Test in Physics Chemistry and Mathematics (Shift 1)

1. Force between two charges is given by

   (A) $\dfrac{Qq}{4\pi\varepsilon_0 r^2}$

   (B) $\dfrac{Qq}{4\pi\varepsilon_0 r^3}$

   (C) $\dfrac{Qq}{4\pi\varepsilon_0 r}$

   (D) Zero

2. Which quantity is same when resistances are connected in parallel?

   (A) Current
   (B) Potential difference and Current
   (C) Potential difference
   (D) Capacitance

3. How much power is dissipated when 2 A current passes through a wire of 10 Ohm resistance?

   (A) 40 watt
   (B) 30 watt
   (C) 20 watt
   (D) 10 watt

4. Magnetic field is produced by

   (A) rest charge alone
   (B) moving charge alone
   (C) moving charge with intrinsic magnetic moment
   (D) intrinsic magnetic moment alone

5. Which magnetism shows Curie temperature?

   (A) Diamagnetism
   (B) Paramagnetism
   (C) Ferromagnetism
   (D) Ferrimagnetism

6. Inconsistency of Ampere's circuit law is due to

   (A) standard current
   (B) flow of current
   (C) displacement current
   (D) zero current

7. What are the components present in electromagnetic waves?

   (A) Electric field
   (B) Electric field and velocity
   (C) Magnetic field
   (D) Electric field and Magnetic field

8. Which radiation is having higher energy in electromagnetic spectrum?

   (A) X-ray
   (B) Gamma ray
   (C) Microwave
   (D) Radio wave

9. What is the frequency of LC circuit?

   (A) $\dfrac{1}{2\pi\sqrt{LC}}$

   (B) $\dfrac{1}{2\pi LC}$

   (C) $2\pi\sqrt{LC}$

   (D) $2\pi LC$

10. If the focal length of a lens is 2 cm, then its power is

    (A) 3 dioptre
    (B) 0.4 dioptre
    (C) 0.7 dioptre
    (D) 0.5 dioptre

11. The angle of incidence at which reflected light is totally polarised for reflection from air to glass (refractive index n), is

(A) $\tan^{-1}(1/n)$

(B) $\sin^{-1}(1/n)$

(C) $\sin^{-1}(n)$

(D) $\tan^{-1}(n)$

12. The number of electron in M shell is limited to

(A) 2
(B) 10
(C) 18
(D) 32

13. Which of the following ray is emitted during the radioactive decay process?

(A) Alpha ray
(B) Gamma Ray
(C) Beta ray
(D) All the above

14. Formation of shadows can be explained by

(A) rectilinear propagation of light
(B) curvilinear propagation of light
(C) the total internal reflection
(D) refraction

15. When the temperature of the semiconductor is increased, its

(A) resistivity increases
(B) charge carrier reduces
(C) conductivity increases
(D) temperature coefficient becomes zero

16. Which of the following is an active device?

(A) Electric bulb
(B) Transformer
(C) Silicon controlled rectifier
(D) Loud speaker

17. The material suitable for making electromagnets should have

   (A) high retentivity and high coercivity
   (B) low retentivity and low coercivity
   (C) high retentivity and low coercivity
   (D) low retentivity and high coercivity

18. A carbon resistor has color code as Brown, Black, Blue and Silver. The resistance and tolerance values are

   (A) $10 \ M\Omega \ \pm 10\%$
   (B) $20 \ M\Omega \ \pm 5\%$
   (C) $10 \ M\Omega \ \pm 5\%$
   (D) $20 \ k\Omega \ \pm 10\%$

19. Which unit is appropriate for specifying magnetic induction?

   (A) Tesla

   (B) V/m

   (C) A/m^2

   (D) Henry

20. Two particles *A* and *B* initially at rest move towards each other by mutual forces of attraction. At an instant when the speed of *A* is *V* and the speed for *B* is 2 *V*, then the speed of centre of mass is

   (A) 1 *V*
   (B) 2 *V*
   (C) 3 *V*
   (D) Zero

21. The blue colour of the sky is due to

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

22. Which of the following statements is wrong?

   (A) Sound travels in a straight line
   (B) Sound travels as waves
   (C) Sound is a form of energy
   (D) Sound travels faster in vacuum than that in air

23. A proton and an electron are accelerated through the same accelerating potential. Which one of these two has the greater momentum?

    (A) Proton
    (B) Electron
    (C) Equal momentum
    (D) Zero momentum

24. In a circuit containing inductor and resistor, as the frequency of the applied alternating current increases, the impedance

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

25. How many electron flow per second in 1 Ampere of current?

    (A) 6.25×10^{18}

    (B) 6×10^{18}

    (C) 1.6×10^{19}

    (D) 1.6×10^{23}

26. If copper and silicon are heated, then their resistance will

    (A) increase and decrease respectively
    (B) increase and increase respectively
    (C) decrease and increase respectively
    (D) decrease and decrease respectively

27. The unit of Universal Gravitational constant is

    (A) Nm^2/kg^2

    (B) Nm/kg^2

    (C) Unit less

    (D) m/s^2

28.   Adiabatic expansion of a gas results in

      (A)   heating
      (B)   cooling
      (C)   no change in temperature
      (D)   initial cooling and then heating

29.   The function of the moderator in the nuclear reactor is to

      (A)   decrease the speed of neutron
      (B)   increase the speed of neutron
      (C)   fuel the reactor
      (D)   increase the temperature of the reactor

30. $\int \dfrac{dx}{\sqrt{2ax - x^2}} = a^n \sin^{-1}\left(\dfrac{x}{a} - 1\right)$, then the value of n is

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

31.   A raindrop falls near the surface of the earth with almost uniform velocity because

      (A)   its weight is negligible
      (B)   the force of surface tension balances its weight
      (C)   the force of viscosity of air balances its weight
      (D)   the drops are charged and atmospheric electric field balances its weight

32.   The susceptibility of magnesium at 300 K is 1.2×10^{-5}. At what temperature will the susceptibility increase to 1.8×10^{-5}?

