) $a * b = b * a$ for all $a, b \in \mathbb{Q}$

(D) $a * (b * c) = (a * b) * c$ for all $a, b \in \mathbb{Q}$

167. Let f be a linear function for which $f(6) - f(2) = 12$. Then $f(12) - f(2)$ is

(A) 12

(B) 18

(C) 25

(D) 30

168. Number of all possible matrices of order 3×3 with each entry as 1 or 2 is
- (A) 27
 - (B) 256
 - (C) 81
 - (D) 512
169. The largest integer that is a divisor of $(n + 1)(n + 3)(n + 5)(n + 7)(n + 9)$ for all positive even integers n is
- (A) 3
 - (B) 5
 - (C) 11
 - (D) 15
170. For a complex number $u = a + ib$ and $v = c + id$, define $u * v = ac + ibd$. Suppose z is a complex number such that $z * z = z^2 + 40$. Then $|z|$ is
- (A) 5
 - (B) $\sqrt{5}$
 - (C) $\sqrt{10}$
 - (D) $5\sqrt{2}$
171. Define $x \circ y = |x - y|$ for all real numbers x and y . Which of the following is **not** true?
- (A) $x \circ y = y \circ x$ for all x and y
 - (B) $2(x \circ y) = (2x) \circ (2y)$ for all x and y
 - (C) $x \circ 0 = x$ for all x
 - (D) $x \circ y > 0$ if $x \neq y$
172. A polynomial equation in x of degree n always has
- (A) n distinct roots
 - (B) n real roots
 - (C) n complex roots
 - (D) at most one root
173. Let $f, g : \mathbb{R} \rightarrow \mathbb{R}$ be defined by $f(x) = [x]$ and $g(x) = \frac{3-2x}{4}$. Then
- (A) f is not one-one and g is onto
 - (B) f is onto and g is not one-one
 - (C) neither f nor g is one-one
 - (D) both f and g is onto

174. One function is selected from all the functions $F : S \rightarrow S$, where $S = \{a, b, c, d, e\}$. The probability that it is an onto function is

(A) $\frac{5}{81}$

(B) $\frac{5}{162}$

(C) $\frac{5}{324}$

(D) $\frac{7}{324}$

175. Let $a \in \left(0, \frac{\pi}{2}\right)$. Then the expression $\sqrt{x^2 + x} + \frac{\tan^2 \alpha}{\sqrt{x^2 + x}}$ is always greater than or equal to

(A) $\sec^2 \alpha$

(B) $2 \tan \alpha$

(C) 2

(D) 1

176. The set of all solutions of $|x - 1| > |x - 3|$ satisfies

(A) $x < 2$

(B) $x \geq 2$

(C) $[1, 3]$

(D) $[3, 4]$

177. The greatest value of $P = a^2 b^3 c^4$, when $a + b + c = 18$ is

(A) $P = 4^4 \cdot 6^4 \cdot 8^4$

(B) $P = 4^2 \cdot 6^3 \cdot 8^4$

(C) $P = 3^2 \cdot 6^3 \cdot 8^4$

(D) $P = 4^2 \cdot 6^2 \cdot 8^2$

178. If $t = \cos \frac{4\pi}{3} + i \sin \frac{4\pi}{3}$, then the value of $\left(\frac{1+t}{2}\right)^{3n}$ is

(A) $(-1)^n$

(B) $\frac{(-1)^n}{2^{3n}}$

(C) $\frac{1}{2^{3n}}$

(D) $(-1)^n + 1$

179. The equation $\bar{z} = \bar{a} + \frac{r^2}{(z-a)}$, $r > 0$ represents

(A) an ellipse

(B) a parabola

(C) a circle

(D) a straight line through the point \bar{a}

180. $2^{\frac{1}{4}} \cdot 4^{\frac{1}{8}} \cdot 8^{\frac{1}{16}} \dots \infty$ is equal to

