PHYSICS UG – SHIFT I

1. Accuracy of measurement in an experiment expresses

(A) correctness of the measurement
(B) deviation of the measured value from the predicted value
(C) feasibility of the experiment
(D) reproducibility of the experiment

2. In a tug of war contest, two men pull on a horizontal rope from opposite sides. The winner will be the man who

(A) exerts greater force on the rope with larger angle with the vertical
(B) exerts greater force on the ground
(C) exerts force on the rope which is greater than the tension in the rope
(D) makes a smaller angle with the vertical

3. A body of weight w_1 is suspended from the ceiling of a room by a chain of weight w_2. The ceiling pulls the chain by a force

(A) w_1

(B) w_2

(C) $\frac{w_1 + w_2}{2}$

(D) $w_1 + w_2$

4. The kinetic energy of a body of moment of inertia I and angular momentum L is

(A) $\frac{L^2}{I}$

(B) $\frac{L}{2I}$

(C) $\frac{L^2}{2I}$

(D) $\frac{IL^2}{2}$

5. It is difficult to cook rice in an open vessel by boiling it at high altitude because of

(A) low boiling point and high pressure
(B) high boiling point and low pressure
(C) low boiling point and low pressure
(D) high boiling point and high pressure

6. Coulomb force is

(A) force between nucleons
(B) a gravitational force
(C) an electrostatic force
(D) a weak van der Waal's force

7. Geostationary satellites are in specified orbits at a height of about

(A) 600 km
(B) 36,000 km
(C) 1000 km
(D) 100 km

8. A tank containing liquid has an orifice on its vertical side. If the center of the orifice is 19.6 m below the water surface level in the tank, what is the velocity of discharge of the water?

(A) 19.6 m/s
(B) 20 m/s
(C) 15 m/s
(D) 9.8 m/s

9. A brass rod has a length of 10 m at 0°C. What is its length at 100°C, if the coefficient of linear expansion of brass is 0.000018 per °C ?

(A) 10 m
(B) 10. 018 m
(C) 9.82 m
(D) 11.018 m

10. Eight identical cells each of emf E and internal resistance r are connected in series. If the polarity of two cells are reversed, then the total internal resistance of the circuit will be

(A) $8r$
(B) $6r$
(C) $4r$
(D) $2r$

11. The kinetic energy of photoelectrons depends on

(A) the intensity of the radiation incident on the photoelectric material
(B) the frequency of the radiation
(C) the time for which the radiation is incident
(D) the nature of the emitting surface

12. An AC voltage is applied to a circuit consisting of a resistor and inductor in series. If the resistance and inductive reactance of both are 3 Ω, what is the phase difference between the applied voltage and current in the circuit?

(A) $\frac{\pi}{6}$

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

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

(D) Zero

13. Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of the oscillation is 0.05 s and the velocity of the wave is 300 m/s. Then the phase difference between the oscillations at the two points is

(A) $\frac{\pi}{6}$

(B) π

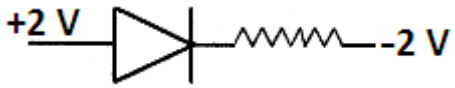
(C) $\frac{\pi}{3}$

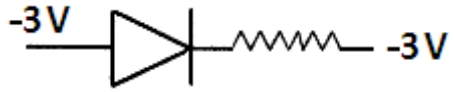
(D) $\frac{2\pi}{3}$

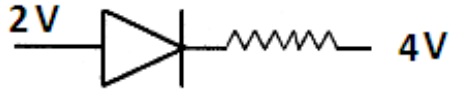
14. Maximum diffraction takes place in a given slit for

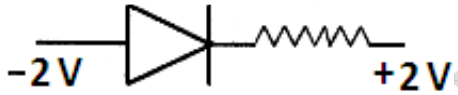
(A) ultraviolet rays
(B) infrared rays
(C) radio waves
(D) gamma rays

15. Which one of the following represents a forward biased junction diode?

(A) 

(B) 

(C) 

(D) 

16. If the carrier power of a 100 % modulated AM wave is suppressed, the percentage saving in power will be

(A) 50%
(B) 100%
(C) 66.66%
(D) 75%

17. The Vernier scale is divided into 30 divisions, which coincides with 29 main scale divisions. If each division is $\frac{1}{2}$ mm, the least count by the instrument is

(A) $\frac{1}{60}$ mm
(B) 1 mm
(C) $\frac{1}{30}$ mm
(D) 0.5 mm

18. Zener diode is used for

(A) Rectification
(B) Stabilization
(C) Amplification
(D) Modulation

19. An inductor may store energy in

(A) its coil
(B) its magnetic field
(C) its electric field
(D) both in electric and magnetic fields

20. Avalanche breakdown is due to

(A) Noise effect
(B) High speed electron colliding with the valence electron
(C) Direct breaking of bands due to the electric field
(D) Temperature rise

21. The Wien's displacement law express relation between

(A) Frequency and temperature
(B) Temperature and amplitude
(C) Wavelength corresponding to maximum energy and temperature
(D) Wavelength and radiating power of black body

22. The time period of a satellite is 5h. If the separation between the earth and the satellite is increased 4 times from the previous value, the new time period will be

(A) 80h
(B) 40h
(C) 20h
(D) 10h

23. At constant volume the temperature of a gas in a container is increased. Then

(A) collisions on walls will be less
(B) number of collisions per unit time will increase
(C) collisions will not change
(D) flow of heat occurs in a particular direction

24. A magnet drops down a long vertical copper tube. Its velocity as it falls down the tube

(A) increases
(B) remains constant
(C) decreases
(D) first increases and then decreases

25. Platinum and silicon are heated up to 250°C and after that cooled. In the process of cooling

(A) resistance of platinum will increase and that of silicon will decrease
(B) resistance of silicon will increase and that of platinum will decrease
(C) resistance of both will increase
(D) resistance of both will decrease

26. The diameter of the solid ball is measured with a screw gauge, whose pitch is 0.5 mm and there are 50 divisions on the circular scale. The reading on the main scale is 2.5 mm and that on the circular scale is 20 divisions. If the measured mass of the ball has a relative error of 1.5%, the relative percentage error in the density is

(A) 1.5%
(B) 2.6%
(C) 3.1%
(D) 4.3%

27. The velocity v and displacement x of a particle executing simple harmonic motion are related as $v\frac{dv}{dx} = -\omega^2 x$. If at $x = 0$, $v = v_0$. The velocity v when the displacement becomes x is

(A) $v = \sqrt{v_0^2 - \omega^2 x^2}$
(B) $v = \sqrt{v_0^2 + \omega^2 x^2}$
(C) $v = \sqrt{\omega^2 x^2 - v_0^2}$
(D) $v = v_0^2 + \omega^2 x^2$

28. A steel wire of length 2 m is stretched by 2 mm. The cross sectional area of the wire is 4 mm^2. If the Young's modulus is 2×10^{11} N/m^2, the elastic potential energy stored in the wire in stretched condition is

(A) 0.8 J
(B) 1.2 J
(C) 2.4 J
(D) 4 J

29. If R and H represent horizontal range and maximum height of the projectile, then the angle of projection with the horizontal is

(A) $\tan^{-1}\left(\frac{H}{R}\right)$

(B) $\tan^{-1}\left(\frac{2H}{R}\right)$

(C) $\tan^{-1}\left(\frac{4H}{R}\right)$

(D) $\tan^{-1}\left(\frac{4R}{H}\right)$

30. A wheel having moment of inertia 2 kg m^2 about its axis, rotates at 50 rpm, about this axis. Then the torque that can stop the wheel in one minute is