      (A)   400 K
      (B)   300 K
      (C)   600 K
      (D)   200 K

33. A convex lens is placed 8 cm from a light source and it makes a sharp image on a screen, kept 8 cm from the lens. Now a glass block (refractive index 1.5) of 1.2 cm thickness is placed in contact with the light source. To get the sharp image again, the screen is shifted by a distance d. Then d is

    (A) 0.44 cm towards the lens
    (B) 1.6 cm away from the lens
    (C) 0.44 cm away from the lens
    (D) 0

34. The resistance of 3 Ω and 6 Ω are joined in series are connected across a battery of emf 10 V and internal resistance 1 Ω. The power dissipated by the battery is

    (A) 3 W
    (B) 8 W
    (C) 9 W
    (D) 10 W

35. Consider two light sources of wavelength λ_1 and λ_2 ($\lambda_2 > \lambda_1$) which are emitting n_1 and n_2 photons respectively, in a given time. Assume equal power for both sources, then

    (A) $n_1 > n_2$

    (B) $n_1 < n_2$

    (C) $n_1 = n_2$

    (D) None of the above

36. As the orbit number increases, the distance between two consecutive orbits in an atom

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

37. For audible sound, the time interval between two words should be

    (A) 0.1 s
    (B) 3 s
    (C) 0.4 s
    (D) 2 s

38. If S is stress and Y is Young's modulus of material of a wire, the energy stored in the wire per unit volume is

(A) $2S^2Y$

(B) $S^2/2Y$

(C) $2Y/S^2$

(D) $S/2Y$

39. If a charge Q is to be divided into two parts q and $(Q – q)$, such that the force between them is maximum at a certain distance, then the value of q must be

(A) $Q/3$
(B) $Q/2$
(C) $Q/4$
(D) $3Q/4$

40. If the electric field in a region of space is given by $5\mathbf{i} + 4\mathbf{j} + 9\mathbf{k}$. The electric flux through a surface of area 20 units lying in the y-z plane is

(A) 100 units
(B) 4 units
(C) 500 units
(D) 44 units

41. A 25 Watt -220 V bulb and 100 Watt-220 V bulb are connected in series across 220 V line. Which bulb will glow more brightly?

(A) 25 Watt bulb
(B) 100 Watt bulb
(C) Both will glow with equal brightness
(D) Each bulb will glow bright alternatively

42. A proton is projected horizontally eastward in a uniform magnetic field which is horizontal and southward in direction. The proton will be deflected

(A) upward
(B) downward
(C) southward
(D) northward

43. Two long parallel wires separated by a distance 'r' have equal current 'I' flowing in each. The magnetic field of one exerts a force 'F' on the other. If the distance between them is doubled and the current in each wire is halved, the force between them will become

   (A) 4 F
   (B) unchanged
   (C) F / 4
   (D) F / 8

44. The magnetic field energy in an inductor changes from maximum value to minimum value in 2.5 ms, when connected to an AC source. The frequency of the source is

   (A) 100 Hz
   (B) 400 Hz
   (C) 50 Hz
   (D) 25 Hz

45. Alternating current / e.m.f measuring instrument measures its

   (A) peak value
   (B) r.m.s value
   (C) average value
   (D) square of current and voltage

46. In vacuum, the speed of electromagnetic waves depend up on

   (A) wavelength
   (B) frequency
   (C) electric and magnetic field
   (D) None of the above

47. A convex mirror has a focal length 'f'. A real object placed at a distance 'f' in front of it from the pole produces an image at

   (A) infinity
   (B) f
   (C) f/2
   (D) 2f

48. The refracting angle of a prism is A and refractive index of the material of the prism is cot A/2. Then, the angle of minimum deviation is

(A) 180 – 3A
(B) 180 + 2A
(C) 90 – A
(D) 180 – 2A

49. Which one of the following cannot be polarised?

(A) Radio waves
(B) Ultraviolet rays
(C) Infrared rays
(D) Ultrasonic waves

50. Threshold wavelength for a metal having work function φ_0 is λ. What is the threshold wavelength for the metal having work function $\varphi_0/2$?

(A) 4λ
(B) 2λ
(C) λ
(D) $\lambda/2$

51. Bohr's atomic model cannot explain

(A) quantization of the angular momentum of the orbiting electrons
(B) emission of photon due to the transition of electron from one orbit to other
(C) intensity of spectral lines
(D) spectral series of hydrogen like atom

52. The process underlying β-decay is the

(A) conversion of neutron to proton
(B) conversion of proton to neutron
(C) emission of gamma rays
(D) emission of helium nucleus

53. A sample of radioactive element has a mass of 10 gm at an instant t = 0. The approximate mass of the element in the sample after two mean lives is

(A) 2.5 gm
(B) 3.7 gm
(C) 6.30 gm
(D) 1.35 gm

54. A potential difference of V is applied at the ends of a copper wire of length 'l' and diameter 'd'. On doubling the 'd' value , the drift velocity

(A) becomes two times
(B) becomes half
(C) becomes one fourth
(D) does not change

55. If a resistance is introduced in series with the cell in the secondary circuit of a potentiometer, the balancing length

(A) increases
(B) decreases
(C) remains the same
(D) cannot be found

56. A vernier calliper has its main scale of 10 cm equally divided into 200 equal parts. Its vernier scale of 25 divisions coincides with 12 mm on the main scale. The least count of the instrument is

(A) 0.020 cm
(B) 0.002 cm
(C) 0.010 cm
(D) 0.001 cm

57. A body starts from rest and with a uniform acceleration of 10 ms^{-2} for 5 seconds. During the next 10 seconds, it moves with uniform velocity. The total distance traveled by the body is

(A) 100 m
(B) 125 m
(C) 500 m
(D) 625 m

58. Two capacitors of equal capacity are first connected in parallel and then in series. The ratio of the total capacities in the two cases will be

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

59. The strength of the magnetic field of a vibration magnetometer is increased to 4 times its original value. The frequency of oscillation of the magnet would then become

(A) twice
(B) four times
(C) half
(D) one-fourth

60. An endoscope is employed by a physician to view the internal parts of a body organ. It is based on the principle of

(A) refraction
(B) reflection
(C) total internal reflection
(D) dispersion

61. What will be the direction in the following reaction upon increasing pressure of the system?

$$N_2O_4 \text{ (g)} \rightleftharpoons 2NO_2\text{(g)}$$
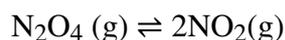
(A) Formation of N_2O_4 favored

(B) Formation of NO_2 favored

(C) No change in reaction

(D) Increase in equilibrium constant

62. When solid NH_4Cl is added to NH_4OH solution, the equilibrium shifts to the left, due to

(A) common ion effect
(B) buffer formation
(C) neutralization
(D) keep pH constant

63. The obtained slope in the Arrhenius plot of $\log k$ Vs $\dfrac{1}{T}$ is equal to

    (A) $\dfrac{E_a}{R}$

    (B) $-\dfrac{E_a}{R}$

    (C) $\dfrac{E_a}{(2.303)R}$

    (D) $-\dfrac{E_a}{(2.303)R}$

64. If the first order rate constant for a reaction is $6.93 \times 10^{-4}\ s^{-1}$, calculate the half life for the reaction.