(A) 2

(B) 1

(C) $\frac{3}{2}$

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

181. Assume that a, b, c are three distinct real numbers and they are in Geometric Progression. If $a + b + c = xb$, then

(A) $x < -1$ or $x > 3$

(B) $x \leq -3$ or $x \geq 2$

(C) $x < -4$ or $x > 3$

(D) $x \leq -1$ or $x \geq 3$

182. The values of x satisfying $\log_{|\sin x|} |\cos x| + \log_{|\cos x|} |\sin x| = 2$ when $x \in \left(0, \frac{\pi}{2}\right)$ is

(A) $\left\{\frac{\pi}{4}\right\}$

(B) $\left\{\frac{\pi}{3}\right\}$

(C) $\left(0, \frac{\pi}{4}\right)$

(D) $\left\{\frac{\pi}{4}, \frac{\pi}{2}\right\}$

183. The positive integer n for which $2 \times 2^2 + 3 \times 2^3 + 4 \times 2^4 + \dots + n \times 2^n = 2^{n+10}$ is

(A) 510

(B) 511

(C) 512

(D) 513

184. If $x = 2 + 2^{\frac{1}{3}} + 2^{\frac{2}{3}}$, then the value of $x^3 - 6x^2 + 6x$, is

(A) 1

(B) 2

(C) 3

(D) 4

185. The roots of the equation $2^{x+2} \cdot 3^{\frac{3x}{x+1}} = 9$ are given by

(A) $\log_2 \left(\frac{2}{3}\right), -2$

(B) 3, -3

(C) -2, $1 - \log_2 3$

(D) $-\frac{1}{9}, -2$

186. The number of positive integral solutions of $15 < x_1 + x_2 + x_3 \leq 20$ is equal to
- (A) 1150
 - (B) 980
 - (C) 715
 - (D) 685
187. The number of triangles which can be formed by using the vertices of a regular polygon of $t + 3$ sides is 680. Then t is equal to
- (A) 8
 - (B) 11
 - (C) 14
 - (D) 17
188. The middle term in the expansion of $\left(x - \frac{1}{x}\right)^{18}$ is
- (A) ${}^{18}C_9$
 - (B) $-{}^{18}C_9$
 - (C) ${}^{18}C_{10}$
 - (D) $-{}^{18}C_{10}$
189. From 4 gentlemen and 6 ladies, a committee of five is to be selected. The number of ways, in which the committee can be formed so that gentlemen are in majority, is
- (A) 60
 - (B) 66
 - (C) 90
 - (D) 140
190. If the k^{th} term in the expansion of $\left(\frac{x}{3} - \frac{2}{x^2}\right)^{10}$ is a constant multiple of x^4 , then k is equal to
- (A) 2
 - (B) 3
 - (C) 4
 - (D) 5

191. If $A = \begin{bmatrix} x-1 & 5x & 7 \\ x^2-1 & x-1 & 8 \\ 2x & 3x & 0 \end{bmatrix} = ax^3 + bx^2 + cx + d$, then the value of c is equal to

- (A) -1
- (B) 12
- (C) 15
- (D) 17

192. The sum of the series $1 + \frac{3}{2!} + \frac{7}{3!} + \frac{15}{4!} + \dots + \infty$ is

- (A) $e(e+1)$
- (B) $e(e-1)$
- (C) $e(1-e)$
- (D) $3e$

193. The sum of the series $\sum_{n=1}^{\infty} \frac{n^2 + n + 1}{n!}$ is

- (A) $3e$
- (B) $\frac{3}{2}e$
- (C) $2e$
- (D) $4e$

194. If the function $f: R \rightarrow A$ given by $f(x) = \frac{x^2}{x^2+1}$ is a surjection, then A is equal to

- (A) R
- (B) $[0, 1]$
- (C) $(0, 1)$
- (D) $(0, 1)$

195. Let R be the relation over the set of integers defined by $(x, y) \in R \Leftrightarrow |x - y| \leq 1$. Then R is

- (A) reflexive and transitive
- (B) reflexive and symmetric
- (C) symmetric and not transitive
- (D) an equivalence relation