(A) $\frac{\pi}{18}$ N-m

(B) $\frac{5\pi}{3}$ N-m

(C) $\frac{\pi}{6}$ N-m

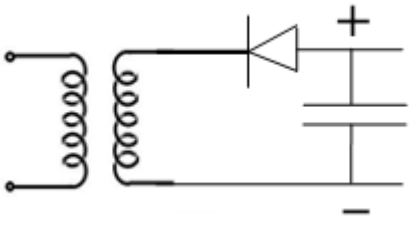
(D) $\frac{2\pi}{3}$ N-m

31. The fundamental frequency of guitar string of length 90 cm is 124 Hz. To produce a fundamental frequency of 186 Hz it has to be pressed at

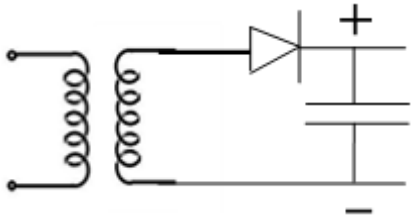
(A) 45 cm
(B) 60 cm
(C) 75 cm
(D) 55 cm

32. Which is the correct diagram of a half wave rectifier?

(A)



(B)



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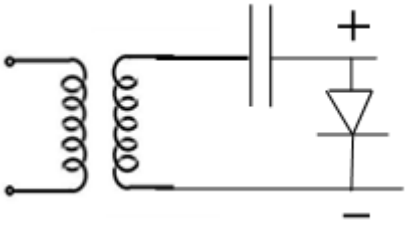
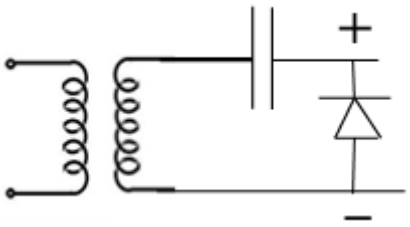
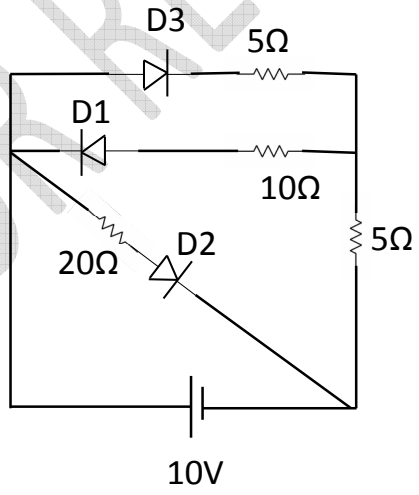


(D)



33. In the given circuit, the current through the battery is



(A) 1 A
(B) 1.5 A
(C) 2 A
(D) 10 A

34. Nuclei with same atomic number and mass number but existing in different energy states is known as

(A) Isotones
(B) Isomers
(C) Isobars
(D) Isotopes

35. Direction: In the given question a statement of assertion and a corresponding statement of reason is given

Assertion: When a light wave travels from a rarer to denser medium, its speed decreases. The decrease in speed imply a reduction in energy carried by the light wave.
Reason: The energy of a wave is inversely proportional to velocity of wave

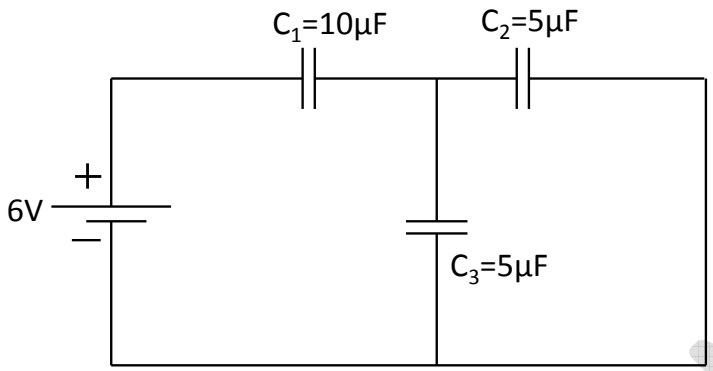
Choose the correct alternative from given below.

(A) Both assertion and reason are true and reason is the is the correct explanation of assertion
(B) Both assertion and reason are true but reason is not the correct explanation of assertion
(C) Assertion is true but reason is false
(D) Both assertion and reason are false

36. Direction of current induced in a wire moving in a magnetic field is found using

(A) Fleming's left hand rule
(B) Fleming's right hand rule
(C) Ampere's rule
(D) Right hand clasp rule

37. Three capacitors C_1, C_2 and C_3 are connected to a 6 V battery as shown. Then the charge on C_1 will be



(A) 30 μC
(B) 25 μC
(C) 15 μC
(D) 60 μC

38. Heat required to raise the temperature of one gram of water through 1°C is

(A) 0.1 cal
(B) 0.1 kcal
(C) 0.001 kcal
(D) 1 kcal

39. The current amplification factor α of a common base transistor and the current amplification factor β of a common emitter transistor are not related by

(A) $\alpha = \frac{\beta}{1+\beta}$

(B) $\frac{1}{\alpha} - \frac{1}{\beta} = 1$

(C) $\beta = \frac{\alpha}{1-\alpha}$

(D) $\beta = \frac{\alpha}{1+\alpha}$

40. The Paint gun works on the principle of

(A) Bernoulli's principle
(B) Boyle's law
(C) Archimedes' principle
(D) Newton's law of motion

41. Louis de-Broglie was credited for his work on

(A) Theory of relativity
(B) Matter waves
(C) Electromagnetic theory
(D) Photoelectric effect

42. Physical independence of force is a consequence of

(A) Third law of motion
(B) First law of motion
(C) Law of gravitation
(D) Second law of motion

43. Moment of inertia of an object does not depend upon

(A) Mass of the object
(B) Mass distribution
(C) Axis of rotation
(D) Angular velocity

44. Plants get water through the roots by the action of

(A) Capillarity
(B) Viscosity
(C) Gravity
(D) Elasticity

45. Which of the following does not belong to the thermodynamic state of matter?

(A) Temperature
(B) Pressure
(C) Volume
(D) Work

46. When two waves of the same frequency and amplitude are superimposed in phase, the resulting wave will have

(A) Lower amplitude
(B) Higher frequency
(C) Lower frequency
(D) Higher amplitude

47. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A is

(A) proportional to the square root of the distance between the plates
(B) linearly proportional to the distance between the plates
(C) independent of the distance between the plates
(D) inversely proportional to the distance between the plates

48. When the cells are connected in parallel, then

(A) the current capacity increases
(B) the current capacity decreases
(C) the emf increases
(D) the emf decreases

49. The primary origin of magnetism lies in

(A) Intrinsic spin of electrons
(B) Polar and non polar nature of molecules
(C) Pauli exclusion principle
(D) Extrinsic spin of electrons

50. If number of turns in primary and secondary coils is increased to two times each, the mutual inductance

(A) becomes 4 times
(B) becomes 2 times
(C) reduces to 0.5 times
(D) remains unchanged

51. Two light sources are said to be coherent when light waves from both the sources have

(A) same speed
(B) same amplitude and phase
(C) same wavelength and a constant phase difference
(D) same intensity and wavelength

52. The green house effect is due to trapping of …….. in the atmosphere.

(A) Ultraviolet rays
(B) X-rays
(C) Infrared rays
(D) Radiowaves

53. The increasing order of penetrating power of α, β and γ radiations of 0.5 MeV energy is

(A) α, β, γ
(B) β, γ, α
(C) γ, α, β
(D) γ, β, α

54. Which of the following is wrongly matched?

(A) Barometer-Pressure
(B) Lactometer-Milk
(C) Coulomb's law-Charges
(D) Humidity-Calorimeter

55. If the force applied to a body is doubled and the mass is cut in half, what would be the accelerations' ratio?

(A) 1 : 2
(B) 2 : 1
(C) 1 : 4
(D) 4 : 1

56. What will be the value of acceleration due to gravity on the surface of the earth if the radius of the earth suddenly decreases to 60% of its present value, keeping the mass of the earth unchanged?