    (A) 100 s
    (B) 200 s
    (C) 500 s
    (D) 1000 s

65. The standard E^0_{red} values of A, B and C are 0 V, +0.68 V and –0.50 V, respectively. The order of their power as reducing agent is

    (A) $B > A > C$
    (B) $A > B > C$
    (C) $C > A > B$
    (D) $C > B > A$

66. If the ratio of composition of oxidised and reduced species in an electrochemical cell is given as $\dfrac{[O]}{[R]} = e^2$, the correct potential difference will be

    (A) $E - E^0 = +\dfrac{2RT}{nF}$

    (B) $E - E^0 = -\dfrac{2RT}{nF}$

    (C) $E - E^0 = +\dfrac{RT}{nF}$

    (D) $E - E^0 = -\dfrac{RT}{nF}$

67. If we pass 1 Coulomb of charge in an electrolytic cell, then 10 mg of substance will get deposited. Calculate the gram equivalent of the substance.
(1 Faraday = 96500 C)

(A) 9.65
(B) 96.5
(C) 965
(D) 9650

68. The packing fraction efficiency of a simple cubic lattice is close to

(A) 34.0%
(B) 52.4%
(C) 68.0%
(D) 74.0%

69. How many NaCl are in the unit cell of sodium chloride crystal?

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

70. Alkali halides do not show Frenkel defect because

(A) cations and anions have high coordination number
(B) cations and anions have low coordination number
(C) anions cannot be accommodated in voids
(D) cations and anions have almost equal size

71. Coordination number for body centered cubic is

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

72. Which one of the following is **NOT** applicable to chemisorption?

(A) Its heat of adsorption is high
(B) It takes place at high temperature
(C) It is reversible
(D) It forms mono-molecular layers

73. Lyophilic colloids are stable due to

    (A) small size of the particle
    (B) large size of the particle
    (C) layer of dispersion medium on the particle
    (D) high Tyndall effect

74. IUPAC name for the following compound is
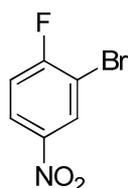
    (A) 2-bromo-1-fluoro-4-nitrobenzene
    (B) 3-bromo-4-fluoro-1-nitrobenzene
    (C) 2-fluoro-5-nitro-1-bromobenzene
    (D) 1-bromo-6-fluoro-3-nitrobenzene

75. Dumas method is preferred over Kjeldahl's method for determining nitrogen quantitatively in

    (A) explosives such as trinitrotoluene
    (B) aminoacids
    (C) amides
    (D) compounds containing both sulfur and nitrogen

76. Pick the statement that is **NOT** true for a pair of cis and trans isomers such as 1,2-diphenylethene (stilbene).
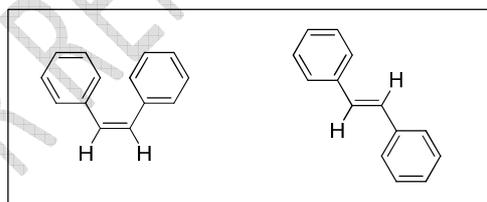
    (A) trans isomer has a higher melting point

    (B) trans isomer has higher heat of combustion

    (C) trans isomer has a higher retardation factor (R_f) in adsorption chromatography over silica gel

    (D) planarity is better maintained in the trans isomer

77. How will you selectively convert 2-bromopropane to 1-bromopropane?
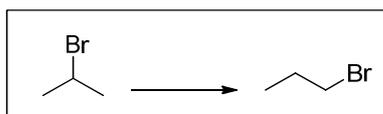
(A) Treatment with alcoholic potassium chloride followed by reaction with HBr
(B) Reaction with metallic sodium followed by reaction with bromine
(C) Reaction with magnesium metal followed by treatment with HOBr
(D) Reaction with alcoholic potassium hydroxide followed by heating with HBr in the presence of benzoyl peroxide.

78. Pick the **WRONG** statement about propyne.

(A) Addition of excess HBr to propyne gives 1,2-dibromopropane
(B) It is less acidic than acetylene
(C) Upon reaction with dilute sulfuric acid in the presence of mercuric sulfate, it gives acetone as the major product
(D) It reacts with sodamide ($NaNH_2$) to give sodium propynide

79. In aromatic electrophilic substitution reactions carried out under kinetically controlled conditions

(A) all activating groups are *meta* orienting
(B) all deactivating groups are *ortho-para* orienting
(C) all deactivating groups are *meta* orienting
(D) deactivating groups possessing unshared pair of electrons on atoms directly attached to aromatic ring are *ortho-para* orienting

80. Compounds possessing certain distinct structural features give a yellow precipitate of iodoform on reacting with iodine in the presence of a base. This question is based on the ability of alcohols having no other functional groups to undergo iodoform reaction. Pick the **WRONG** statement.

(A) Ethanol is the only primary alcohol that gives a positive iodoform test
(B) Several secondary alcohols give positive iodoform test
(C) All tertiary alcohols test negative for iodoform reaction
(D) All alcohols test negative for iodoform reaction

81. Acidity of compounds is decided by several factors including electrometric effects, *H*-bonding, aromaticity etc. for acids and their conjugate bases. Pick the correct statement. pK_a of

| 2-hydroxybenzoic acid | 3-hydroxybenzoic acid | 4-hydroxybenzoic acid |
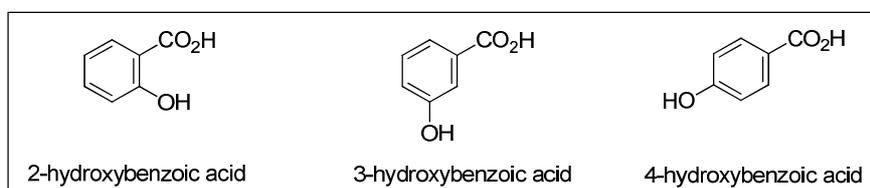
- (A) 2-hydroxybenzoic acid > 3-hydroxybenzoic acid > 4-hydroxybenzoic acid
- (B) 4-hydroxybenzoic acid > 3-hydroxybenzoic acid > 2-hydroxybenzoic acid
- (C) 3-hydroxybenzoic acid > 2-hydroxybenzoic acid > 4-hydroxybenzoic acid
- (D) 4-hydroxybenzoic acid ≈ 2-hydroxybenzoic acid > 3-hydroxybenzoic acid

82. The following statements are on the reactivity of phenols. Pick the **WRONG** statement.
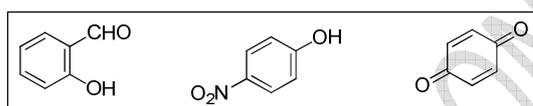
- (A) Bubbling carbon dioxide through a solution of phenol in aqueous sodium hydroxide followed by acidification gives 2-hydroxybenzoic acid (salicylic acid)
- (B) Treatment of phenol with chloroform in the presence of sodium hydroxide followed by acidification of the reaction mixture gives 2-hydroxybenzaldehyde (salicylaldehyde)
- (C) Phenol on treatment with concentrated nitric acid gives 4-nitrophenol as the only product
- (D) Phenol on oxidation with sodium dichromate in the presence of concentrated sulfuric acid gives 1,4-benzoquinone

