101 – TEST FOR B TECH / 5 YR INTEGRATED MSC
PHYSICS UG
(SHIFT II)

1. An athlete completes one round of a circular track of radius R in 40 s. What will be his displacement at the end of 2 min 20 seconds?

(A) $7\,R$
(B) $2\,R$
(C) $2\,\pi R$
(D) $7\,\pi R$

2. The phase difference between the displacement and velocity of a particle executing SHM is

(A) $\pi/2$
(B) π
(C) $\pi/4$
(D) 0

3. The work done per unit volume in stretching a wire is

(A) $\frac{\text{force} \times \text{extension}}{2}$
(B) $\frac{\text{stress} \times \text{strain}}{2}$
(C) force × extension
(D) stress × strain

4. A capacitor connected to a cell of emf E is fully charged. If V is the potential difference across the capacitor, then which one of the following is correct?

(A) V > E
(B) V = E = 0
(C) V = E
(D) V < E

5. In a common emitter amplifier circuit using an *n-p-n* transistor, the phase difference between the input and the output voltage will be

(A) 135°
(B) 180°
(C) 45°
(D) 90°

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6. If λ is the decay constant, $T_{½}$ is the half life and T is the mean life of a radioactive element, then which of the following is true

(A) $T_{½} = \frac{1}{\lambda}$, $T = \frac{ln2}{\lambda}$

(B) $T_{½} = \frac{ln2}{\lambda}$, $T = \frac{1}{\lambda}$

(C) $T_{½} = \lambda\, ln2$, $T = \frac{1}{\lambda}$

(D) $T_{½} = \frac{\lambda}{ln2}$, $T = \frac{ln2}{\lambda}$

7. Ozone layer in the atmosphere absorbs

(A) radio waves
(B) infrared
(C) ultra violet rays
(D) X-rays

8. In a Rutherford experiment, for head-on collision of α- particles with a gold nucleus, the impact parameter is

(A) of the order of 10^{-14} m
(B) of the order of 10^{-10} m
(C) of the order of 10^{-6} m
(D) zero

9. The speed of electromagnetic waves in free space is 3×10^{8} ms^{-1}. The frequency of a radio wave of wavelength 150 m is

(A) 45 MHz
(B) 2 MHz
(C) 20 kHz
(D) 2 kHz

10. In a series resonant circuit, the AC voltages across R, L and C are respectively 5 V, 10 V and 10 V. The AC voltage applied to the circuit is

(A) 25 V
(B) 15 V
(C) 5 V
(D) 20 V

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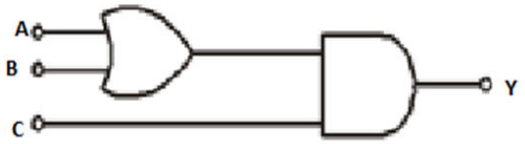
11. To get output 1 for the following circuit, the correct choice for the input is



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

12. For a transistor amplifier, the voltage gain

(A) is high at high and low frequencies and constant at middle frequency range
(B) constant at high frequencies and low at low frequencies
(C) remains constant at all frequencies
(D) is low at high and low frequencies and constant at mid frequencies

13. Frequency of revolution of an electron revolving in the n^{th} orbit of H- atom is proportional to

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

14. In which of the following devices, the eddy current effect is not used?

(A) Induction furnace
(B) Magnetic braking in train
(C) Electromagnet
(D) Electric heater

15. The center of mass of a system of particles does not depend on

(A) mass of the particles
(B) position of the particles
(C) forces on the particles
(D) relative distance between particles

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16. 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°

17. In a sample of radioactive material, what percentage of initial number of active nuclei will decay during one mean life?

(A) 37%
(B) 63%
(C) 50%
(D) 69.3%

18. In a compound microscope, maximum magnification is obtained when the image

(A) is formed at infinity
(B) is formed at the least distance of distinct vision
(C) coincides with objective lens
(D) is at any finite distance

19. If P, Q and R are physical quantities having different dimensions, which one of the following combinations can never be a meaningful quantity?

(A) $PQ - R$

(B) $\frac{PR - Q^2}{R}$

(C) $\frac{P - Q}{R}$

(D) $\frac{PQ}{R}$

20. Light of a certain frequency and intensity is incident on a photosensitive material causing photoelectric effect. If both the frequency and intensity are doubled, the photoelectric saturation current becomes

(A) unchanged
(B) doubled
(C) halved
(D) quadrupled

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21. The phenomenon involved in the reflection of radio waves by ionosphere is similar to

(A) scattering of light by air particles
(B) total internal reflection of light in air during a mirage
(C) reflection of light by plane mirror
(D) dispersion of light by water molecules during the formation of a rainbow

22. Gyromagnetic ratio of a nucleus is

(A) a vector
(B) a scalar
(C) a tensor
(D) zero

23. The following four wires of length L and radius r are made of the same material. Which of these wires will have the largest extension, when the same tension is applied?

(A) L = 50 cm, r = 0.25 mm
(B) L = 100 cm, r = 0.5 mm
(C) L = 200 cm, r = 1 mm
(D) L = 300 cm, r = 1.5 mm

24. Kepler's second law regarding constancy of aerial velocity of a planet is a consequence of conservation of

(A) energy
(B) mass
(C) linear momentum
(D) angular momentum

25. A hollow metal sphere carrying electric charge produces no electric field at the points

(A) outside the sphere
(B) inside the sphere
(C) on its surface
(D) at a distance more than its radius

26. When the force between two charges in vacuum is 0.6 N, then what will be the force if vacuum is replaced by a medium whose permittivity is five times greater than that of in vacuum?

(A) 0.30 N
(B) 0.12 N
(C) 8.33 N
(D) 4.165 N

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27. In a thermocouple at one of the junction, the Peltier coefficient depends on

(A) the temperature of the junction
(B) the current in the junction
(C) the time for which the current flows
(D) the heat absorbed or evolved

28. An ideal voltmeter has

(A) zero resistance
(B) finite resistance
(C) infinite resistance
(D) resistance depends on the load

29. The intensity of the X-rays emitted in an X-ray tube can be increased by

(A) increasing the target potential
(B) increasing the filament current
(C) increasing the target resistance
(D) increasing the filament resistance

30. A photon having energy 15.2 eV will have the frequency

(A) 3.67×10^{15} Hz
(B) 2.29×10^{15} Hz
(C) 3.67×10^{22} Hz
(D) 2.29×10^{22} Hz

31. The wave number of the sodium vapour lamp having spectral line of wavelength 5890 Å is,

(A) $1.6978 \times 10^{6}\ m^{-1}$
(B) $1.6978 \times 10^{8}\ m^{-1}$
(C) $5.0933 \times 10^{6}\ m^{-1}$
(D) $5.0933 \times 10^{8}\ m^{-1}$

32. Which part of the electromagnetic wave is used for the communication purpose?

(A) Radio waves only
(B) Microwaves only
(C) Infrared waves only
(D) Both radio waves and microwaves

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33. If E_c and E_s are the amplitudes of the carrier and signal waves, then the magnitude of the upper side band and lower side band is

(A) $m E_c / 2$
(B) $m E_s / 2$
(C) $m (E_c + E_s) / 2$
(D) $m (E_c - E_s) / 2$

34. A rectangular coil having 100 turns of size 5 cm × 2 cm is placed perpendicularly in a magnetic field of induction 0.10 Wb/m^2. When the magnetic field of induction is changed to 0.01 Wb/m^2 in 0.1 second, then the emf induced is

(A) 0.09 V
(B) 0.06 V
(C) 0.03 V
(D) 0.003 V

35. The self-inductance of a long solenoid having N turns, length (l), area of cross section A in air medium is

(A) $L = N \varphi$
(B) $L = \mu_o N^2 A / l$
(C) $L = \mu_o \varphi N A / l$
(D) $L = N \varphi / l$

36. Herapathite (iodoquinine sulphate) is a

(A) polarizer
(B) uniaxial crystal
(C) biaxial crystal
(D) reflector

37. Tyndall effect is due to the _____ of light.

(A) reflection
(B) refraction
(C) polarization
(D) scattering

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38. From the Laue pattern, one can get information about the material

(A) crystal system
(B) Bravais lattice
(C) lattice constants
(D) crystal symmetry

39. A nuclear reactor is producing energy of 1000 MW. When the energy per fission is 200 MeV, then the number of fission per second is

(A) 3.125×10^{19}
(B) 5.000×10^{19}
(C) 6.250×10^{19}
(D) 9.375×10^{19}

40. The coolant materials used in the nuclear reactors have the characteristic of _____ specific heat capacity and _____ boiling point.