(A) 9.81 m/s^2
(B) 5.89 m/s^2
(C) 16.35 m/s^2
(D) 27.25 m/s^2

57. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio $\frac{Cp}{Cv}$ for the gas is

(A) 2
(B) $\frac{3}{2}$
(C) $\frac{4}{3}$
(D) $\frac{5}{3}$

58. Three equal resistors connected in series across a source of e.m.f. together dissipate 10 watts of power. What would be the power dissipated if the same resistors are connected in parallel across the same source of e.m.f.?

(A) 9 watts
(B) 90 watts
(C) 10 watts
(D) 100 watts

59. Which of the following statement is **wrong**?

(A) Clouds appear white for most of the day because the sun radiates all visible wavelengths of light
(B) The rays have to travel a shorter distance than usual at sunrise and sunset
(C) Danger signals are red because red color gets scattered the least
(D) The sky is blue because blue light is scattered more than other colors since it travels as shorter waves

60. What should be done to obtain an OR gate from a NAND gate?

(A) We need only 3 NAND gates
(B) We need two NOT gates obtained from NAND gates and one NAND gate
(C) We need 3 NOT gates obtained from NAND gates and 3 NAND gates
(D) We need 2 NAND gates and 4 AND gates obtained from NAND gates

61. Audio sine waves of 3 kHz frequency are used to amplitude modulate a carrier signal of 1.5 MHz. Which of the following statements are true?

(A) The side band frequencies are 1506 kHz and 1494 kHz.
(B) The bandwidth required for amplitude modulation is 6 kHz.
(C) The bandwidth required for amplitude modulation is 3 MHz.
(D) The side band frequencies are 1503 kHz and 1497 kHz.

62. In projectile motion, the maximum height attained by the projectile depends on

(A) Initial speed
(B) Angle of projection
(C) Both initial speed and angle of projection
(D) Mass of the projectile

63. A 2 kg object moving with a velocity of 4 m/s collides with a stationary object of mass 3 kg. After the collision, both objects move together. What is their common velocity?

(A) 0.4 m/s
(B) 0.8 m/s
(C) 1.2 m/s
(D) 1.6 m/s

64. A spring of force constant 100 N/m is compressed by 10 cm. What is the potential energy stored in the spring?

(A) 0.5 J
(B) 5 J
(C) 10 J
(D) 1000 J

65. What is the stress experienced by a solid when a force of 50 N is applied uniformly over a cross-sectional area of 5 m^2?

(A) 10 Pa
(B) 50 Pa
(C) 100 Pa
(D) 250 Pa

66. A quasi-static process is

(A) a slow process
(B) an infinitely slow process
(C) a fast process
(D) an infinitely fast process

67. In simple harmonic motion, how does the force relate to displacement and its direction?

(A) Force is proportional to displacement, directed away from the centre.
(B) Force is inversely proportional to displacement, directed towards the centre
(C) Force is proportional to displacement, directed towards the centre.
(D) Force is inversely proportional to displacement, directed away from the centre.

68. A mass of 1.0 kg is attached to a spring of stiffness constant 16 N/m. Find its natural frequency.

(A) 6.40 Hz
(B) 64 Hz
(C) 6400 Hz
(D) 0.64 Hz

69. Calculate the energy of an electron of wavelength 4.35×10^{-7} m

(A) 4.56×10^{-19} Cal
(B) 4.56×10^{-19} J
(C) 4.56×10^{-19} KJ
(D) 4.56×10^{-19} Kcal

70. The sound waves whose frequencies lie below the audible limit are called

(A) Ultrasonic waves
(B) Supersonic waves
(C) Inaudible waves
(D) Infrasonic waves

71. …… should be increased to increase the angular magnification of a simple microscope.

(A) The focal length of the lens
(B) Lens aperture
(C) The power of the lens
(D) Object size

72. When making side-by-side comparisons of glass fragments for color analysis, it is essential that the

(A) Fragments are of equal and sufficient size
(B) Fragments are visually identical
(C) Fragments are as small as possible
(D) Fragment sizes are not relevant

73. Gray is a unit of

(A) Radiation dose
(B) Photon energy
(C) Phonon energy
(D) Magnetic field

74. A spring of force constant k is stretched a certain distance. It takes twice as much work to stretch a second spring by half this distance. The force constant of the second spring is

(A) k
(B) $2k$
(C) $4k$
(D) $8k$

75. Which of the following effects **cannot** be observed for sound waves in air?

(A) Interference
(B) Refraction
(C) Polarization
(D) Diffraction

CHEMISTRY UG
(SHIFT I FINAL)

76. Which of the following sets of conditions makes a process spontaneous at all temperatures?

(A) $\Delta H = 0; \Delta S > 0$
(B) $\Delta H = 0; \Delta S < 0$
(C) $\Delta H < 0; \Delta S > 0$
(D) $\Delta H < 0; \Delta S < 0$

77. The increase in internal energy of the system is 100 J when 300 J heat is supplied to it. What is the amount of work done by the system?

(A) –200 J
(B) +200 J
(C) –300 J
(D) –400 J

78. The hydrogen ion concentration of a solution with pH value 3.69 is

(A) 2.042×10^{-4} M
(B) 3.69×10^{-2} M
(C) 4.31×10^{-4} M
(D) 0.369 M

79. The correct statement between free energy change in a reaction and the corresponding equilibrium constant K_c is

(A) $\Delta G = RT \ln K_c$
(B) $-\Delta G = RT \ln K_c$
(C) $\Delta G° = RT \ln K_c$
(D) $-\Delta G^{o} = RT \ln K_c$

80. The molecular weight of NaCl, assuming 100% dissociation in solution, as determined by elevation of boiling point method is

(A) 58.5
(B) 29.25
(C) > 58.5
(D) Zero

81. The molar conductances of NaCl, HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and 91 $Ohm^{-1}\ cm^2\ mol^{-1}$ respectively. The molar conductance of acetic acid at infinite dilution is

(A) 590.71 $ohm^{-1}\ cm^2\ mol^{-1}$
(B) 698.28 $ohm^{-1}\ cm^2\ mol^{-1}$
(C) 252.9 $ohm^{-1}\ cm^2\ mol^{-1}$
(D) 390.71 $ohm^{-1}\ cm^2\ mol^{-1}$

82. The hydrogen electrode is dipped in a solution of pH = 3 at 25°C, the potential of the cell would be (the value of $\frac{2.303RT}{F}$ = 0.059 V)

(A) +0.177 V
(B) −0.177 V
(C) +0.087 V
(D) +0.059 V

83. Arrhenius equation is given by

(A) $k = Ae^{-E_a/R}$
(B) $A = ke^{-E_a/RT}$
(C) $k = Ae^{-E_a/RT}$
(D) $A = ke^{-E_a/R}$

84. The rate constant of a zero-order reaction is 0.04 M sec^{-1}. The concentration of the reactant remaining after 25 sec is 0.5 M. The initial concentration of the reactant is

(A) 0.5 M
(B) 1.25 M
(C) 0.125 M
(D) 1.5 M

85. The number of entities or particles together in mole concept is known as

(A) Avogadro's number
(B) Boltzmann constant
(C) Universal gas constant
(D) Reynold's number

86. If the first order reaction involves gaseous reactant and gaseous products, the units of its rate are

(A) atm
(B) atm sec
(C) atm sec^{-1}
(D) atm^2 sec^2

87. The half-life of a first order reaction

(A) depends on the reactant concentration raised to the first power
(B) is inversely proportional to the square of the reactant concentration
(C) is inversely proportional to the reactant concentration
(D) is independent of the reactant concentration

88. Viscosity of gases will ……. with increase in temperature

(A) increase
(B) not change
(C) decrease
(D) increase or decrease

89. The Langmuir adsorption isotherm is given by $\theta = \frac{k_p}{1+k_p}$, where p is the pressure of the adsorbate gas. The Langmuir adsorption isotherm for diatomic gas A_2 undergoing dissociative adsorption is