83. On refluxing with constant boiling hydroiodic acid (57% HI in water), most methyl ethers are cleaved to give methyl iodide and an alcohol as the products. Which among the following methyl ethers is most likely to give methanol instead of methyl iodide upon treatment with constant boiling HI?

| anisole | methoxyethane | 2-methoxypropane | 2-methoxy-2-methylpropane |
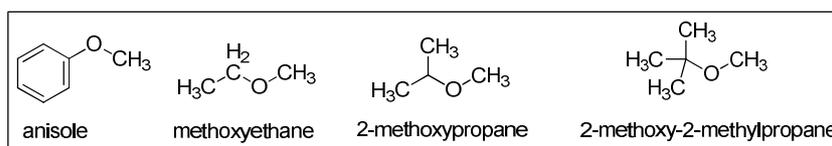
- (A) anisole
- (B) methoxyethane
- (C) 2-methoxypropane
- (D) 2-methoxy-2-methylpropane

84. Carbonyl compounds can be separated from aliphatic hydrocarbons by

   (A) extraction with acid
   (B) extraction with base
   (C) as bisulfite addition compounds by treating with sodium bisulfite
   (D) as picrates by treating with picric acid

85. Which among the following methods is **NOT** suitable for the preparation of hydrocarbons?

   (A) Meerwein-Verley-Ponndorf reduction of aldehydes
   (B) Clemmensen reduction of ketones
   (C) Wolff-Kishner reduction of aldehydes
   (D) Treatment of alkyl chlorides with metallic sodium in dry ether

86. An organic compound gave positive tests with 2,4-DNP reagent, Tollens reagent and Fehling solution. Upon treatment with iodine in the presence of sodium hydroxide it gave iodoform and methanoic acid. The compound most probably is

   (A) methanal
   (B) ethanal
   (C) ethanoic acid
   (D) acetone

87. Gabriel phthalimide synthesis is **NOT** a viable method for the direct synthesis of
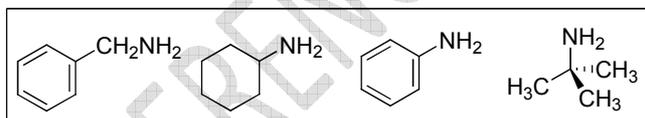
   (A) benzylamine
   (B) cyclohexanamine
   (C) aniline
   (D) 2-methylpropan-2-amine

88. While H_2S and H_2Se are gases, H_2O is liquid due to

   (A) smaller size of oxygen
   (B) arrangement of molecules
   (C) presence of H-bonding
   (D) difference in bonding of their molecule

89. Cd and Cu can be separated and analyzed using

  (A) KCN

  (B) H_2S

  (C) NH_4OH

  (D) H_2SO_4

90. What will be the product of the reaction $_{26}Fe^{58}$ (d, p)?

  (A) $_{25}Mn^{59}$

  (B) $_{26}Fe^{60}$

  (C) $_{26}Fe^{59}$

  (D) $_{25}Mn^{60}$

91. $[Cu(NH_3)_4]^{2+}$ ion has a ……………….. structure.

  (A) square planar
  (B) trigonal
  (C) pyramidal
  (D) tetrahedral

92. In Ellingham diagram, the slope obtained is equal to

  (A) ΔG
  (B) ΔH
  (C) ΔS
  (D) ΔE

93. How many 2c-2e centered bonds are present in diborane?

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

94. Choose the correct structure for Caro`s acid.

(A)
$$HOO-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-OH$$

(B)
$$HO-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-O-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-OH$$

(C)
$$HO-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-OH$$

(D)
$$HOOC-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-COOH$$
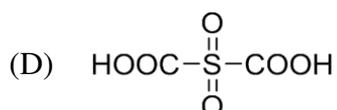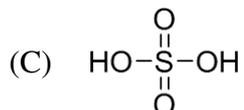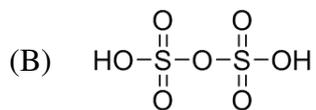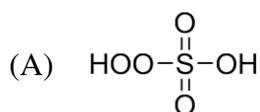
95. Balmer lines are observed in

(A) UV region
(B) IR region
(C) microwave region
(D) visible region

96. Hybridization of Mn in $KMnO_4$ is

(A) sp^2

(B) sp^2d

(C) dsp^2

(D) sp^3

97. The magnetic moment for the complex $[CoF_6]^{3-}$ is

(A) 4.89 BM
(B) 1.73 BM
(C) 0 BM
(D) 5.90 BM

98. With respect to diamond and graphite, which of the following statement is **CORRECT**?

(A) Graphite is lower thermal conductor than diamond
(B) Graphite is harder than diamond
(C) Graphite is lower bond order than diamond
(D) Graphite has higher electrical conductivity than diamond

99. The hybridisation and magnetic behavior of complexes $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ is

 (A) dsp^2 and sp^3, both are paramagnetic

 (B) dsp^2 and sp^3, both are diamagnetic

 (C) sp^3 and dsp^2, paramagnetic and diamagnetic

 (D) sp^3 and dsp^2, both are diamagnetic

100. Two electrons occupying the same orbital are distinguished by

 (A) Magnetic quantum number
 (B) Azimuthal quantum number
 (C) Spin quantum number
 (D) Principal quantum number

101. The number of onto functions from $\{1, 2, ..., n\}$ to itself is

 (A) n
 (B) $n-1$
 (C) $(n-1)!$
 (D) $n!$

102. $\lim\limits_{x \to \frac{\pi}{6}} \dfrac{2\sin^2 x + \sin x - 1}{2\sin^2 x - 3\sin x + 1}$ is equal to

 (A) 3
 (B) -3
 (C) 6
 (D) 0

103. For any complex number z, the minimum value of $|z| + |z - 2i|$ is

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

104. Let $f(x) = a + b|x| + c|x|^2$, where a, b and c are real constants. Then $f'(0)$ exists if

 (A) $b = 0$
 (B) $c = 0$
 (C) $a = 0$
 (D) $b = c$

105. The equation of the circle passing through $(1, -3)$ and the points common to the two circles $x^2 + y^2 - 6x + 8y - 16 = 0$ and $x^2 + y^2 + 4x - 2y - 8 = 0$ is