196. One ticket is selected at random from 50 tickets numbered 00, 01, . . . , 50. Then, the probability that the sum of the digits on the selected ticket is 8, given that the product of these digits is zero, equals

(A) $\frac{1}{14}$

(B) $\frac{1}{7}$

(C) $\frac{5}{14}$

(D) $\frac{1}{50}$

197. If probability of a defective bolt is 0.1, then mean and standard deviation of distribution of bolts in a total of 400 are

(A) 30, 3

(B) 40, 5

(C) 30, 4

(D) 40, 6

198. Let a, b, c, d, e, f be independent of x . If

$$\begin{vmatrix} x^3 - 4x & x + 3 & x - 2 \\ x - 2 & 5x & x - 1 \\ x - 3 & x + 2 & 4x \end{vmatrix} = ax^5 + bx^4 + cx^3 + dx^2 + ex + f$$
 is true, then the

value of f is

(A) 0

(B) 15

(C) 17

(D) 19

199. If $\cos(x - y)$, $\cos x$ and $\cos(x + y)$ are in Harmonic Progression, then $\cos x \cdot \sec\left(\frac{y}{2}\right)$

is equal to

(A) ± 1

(B) ± 2

(C) $\pm\sqrt{3}$

(D) $\pm\sqrt{2}$

200. If $\sin^2 x + a \sin x + 1 = 0$ has no real solutions, then

- (A) $|a| \geq 2$
- (B) $|a| \geq 1$
- (C) $|a| < 2$
- (D) $|a| > 2$

201. The area of the Δ is $a^2 - (b - c)^2$. Then

- (A) a^2, b^2, c^2 are in Arithmetic Progression
- (B) a, b, c are in Arithmetic Progression
- (C) $\cos A, \cos B, \cos C$ are in Arithmetic Progression
- (D) $\sin A, \sin B, \sin C$ are in Arithmetic Progression

202. The equation $\sqrt{3} \sin x + \cos x = 4$ has

- (A) only one solution
- (B) two solutions
- (C) infinitely many solutions
- (D) no solution

203. If $\tan^{-1}\left(\frac{a}{x}\right) + \tan^{-1}\left(\frac{b}{x}\right) = \frac{\pi}{2}$, then x is equal to

- (A) \sqrt{ab}
- (B) $\sqrt{2ab}$
- (C) $2ab$
- (D) ab

204. If $x^y y^x = 100$, then $\frac{dy}{dx}$ is equal to

- (A) $\frac{y(y + x \log x)}{x(y \log x + x)}$
- (B) $-\frac{y(x + y) \log x}{x(x \log y + y)}$
- (C) $-\frac{y}{x}$
- (D) $-\frac{x}{y}$

205. If $f(x) = 2x^3 + 9x^2 + \lambda x + 20$ is a decreasing function of x in the largest possible interval $(-2, -1)$, then λ is equal to
- (A) 12
 - (B) -12
 - (C) 6
 - (D) -6
206. $\int_{-2}^2 |[x]|$ is equal to
- (A) 1
 - (B) 2
 - (C) 4
 - (D) 5
207. Consider the points $A(-3, 0)$ and $B(0, 4)$. Let P be a point on the line $2x - 3y - 12 = 0$ and such that $|PA - PB|$ is maximum. Then P is
- (A) $(12, -2)$
 - (B) $(-2, 12)$
 - (C) $(-12, -12)$
 - (D) $(12, 12)$
208. If centroid of tetrahedron $OABC$, where A, B, C are given by $(a, 1, 2)$, $(2, b, 3)$ and $(3, 1, c)$ respectively be $(1, 2, -1)$, then distance of $P(a, b, c)$ from origin is equal to
- (A) $\sqrt{107}$
 - (B) $\sqrt{114}$
 - (C) $\sqrt{109}$
 - (D) $\sqrt{118}$