(A) $\theta = \dfrac{k_p}{1+k_p}$

(B) $\theta = \dfrac{2k_p}{1+2k_p}$

(C) $\theta = \dfrac{\left(k_p\right)^2}{1+\left(k_p\right)^2}$

(D) $\theta = \dfrac{\left(k_p\right)^{1/2}}{1+\left(k_p\right)^{1/2}}$

90. Which among the following statement is correct with respect to adsorption of gases on a solid?

I. The extent of adsorption is equal to kp^n according to Freundlich isotherm

II. The extent of adsorption is equal to $kp^{1/n}$ according to Freundlich isotherm

III. The extent of adsorption is equal to $\frac{1+bp}{ap}$ according to Langmuir isotherm

IV. The extent of adsorption is equal to $\frac{bp}{1+bp}$ according to Langmuir isotherm

(A) I and III
(B) I and IV
(C) II and III
(D) II and IV

91. Select the correct statement.

(a) Physical adsorption is reversible while the chemical adsorption is irreversible
(b) High activation energy is involved in physical adsorption
(c) Physical adsorption is specific while chemical adsorption is nonspecific
(d) High activation energy is involved in chemical adsorption

(A) a and d
(B) b and c
(C) b and d
(D) a and c

92. For a value $l = 2$, then the minimum value of principle quantum number for d-orbital is

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

93. For a hypothetical reaction:

$$2A + B \rightarrow \text{Product}$$

The rate constant, k is equal to 5.6×10^{-6} $Lmol^{-1}$ s^{-1}, the order of the reaction is

(A) One
(B) Two
(C) Three
(D) Fractional

94. The s-orbital of an atom is

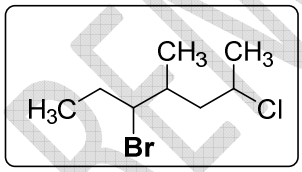
(A) Independent of angles
(B) Dependent of angles
(C) Dependent on only $\sin\theta$
(D) Dependent on $\sin\theta$ and $\cos\theta$

95. Which of the following involves coagulation?

I. Peptization
II. Formation of delta regions
III. Treatment of drinking water by potash alum
IV. Clotting of blood by the use of ferric chloride

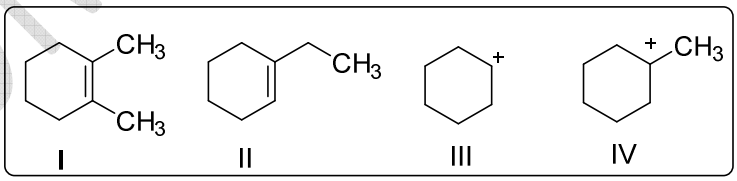
(A) I and IV
(B) II, III and IV
(C) I, III and IV
(D) I, II and III

96. Give the correct IUPAC nomenclature for the following compound.



(A) 1-Bromo-4-chloro-1-ethyl-2-methylpentane
(B) 3-Bromo-6-chloro-4-methylheptane
(C) 2-Chloro-4 (bromopropyl)-pentane
(D) 5-Bromo-2-chloro-4-methylheptane

97. Arrange the following compounds based on the order of number of hyperconjugative structures possible.



(A) I > II > III > IV
(B) I > IV > II > III
(C) IV > I > II > III
(D) IV > III > I > II

98. Which of the following solvents forms explosive peroxides when they come in contact with air and light?

(A) Toluene
(B) Chloroform
(C) Hexane
(D) Diethyl ether

99. Product/products formed in the reaction of benzaldehyde (PhCHO) with sodium hydroxide followed by acidification is/are

(A) $PhCO_2H + HCHO$
(B) $PhCH(OH)CO_2H$
(C) $PhCH_2OH + HCHO$
(D) $PhCH_2OH + PhCO_2H$

100. How many moles of formic acid and formaldehyde are formed when 1 mole of glucose ($C_6H_{12}O_6$) is oxidized using excess HIO_4?

(A) 2 and 4 respectively
(B) 3 and 3 respectively
(C) 4 and 2 respectively
(D) 5 and 1 respectively

101. Function of adrenaline hormone is

(A) to make heart beat faster and lungs breathe more efficiently
(B) to control metabolism of glucose
(C) to reduce fat burning
(D) to control calcium metabolism

102. Chemical produced by **addition reaction** between benzene and chlorine is

(A) DDT
(B) BHC
(C) Chlorobenzene
(D) Chloroprene

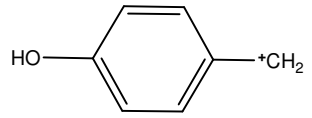
103. A major pollutant in photochemical smog is

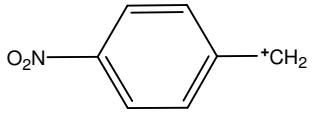
(A) CO_2
(B) H_2CO_3
(C) CH_4
(D) Peroxyacetyl nitrate

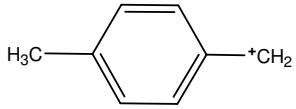
104. An example of a sulphur containing amino acid present in human hair is

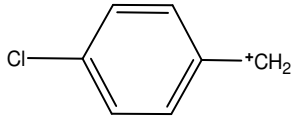
(A) Lysine
(B) Valine
(C) Serine
(D) Cysteine

105. Which among the following substituted benzyl carbocations is the most stable?

(A) 

(B) 

(C) 

(D) 

106. In aromatic electrophilic substitution reaction, cyano (—C≡N) group present in benzene ring is

(A) Deactivating and meta directing
(B) Activating and ortho, para directing
(C) Deactivating and ortho, para directing
(D) Activating and meta directing

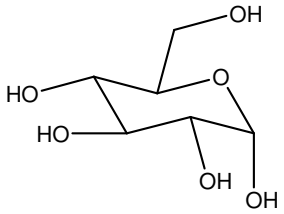
107. Which among the following compounds will give a positive iodoform test?

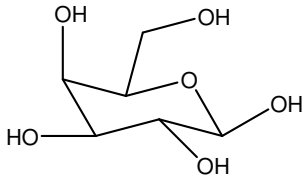
(A) Iodomethane
(B) 2-Iodopropane
(C) Iodobenzene
(D) Butan-2-ol

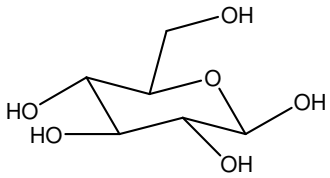
108. The reaction of toluene with bromine in the presence of light yields

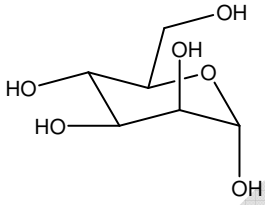
(A) *o*-bromotoluene
(B) benzyl bromide
(C) *m*-bromotoluene
(D) *p*-bromotoluene

109. α-D-Glucose is represented as

(A) 

(B) 

(C) 

(D) 

110. Nylon 6,6 is prepared by reacting

(A) Hexamethylenediamine with adipic acid by condensation reaction
(B) Hexamethylenediamine with succinic acid by addition reaction
(C) Hexamethylenediamine with glutaric acid by elimination reaction
(D) Ring opening polymerization of ε-caprolactam

111. C-C-C Bond angle in 1-propyne is

(A) 109.5°
(B) 120°
(C) 180°
(D) 104.3°

112. Butane-2,3-diol has two chiral carbon. One of the stereoisomers of butane-2,3-diol exhibited specific rotation of 13.0°. Other stereoisomers will exhibit optical rotation

(A) -13.0, +26.0, -26.0 degrees
(B) 0, 0, 0 degrees
(C) -13.0, +6.5, -6.5 degrees
(D) 0 and -13.0 degrees

113. Ethanol can be converted to ethanal by

(A) treatment with chromic acid
(B) treatment with alkaline $KMnO_4$
(C) treatment with pyridinium chlorochromate
(D) treatment with OsO_4