(A) $x^2 + y^2 - 4x + 6y + 24 = 0$

(B) $2x^2 + 2y^2 + 3x + y - 20 = 0$

(C) $3x^2 + 3y^2 - 5x + 7y - 19 = 0$

(D) $x^2 + y^2 + 4x - 6y + 24 = 0$

106. Let $f(x) = \int_{1}^{x} \sqrt{2 - t^2}\, dt$. Then the roots of the equation $x^2 - f'(x) = 0$ are

(A) ± 1

(B) $\pm \dfrac{1}{\sqrt{2}}$

(C) $\pm \dfrac{1}{2}$

(D) 0 and 1

107. If $(\vec{i} + \vec{j} - \vec{k}) \times (3\vec{i} + a\vec{j} + b\vec{k}) = 0$, then the values of a and b are

(A) $a = 1,\ b = 3$
(B) $a = -3,\ b = 3$
(C) $a = 3,\ b = -3$
(D) $a = \dfrac{1}{3},\ b = \dfrac{-1}{3}$

108. The number of ways that a ring can be made out of 6 black and 4 white men standing on a ring, so that all the white men come together is

(A) 8564
(B) 8640
(C) 8644
(D) 8665

109. In the interval $0 < x < 2$, the function $f(x) = x^2$ has

(A) maximum = 2 and minimum = 0
(B) maximum = 4 and minimum = 0
(C) no maximum and no minimum
(D) some maximum but no minimum

110. For the curve $y = 5x - 2x^3$, if x increases at the rate of 2 units/sec then at $x = 3$, the slope of the curve is changing at

(A) 12 units/sec
(B) -49 units/sec
(C) -72 units/sec
(D) 72 units/sec

111. The LCM of smallest two digit composite number and the smallest composite number is

(A) 12
(B) 4
(C) 20
(D) 44

112. The number of binary operations on a set {1, 2, 3} is

(A) 3

(B) 3^2

(C) 3^3

(D) 3^9

113. The angle between two vectors $\vec{a}$ and $\vec{b}$ with respective magnitude 2 and 3 such that $\vec{a} \cdot \vec{b} = 3$ is

(A) $\dfrac{\pi}{2}$

(B) 0

(C) $\dfrac{\pi}{6}$

(D) $\dfrac{\pi}{3}$

114. The mean of *n* observation is $\bar{x}$. If the first observation is increased by 1, second by 2, the third by 3, and so on, then the new mean is

(A) $\bar{x} + (2n+1)$

(B) $\bar{x} + \dfrac{n+1}{2}$

(C) $\bar{x} + (n+1)$

(D) $\bar{x} - \dfrac{n+1}{2}$

115. The domain of the function $f(t) = \sqrt{t - \dfrac{t}{1-t}}$ is

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

116. For every natural number n, $2^{3n} - 1$ is divisible by

(A) 6
(B) 16
(C) 8
(D) 7

117. If *x*, *y* and *z* be greater than 1, then the value of $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$ is

(A) $\log x \log y \log z$
(B) $\log x + \log y + \log z$
(C) 0
(D) $1 - (\log x \log y \log z)$

118. The first two terms of a geometric progression add to 12. The sum of the third and the fourth terms is 48. If the terms of the geometric progression are alternately positive and negative, then the first term is

(A) −4
(B) −12
(C) 12
(D) 4

119. Let P be a 2×2 matrix.

Statement-1: $adj(adj P) = P$

Statement-2: $|adj P| = |P|$

(A) Statement-1 is true, Statement-2 is false
(B) Statement-1 is false, Statement-2 is true
(C) Statement-1 is true, Statement-2 is true; Statement-2 is a correct explanation for Statement-1
(D) Statement-1 is true, Statement-2 is true; Statement-2 is not a correct explanation for Statement-1

120. If a line is equally inclined with the coordinate axes, then the angle of inclination is

(A) $\cos^{-1}\left(\dfrac{1}{2}\right)$

(B) $\cos^{-1}\left(\dfrac{1}{\sqrt{2}}\right)$

(C) $\cos^{-1}\left(\dfrac{\sqrt{3}}{2}\right)$

(D) $\cos^{-1}\left(\dfrac{1}{\sqrt{3}}\right)$

121. Solution set of $|2x-3| < |x+2|$ is

(A) $\left(-\infty, \dfrac{1}{3}\right)$

(B) $\left[-\infty, \dfrac{1}{3}\right]$

(C) $\left(\dfrac{1}{3}, 5\right)$

(D) $\left(-\infty, -\dfrac{1}{3}\right)$

122. If $\sin^x \alpha + \cos^x \alpha \geq 1$, $0 < \alpha < \dfrac{\pi}{2}$, then

(A) $x \in [2, \infty)$

(B) $x \in (-\infty, 2]$

(C) $x \in [-1, 1]$

(D) $x \in [0, 1]$

123. The maximum value of $8 \cos x + 6 \sin x$ is

(A) 1

(B) 5

(C) 10

(D) 100

124. If $\tan x + \tan\left(x + \dfrac{\pi}{3}\right) + \tan\left(x + \dfrac{2\pi}{3}\right) = 3$, which of the following values is equal to 1?

(A) $\tan x$

(B) $\tan 2x$

(C) $\tan 3x$

(D) $\tan 4x$

125. The value of the expression $1 - \dfrac{\sin^2 y}{1 + \cos y} + \dfrac{1 + \cos y}{\sin y} - \dfrac{\sin y}{1 - \cos y}$ is equal to

(A) 0

(B) 1

(C) $\sin y$

(D) $\cos y$

126. The value of i^i is

(A) $e^{\frac{\pi}{2}}$

(B) $e^{\frac{i\pi}{2}}$

(C) $e^{\frac{-i\pi}{2}}$

(D) $e^{\frac{-\pi}{2}}$

127. The complex number $\sqrt{2}i$ equals

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

128. If $a = p + q$, $b = p\omega + q\omega^2$, $c = p\omega^2 + q\omega$, where ω is the cube root of unity, then the product of a, b and c is equal to

    (A) $(p + q)^3$
    (B) $p^3 + q^3$
    (C) $p^3 - q^3$
    (D) $(p + q)^3 + 3pq(p + q)$

129. The equation $z\bar{z} + p\bar{z} + \bar{p}z + q = 0, \ q \in \square$ represents a circle, if

    (A) $|p|^2 = q$

    (B) $|p|^2 > q$

    (C) $|q|^2 = b$

    (D) $pq = 1$

130. Let a, b, c be three distinct real numbers and they are in a Geometric Progression. If $a + b + c = xb$, then

    (A) $x \le -1$ or $x \ge 3$
    (B) $x < -1$ or $x > 3$
    (C) $x < -3$ or $x > 2$
    (D) $x \le -3$ or $x \ge 2$