(A) high, high
(B) high, low
(C) low, high
(D) low, low

41. One Curie is equal to _____ disintegrations per second.

(A) 3.7×10^{8}
(B) 3.7×10^{9}
(C) 3.7×10^{10}
(D) 3.7×10^{12}

42. The average binding energy per nucleon in the mass number region 20 to 80 is

(A) 8.7 MeV
(B) 5.8 MeV
(C) 6.9 MeV
(D) 7.8 MeV

43. Three resistances each of 1 Ω are connected to form a triangle. The resistance between any two terminals is

(A) 2 Ω
(B) 2/3 Ω
(C) 3/2 Ω
(D) 1/3 Ω

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44. When a piece of copper and another of germanium are cooled from room temperature to 89 K then the resistance of

(A) copper decreases and germanium increases
(B) copper increases and germanium decreases
(C) each of them decreases
(D) each of them increases

45. A sonometer wire vibrates with a frequency f Hz. It is replaced by another wire of thrice the diameter. The frequency of vibration of the wire, when the tension and other parameters remain constant, is

(A) $3f$ Hz
(B) $f/3$ Hz
(C) $f/9$ Hz
(D) $9f$ Hz

46. Sound waves are travelling in a medium whose adiabatic elasticity is E and isothermal elasticity is E'. Then the velocity of sound waves is proportional to

(A) E'
(B) $\sqrt{E'}$
(C) E
(D) $\sqrt{E}$

47. A converging lens is used to form an image on a screen. When the upper half of the lens is covered by an opaque screen

(A) half the image will disappear
(B) intensity of the image will increase
(C) complete image will be formed
(D) intensity of the image will remain same

48. The motion of the molecules of a monoatomic gas is

(A) vibratory
(B) rotatory
(C) translatory
(D) constant

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49. When a charged particle absorbs radiant energy ε in the time $2\pi/\omega$, then the linear momentum transferred to the particle in the same time is

(A) ε/c
(B) c/ε
(C) $c+\varepsilon$
(D) $c-\varepsilon$

50. Which of the following is correct in terms of the relative strength of the four fundamental forces of nature in their decreasing order?

(A) Gravitational, electromagnetic, electroweak and strong
(B) Strong, electroweak, electromagnetic and gravitational
(C) Strong, electroweak, gravitational and electromagnetic
(D) Strong, electromagnetic, electroweak and gravitational

51. The principle involved when we squeeze one end of a tube to get toothpaste out from the other end is

(A) Archimedes principle
(B) Pascal's principle
(C) principle of reflection
(D) principle of superposition for forces

52. Of the following radiations, which one penetrates less through matter?

(A) Gamma
(B) Beta
(C) Alpha
(D) X-rays

53. The electric field intensity at the surface of charged conductor is

(A) perpendicular to the surface
(B) at 45° to the surface
(C) zero
(D) tangential to the surface

54. When milk is churned, cream gets separated due to

(A) centripetal force
(B) centrifugal force
(C) frictional force
(D) gravitational force

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55. Two bodies of masses m and 4m are moving with equal kinetic energies. The ratio of their linear momenta will be

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

56. At which temperature, Centigrade and Fahrenheit scales are equal?

(A) 40 degrees
(B) –40 degrees
(C) 37 degrees
(D) –80 degrees

57. During melting of ice, its entropy

(A) increases
(B) decreases
(C) remains same
(D) cannot change

58. The average acceleration in one time period in simple harmonic motion is

(A) $A\omega^2$
(B) $A\omega^2/2$
(C) $A\omega^2/\sqrt{2}$
(D) zero

59. Below the superconducting transition temperature, the material exhibits

(A) ferromagnetism
(B) super fluidity
(C) super capacitance
(D) diamagnetism

60. A 100 millihenry coil carries a current of 1 A. Energy stored in its magnetic field is

(A) 0.5 J
(B) 1 J
(C) 0.05 J
(D) 0.1 J

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61. When a drop of oil spread on a water surface, it displays beautiful colours in daylight because of

(A) dispersion of light
(B) reflection of light
(C) polarization of light
(D) interference of light

62. The resistance R = V/I where V = 100 ± 5 volts and I = 10 ± 0.2 amperes. What is the total error in R?

(A) 5%
(B) 7%
(C) 5.2%
(D) 5/2%

63. A shell of mass 10 kg is moving with a velocity of 10 ms^{-1}. Then it blasts and forms two parts of mass 9 kg and 1 kg respectively. If the 1^{st} mass is stationary, the velocity of the 2^{nd} is

(A) 1 m/s
(B) 10 m/s
(C) 100 m/s
(D) 1000 m/s

64. If the distance between two masses is doubled, the gravitational attraction between them

(A) is doubled
(B) become four times
(C) is reduced to half
(D) is reduced to quarter

65. In a Carnot engine, when $T_2 = 0°C$ and $T_1 = 200°C$, its efficiency is η_1, and when $T_1 = 0°C$ and $T_2 = -200°C$ its efficiency is η_2. Then η_1/η_2, is given by

(A) 0.577
(B) 0.733
(C) 0.638
(D) 1.577

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66. Eight drops of mercury of equal radii combine to form a big drop. Then the radius of bigger drop compared to each individual small drop is

(A) 8 times
(B) 4 times
(C) 2 times
(D) 32 times

67. The self inductance of a coil is 5 Henry. A current of 1 Amp changes to 2 Amp within 5 second through the coil. The value of induced e.m.f. will be

(A) 10 volt
(B) 0.10 volt
(C) 1.0 volt
(D) 100 volt

68. Relation between critical angles of water and glass is

(A) $C_w > C_g$
(B) $C_w < C_g$
(C) $C_w = C_g$
(D) $C_w = C_g = 0$

69. If the potential difference applied across X-ray tube is V volts, then approximately minimum wavelength of the emitted X-rays will be

(A) $1227/\sqrt{V}$ Å
(B) $1240/V$ Å
(C) $2400/V$ Å
(D) $12400/V$ Å

70. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius (1.01)R. The period of the second satellite is larger than the first one by approximately

(A) 0.7%
(B) 1%
(C) 1.5%
(D) 3%

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71. The potential energy of a simple harmonic oscillator when the particle is half way to its end point is

(A) E/2
(B) 2E/3
(C) E/8
(D) E/4

72. At the top of the trajectory of a projectile, the acceleration is

(A) maximum
(B) minimum
(C) zero
(D) *g*

73. A potential of $V = 200\sqrt{2}\ \cos \omega t$ is passed through a dc voltmeter. Its reading will be

(A) $200\sqrt{2}$ V
(B) 200 V
(C) 100 V
(D) zero

74. Which of the following properties show light is a transverse wave?

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

75. The energy released when 1/12 carbon atom of $^{12}_{6}C$ (or 1 amu) is converted into energy is

(A) 931 MeV
(B) 939 MeV
(C) 935 MeV
(D) 938 MeV

CHEMISTRY

76. The packing efficiency of simple cubic unit cell is

(A) higher than that of ccp
(B) higher than that of bcc
(C) lower than that of both ccp and bcc
(D) equal to that of ccp and bcc

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77. The density of a unit cell is

(A) higher than that of its crystal
(B) lower than that of its crystal
(C) same as that of its crystal
(D) None of the above

78. The conductivity of 0.001028 M acetic acid is 4.95×10^{-5} S cm^{-1} and its limiting molar conductivity is 390.5 S cm^2 mol^{-1}. It is degree of dissociation is equal to