114. Hinsberg test is used to differentiate between

(A) Primary, Secondary and Tertiary alcohols
(B) Phenols and Aliphatic alcohols
(C) Aromatic amines and Phenols
(D) Primary, Secondary and Tertiary amines

115. Types of isomerism found in butene is/are

(A) Position isomerism only
(B) Both position and geometrical isomerism
(C) Geometrical isomerism only
(D) Both Position and optical isomerism

116. What is the number of available coordination sites in ethylene diamine tetraacetate?

(A) 2
(B) 4
(C) 6
(D) 8

117. The number of ligands in the outer coordination sphere of $CoCl_3.6NH_3$, $CoCl_3.5NH_3$ and $CoCl_3.4NH_3$ are

(A) 1, 2 and 3
(B) 2, 2 and 3
(C) 3, 2 and 1
(D) 3, 2 and 2

118. The number of ions that can react with $AgNO_3$ in $PtCl_2.2NH_3$ are

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

119. Predict the stability of the complexes $[Fe(CN)_6]^{4-}$ and $[Fe(CN)_6]^{3-}$ according to EAN rule

(A) stable, stable
(B) stable, unstable
(C) unstable, stable
(D) unstable, unstable

120. The IUPAC nomenclature of $[Pt(NH_3)BrCl(CH_3NH_2)]$ is

(A) methyl amine chloro bromo ammine platinum(II)
(B) bromo chloro ammine methyl amine platinum(II)
(C) amine methyl amine chloro bromo platinum(II)
(D) ammine bromo chloro methyl amine platinum(II)

121. Which among the complexes $[Co(CN)_6]^{4-}$, $[Cr(NH_3)_6]^{3+}$ exhibit Jahn-Teller distortion?

(A) $[Co(CN)_6]^{4-}$, $[Cr(NH_3)_6]^{3+}$
(B) $[Co(CN)_6]^{4-}$
(C) $[Cr(NH_3)_6]^{3+}$
(D) None of the above

122. How many elements are there in the periodic table?

(A) 116
(B) 114
(C) 118
(D) 120

123. What is the chemical element for the symbol Rn?

(A) Rutherfordium
(B) Rhenium
(C) Radon
(D) Radium

124. Which element is in group 2 and period 3 of the periodic table?

(A) Magnesium
(B) Aluminium
(C) Boron
(D) Calcium

125. Which of the following pairs of elements belong to the same group?

(A) H and He
(B) Li and Be
(C) C and Pb
(D) Ga and Ge

126. State the number of valence electrons in a sulphur atom

(A) 16
(B) 12
(C) 10
(D) 6

127. Based on the values for the first through fifth ionization energies in the table, what is the most likely identity of Element A and B?

	IE_1 (kJ/mol)	IE_2 (kJ/mol)	IE_3 (kJ/mol)	IE_4 (kJ/mol)	IE_5 (kJ/mol)
Element A	498	4560	6910	9540	13400
Element B	787	1575	3220	4350	16100

(A) Ca and S
(B) Na and Si
(C) K and P
(D) Ne and Al

128. Which of the following statements describes a correct step in the formation of an ionic bond between sodium and chlorine?

(A) Removing an electron from sodium will provide energy for the bond formation
(B) Adding an electron to chlorine will require energy for bond formation
(C) The Coulombic potential between the ions will release energy
(D) Overcoming the Pauli repulsion from the overlap of wave functions of core electrons will release energy

129. How many covalent bonds can carbon form?

(A) 0
(B) 2
(C) 3
(D) 4

130. Which of the following formulas for magnesium compounds is correct?

(A) MgO_2
(B) MgS_2
(C) MgF_2
(D) Mg_2O

131. Which of the following statements explains why silicon dioxide has a high melting point?

(A) It has a giant ionic structure with strong electrostatic attraction between ions
(B) It has a giant covalent structure with strong covalent bonds between atoms
(C) It has a simple molecular structure with weak forces between molecules
(D) It has a giant metallic structure with a strong attraction between positive ions and the sea of electrons

132. Which of the following does **not** contain ionic bonds?

(A) Sulphur dioxide
(B) Sodium oxide
(C) Silver oxide
(D) Strontium oxide

133. Which of the following gives the best explanation for why a substance does not conduct electricity?

(A) The bonding in the substance is not ionic
(B) The bonding model in the substance does not have free electrons
(C) The bonding model does not have ions which are free to move or free electrons
(D) The bonding model does not have ions or free electrons

134. What is the electron pair geometry and molecular geometry of ICl_3?

(A) trigonal-planar and T-shaped
(B) trigonal-bipyramidal and trigonal-planar
(C) trigonal-bipyramidal and linear
(D) trigonal-bipyramidal and T-shaped

135. Which of the following was **not** one of the assumptions of Bohr's model for the hydrogen atom?

(A) The energy of the hydrogen atom can only change when a photon of energy equal to the energy difference between two allowed energy levels is emitted or absorbed
(B) The energy of the hydrogen atom does not change while the electron moves around the nucleus
(C) A hydrogen atom has certain allowed energy levels
(D) It is not possible to know simultaneously the exact position and momentum of the electron as it moves around the nucleus

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(FINAL)

136. The value of $\begin{vmatrix} 43 & 1 & 6 \\ 35 & 7 & 4 \\ 17 & 3 & 2 \end{vmatrix}$ is

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

137. The infinite series $\frac{1}{1^p}+\frac{1}{2^p}+\frac{1}{3^p}+...$ is convergent if

(A) $p > 1$
(B) $p = 1$
(C) $p < 1$
(D) $p \leq 1$

138. $\cos 4\theta =$

(A) $8\cos^4\theta - 8\cos^2\theta + 1$
(B) $8\cos^4\theta + 8\cos^2\theta - 1$
(C) $4\cos^4\theta - 8\cos^2\theta + 1$
(D) $8\cos^4\theta + 4\cos^2\theta - 1$

139. If $(\cos x)^y = (\sin y)^x$, then $\frac{dy}{dx} =$

(A) $\frac{\log(\sin y) + y\tan x}{\log(\cos x) - x\cot y}$

(B) $\frac{\log(\cos x) - x\cot y}{\log(\sin y) + y\tan x}$

(C) $\frac{\log(\sin y) - y\tan x}{\log(\cos x) + x\cot y}$

(D) $\frac{\log(\cos x) + x\cot y}{\log(\sin y) - y\tan x}$

140. $\int_0^{\frac{\pi}{2}} \cos^6 x \, dx =$

(A) $\frac{3\pi}{32}$

(B) $\frac{5\pi}{32}$

(C) $\frac{7\pi}{32}$

(D) $\frac{\pi}{32}$

141. The area between the curve $y = x^2 - 2x$ and the straight line $y = x$, is

(A) $\frac{3}{2}$ sq.units

(B) $\frac{5}{2}$ sq.units

(C) $\frac{7}{2}$ sq.units

(D) $\frac{9}{2}$ sq.units

142. If A, B, C are three arbitrary events such that $P(A) = P(B) = P(C) = \frac{1}{4}$, $P(A \cap B) = P(B \cap C) = 0$ and $P(A \cap C) = \frac{1}{8}$, then the probability that at least one of A, B, C occurs is

(A) $\frac{1}{8}$

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

(C) $\frac{7}{8}$

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

143. The rank of the matrix $\begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{bmatrix}$ is

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

144. The rate of change of the area of a circle with respect to its radius r when $r = 6$ is

(A) 10π
(B) 12π
(C) 8π
(D) 11π

145. The positive integer n so that $\lim_{x \to 2} \frac{x^n - 2^n}{x - 2} = 32$ is

(A) $n = 2$
(B) $n = 3$
(C) $n = 4$
(D) $n = 1$

146. If $f: R \to R$ is the function defined by $f(x) = \left(3 - x^3\right)^{\frac{1}{3}}$, then $(f \circ f)(x)$ is equal to