131. If the sum of the first n terms of a series be $5n^2 + 2n$, then its third term is

    (A) 11
    (B) 17
    (C) 23
    (D) 27

132. Given that $\cos(x-y)$, $\cos x$, $\cos(x+y)$ are in HP. Then $\cos x \sec \dfrac{y}{2}$ is equal to

(A) $\sqrt{2}$

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

(C) $\dfrac{1}{\sqrt{2}}$

(D) $\pm\dfrac{1}{\sqrt{2}}$

133. Let $x^2 + y^2 = t + \dfrac{1}{t}$ and $x^4 + y^4 = t^2 + \dfrac{1}{t^2}$. Then $\dfrac{dy}{dx}$ is equal to

(A) $\dfrac{y}{x}$

(B) $\dfrac{x}{y}$

(C) $-\dfrac{y}{x}$

(D) $-\dfrac{x}{y}$

134. Let $f(x) = \sin x$, $g(x) = 2x$ and $h(x) = \cos x$. If $\phi(x) = [g \circ f \circ h](x)$,

then $\phi''\left(\dfrac{\pi}{4}\right)$ is equal to

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

135. If $y = \cos^2 \dfrac{3x}{2} - \sin^2 \dfrac{3x}{2}$, then $\dfrac{d^2 y}{dx^2}$ equals

(A) $-3\sqrt{1-y^2}$

(B) $9y$

(C) $-9y$

(D) $3\sqrt{1-y^2}$

136. A rectangle *ABCD*, where $A = (0, 0)$, $B = (4, 0)$, $C = (4, 2)$, $D = (0, 2)$, undergoes the following transformations successively.

(i) $f_1(x, y) \rightarrow (y, x)$

(ii) $f_2(x, y) \rightarrow (x + 3y, y)$

(iii) $f_3(x, y) \rightarrow \left(\dfrac{x - y}{2}, \dfrac{x + y}{2} \right)$

The final figure will be

(A) a square
(B) a rhombus
(C) a rectangle
(D) a parallelogram

137. If a point $P(1, 2)$ is shifted by a distance $\sqrt{2}$ unit parallel to the line $y = x$, then coordinates of P in the new position are

(A) $(2, 3)$

(B) $\left(2+\sqrt{2}, 3+\sqrt{2}\right)$

(C) $\left(2-\sqrt{2}, 3-\sqrt{2}\right)$

(D) $(3, 2)$

138. If $5x - 12y + 10 = 0$ and $12y - 5x + 16 = 0$ are two tangents to a circle, then the radius of the circle is

(A) 1
(B) 2
(C) 4
(D) 6

139. The equation of the tangents to the circle $x^2 + y^2 = 13$ at the points, whose absissa is 2, are

(A) $2x + 3y = 13$ and $2x - 3y = 13$
(B) $3x + 2y = 13$ and $2x - 3y = 13$
(C) $2x + 3y = 13$ and $3x - 2y = 13$
(D) $3x + 2y = 13$ and $3x - 2y = 13$

140. The equation of a common tangent to the circle $x^2 + y^2 = 2$ and the parabola $y^2 = 8x$ is

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

141. The latus rectum of an ellipse is equal to one-half of its minor axis. The eccentricity of the ellipse is

(A) $\dfrac{1}{\sqrt{6}}$

(B) $\dfrac{\sqrt{3}}{2}$

(C) $\dfrac{\sqrt{3}}{4}$

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

142. The image of the interval $[1,3]$ under the mapping $f : \square \to \square$, given by
$f(x) = 2x^3 - 24x + 107$ is

(A) $[0,89]$
(B) $[75,89]$
(C) $[85,89]$
(D) $[75,0]$

143. The value of $\lim\limits_{x \to 0} \left(\dfrac{1+5x^2}{1+3x^2} \right)^{\frac{1}{x^2}}$ is equal to

(A) e^2

(B) e

(C) e^{-1}

(D) e^{-2}

144. $\lim\limits_{n\to\infty}\left[\dfrac{1}{1\cdot2}+\dfrac{1}{2\cdot3}+\dfrac{1}{3\cdot4}+...+\dfrac{1}{n\cdot(n+1)}\right]$ is equal to

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

145. If $\lim\limits_{x\to\infty}\left(\dfrac{x^3+1}{x^2+1}-(ax+b)\right)=2,$ then

    (A) $a=1$ and $b=1$
    (B) $a=1$ and $b=-1$
    (C) $a=1$ and $b=-2$
    (D) $a=1$ and $b=2$

146. If $f'(x)=\dfrac{1}{1+x^2}$ for all real x and $f(0)=0,$ then

    (A) $f(2)<0.4$

    (B) $f(2)>2$

    (C) $0.4<f(2)<2$

    (D) $f(2)=2$

147. $\int\dfrac{x^4+x^2+1}{x^2-x+1}dx$ is equal to

    (A) $\dfrac{x^3}{3}-\dfrac{x^2}{2}+x+c$

    (B) $\dfrac{x^3}{3}+\dfrac{x^2}{2}+x+c$

    (C) $\dfrac{x^3}{3}-\dfrac{x^2}{2}-x+c$

    (D) $\dfrac{x^3}{3}+\dfrac{x^2}{2}-x+c$

148. $\int \dfrac{\sin^{-1} x}{\sqrt{1-x^2}} dx$ is equal to

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

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

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

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

149. The solution of the differential equation $\dfrac{d^2 y}{dx^2} = e^{-2x}$ is $y = c_1 e^{-2x} + c_2 x + c_3$, where c_1 is

(A) 1

(B) $\dfrac{1}{4}$

(C) $\dfrac{1}{2}$

(D) 2

150. The area of the triangle having vertices as $\hat{i} - 2\hat{j} + 3\hat{k}, \ -2\hat{i} + 3\hat{j} - \hat{k}, \ 4\hat{i} - 7\hat{j} + 7\hat{k}$ is

(A) 36 sq unit
(B) 0 sq unit
(C) 39 sq unit
(D) 11 sq unit

151. If the position vectors of A, B and C are respectively $2\hat{i} - \hat{j} + \hat{k}, \ \hat{i} - 3\hat{j} - 5\hat{k}$, and $3\hat{i} - 4\hat{j} - 4\hat{k}$, then $\cos^2 A$ is equal to

(A) 0

(B) $\dfrac{6}{41}$

(C) $\dfrac{35}{41}$

(D) 1

152. Let $*$ be the binary operation defined by $a * b = a + b + a \cdot b$ for $a, b \in R$ where R be the set of all real numbers. Then

    (A) $\left(R \setminus \{-1\}, *\right)$ is an abelian group

    (B) $\left(R \setminus \{-1\}, *\right)$ is a group

    (C) $\left(R \setminus \{0\}, *\right)$ is an abelian group

    (D) $\left(R \setminus \{0\}, *\right)$ is a group

153. Assume that $\begin{bmatrix} 0 & a \\ b & 0 \end{bmatrix}^4 = I$. Then

    (A) $a = 1 = 2b$

    (B) $a = b$

    (C) $a = b^2$

    (D) $ab = 1$

154. If $\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ and $A_1, B_1, C_1 \ldots$ are the cofactors of $a_1, b_1, c_1 \ldots\ldots$ then