209. Let $f(x)$ and $g(x)$ be two functions such that $g(x) = x - \frac{1}{x}$ and $f \circ g(x) = x^3 - \frac{1}{x^3}$.

Then $f'(x)$ is

(A) $x^2 + 3$

(B) $\frac{1}{x^2} + 2$

(C) $3x^2 + 3$

(D) $3x^2 - 3$

210. A vector which makes equal angles with the vectors $\frac{1}{3}(\hat{i} - 2\hat{j} + 2\hat{k})$, $\frac{1}{5}(-4\hat{i} - 3\hat{k})$, \hat{j} is

(A) $5\hat{i} + \hat{j} + 5\hat{k}$

(B) $-5\hat{i} + \hat{j} + 5\hat{k}$

(C) $5\hat{i} - \hat{j} - \hat{k}$

(D) $5\hat{i} + \hat{j} - 5\hat{k}$

211. Let AB be a diameter of a circle of radius 5 cm. Let P and Q be the two points on the circle so that the length of PB is 6 cm, and the length of AB is twice that of AQ . Then the length, QB is nearest to

(A) 9.1 cm

(B) 7.8 cm

(C) 9.3 cm

(D) 8.5 cm

212. If $A = \{(x, y) : x^2 + y^2 = 25\}$ and $B = \{(x, y) : x^2 + 9y^2 = 144\}$ then number of points in $A \cap B$ is

(A) 1

(B) 2

(C) 4

(D) 3

213. Let $xy = c^2$. Then the minimum value of $a^2x + b^2y$ is
- (A) $2abc$
 - (B) 2
 - (C) $a^2b^2c^2$
 - (D) $a^2b^2c^4$
214. For complex numbers z_1, z_2 , let $|z_1| = 12$ and $|z_2 - 3 - 4i| = 5$. Then the minimum value of $|z_1 - z_2|$ is
- (A) 0
 - (B) 2
 - (C) 7
 - (D) 17
215. The number of points where the curve $f(x) = e^{8x} - e^{6x} - 3e^{4x} - e^{2x} + 1$, $x \in R$ cuts x -axis, is equal to
- (A) 0
 - (B) 2
 - (C) 1
 - (D) 8
216. If $a_n = \frac{-2}{4n^2 - 16n + 15}$ then $a_1 + a_2 + \dots + a_{25}$ is equal to
- (A) $\frac{51}{144}$
 - (B) $\frac{48}{138}$
 - (C) $\frac{50}{141}$
 - (D) $\frac{52}{147}$

217. The maximum and minimum values of $f(x) = 3\sin^2 x + 4\cos^2 x$ is
- (A) $\{-4, -3\}$
 - (B) $\{7, 3\}$
 - (C) $\{4, -3\}$
 - (D) $\{4, 3\}$
218. The value of $\lim_{x \rightarrow 0} \frac{e^x - 1}{\sqrt{1 - \cos x}}$ is equal to
- (A) $\frac{1}{\sqrt{2}}$
 - (B) $-\sqrt{2}$
 - (C) $\sqrt{2}$
 - (D) Does not exist
219. Let a dice be rolled n times. The probability of getting odd numbers seven times be equal to the probability of getting odd numbers nine times. If the probability of getting even number twice is $\frac{p}{2^{15}}$, then p is equal to
- (A) 60
 - (B) 30
 - (C) 15
 - (D) 90
220. Let $f(x) = 2x^n + \lambda$, $\lambda \in R$, $n \in N$, and $f(4) = 133$, $f(5) = 255$. Then $f(2) - f(1)$ is equal to
- (A) 60
 - (B) 15
 - (C) 12
 - (D) 14