(A) 0.0012
(B) 0.1233
(C) 0.2233
(D) 0.0123

79. If a current of 500 ampere is passing for one second, it is equal to

(A) 0.000518 F per sec
(B) 0.518 F per sec
(C) 0.0518 F per sec
(D) 0.00518 F per sec

80. Freundlich adsorption isotherm of a gas on a solid surface is

(A) applicable only at high pressures
(B) applicable only at low pressures
(C) applicable only at moderate pressures
(D) applicable at low and moderate pressures

81. Zeolites are

(A) microporous crystalline alumino silicates
(B) non-porous crystalline alumino silicates
(C) amorphous alumino silicates
(D) microporous crystalline magnesium silicates

82. An azeotropic mixture at its boiling point

(A) can be separated into its components
(B) has different composition for the liquid and vapour
(C) cannot be separated into its components
(D) has different components for the liquid and vapour

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83. The wrong statement of chemisorption is

(A) it is highly specific
(B) it is very exothermic
(C) it is reversible
(D) it involves formation of a strong bond

84. The unit cell edge of an element with the bcc structure is 288×10^{-10} cm. Its density is 7.2 g/cm^3. The number of unit cells in 208 g of the element is equal to

(A) 10.01×10^{23}
(B) 12.08×10^{23}
(C) 14.04×10^{23}
(D) 16.03×10^{23}

85. The semiconductors are

(A) alkalimetal oxides
(B) alkaline earth metal oxides
(C) most of the transition metal oxides
(D) oxides of group IV elements

86. According to Le Chatelier's principle, high temperature favours the formation of more products at equilibrium, if the forward reaction

(A) Accompanied by decrease in number of gas molecules
(B) Accompanied by increase in number of gas molecules
(C) Is endothermic
(D) Is exothermic

87. The coordination of each particle in simple cubic, body centred cubic, face centred and hexagonal cubic packing are

(A) 6, 8, 12, 12
(B) 6, 8, 12, 14
(C) 4, 8, 12, 12
(D) 6, 6, 6, 6

88. Vapour pressure of water at 296 K is 19.8 mm of Hg. 0.1 mole of glucose is dissolved in 172.8 g of water. The vapour of the solution is

(A) 19.6 mm
(B) 16.9 mm
(C) 19.0 mm
(D) 18.9 mm

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89. The boiling point of an azeotropic mixture in water-ethanol is less than that of both water and ethanol. This means that the mixture

(A) Shows negative deviation from Rauolt's law
(B) Shows positive deviation from Rauolt's law
(C) Shows no deviation from Rauolt's law
(D) Is an ideal solution

90. A calculator batter provides a current of 10^{-5} A. The number of coulombs required to operate 1000 hours is

(A) 1.0
(B) 10
(C) 0.010
(D) 36

91. The potential of half-cell consisting of zinc electrode in 0.01 M $ZnSO_4$ solution at 25°C is ($E° = –0.763$ V)

(A) –0.704 V
(B) –0.822 V
(C) –0.382 V
(D) +0.704 V

92. The rate constant for a first order reaction is 60 s^{-1}. The time taken to reduce the initial concentration of the reactant to its $1/16^{th}$ value will be

(A) 0.00462 s
(B) 0.462 s
(C) 0.0462 s
(D) 4.63 s

93. Standard free energies of formation (in kJ mol^{-1}) at 298 K are –237.2, –394.4 and –8.2 for $H_2O(I)$, $CO_2(g)$, and pentane(g), respectively. The value of $E°_{cell}$ for the pentane-oxygen fuel cell is

(A) 1.968 V
(B) 2.0968 V
(C) 0.0968 V
(D) 1.0968 V

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94. In what way the ionization energy varies in the 1st group elements?

(A) Increases down the group
(B) Decreases down the group
(C) Remains unchanged
(D) Variation is not regular

95. The set containing only amphoteric oxides is

(A) ZnO, K_2O and SO_3
(B) SnO_2, Al_2O_3 and ZnO
(C) ZnO, P_2O_5 and Cl_2O_7
(D) PbO_2, SnO_2 and SO_3

96. Which of the following has more than one unshared pair of electrons on the central atom?

(A) BrF_5
(B) ClF_3
(C) NF_3
(D) IF_7

97. In metallurgical processes, aluminium acts as

(A) a reducing agent
(B) an oxidizing agent
(C) a flux
(D) a solder

98. Which of the following imparts violet colouration to the Bunsen burner non-luminous flame?

(A) NaCl
(B) $BaCl_2$
(C) $CaCl_2$
(D) KCl

99. The complex, which exhibit optical isomerism, is

(A) trans-$[Co(en)_2Cl_2]Cl$
(B) $[PtCl_2(NH_3)_2]$
(C) $[Co(en)_3]Cl_3$
(D) $[Fe(\eta^5\text{-}C_5H_5)_2]$

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100. Which of the following is π-acid ligand?

(A) NH_3
(B) CO
(C) F^-
(D) ethylenediammine

101. The magnetic moment of the complex ion, $[MnF_6]^{3-}$, is

(A) 1.73 BM
(B) 3.90 BM
(C) 4.90 BM
(D) 2.73 BM

102. Which of the following nuclides is most radioactive?

(A) $^{31}P_{15}$
(B) $^{66}Zn_{30}$
(C) $^{37}Cl_{17}$
(D) $^{108}Ag_{47}$

103. Which of the following is a not a green house gas?

(A) CO
(B) CO_2
(C) Water vapour
(D) CH_4

104. What type of orbital is designated for the set of quantum numbers: $n = 4$, $l = 2$, $m_l = -2$?

(A) 4 *p*
(B) 4 *f*
(C) 4 *d*
(D) 4 *s*

105. Which of the following sets of quantum numbers is not allowed?

(A) $n = 3$, $l = 2$, $m_l = -1$
(B) $n = 6$, $l = 2$, $m_l = -1$
(C) $n = 4$, $l = 3$, $m_l = -1$
(D) $n = 3$, $l = 0$, $m_l = +1$

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106. Ionic size decreases in the order

(A) $N^{3-} > O^{2-} > F^{-} > Na^{+} > Mg^{2+}$
(B) $N^{3-} > O^{2-} > F^{-} > Mg^{2+} > Na^{+}$
(C) $N^{3-} > F^{-} > O^{2-} > Na^{+} > Mg^{2+}$
(D) $O^{2-} > N^{3-} > F^{-} > Na^{+} > Mg^{2+}$

107. The $t_{1/2}$ of a radioisotope is 15 min. What percent of radioactivity of that isotope will remain after 45 min?

(A) 10%
(B) 12.5%
(C) 15%
(D) 17.5%

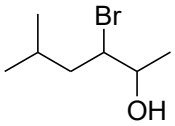
108. Water gas is a mixture of

(A) H_2O + air
(B) CO + H_2
(C) CO + CO_2
(D) H_2 + CO_2

109. Which category of synthetic detergents is used in toothpaste?

(A) Zwitterionic detergent
(B) Anionic detergent
(C) Cationic detergent
(D) Non-ionic detergent

110. The IUPAC name of the following compound is



(A) 4-bromo-5-hydroxy-2-methylhexane
(B) 1,4,4-trimethyl-2-bromobutanol
(C) 2-bromo-2-isobutyl-1-methylethanol
(D) 3-bromo-5-methylhexan-2-ol

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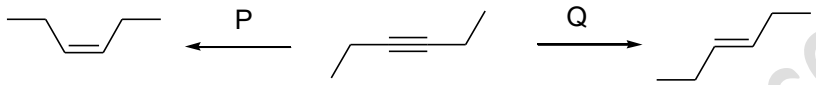
111. On complete combustion, 0.25 g of an organic compound gave 0.30 g of carbon dioxide and 0.10 g of water. The percentage compositions of carbon and hydrogen in the compound are

(A) C = 32.73 and H = 4.44
(B) C = 30.73 and H = 5.33
(C) C = 34.36 and H = 5.33
(D) C = 36.36 and H = 4.44

112. The reagents P and Q in the following transformations are



(A) P = H_2, Pd-$CaCO_3$, $Pb(OAc)_2$, quinoline & Q = Li, $NH_3(\ell)$
(B) P = H_2, Ni & Q = Na, $NH_3(\ell)$
(C) P = H_2, Pd-$CaCO_3$, $Pb(OAc)_2$, quinoline & Q = H_2, Ni
(D) P = $NaBH_4$ & Q = H_2, Pd-$CaCO_3$, $Pb(OAc)_2$, quinoline

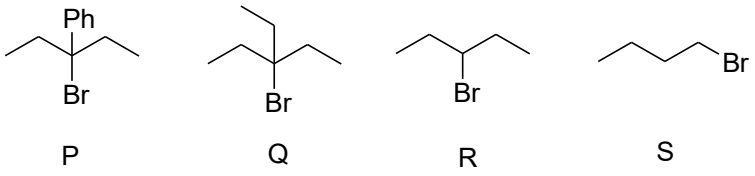
113. Which of the following alkenes forms acetone as the only product upon ozonolysis?