(A) $x^{\frac{1}{3}}$

(B) x^3

(C) x

(D) $\left(3 - x^3\right)$

147. The area of the triangle whose vertices are (3, 5), (1, 1), (–4, 1) is

(A) –20
(B) 0
(C) 10
(D) 20

148. $\log_{e^2}(e)$ is

(A) 0.4343
(B) 1
(C) 0
(D) 0.5

149. The critical point of $f(x) = \frac{x^3}{3} - 4x$ is at

(A) $x = 4$
(B) $x = 3$
(C) $x = 2$
(D) no point x

150. Let $\vec{a}$ and $\vec{b}$ be two vectors such that $\left|\vec{a}\cdot\vec{b}\right| = \sqrt{3}\left|\vec{a}\times\vec{b}\right|$. Then θ is

(A) $\frac{\pi}{6}$

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

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

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

151. Which of the following pair of vectors are in same direction?

(A) $\vec{a} = 2\vec{i} + \vec{j} + \vec{k},\ \vec{b} = \frac{1}{\sqrt{3}}\vec{i} + \frac{1}{\sqrt{3}}\vec{j} + \frac{1}{\sqrt{3}}\vec{k}$

(B) $\vec{a} = \vec{i} + \vec{j} + \vec{k},\ \vec{b} = \frac{1}{\sqrt{3}}\vec{i} + \frac{1}{\sqrt{3}}\vec{j} + \frac{1}{\sqrt{3}}\vec{k}$

(C) $\vec{a} = \vec{i} + \vec{j} + \vec{k},\ \vec{b} = \frac{2}{\sqrt{3}}\vec{i} + \frac{1}{\sqrt{3}}\vec{j} + \frac{2}{\sqrt{3}}\vec{k}$

(D) $\vec{a} = \vec{i} + \vec{j} + \vec{k},\ \vec{b} = \frac{1}{\sqrt{3}}\vec{i} + \frac{2}{\sqrt{3}}\vec{j} + \frac{1}{\sqrt{3}}\vec{k}$

152. Let $f(x) = \sin x$ and $g(x) = \tan x$. Then f/g is not

(A) continuous at $x = 1/2$

(B) continuous at $x = 0$

(C) defined at $x = \pi/2$

(D) defined at $x = 1$

153. $\begin{vmatrix} 1 & 27 & 27^3 \\ 1 & 28 & 28^3 \\ 1 & 29 & 29^3 \end{vmatrix} =$

(A) 168
(B) 268
(C) 368
(D) 468

154. A circle of radius n units touches both the axes. Then equations of all possible circles formed in the general form

(A) $x^2 + y^2 = n^2$
(B) $x^2 + y^2 + 2nx + 2ny + n = 0$
(C) $x^2 + y^2 \pm 2nx \pm 2ny \pm n^2 = 0$
(D) $x^2 + y^2 \pm 2nx \pm 2ny + n^2 = 0$

155. If $\cot^{-1}\left(\frac{1}{5}\right) = \theta$, then $\sin\theta$ is

(A) $\frac{5}{\sqrt{26}}$

(B) $\frac{1}{\sqrt{26}}$

(C) $\frac{5}{26}$

(D) $\frac{1}{26}$

156. $\lim_{x \to 1} x^{\frac{1}{x-1}} =$

(A) ∞
(B) e
(C) 1
(D) π

157. $\int_{-\log 2}^{\log 2} e^{-|x|} dx =$

(A) 0

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

(C) 1

(D) -1

158. The probability of arranging $\alpha, \alpha, \alpha, \alpha, \beta, \beta$ such an order that no two α's are adjacent is

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

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

(C) $\frac{1}{6!}$

(D) 0

159. $(1+i)^{18} =$

(A) 512
(B) $512i$
(C) $1 + i$
(D) $1 - i$

160. The mean of number of heads in two tosses of a coin is

(A) 0

(B) 1

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

(D) $\frac{3}{4}$

161. The function f has the property that for each real number x in its domain, $\frac{1}{x}$ is also in its domain and $f(x)+f\left(\frac{1}{x}\right)=x$. Then the largest set of real numbers that can be in the domain of f is

(A) $\{x \mid x \neq 0\}$
(B) $[-1, 1]$
(C) $\{x \mid x > 0\}$
(D) $\{-1, 1\}$

162. A function f is defined by $f(z) = i\overline{z}$. The number of values of z that satisfy both $|z| = 5$ and $f(z) = z$ is

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

163. Consider the problem:

Maximize $z = 2x + 3y$ subject to the constraints $x + y \leq 1$, $2x + 2y \geq 6$, $x, y \geq 0$.

Then the number of optimal solutions is

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

164. An integer x, satisfying $10 \le x \le 99$, is to be chosen. The probability that at least one digit of x is 7

(A) $\frac{1}{9}$

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

(C) $\frac{19}{90}$

(D) $\frac{2}{9}$

165. Which of the following statement is **false**?

(A) If $z = r(\cos\theta + i\sin\theta)$, then $z^{-1} = \frac{1}{r}(\cos\theta - i\sin\theta)$

(B) Given any complex number $\cos\theta + i\sin\theta$ and any integer n, $(\cos\theta + i\sin\theta)^n = \cos n\theta + i\, n\sin\theta$

(C) Given any complex number $\cos\theta + i\sin\theta$ and any real x, $(\cos\theta + i\sin\theta)^x = \cos x\theta + i\sin x\theta$

(D) $z^{\frac{1}{n}} = r^{\frac{1}{n}}\left(\cos\left(\frac{\theta + 2k\pi}{n}\right) + \cos\left(\frac{\theta + 2k\pi}{n}\right)\right),\ k = 0,1,2,3,...$

166. Let $\begin{pmatrix} 1 & \cos\theta & 1 \\ -\cos\theta & 1 & \cos\theta \\ -1 & -\cos\theta & 1 \end{pmatrix}$, where $0 \le \theta \le 2\pi$. Then

(A) $\det(A) \in (2, 4]$
(B) $\det(A) \in (2, 4)$
(C) $\det(A) \in [2, 4)$
(D) $\det(A) \in [2, 4]$

167. Inverse of cosine function exists if the domain of cosine is

(A) $\mathbb{R}$

(B) $\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$

(C) $[0, 2\pi]$

(D) $[0, \pi]$

168. If x and y are positive integers for which $2^x 3^y = 1296$, then the value of $x + y$ is

(A) 8
(B) 9
(C) 10
(D) 11

169. The total number of proper factors of 2024 is

(A) 14
(B) 15
(C) 16
(D) 17

170. For an integer n, with $1 \le n \le 2024$, let $a_n = \begin{cases} 8, & \text{if } n \text{ is divisible by 11 and 23} \\ 11, & \text{if } n \text{ is divisible by 8 and 23} \\ 23, & \text{if } n \text{ is divisible by 8 and 11} \\ 0, & \text{otherwise} \end{cases}$.