221. The solution of equation $|z| - z = 1 + 2i$ is

(A) $\frac{3}{2} + 2i$

(B) $\frac{3}{2} - 2i$

(C) $3 - 2i$

(D) $3 + 2i$

222. $\lim_{n \rightarrow \infty} \left\{ \left(2^{\frac{1}{2}} - 2^{\frac{1}{3}} \right) \left(2^{\frac{1}{2}} - 2^{\frac{1}{5}} \right) \dots \left(2^{\frac{1}{2}} - 2^{\frac{1}{2n+1}} \right) \right\}$ is equal to

(A) 0

(B) $\frac{1}{\sqrt{2}}$

(C) $\sqrt{2}$

(D) 1

223. If the solution curve $f(x, y) = 0$ of the differential equation

$(1 + \log_e x) \frac{dy}{dx} - x \log_e x = e^{-y}$, $x > 0$, passes through the point $(1, 0)$, then arbitrary

constant c in the solution is equal to

(A) -2

(B) -1

(C) 1

(D) 0

224. Let $\bar{a} = p\hat{i} + \hat{j} - \hat{k}$ and $\bar{b} = 2\hat{i} + \hat{j} - p\hat{k}$, $p > 0$. If the projection of $\bar{a} \times \bar{b}$ on the vector $-\hat{i} + 2\hat{j} - 2\hat{k}$ is 30, then p is equal to

(A) 8

(B) $\frac{15}{2}$

(C) 7

(D) $\frac{13}{2}$

225. The product $(16)(16)^{\frac{1}{3}}(16)^{\frac{1}{9}} \dots \infty$ is equal to

- (A) 64
- (B) 16
- (C) 32
- (D) 0

FOR REFERENCE ONLY

ANSWER KEY**Subject Name: 101 B TECH 12 MAY 2024 - S1**

SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	A	31	B	61	D	91	C	121	D	151	B	181	D	211	A
2	D	32	C	62	B	92	C	122	A	152	D	182	A	212	C
3	D	33	B	63	D	93	D	123	B	153	A	183	D	213	A
4	C	34	B	64	C	94	B	124	A	154	B	184	B	214	B
5	A	35	C	65	A	95	D	125	D	155	A	185	C	215	B
6	A	36	B	66	D	96	B	126	D	156	B	186	D	216	C
7	D	37	D	67	A	97	A	127	A	157	C	187	C	217	D
8	A	38	C	68	C	98	C	128	B	158	D	188	B	218	D
9	C	39	C	69	D	99	C	129	D	159	A	189	B	219	A
10	C	40	D	70	D	100	B	130	A	160	D	190	B	220	D
11	A	41	A	71	C	101	C	131	A	161	C	191	D	221	B
12	D	42	A	72	A	102	A	132	A	162	D	192	B	222	A
13	D	43	C	73	A	103	D	133	B	163	A	193	D	223	D
14	A	44	A	74	C	104	A	134	A	164	D	194	C	224	C
15	B	45	A	75	A	105	A	135	A	165	B	195	C	225	A

16	B	46	B	76	C	106	A	136	A	166	C	196	A
17	D	47	A	77	B	107	C	137	B	167	D	197	D
18	D	48	D	78	D	108	C	138	B	168	D	198	C
19	C	49	D	79	B	109	A	139	A	169	D	199	D
20	D	50	D	80	D	110	B	140	C	170	D	200	C
21	A	51	D	81	B	111	C	141	C	171	C	201	A
22	D	52	D	82	A	112	B	142	D	172	C	202	D
23	D	53	B	83	B	113	A	143	B	173	A	203	A
24	D	54	D	84	B	114	A	144	B	174	C	204	A
25	C	55	C	85	A	115	B	145	A	175	B	205	A
26	D	56	A	86	A	116	C	146	A	176	B	206	C
27	B	57	C	87	B	117	C	147	B	177	B	207	C
28	B	58	D	88	D	118	C	148	A	178	B	208	D
29	B	59	A	89	D	119	B	149	D	179	C	209	C
30	A	60	A	90	B	120	C	150	C	180	A	210	B