(A) 2-Methylpropene
(B) But-2-ene
(C) 2,3-Dimethylbut-2-ene
(D) 2-Methylbut-1-ene

114. When the nucleophile is changed from H_2O to ^{-}OH (^{-}OH is more powerful nucleophile than H_2O) in the nucleophilic substitution reaction of *tert*-butylbromide, to give *tert*-butanol

(A) the rate of the reaction remains nearly unaffected
(B) the rate of the reaction increases substantially
(C) the rate of the reaction decreases
(D) mechanism of substitution changes from S_N1 to S_N2

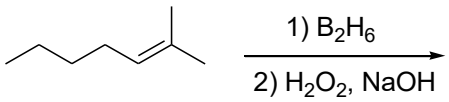
115. Which among the following compounds undergoes fastest S_N1 reaction?

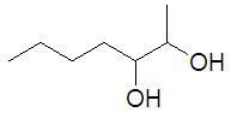


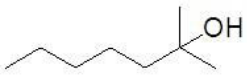
(A) P
(B) Q
(C) R
(D) S

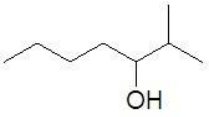
Only for reference. Do not copy

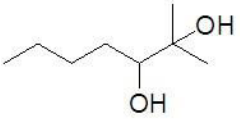
116. Major product of the following reaction is



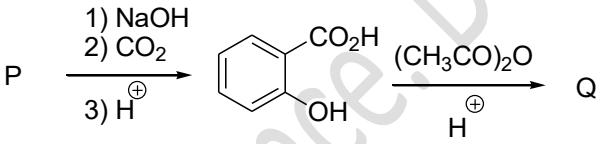
(A) 

(B) 

(C) 

(D) 

117. The starting material P and product Q in the following reaction are:



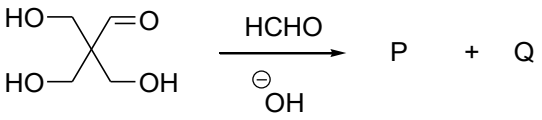
(A) P = phenol and Q = aspirin
(B) P = benzoic acid and Q = aspirin
(C) P = phenol and Q = methyl salicylate
(D) P = benzoic acid and Q = methyl salicylate

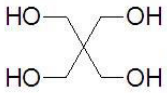
118. An organic compound P with molecular formula C_8H_8O forms an orange-red precipitate with 2,4-dinitrophenylhydrazine and yellow precipitate on heating with iodine in the presence of NaOH. It does not reduce Tollens' or Fehling's reagent and it does not decolorize bromine water. When treated with zinc-amalgam and con. HCl, it gives a compound Q with molecular formula C_8H_{10}. The compounds P and Q are

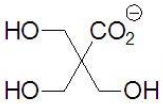
(A) P = acetophenone and Q = 1,2-dimethylbenzene (*o*-xylene)
(B) P = 2-phenylacetaldehyde and Q = ethylbenzene
(C) P = 4-methylbenzaldehyde and Q = 1,4-dimethylbenzene (*p*-xylene)
(D) P = acetophenone and Q = ethylbenzene

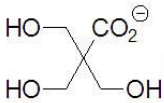
Only for reference, Do not copy

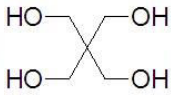
119. The products P and Q in the following reaction are



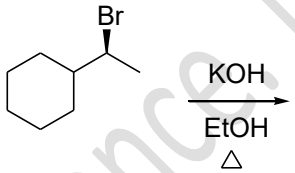
(A) P =  & Q = $HCO_2^{\ominus}$

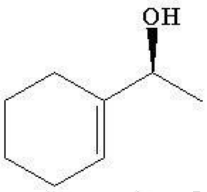
(B) P =  & Q = CH_3OH

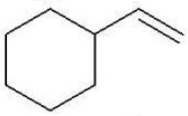
(C) P =  & Q = $HCO_2^{\ominus}$

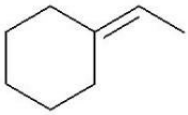
(D) P =  & Q = CH_3OH

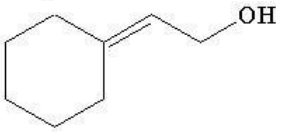
120. Major product formed in the following reaction is



(A) 

(B) 

(C) 

(D) 

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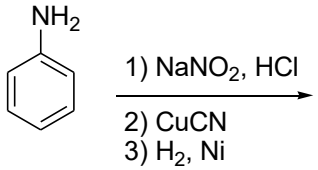
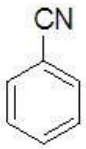
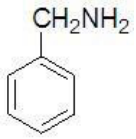
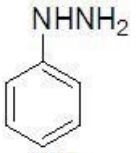
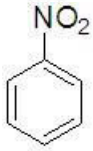
121. Major product formed in the following reaction sequence is



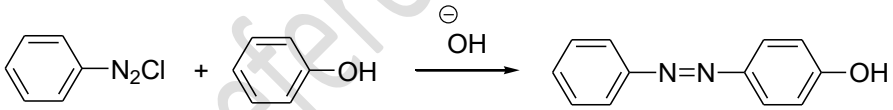
(A) 

(B) 

(C) 

(D) 

122. Consider the following reaction.



Here, benzene diazonium chloride acts as

(A) nucleophile
(B) electrophile
(C) Lewis base
(D) Bronsted base

123. The maximum number of dipeptides that could be made from the three different amino acids is

(A) 4
(B) 6
(C) 9
(D) 8

Only for reference. Do not copy

124. Which one of the following is an example for biodegradable polymers?

(A) Nylon 6
(B) Nylon 6,6
(C) Glyptal
(D) Nylon 2-nylon 6

125. Which among the following is not a detergent?

(A) Sodium laurylsulphate
(B) Sodium dodecylbenzenesulphonate
(C) cetyltrimethylammonium bromide
(D) calcium stearate

MATHEMATICS

126. The value of x, for which $\log_e(x-3) < 1$ lies in

(A) (0, 3)
(B) (0, e)
(C) (0, e + 3)
(D) (3, 3 + e)

127. The area bounded by the curve $y = \cos x$ between $x = \frac{-\pi}{2}$ and $x = \frac{3\pi}{2}$ is

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

128. The number of values of x satisfying is $\left(\sqrt{12}\right)^x + \left(\sqrt{3}\right)^x = \left(\sqrt{13}\right)^{x/2}$

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

129. If $f(x) = x(x+3)e^{-\left(\frac{1}{2}\right)x}$ satisfies Rolle's Theorem in $[-3, 0]$, then the value of c is

(A) –3
(B) –1
(C) 0
(D) –2

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130. Let $f(x) = ax^2 + bx + c$ and $a \neq 0$. Suppose $f(-1) < 1$, $f(1) > -1$ and $f(3) < -4$. Then