$a_1 A_2 + b_1 B_2 + c_1 C_2$ is equal to

    (A) Δ

    (B) 0

    (C) $-\Delta$

    (D) Δ^2

155. The value of $\sqrt{12 + \sqrt{12 + \sqrt{12 + \ldots\ldots}}}$ is

    (A) 3.9242

    (B) 3.4646

    (C) 2.0000

    (D) 4.0000

156. If $\cos x$ is an integrating factor of the differential equation $\dfrac{dy}{dx} + Py = Q$, then $P =$

    (A) $-\cot x$
    (B) $\cot x$
    (C) $\tan x$
    (D) $-\tan x$

157. The particular integral of $f(D)y = 2^x + 2^2$ is

    (A) $\dfrac{1}{f(0)} x^2 + \dfrac{1}{f(1)} 2^2$, where $f(0),\ f(1) \neq 0$

    (B) $\dfrac{1}{f(\log 2)} 2^x + \dfrac{1}{f(0)} 2^2$, where $f(\log 2),\ f(0) \neq 0$

    (C) $\dfrac{1}{f(0)} 2^x + \dfrac{1}{f(\log 2)} 2^2$, where $f(\log 2),\ f(0) \neq 0$

    (D) $\dfrac{1}{f(\log 2)} \left(2^x + 2^2\right)$, where $f(\log 2) \neq 0$

158. $\displaystyle\lim_{x \to \infty} \left(\dfrac{4 - x^2}{x^2 - 1} \right)$ is equal to

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

159. $\displaystyle\int \dfrac{1}{x \ln x}\, dx$ is equal to

    (A) $\dfrac{1}{\ln^2 x} + c$

    (B) $\dfrac{1}{x(\ln x)^2} + c$

    (C) $\ln(x \ln x) + c$

    (D) $\ln(\ln x) + c$

160. The maximum value of the function $f(x) = \dfrac{e^{\sin x}}{e^{-\cos x}}$ is

    (A) $\sin\left(e^2\right)$

    (B) e

    (C) 1

    (D) $e^{\sqrt{2}}$

161. The solution of the equation $|z| - z = 1 + i$ is

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

162. Let A be the set of all z satisfying $\log_{\frac{1}{3}} \log_{\frac{1}{2}} \left(|z|^2 + 4|z| + 3\right) < 0$. Then A is

    (A) an empty set

    (B) an infinite set

    (C) $\{z : |z| = 0\}$

    (D) $-\dfrac{1}{\sqrt{3}}$

163. If $\sin^{-1}\left(x - \dfrac{x^2}{2} + \dfrac{x^3}{4} - \dfrac{x^4}{8} + ...\right) + \cos^{-1}\left(x^2 - \dfrac{x^4}{2} + \dfrac{x^6}{4} - \dfrac{x^4}{8} + ...\right) = \dfrac{\pi}{2}$ for $0 < |x| < \sqrt{2}$,

    then x equals

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

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

    (C) 0

    (D) 1

164. Which of the following functions is differentiable at $x = 0$?

(A) $\cos(|x|) + |x|$

(B) $\cos(|x|) - |x|$

(C) $\sin(|x|) + |x|$

(D) $\sin(|x|) - |x|$

165. If $P(A \cup B) = P(A) + P(B) - P(A)P(B)$, then

(A) $P(B/A) = P(B) - P(A)$

(B) $P(A' \cup B') = P(B') - P(A')$

(C) $P((A \cup B')) = P(B')$

(D) $P(A/B) = P(A)$

166. If $A = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}, 0 < x < \dfrac{\pi}{2}$ and $A + A' = I$, then the value of x is

(A) $\dfrac{\pi}{3}$

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

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

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

167. The maximum and minimum values of the function $f(x) = |\sin 2x + 3|$ are respectively

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

168. The area of the region bounded by the curve $|x|+y=1$ and the axis of x is given by

(A) 2
(B) 10
(C) 1
(D) 4

169. The ratio in which the area bounded by the curves $y^2=12x$ and $x^2=12y$ is divided by the line $x=3$, is

(A) 19 : 49
(B) 15 : 49
(C) 12 : 37
(D) 1 : 3

170. The line $y=mx$ bisects the area enclosed by the lines $x=0$, $y=0$, $x=\dfrac{3}{2}$ and the curve $y=1+4x-x^2$. The value of m is

(A) $\dfrac{13}{6}$

(B) $\dfrac{13}{8}$

(C) $\dfrac{8}{13}$

(D) $\dfrac{6}{13}$

171. The value of the integral $\displaystyle\int_1^3 \sqrt{(2x+3)(3x^2+4)}\,dx$ cannot exceed

(A) $\sqrt{48}$
(B) $\sqrt{66}$
(C) $\sqrt{73}$
(D) $\sqrt{6}$

172. Let * be a binary operation, on the set of all non-zero real numbers, given by $a*b=\dfrac{ab}{5}$ for all $a,b\in R-\{0\}$. Then the value of 'x' such that $2*(x*5)=10$, is

  (A) 31
  (B) 22
  (C) 25
  (D) 43

173. If the points $\left(au^2,2au\right)$ and $\left(av^2,2av\right)$ are the extremities of a focal chord of the parabola $y^2=4ax$, then

  (A) $uv-1=0$
  (B) $uv+1=0$
  (C) $u+v=0$
  (D) $u-v=0$

174. For a constant a, the line $y=2a^2$ meets the ellipse $\dfrac{x^2}{9}+\dfrac{y^2}{4}=1$ at the real points if

  (A) $|a|\le 1$
  (B) $|a|>1$
  (C) $|a|<3$
  (D) $-\infty<|a|$

175. The mirror image of the directrix of the parabola $y^2=4(x+1)$ in the line mirror $x+2y=3$ is

  (A) $x=-2$
  (B) $4y+3x=16$
  (C) $3x-4y=-16$
  (D) $y=-1$

176. The curve represented by $x=3(\cos t+\sin t)$ and $y=4(\cos t-\sin t)$ is

  (A) an ellipse
  (B) a parabola
  (C) a hyperbola
  (D) a circle

177. Given $E(X + c) = 8$ and $E(X - c) = 12$ then the value of c is

(A) −2
(B) 4
(C) −4
(D) 2

178. A random variable X has the following probability distribution:

X	0	1	2	3	4	5	6	7	8
$P(X = x)$	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