Then $\sum_{n=1}^{2024} a_n =$

(A) 448
(B) 486
(C) 672
(D) 2024

171. There are 24 different complex numbers z such that $z^{24} = 1$. Then the number of z such that z^6 is real is

(A) 0
(B) 4
(C) 6
(D) 12

172. $\lim_{x \to \infty} \frac{e^x}{x^m}$, $m \in \mathbb{N}$ is

(A) 0
(B) 1
(C) e
(D) ∞

173. Integers x and y with $x > y > 0$ satisfy $x + y + xy = 80$. Then x is

(A) 26
(B) 27
(C) 80
(D) 81

174. The variance of first 30 natural numbers is

(A) $\frac{899}{2}$
(B) $\frac{899}{4}$
(C) $\frac{899}{12}$
(D) $\frac{899}{16}$

175. In a group of 9 boys, three are brothers. The number of ways in which the boys can sit so that three brothers are not sitting together is

(A) 332640
(B) 352800
(C) 347760
(D) 364640

176. For a positive integer $n \geq 2$ satisfying $n^4 < 10^n$, we have

(A) $(n-2)^4 < 10^{n-2}$
(B) $(n+1)^4 < 10^{n-1}$
(C) $n < 10^2$
(D) $(n+1)^4 < 10^{n+1}$

177. Solution set of $\left|x+\frac{1}{x}\right| < 4$ is

(A) $x \in \left(2-\sqrt{3}, 2+\sqrt{3}\right) \cup \left(-2-\sqrt{3}, -2+\sqrt{3}\right)$
(B) $R - \left(2-\sqrt{3}, 2+\sqrt{3}\right)$
(C) $R - \left(-2-\sqrt{3}, -2+\sqrt{3}\right)$
(D) $R - \left(\left(2-\sqrt{3}, 2+\sqrt{3}\right) \cup \left(-2-\sqrt{3}, -2+\sqrt{3}\right)\right)$

178. Let $a = \dfrac{2}{\sqrt{7}+\sqrt{5}}$ and $b = \dfrac{2}{\sqrt{13}+\sqrt{11}}$. Then

(A) $a = b$
(B) $a < b$
(C) $a > b$
(D) $a = \sqrt{2}b$

179. The expression $\tan\left(i \log\left(\dfrac{a-ib}{a+ib}\right)\right)$ reduces to

(A) $\dfrac{ab}{a^2+b^2}$

(B) $\dfrac{2ab}{a^2-b^2}$

(C) $\dfrac{ab}{a^2-b^2}$

(D) $\dfrac{2ab}{a^2+b^2}$

180. The equation $z\overline{z} + (2-3i)z + (2+3i)\overline{z} + 4 = 0$ represents a circle of radius

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

181. Let $a_1 = 0$ and $a_1, a_2, a_3, \ldots, a_n$ be real numbers such that $|a_i| = |a_{i-1} + 1|$ for all i. Then the arithmetic mean of the numbers $a_1, a_2, a_3, \ldots, a_n$ has a value t where

(A) $t \le \dfrac{1}{2}$

(B) $t < -\dfrac{1}{2}$

(C) $t \ge -\dfrac{1}{2}$

(D) $t > \dfrac{1}{2}$

182. If the fourth, seventh and tenth terms of a Geometric Progression are p, q and r respectively, then

(A) $p^2 = q^2 + r^2$
(B) $p^2 = qr$
(C) $q^2 = pr$
(D) $r^2 = p^2 + q^2$

183. The number of triangles formed by the lines represented by $x^3 - x^2 - x - 2 = 0$ and $xy^2 + 2xy + 4x - 2y^2 - 4y - 8 = 0$ is

(A) One
(B) Two
(C) Three
(D) Zero

184. The coefficient of x in the quadratic equation $ax^2 + bx + c = 0$ was wrongly taken as 17 in place of 13 and its roots were found to be -2 and -15 . The actual roots of the equation are

(A) -2 and 15
(B) -3 and -10
(C) -4 and -9
(D) -5 and -6

185. The roots of the equation $3^{2x+1} + 3^2 = 3^{x+3} + 3^x$ are

(A) 1, -2
(B) 1, 2
(C) -1, 2
(D) -1, -2

186. The number of roots of the equation $|x| = x^2 + x - 4$ is

(A) 1
(B) 2
(C) 3
(D) 4

187. If $\frac{{}^{n}P_{r-1}}{a} = \frac{{}^{n}P_{r}}{b} = \frac{{}^{n}P_{r+1}}{c}$, then

(A) $a - b + c = 1$
(B) $abc = 1$
(C) $b^2 = a(b + c)$
(D) $a^2 = c(a + b)$

188. The coefficient of x^8 in $\left\{(1+x)^6 + (1+x)^7 + ... + (1+x)^{15}\right\}$ is

(A) ${}^{16}C_4$
(B) ${}^{16}C_5$
(C) ${}^{16}C_6$
(D) ${}^{16}C_7$

189. The number of subsets of the set $X = \left\{x_1, x_2, ..., x_n\right\}$ which contain even number of elements is

(A) 2^n
(B) $2^n - 1$
(C) 2^{n-2}
(D) 2^{n-1}

190. The total number of flags with three horizontal strips, in order that can be formed using 2 identical red, 2 identical green and 2 identical white strips, is equal to

(A) 4!
(B) 2.(4!)
(C) 3.(4!)
(D) 4(4!)

191. Given the matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 2 & -1 \end{bmatrix}$. If constants p, q, r satisfy

$A^3 = pA^2 + qA + rI$, then

(A) $p = 2, q = 2, r = -1$
(B) $p = 1, q = 2, r = -1$
(C) $p = -1, q = 2, r = 1$
(D) $p = -2, q = 2, r = 1$

192. If $A = \begin{bmatrix} 1 & 0 & 0 \\ x & 1 & 0 \\ x & x & 1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then $A^3 - 3A^2 + 3A + I$ is equal to

(A) $-2I$
(B) I
(C) $2I$
(D) $3I$

193. The sum of the series $\frac{1}{1.2} + \frac{1.3}{1.2.3.4} + \frac{1.3.5}{1.2.3.4.5.6} + ... + \infty$ is

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

194. The coefficient of n in the expansion of $\log\left[(1+x)^{1+x}(1-x)^{1-x}\right]$ is equal to

(A) $\frac{1}{30}$
(B) $\frac{1}{15}$
(C) $\frac{1}{10}$
(D) $\frac{1}{45}$

195. If the function $f(x) = \cos(\log x)$, then the value of

$$f\left(x^2\right) f\left(y^2\right) - \frac{1}{2}\left[f\left(\frac{x^2}{y^2}\right) + f\left(x^2 y^2\right)\right] \text{ is}$$

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

196. If $f(x) = \log\frac{1+x}{1-x}$, then $f(a) + f(b)$ is equal to

(A) $f\left(\frac{a+b}{1-ab}\right)$

(B) $f\left(\frac{a+b}{1+ab}\right)$

(C) 0

(D) 1

197. The chances to fail in Physics are 20% and the chances to fail in Mathematics are 10%. The percentage of chance to fail in at least one subject is

(A) 72%
(B) 38%
(C) 28%
(D) 82%

198. The coefficient of x^{20} in the expansion of $\left(1+x^2\right)^{40}\left(x^2+2+\frac{1}{x^2}\right)^{-5}$ is

(A) ${}^{30}C_{10}$

(B) ${}^{30}C_{25}$

(C) 1
(D) 0

199. The value of $\sin A \sin(60° - A) \sin(60° + A)$ is equal to

(A) $\frac{1}{4}\sin 3A$

(B) $\frac{1}{2}\sin 3A$

(C) $\frac{1}{4}\sin 2A$

(D) $\frac{1}{3}\sin 3A$

200. The PDF of a continuous random variate is $f(x) = \begin{cases} 0, & x < 2 \\ \frac{(3+2x)}{18}, & 2 \le x \le 4 \\ 0, & x > 4 \end{cases}$. Then,

the probability that x will lie between $2 \le x \le 3$ is

(A) $\frac{4}{9}$

(B) $\frac{2}{9}$

(C) $\frac{5}{9}$

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

201. For $0 \le x \le 2\pi$, the number of real solutions of the equation $[\sin x] = [1 + \sin x] + [1 - \cos x]$ is

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

202. If a, b, c and d are sides of a quadrilateral, then the minimum value of $\frac{a^2+b^2+c^2}{d^2}$ is

(A) 1

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

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

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

203. In any ΔABC, $a(b\cos C - c\cos B)$ is equal to

(A) b^2+c^2

(B) b^2-c^2

(C) $\frac{1}{b}+\frac{1}{c}$

(D) $\frac{1}{b^2}-\frac{1}{c^2}$

204. If $\sin\theta = \frac{x^2+y^2}{x^2-y^2}$, then

(A) $x \neq y$

(B) $x \neq y,\ x, y \in \mathbb{R}$

(C) $x = 0$ or $y = 0$

(D) $x \neq y$ and $x \neq 0, y \neq 0$

205. If $x^x y^y z^z = c$, then $\frac{\partial z}{\partial x}$ is equal to

(A) $\frac{1+\log x}{1+\log z}$

(B) $-\frac{1+\log x}{1+\log z}$

(C) $\frac{1+\log z}{1+\log x}$

(D) $\frac{1-\log z}{1+\log x}$

206. $\int \frac{\sin x \cos x}{\sqrt{1-\sin^4 x}}\,dx$ is equal to

(A) $\frac{1}{2}\sin^{-1}\left(\sin^2 x\right)+c$

(B) $\frac{1}{2}\cos^{-1}\left(\sin^2 x\right)+c$

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

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

207. Solution of the differential equation $x\,dy - y\,dx = 0$ represents

(A) parabola whose vertex is at origin
(B) circle whose center is a origin
(C) a rectangular hyperbola
(D) straight line passing through origin