(A) b is an integer
(B) $b + 1 > 0$
(C) $b + 1 < 0$
(D) b is positive real

131. If $z = x + iy$ and x, y are real, then $|x| + |y| \leq k|z|$, where k is equal to

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

132. For any complex number z, the minimum value of $|z| + |z - 1| \geq$

(A) 1
(B) 0
(C) $\frac{1}{2}$
(D) $\frac{3}{2}$

133. Locus of the point z satisfying the equation $|iz - 1| + |z - i| = 2$ is

(A) a straight line
(B) a circle
(C) an ellipse
(D) a pair of straight lines

134. The value of $\left(\frac{1+i}{\sqrt{2}}\right)^8 + \left(\frac{1-i}{\sqrt{2}}\right)^8$ is equal to

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

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135. Number of elements of order 4 in the group $\left(Z_5 - \{[0]\}, \cdot_5\right)$ is

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

136. The equation of the ellipse whose axes are coincident with the coordinate axes and which touches the straight lines $3x - 2y - 20 = 0$ and $x + 6y - 20 = 0$ is

(A) $\frac{x^2}{5} + \frac{y^2}{8} = 1$
(B) $\frac{x^2}{8} + \frac{y^2}{5} = 1$
(C) $\frac{x^2}{40} + \frac{y^2}{10} = 1$
(D) $\frac{x^2}{10} + \frac{y^2}{40} = 1$

137. $\lim_{x \to 0} \frac{\sin 2x + 2\sin^2 x - 2\sin x}{\cos x - \cos^2 x}$ is equal to

(A) –4
(B) –2
(C) 2
(D) 4

138. Sum of *n* terms of the series $\sqrt{2} + \sqrt{8} + \sqrt{18} + \sqrt{32} + \ldots$ is equal to

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

Only for reference. Do not copy

139. If $f(x)$ is a function satisfying $f(x+y)=f(x).f(y)$ for all $x, y \in \square$ such that $f(1)=3$ and $\sum_{x=1}^{n} f(x)=120,$ then the value of n is

(A) 4
(B) 5
(C) 6
(D) 7

140. The sum of the series $1+2x+3x^2+4x^3+...$ up to infinity when x lies between 0 and 1 (i.e., $0<x<1$) is

(A) $\frac{1}{1+x}$
(B) $\frac{1}{1-x}$
(C) $\frac{1}{1-2x}$
(D) $\frac{1}{(1-x)^2}$

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

(A) 510
(B) 511
(C) 512
(D) 513

142. If $\sin\alpha,\ \cos\alpha$ are the roots of the equation $ax^2+bx+c=0\ (c\neq 0),$ then

(A) $a^2-b^2+2ac=0$
(B) $(a+c)^2=b^2-c^2$
(C) $a^2+b^2-ac=0$
(D) $(a-c)^2=b^2+c^2$

143. The positive value of $\sqrt{6+\sqrt{6+\sqrt{6+...\infty}}}$ is

(A) 3
(B) 6
(C) –2
(D) –4

Only for reference. Do not copy

144. If $\int_a^b f(x)dx = 5a + 3b,$ then $\int_a^b \big(f(x) + 10\big)dx$ is equal to

(A) $13b + 15a$
(B) $15a - 7b$
(C) $-5a - 5b$
(D) $13b - 5a$

145. The functions f and g are given by $f(x) = (x),$ where (x) denotes the fractional part of x and $g(x) = \frac{1}{2}\sin[x]\pi,$ where $[x]$ denotes the integral part of x. Then the range of $g \circ f$ is

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

146. If $\big(a^2 - 1\big)x^2 + (a-1)x + a^2 - 4a + 3 = 0$ is an identity in x, then the value of a is

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

147. The inequality $|z - i| < |z + i|$ represents the region

(A) $\text{Im}(z) > 0$
(B) $\text{Im}(z) < 0$
(C) $\text{Re}(z) > 0$
(D) $\text{Re}(z) < 0$

148. The total number of 9 digit numbers with different digits is

(A) 10!
(B) 9!
(C) 9.9!
(D) 10.10!

Only for reference. Do not copy

149. The sum of all the values of x satisfying the equation $\log_{17}\log_{11}\left(\sqrt{x+11}+\sqrt{x}\right)=0$ is

(A) 25
(B) 36
(C) 171
(D) 0

150. The number of five-digit telephone numbers having at least one of their digits repeated is

(A) 90000
(B) 100000
(C) 30240
(D) 69760

151. In a group of 8 girls, two of them are sisters. The number of ways in which the girls can sit so that two sisters are not sitting together is

(A) 34820
(B) 31410
(C) 30830
(D) 30240

152. The function $f:\square\to\square$ defined by $f(n)=\begin{cases}\dfrac{n-1}{2}, & \text{when } n \text{ is odd}\\ \dfrac{n}{2}, & \text{when } n \text{ is even}\end{cases}$

(A) is onto but not one-one
(B) is one-one and onto both
(C) is neither one-one nor onto
(D) is one-one but not onto

153. In the expansion of $\left(x-\dfrac{1}{x}\right)^6$, the constant term is

(A) 20
(B) –20
(C) 30
(D) –30

Only for reference. Do not copy

154. The sum of all three digit numbers which are even is

(A) 247050
(B) 247052
(C) 247048
(D) 247060

155. The value of n for which the determinant $\begin{vmatrix} \binom{8}{3} & \binom{9}{5} & \binom{10}{7} \\ \binom{8}{4} & \binom{9}{6} & \binom{10}{8} \\ \binom{9}{n} & \binom{10}{n+2} & \binom{11}{n+4} \end{vmatrix}$ becomes zero is

(A) 2
(B) 3
(C) 4
(D) 5

156. If $\sin\theta + \operatorname{cosec}\theta = 2,$ then $\sin^2\theta + \operatorname{cosec}^2\theta$ is equal to

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

157. If $x > 0,$ and $\log_2 x + \log_2\left(\sqrt{x}\right) + \log_2\left(\sqrt[4]{x}\right) + \log_2\left(\sqrt[8]{x}\right) + \ldots = 4,$ then x equals

(A) 2
(B) 3
(C) 4
(D) 5

158. If z and w are two non-zero complex number such that $|z| = |w|$ and $\arg z + \arg w = \pi,$ then z equals

(A) $\bar{w}$
(B) $-\bar{w}$
(C) w
(D) $-w$

Only for reference Do not copy

159. The number of different positive divisors of 2160 is

(A) 30
(B) 40
(C) 50
(D) 60

160. The maximum value of $f(x) = 4x^3 - 15x^2 + 12x - 2$ is

(A) $\frac{3}{4}$
(B) $-\frac{3}{4}$
(C) –6
(D) 6

161. If $\lim_{x \to 0}(1+ax)^{b/x} = e^4$, where a and b are natural numbers, then

(A) $a = 4,\ b = 2$
(B) $a = 8,\ b = 4$
(C) $a = 16,\ b = 8$
(D) $ab = 4$

162. In a ΔABC, if $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$ and the side $a = 2$, then area of the triangle is

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

163. $\lim_{x \to 0}\left(\frac{1+\tan x}{1+\sin x}\right)^{\operatorname{cosec} x}$ is equal to

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

Only for reference. Do not copy

164. The coefficient of x in $f(x)=\begin{vmatrix} x & 1+\sin x & \cos x \\ 1 & \log(1+x) & 2 \\ x^2 & 1+x^2 & 0 \end{vmatrix}$, $-1<x\le 1$, is

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

165. If $\cos A+\cos B+\cos C=3/2$, then the triangle is

(A) equilateral
(B) right angled
(C) isosceles
(D) with an angle 45°

166. The value of $1000\left[\frac{1}{1\times 2}+\frac{1}{2\times 3}+...+\frac{1}{999\times 1000}\right]$ is equal to

(A) 1000
(B) 999
(C) 1001
(D) $\frac{1}{999}$

167. The line $y=3x$ bisects the angle between the lines $ax^2+2axy+y^2=0$ if $a=$

(A) 3
(B) 11
(C) $3/11$
(D) $11/3$

168. If the locus of a point which moves so that the line joining the points of contacts of the tangents drawn from it to the circle $x^2+y^2=b^2$ touches the circle $x^2+y^2=a^2$, is the circle $x^2+y^2=c^2$, then a, b, c are in

(A) A.P.
(B) G.P.
(C) H.P.
(D) $a=b=c$

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169. If x satisfies the equation $x^2 - 2x\cos\theta + 1 = 0$, then the value of $x^n + 1/x^n$ is equal to