The value of 'a' is

(A) $\dfrac{7}{81}$

(B) $\dfrac{5}{81}$

(C) $\dfrac{1}{81}$

(D) $\dfrac{2}{81}$

179. If $\sin\left(\sin^{-1}\left(\dfrac{1}{5}\right) + \cos^{-1} x\right) = 1$, then the value of x is

(A) $\dfrac{32}{31}$

(B) $\dfrac{31}{32}$

(C) $\dfrac{1}{2}$

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

180. The equation of the normal to the curve $y = 1 - 2^{\frac{x}{2}}$ at the point of intersection with the y-axis is

   (A) $2y - x\log 2 = 0$

   (B) $2x - y\log 2 = 0$

   (C) $y - x\log 2 = 0$

   (D) $2y + x = 0$

181. If $y = x^2 + ax + b$ attains the minimum value 5 at $x = 3$, then the values of a and b are

   (A) $a = 6, b = -14$
   (B) $a = -6, b = 14$
   (C) $a = 14, b = -6$
   (D) $a = -14, b = 6$

182. The product $(32)(32)^{\frac{1}{6}}(32)^{\frac{1}{36}}...\infty$ is equal to

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

183. If the volume of a parallelepiped whose edges are represented by $-12\vec{i} + \lambda\vec{k},\ 3\vec{j} - \vec{k}$ and $2\vec{i} + \vec{j} - 15\vec{k}$ is 546, then the value of λ is

   (A) 3
   (B) −5
   (C) −179
   (D) 179

184. If $3f(x) + 5f\left(\dfrac{1}{x}\right) = \dfrac{1}{x} - 3, \forall x (\neq 0) \in R$, then $f(x) =$

(A) $\dfrac{1}{16}\left(\dfrac{3}{x} + 5x - 6\right)$

(B) $\dfrac{1}{16}\left(-\dfrac{3}{x} + 5x - 6\right)$

(C) $\dfrac{1}{16}\left(-\dfrac{3}{x} + 5x + 6\right)$

(D) $\dfrac{1}{16}\left(-\dfrac{3}{x} - 5x + 6\right)$

185. If $1, \omega, \omega^2$ are the three cube roots of unity, then
$\left(1 - \omega + \omega^2\right)\left(1 - \omega^2 + \omega^4\right)\left(1 - \omega^4 + \omega^8\right)...$ to $2n$ factors is equal to

(A) 2^n

(B) 2^{2n}

(C) 2^{4n}

(D) 2^{3n}

186. For the equation $\left|x^2\right| + |x| - 6 = 0$, the roots are

(A) real and equal
(B) real with sum 0
(C) real with sum 1
(D) real with product 0

187. If $A = \begin{bmatrix} 1 & 2 & -1 \\ -1 & 1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$, then $\det\left[adj(adj\ A)\right]$ is

(A) 14^4

(B) 14^3

(C) 14^2

(D) 14^1

188. If $\Delta = \begin{vmatrix} 1 & 3\cos\theta & 1 \\ \sin\theta & 1 & 3\cos\theta \\ 1 & \sin\theta & 1 \end{vmatrix}$, then the maximum value of Δ is

  (A) 10
  (B) 11
  (C) 12
  (D) 14

189. The value of the sum of the series $14C_0 \cdot 15C_1 + 14C_1 \cdot 15C_2 + \ldots 14C_{14} \cdot 15C_{15}$ is

  (A) $29C_{12}$

  (B) $29C_{10}$

  (C) $29C_{14}$

  (D) $29C_{16}$

190. Let a_n be the nth term of the G.P of positive numbers. Let $\sum_{n=1}^{100} a_{2n} = \alpha$ and $\sum_{n=1}^{100} a_{2n-1} = \beta$, such that $\alpha \neq \beta$. Then the common ratio is

  (A) $\dfrac{\alpha}{\beta}$

  (B) $\dfrac{\beta}{\alpha}$

  (C) $\sqrt{\dfrac{\alpha}{\beta}}$

  (D) $\sqrt{\dfrac{\beta}{\alpha}}$

191. $\lim_{x \to 0} \dfrac{e^x + e^{-x} + 2\cos x - 4}{x^4}$ is equal to

   (A) 0

   (B) 1

   (C) $\dfrac{1}{6}$

   (D) $-\dfrac{1}{6}$

192. The value of k so that the equations $x^2 - x - 12 = 0$ and $kx^2 + 10x + 3 = 0$ may have one root in common, is

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

193. If f and g be differentiable functions satisfying $g'(a) = 2$, $g(a) = b$ and $f \circ g = I$, then $f'(b)$ is equal to

   (A) 2

   (B) $\dfrac{2}{3}$

   (C) $\dfrac{1}{2}$

   (D) $-\dfrac{1}{2}$

194. $\int \dfrac{\sqrt{1+\sqrt{x}}}{x}\,dx$ is equal to

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

(B) $4\sqrt{1+\sqrt{x}} - 2\log\left(\dfrac{\sqrt{1+\sqrt{x}}-1}{\sqrt{1+\sqrt{x}}+1}\right) + C$

(C) $4\sqrt{1+\sqrt{x}} + 2\log\left(\dfrac{\sqrt{1+\sqrt{x}}-1}{\sqrt{1+\sqrt{x}}+1}\right) + C$

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

195. A book contains 1,000 pages. A page is chosen at random. The probabilities that the sum of the digits of the marked number on the page is equal to 9, is

(A) $\dfrac{23}{500}$

(B) $\dfrac{11}{200}$

(C) $\dfrac{7}{100}$

(D) $\dfrac{7}{500}$

196. If $|\vec{a}| = 10$, $|\vec{b}| = 2$ and $\vec{a}.\vec{b} = 12$, then the value of $|\vec{a}\times\vec{b}|$ is

(A) 5
(B) 10
(C) 14
(D) 16

197. A plane meets the coordinate axes in points A, B and C and the centroid of the triangle ABC is (α, β, γ). Then the equation of the plane is

(A) $\dfrac{x}{\alpha} + \dfrac{y}{\beta} + \dfrac{z}{\gamma} = 1$

(B) $\dfrac{x}{\alpha} + \dfrac{y}{\beta} + \dfrac{z}{\gamma} = 3$

(C) $\alpha x + \beta y + \gamma z = 3$

(D) $\alpha x + \beta y + \gamma z = \dfrac{1}{3}$

198. The reflection of the point (α, β, γ) in the XOY − plane is

(A) $(\alpha, \beta, 0)$
(B) $(0, 0, \gamma)$
(C) $(-\alpha, -\beta, \gamma)$
(D) $(\alpha, \beta, -\gamma)$

199. The mean and variance of a random variable X having binomial distribution are 3 and 2 respectively. Then the probability $P(X = 2)$ is

(A) $\dfrac{2^7}{3^7}$

(B) $\dfrac{2^9}{3^7}$

(C) $\dfrac{2^7}{3^9}$

(D) $\dfrac{2^9}{3^9}$

200. A flashlight has 8 batteries out of which 3 are dead. If 2 batteries are selected one after the other without replacement and tested, the probability that both are dead is

(A) $\dfrac{33}{56}$

(B) $\dfrac{9}{64}$

(C) $\dfrac{1}{14}$

(D) $\dfrac{3}{28}$

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