208. The largest interval for which $x^{12} - x^9 + x^4 - x + 1 > 0$ is

(A) $-4 < x \le 0$
(B) $0 < x < 1$
(C) $-100 < x < 100$
(D) $-\infty < x < \infty$

209. The circles $x^2 + y^2 - 10x + 16 = 0$ and $x^2 + y^2 = a^2$ intersect at two distinct points, if

(A) $a < 2$
(B) $2 < a < 8$
(C) $a > 8$
(D) $a = 2$

210. Let $f : R \to R$ be a function satisfying $f(2x + 3) + f(2x + 7) = 2$ for all $x \in R$. Then the period of $f(x)$ is

(A) 2
(B) 4
(C) 8
(D) 12

211. Let a, b, x, y be real numbers such that $a^2 + b^2 = 25$, $x^2 + y^2 = 169$, and $ax + by = 65$. If $k = ay - bx$, then

(A) $k > \frac{5}{13}$

(B) $k = 0$

(C) $0 < k \leq \frac{5}{13}$

(D) $k = \frac{5}{13}$

212. Let x and y be positive real numbers such that $\log_5(x+y) + \log_5(x-y) = 3$, and $\log_2 y - \log_2 3$. Then xy is equal to

(A) 150
(B) 100
(C) 250
(D) 25

213. If $f(x+y)=f(x)\cdot f(y)$ and $\sum_{x=1}^{\infty} f(x)=2,\ x, y\in N,$ where N is the set of all natural numbers, then the value of $\frac{f(4)}{f(2)}$ is

(A) $\frac{1}{9}$

(B) $\frac{4}{9}$

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

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

214. Let $f:(-1,1)\to B$ be the function defined by $f(x)=\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ and such that it is a one-one and onto function. Then B is

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

(B) $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$

(C) $\left(0,\frac{\pi}{2}\right)$

(D) $\left[0,\frac{\pi}{2}\right]$

215. The complex number $\sin x+i\cos 2x$ and $\cos x-i\sin 2x$ are conjugates to each other for

(A) $x=n\pi$

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

(C) $x=0$

(D) no values of x

216. Eight people are to be transported from city A to city B in three cars of different makes. If each car can accommodate at most three persons, then the number of ways, in which they can be transported, is

(A) 1120
(B) 560
(C) 3360
(D) 1680

217. Area of the parallelogram whose sides are
$2x+y+1=0,\ 2x+y+4=0,\ x-3y-1=0$ and $x-3y+2=0$ is equal to

(A) $\frac{7}{9}$ sq.units
(B) $\frac{9}{7}$ sq.units
(C) $\frac{5}{7}$ sq.units
(D) $\frac{7}{5}$ sq.units

218. The largest term of the sequence given by $a_n = \frac{n}{n^4+1875},\ n \in N$ is

(A) $\frac{1}{200}$
(B) $\frac{1}{500}$
(C) $\frac{5}{727}$
(D) $\frac{1}{20}$

219. For the curve $y = 7x - x^3,$ if x increases at the rate of 4 units/sec. then at $x = 2$, the slope of the curve is changing at

(A) 72 units/sec
(B) –72 units/sec
(C) 48 units/sec
(D) –48 units/sec

220. Let the mean of 6 observations $1, 2, 4, 5, x$ and y be 5 and their variance be 10. Then x is equal to

(A) 4
(B) 6
(C) 8
(D) 10

221. For $x \in [-1, 1]$, the number of solutions of the equation $\sin^{-1} x = 2\tan^{-1} x$ is equal to

(A) 2
(B) 3
(C) 1
(D) 4

222. If $e^{\sin x} - e^{-\sin x} = 4$ then the number of real values of x is

(A) 0
(B) 1
(C) 2
(D) infinite

223. If a_n is the greatest term in the sequence $a_n = \frac{n^3}{n^4 + 147}$, $n = 1, 2, 3, \ldots$, then n is equal to

(A) 5
(B) 6
(C) 4
(D) 8

224. If θ is the acute angle between any two diagonals of a cube, then

(A) $\cos\theta = \frac{1}{3}$

(B) $\sin\theta = \frac{1}{3}$

(C) $\cos\theta = \frac{1}{\sqrt{3}}$

(D) $\sin\theta = \frac{1}{\sqrt{3}}$

225. The value of $\int_3^6 \left(\sqrt{x+\sqrt{12x-36}}+\sqrt{x-\sqrt{12x-36}}\right)dx$ is equal to

(A) $4\sqrt{3}$
(B) $6\sqrt{3}$
(C) $12\sqrt{3}$
(D) $2\sqrt{3}$

Subject Name: 101 B TECH 10 MAY S1 2024															
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	A	91	A	121	B	151	B	181	C	211	B
2	B	32	B	62	C	92	B	122	C	152	C	182	C	212	A
3	D	33	B	63	D	93	B	123	C	153	A	183	D	213	B
4	C	34	B	64	A	94	A	124	A	154	D	184	B	214	A
5	C	35	D	65	A	95	B	125	C	155	A	185	C	215	D
6	C	36	B	66	B	96	D	126	D	156	B	186	B	216	D
7	B	37	A	67	C	97	B	127	B	157	C	187	C	217	B
8	A	38	C	68	D	98	D	128	C	158	D	188	D	218	B
9	B	39	D	69	B	99	D	129	D	159	B	189	D	219	D
10	A	40	A	70	D	100	D	130	C	160	B	190	A	220	C
11	B	41	B	71	C	101	A	131	B	161	D	191	C	221	B
12	B	42	B	72	A	102	B	132	A	162	C	192	C	222	A
13	D	43	D	73	A	103	D	133	C	163	D	193	B	223	A
14	C	44	A	74	D	104	D	134	D	164	B	194	B	224	A
15	A	45	D	75	C	105	A	135	D	165	C	195	D	225	B
16	C	46	D	76	C	106	A	136	B	166	D	196	B		
17	A	47	A	77	B	107	D	137	A	167	D	197	C		
18	B	48	A	78	A	108	B	138	A	168	A	198	B		
19	B	49	A	79	D	109	A	139	A	169	B	199	A		
20	B	50	A	80	B	110	A	140	B	170	C	200	A		
21	C	51	C	81	D	111	C	141	D	171	D	201	A		
22	B	52	C	82	B	112	D	142	D	172	D	202	C		
23	B	53	A	83	C	113	C	143	A	173	A	203	B		
24	B	54	D	84	D	114	D	144	B	174	C	204	C		
25	B	55	C	85	A	115	B	145	C	175	A	205	B		
26	B	56	D	86	C	116	C	146	C	176	D	206	A		
27	A	57	B	87	D	117	C	147	C	177	A	207	D		
28	A	58	B	88	A	118	A	148	D	178	C	208	D		
29	C	59	B	89	D	119	B	149	C	179	B	209	B		
30	A	60	B	90	D	120	D	150	A	180	B	210	B		