(A) $2^n \cos n\theta$
(B) $2^n \cos^n \theta$
(C) $2\cos n\theta$
(D) $2\cos^n \theta$

170. The sum of the series $\cos x - \frac{1}{2}\cos^2 x + \frac{1}{3}\cos^3 x - \frac{1}{4}\cos^4 x + \ldots$ is equal to

(A) $\log 2 + 2\log\left|\cos\left(\frac{x}{2}\right)\right|$
(B) $\log 2 - 2\log\left|\cos\left(\frac{x}{2}\right)\right|$
(C) $\log 2 + \log\left|\cos\left(\frac{x}{2}\right)\right|$
(D) $\log 2 - \log\left|\cos\left(\frac{x}{2}\right)\right|$

171. In a class of 100 students, there are 70 boys whose average marks in a subject is 75. If the average marks of the complete class is 72, then the average marks of the girls is

(A) 73
(B) 74
(C) 68
(D) 65

172. Whatever be the value of θ, the locus of the point of intersection of the lines $x\cos\theta + y\sin\theta = a$ and $x\sin\theta - y\cos\theta = b$ is

(A) an ellipse
(B) a straight line
(C) a circle
(D) a pair of straight lines

173. Let $f(x) = bx^2 + cx + d$. The values of b and c for which the identity $f(x+1) - f(x) = 8x + 3$ is satisfied, are

(A) $b = c,\ c = 1$
(B) $b = 4,\ c = -1$
(C) $b = -1,\ c = 4$
(D) $b = -1,\ c = 1$

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174. For a party 8 guests are invited by a husband and his wife. They sit around a circular table for dinner. The probability that the husband and his wife sit together is

(A) $2/7$
(B) $2/9$
(C) $1/9$
(D) $4/9$

175. The domain of real valued function $f(x) = \sqrt{\left(\log_{16} x^2\right)}$ of the real variable x is

(A) $x > 0$
(B) $|x| \geq 1$
(C) $|x| \geq 4$
(D) $x \geq 4$

176. The straight line $3x + y = 9$ divides the line segment joining the points (1, 3) and (2, 7) in the ratio

(A) 3 : 4 internally
(B) 3 : 4 externally
(C) 4 : 5 internally
(D) 5 : 6 externally

177. The value of $f(0)$ so that $f(x) = \dfrac{\left(4^x - 1\right)^3}{\sin\left(\dfrac{x}{4}\right)\log\left(1 + \dfrac{x^2}{3}\right)}$ is continuous everywhere, is equal to

(A) $3(\log 4)^3$
(B) $(\log 4)^3$
(C) $12(\log 4)^3$
(D) $15(\log 4)^3$

178. If $\log_{0.2}(x-2) < \log_{0.04}(x-2)$, then x lies in the interval

(A) $(3, \infty)$
(B) $(2, 3)$
(C) $(1, 2)$
(D) $(0, \infty)$

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179. A function $y = f(x)$ has a second order derivatives $f''(x) = 6(x-1)$. If its graph passes through the point (2, 1) and at that point the tangent to the graph is $y = 3x - 5$, then the function is

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

180. If $f(x) = \sin\dfrac{e^{x-2}-1}{\log(x-1)}$, then $\lim_{x\to 2} f(x)$ is given by

(A) –2
(B) –1
(C) 0
(D) 1

181. If a function *f* has the property that $f(x) + f(y) = f(x+y)$ for all real *x* and *y*, then $f(-x)$ is equal to

(A) 0
(B) 1
(C) $f(x)$
(D) $-f(x)$

182. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $|\vec{a}| = 3$, $|\vec{b}| = 4$ and $|\vec{c}| = \sqrt{37}$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) $\dfrac{\pi}{4}$
(B) $\dfrac{\pi}{2}$
(C) $\dfrac{\pi}{6}$
(D) $\dfrac{\pi}{3}$

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183. For two data sets, each of size 5, the variances are given to be 4 and 5 and the corresponding means are given to be 2 and 4, respectively. The variance of the combined data set is

(A) $5/2$
(B) $11/2$
(C) 6
(D) $13/2$

184. If a function is defined by $f(x)=\begin{cases} x, & \text{when } x \text{ is rational} \\ -x, & \text{when } x \text{ is irrational} \end{cases}$.

Then

(A) f is continuous at every x, except $x = 0$
(B) f is discontinuous at every x, except $x = 0$
(C) f is continuous at everywhere
(D) f is discontinuous at everywhere

185. Let $f(x)=(x-x_0)g(x)$ where $g(x)$ is continuous at x_0, then $f'(x_0)$ is equal to

(A) 0
(B) x_0
(C) $g(x_0)$
(D) $g'(x_0)$

186. If $u=\sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$, then $\left[x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}\right]=$

(A) u
(B) $\sin u$
(C) $\tan u$
(D) 1

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187. If SD of variate x is σ, then the SD of $\frac{ax+b}{p}$, $\forall a,b,\ p \in R$ is

(A) $\left|\frac{a}{p}\right|\sigma_x$

(B) $\left|\frac{p}{a}\right|\sigma_x$

(C) $\frac{p}{a}\sigma_x$

(D) σ_x

188. If $z = xyf\left(x/y\right)$, then $\left[x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y}\right] =$

(A) z

(B) 0

(C) $1/z$

(D) $2z$

189. If $f(x,y) = \ln\left(x\tan^{-1} y\right)$, then $f_{xy} =$

(A) $-\frac{1}{x^2}$

(B) 0

(C) $\frac{1}{x^2}$

(D) y

190. The ratio in which $\hat{i} + 2\hat{j} + 3\hat{k}$ divides the join of $-2\hat{i} + 3\hat{j} + 5\hat{k}$ and $7\hat{i} - \hat{k}$ is

(A) 1 : 2

(B) 2 : 3

(C) 3 : 4

(D) 1 : 4

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191. In a binomial distribution $B(n, p = 1/4)$ if the probability of at least one success is greater than or equal to $9/10$, then n is greater than

(A) $\dfrac{1}{\log_{10} 4 - \log_{10} 3}$

(B) $\dfrac{1}{\log_{10} 4 + \log_{10} 3}$

(C) $\dfrac{9}{\log_{10} 4 - \log_{10} 3}$

(D) $\dfrac{4}{\log_{10} 4 - \log_{10} 3}$

192. The angle of intersection of the curves $y = x^2$ and $6y = 7 - x^3$ at (1, 1) is

(A) $\pi/4$

(B) $\pi/3$

(C) $\pi/2$

(D) π

193. The transformed equation of $3x^2 + 3y^2 + 2xy = 2$, when the coordinate axes are rotated through an angle of 45°, is

(A) $x^2 + 2y^2 = 1$

(B) $2x^2 + y^2 = 1$

(C) $x^2 + y^2 = 1$

(D) $x^2 + 3y^2 = 1$

194. If orthocenter and circumcentre of a triangle are respectively (1, 1) and (3, 2), then the coordinates of its centroid are

(A) $\left(\frac{7}{3}, \frac{5}{3}\right)$

(B) $\left(\frac{5}{3}, \frac{7}{3}\right)$

(C) (7, 5)

(D) (5, 7)

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195. If the curves $y^2 = 16x$ and $9x^2 + by^2 = 16$ cut each other at right angles, then the value of b is

(A) 2
(B) 4
(C) $9/2$
(D) 0

196. The term independent of x in the expansion of $(1+x)^3\left(x-\frac{1}{x}\right)^6$ is

(A) 25
(B) –25
(C) 65
(D) –65

197. The area of the triangle formed by the tangent and the normal to the parabola $y^2 = 4ax$, both drawn at the same end of the latuscrectum and the axis of the parabola is

(A) $2\sqrt{2}a^2$
(B) $2a^2$
(C) $4a^2$
(D) $4a$

198. If the straight lines $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ intersect on the $x-$ axis, then

(A) $ag = fh$
(B) $ah = fg$
(C) $af = gh$
(D) $a = ghf$

199. The median of a set of 9 distinct observations is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set

(A) is decreased by 2
(B) is two times the original median
(C) remains the same as that of the original set
(D) is increased by 2

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200. The function $f : R \to R$ be defined by $f(x) = 2x - 7$ for all $x \in R$. Then f is

(A) injective but not surjective
(B) surjective but not injective
(C) neither injective nor surjective
(D) bijective

201. If $f(x) = \begin{cases} x, & \text{when } x \text{ is rational} \\ 1-x, & \text{when } x \text{ is irrational} \end{cases}$,

then

(A) f is differentiable for all real x
(B) f is continuous for all real x
(C) f is continuous only at $x = \frac{1}{2}$
(D) f is discontinuous for all real x

202. A square is inscribed in the circle $x^2 + y^2 - 2x + 4y + 3 = 0$. Its sides are equal to the coordinate axes. Then one vertex of the square is

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

203. The centre of the circle which circumscribes the square formed by $x^2 - 8x + 12 = 0$ and $y^2 - 14y + 45 = 0$ is

(A) (3, 7)
(B) (4, 7)
(C) (2, 5)
(D) (6, 9)

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204. The radius of the circle touching the straight lines $x-2y-1=0$ and $3x-6y+7=0$, is

(A) $\frac{3}{\sqrt{5}}$

(B) $\frac{\sqrt{5}}{3}$

(C) $\sqrt{5}$

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

205. ABC is an isosceles triangle and the coordinates of the base are $B(1,3)$ and $C(-2,7)$. Then the coordinates of vertex A can be

(A) $(1, 6)$

(B) $(1/2, 5)$

(C) $(5/6, 6)$

(D) $(-8, 1/8)$

206. The function $f(x)=(3-x)e^{2x}-4xe^{x}-x$ has

(A) a maximum at $x=0$

(B) a minimum at $x=0$

(C) neither a maximum nor a minimum at $x = 0$

(D) $f(x)$ is not differentiable at $x=0$

207. In an arranged discrete series in which total number of observations 'n' is even, then the median is

(A) $\frac{n}{2}^{\text{th}}$ item

(B) $\left(\frac{n}{2}+1\right)^{\text{th}}$ item

(C) The mean of $\frac{n}{2}^{\text{th}}$ and $\left(\frac{n}{2}+1\right)^{\text{th}}$ item

(D) n

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208. The number of solutions of $\tan^{-1}\sqrt{x(x+1)}+\sin^{-1}\sqrt{x^2+x+1}=\pi/2$ is

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

209. A ladder rest against a wall at an angle α to the horizontal. Its foot is pulled away from the wall through a distance a so that it slides a distance b down wall making an angle β with the horizontal, then $\tan(\alpha+\beta)$ is equal to

(A) $\frac{a}{b}$
(B) $\frac{b}{a}$
(C) $\frac{2ab}{a^2-b^2}$
(D) $\frac{2ab}{b^2-a^2}$

210. Area bounded by the curve $y=\log x,\ y=0$ and $x=e$ is given by

(A) e
(B) $e/2$
(C) 1
(D) ∞

211. The line $y=2t^2$ intersects the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ in real points, if

(A) $|t|\le 1$
(B) $|t|<1$
(C) $|t|>1$
(D) $|t|\ge 1$

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212. A man standing on level plane observer the angle of elevation of top of a pole to be α. He walks, a distance equal to double the height of the pole and finds that elevation is 2α. Then α is equal to

(A) $\pi/12$
(B) $\pi/6$
(C) $\pi/4$
(D) $\pi/3$

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

(A) 1
(B) 2
(C) ∞
(D) 0

214. The domain of $f(x) = \cos^{-1}(2x)$ is

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

215. If $y = \sqrt{x \log_x x}$, then $\frac{dy}{dx}$ at $x = e$ is

(A) $\frac{1}{e}$
(B) $\frac{1}{\sqrt{e}}$
(C) $\sqrt{e}$
(D) e

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216. The area enclosed between the curves $y^2 = x$ and $y = |x|$ is

(A) $2/3$ sq unit
(B) 1 sq unit
(C) $1/6$ sq unit
(D) $1/3$ sq unit

217. If y is a function of x and $\log(x+y) - 2xy = 0$, then the value of $y'(0)$ is equal to

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

218. If $x^2 + y^2 = t - \frac{1}{t}$ and $x^4 + y^4 = t^2 + \frac{1}{t^2}$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{1}{x^2 y^3}$
(B) $\frac{1}{xy^3}$
(C) $\frac{1}{x^2 y^2}$
(D) $\frac{1}{x^3 y}$

219. The set of points where $f(x) = \frac{x}{1+|x|}$ is differentiable are in

(A) $(0, \infty)$
(B) $(-\infty, 0) \cup (0, \infty)$
(C) $(-\infty, -1) \cup (-1, \infty)$
(D) $(-\infty, \infty)$

220. If $f(x+y) = 2f(x)f(y)$, $f'(5) = 1024(\log 2)$ and $f(2) = 8$, then the value of $f'(3)$ is equal to

(A) 64(log 2)
(B) 128(log 2)
(C) 256(log 2)
(D) 1024(log 2)

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221. General solution of the equation $\sin x - 3\sin 2x + \sin 3x = \cos x - 3\cos 2x + \cos 3x$ is

(A) $n\pi + \frac{\pi}{2}$

(B) $(-1)^n \frac{n\pi}{2} + \frac{\pi}{8}$

(C) $2n\pi + \cos^{-1}\frac{2}{3}$

(D) $\frac{n\pi}{2} + \frac{\pi}{8}$

222. Domain of the function $f(x) = \sqrt{\log_{10}\left(\frac{5x - x^2}{4}\right)}$ is

(A) $0 \le x \le 5$
(B) $1 \le x \le 4$
(C) $1 \le x \le 5$
(D) $0 \le x \le 4$

223. The domain of the function $f(x) = x^{\frac{1}{\log x}}$ is

(A) $(0,\infty) - \{1\}$
(B) $(0,\infty)$
(C) $[0,\infty)$
(D) $[0,\infty) - \{1\}$

224. The function $f(x) = \frac{\sec^{-1} x}{\sqrt{x - [x]}}$, where $[x]$ denotes the greatest integer less than or equal to x is defined for all x belonging to

(A) $\square$
(B) $\square^+ - (0,1)$
(C) $\square^+ - \{n \mid n \text{ is an integer}\}$
(D) $\square - \{(-1,1) \cup \{n \mid n \text{ is an integer}\}\}$

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225. For the function $f(x) = e^{\cos x}$, Rolle's Theorem is

(A) applicable when $0 \le x \le \frac{\pi}{2}$

(B) applicable when $\frac{\pi}{2} \le x \le \frac{3\pi}{2}$

(C) applicable when $\frac{\pi}{4} \le x \le \frac{\pi}{2}$

(D) applicable when $0 \le x \le \pi$

226. If $f(x) = -x \tan x$, then the function $f(x)$ is

(A) monotonically increasing in $\left(0, \frac{\pi}{2}\right)$

(B) monotonically decreasing in $\left(0, \frac{\pi}{2}\right]$

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

(D) not monotonic in $\left(0, \frac{\pi}{2}\right)$

227. Ram is visiting a friend. Ram knows that his friend has 2 children and 1 of them is a boy. Assuming that a child is equally likely to be a boy or a girl, then the probability that the other child is a girl, is

(A) 1/3
(B) 1/2
(C) 2/9
(D) 2

228. Let $f(x) = 2x^2 + 5x + 1$. If we write $f(x)$ as
$f(x) = a(x+1)(x-2) + b(x-2)(x-1) + c(x-1)(x+1)$ for real numbers a, b, c, then

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

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229. If the function $f:\square \to \square$ is defined by $f(x)=\left(x^2+1\right)^{10}$, for all $x\in\square$, then f is

(A) one-one but not onto
(B) onto but not one-one
(C) neither one-one nor onto
(D) both one-one and onto

230. $\lim_{x\to 1}\left(\frac{1+x}{2+x}\right)^{\frac{1-\sqrt{x}}{1-x}}$ is

(A) 1
(B) $\sqrt{\frac{2}{3}}$
(C) does not exist
(D) 2

231. A function $f(x)$ is defined as follows for real x, $f(x)=\begin{cases}1-x^2, & \text{for } x<1\\ 0, & \text{for } x=1\\ 1+x^2, & \text{for } x>1\end{cases}$.

Then

(A) $f(x)$ is not continuous at $x = 1$
(B) $f(x)$ is continuous but not differentiable at $x = 1$
(C) $f(x)$ is both continuous and differentiable $x = 1$
(D) f is a constant function

232. The greatest value of $f(x)=(x+1)^{1/3}-(x-1)^{1/3}$ on [0, 1] is

(A) 0
(B) 1
(C) 2
(D) −1

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233. $\int\left(\frac{(\log x-1)}{1+(\log x)^2}\right)^2 dx$ is equal to

(A) $\frac{x}{(\log x)^2+1}+c$

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

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

(D) $\frac{\log x}{(\log x)^2+1}+c$

234. The value of $\int x\left(x^x\right)^x(2\log x+1)dx$ is

(A) $\left(x^x\right)^x+c$

(B) x^x+c

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

(D) $\left(x^{\log x}\right)^x+c$

235. The value of $\int_{-\pi/2}^{\pi/2}\log\left(\frac{2-\sin\theta}{2+\sin\theta}\right)d\theta$ is

(A) 0

(B) 1

(C) 2

(D) 3

236. If a,b,c are different and $\begin{vmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{vmatrix}=0,$ then

(A) $a+b+c=0$

(B) $abc=1$

(C) $a+b+c=1$

(D) $ab+bc+ca=0$

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237. If $f(x)=\begin{vmatrix}\cos x & 1 & 0\\ 1 & 2\cos x & 1\\ 0 & 1 & 2\cos x\end{vmatrix}$, then $\int_0^{\pi/2} f(x)dx =$

(A) 1/3
(B) 1/4
(C) 1/2
(D) 0

238. Set *A* has 3 elements and set *B* has 4 elements. The number of injections that can be defined from *A* to *B* is

(A) 144
(B) 12
(C) 24
(D) 64

239. The value of $\int_0^a \sqrt{\frac{a-x}{x}}dx$ is

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

240. Which of the following is an even function?

(A) $f(x)=\frac{a^x+a^{-x}}{a^x-a^{-x}}$
(B) $f(x)=\frac{a^x+1}{a^x-1}$
(C) $f(x)=x\left(\frac{a^x-1}{a^x+1}\right)$
(D) $f(x)=\log_2\left(x+\sqrt{x^2+1}\right)$

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241. From 6 different novels and 3 different dictionaries, 4 novels and 1 dictionary are to be selected and arranged in a row on a shelf so that the dictionary is always in the middle. Then the number of such arrangements is

(A) at least 750 but less than 1000
(B) at least 1000
(C) at least 500 but less than 750
(D) less than 500

242. A ball weighting 0.01 kg hits a head surface vertically with a speed of 5 m/sec and rebounds with the same speed. The ball remains in contact with the surface for 0.01 sec. The average force exerted by the surface on the ball in Newton is

(A) 0.1
(B) 1.0
(C) 5.0
(D) 10.0

243. If the constant term in the expansion of $\left(\sqrt{x}-\frac{k}{x^2}\right)^{10}$ is 405, then k is

(A) ± 2
(B) $\pm\sqrt[4]{3}$
(C) ± 3
(D) $\pm\sqrt[3]{4}$

244. $\log_7 \log_7 \sqrt{7\sqrt{7\sqrt{7}}}$ is equal to

(A) $3\log_2 7$
(B) $\log_7 2$
(C) $1-3\log_7 2$
(D) $1-3\log_2 7$

245. The equation of the sphere with centre at $(2,3,-4)$ and touching the plane $2x+6y-3z+15=0$ is

(A) $x^2+y^2+z^2-4x-6y+8z-20=0$
(B) $x^2+y^2+z^2+4x-6y-8z-20=0$
(C) $x^2+y^2+z^2-4x-6y+8z+20=0$
(D) $x^2+y^2+z^2+4x+6y+8z+20=0$

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246. If $y = \tan^{-1}\left(\frac{\sqrt{a}-\sqrt{x}}{1+\sqrt{ax}}\right)$, then $\frac{dy}{dx} =$

(A) $\frac{1}{2(1+x)\sqrt{x}}$

(B) $\frac{1}{(1+x)\sqrt{x}}$

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

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

247. The distance x covered by a particle moving in a straight line in time t is given by the relation $2x^2 + 3x = t$. If v is the velocity of the particle in time t, then its acceleration at time t is

(A) $-2v^3$
(B) $-4v^3$
(C) $-2v^2$
(D) $-3v^3$

248. If the difference between mean and mode is 63, the difference between mean and median is:

(A) 189
(B) 21
(C) 31.5
(D) 485

249. A function $f : \square \to \square$ is given by $f(x) = \begin{cases} px+q, & \text{when } x > 2 \\ 2px-3q+1, & \text{when } x < 2 \end{cases}$.

If $\lim_{x\to 2} f(x)$ exists, then the relation between p and q is

(A) $2p - 2q = 1$
(B) $2p - 3q = 1$
(C) $3q - 2p = 1$
(D) $4q - 2p = 1$

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250. Let $f:\square \to \square$, $g:\square \to \square$, be continuous functions. Then the value of the integral $\int_{-\pi/2}^{\pi/2} \{f(x)+f(-x)\}\{g(x)-g(-x)\}\,dx$ is

(A) π
(B) 1
(C) -1
(D) 0

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FINAL ANSWER KEY

Subject Name: 101 B TECH 18-S2

SI No.	Key	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	B	31	A	61	D	91	A	121	B	151	D	181	D	211	A	241	B
2	A	32	D	62	B	92	C	122	B	152	C	182	D	212	A	242	D
3	B	33	A	63	C	93	D	123	C	153	B	183	B	213	B	243	C
4	C	34	A	64	D	94	B	124	D	154	A	184	B	214	D	244	C
5	B	35	B	65	A	95	B	125	D	155	C	185	C	215	B	245	A
6	B	36	A	66	C	96	B	126	D	156	C	186	C	216	C	246	C
7	C	37	D	67	C	97	A	127	D	157	C	187	A	217	A	247	B
8	D	38	D	68	A	98	D	128	D	158	B	188	D	218	D	248	B
9	B	39	A	69	D	99	C	129	D	159	B	189	B	219	D	249	D
10	A	40	A	70	C	100	B	130	B	160	A	190	A	220	A	250	D
11	D	41	C	71	D	101	C	131	B	161	D	191	A	221	D		
12	D	42	D	72	C	102	D	132	A	162	D	192	C	222	B		
13	B	43	B	73	D	103	A	133	A	163	A	193	B	223	A		
14	D	44	A	74	D	104	C	134	D	164	B	194	A	224	D		
15	C	45	B	75	A	105	D	135	B	165	A	195	C	225	B		
16	A	46	D	76	C	106	A	136	C	166	B	196	A	226	C		
17	B	47	C	77	C	107	B	137	D	167	C	197	C	227	B		
18	B	48	C	78	B	108	B	138	C	168	B	198	C	228	C		
19	C	49	A	79	D	109	B	139	A	169	C	199	C	229	C		
20	B	50	D	80	D	110	D	140	D	170	A	200	D	230	B		
21	B	51	B	81	A	111	A	141	D	171	D	201	C	231	A		
22	B	52	C	82	C	112	A	142	A	172	C	202	D	232	C		
23	A	53	A	83	C	113	C	143	A	173	B	203	B	233	A		
24	D	54	B	84	B	114	A	144	D	174	B	204	B	234	A		
25	B	55	C	85	C	115	A	145	B	175	B	205	C	235	A		
26	B	56	B	86	C	116	C	146	A	176	A	206	C	236	B		
27	A	57	A	87	A	117	A	147	A	177	C	207	C	237	A		
28	C	58	D	88	A	118	D	148	C	178	A	208	B	238	C		
29	B	59	D	89	B	119	A	149	A	179	A	209	D	239	D		
30	A	60	C	90	D	120	C	150	D	180	D	210	C	240	C		

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