TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT V

PHYSICS UG SHIFT V
(FINAL)

1. The closest length of the simple pendulum which ticks seconds (seconds pendulum) must be

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

2. A force of 1 KN is applied to a wire of cross section $10\,\mu m^2$ results in an increase in its length by 0.1%. The Young's modulus of the wire will be

    (A) $10^{12}\,Nm^{-2}$

    (B) $10\,GNm^{-2}$

    (C) $10^{11}\,Nm^{-2}$

    (D) $10^6\,MNm^{-2}$

3. Which one of the following statements about soap bubble is **TRUE**?

    (A) Excess pressure in a soap bubble is inversely proportional to surface tension
    (B) Excess pressure in a soap bubble is directly proportional to its radius
    (C) Excess pressure in a soap bubble is directly proportional to square of its radius
    (D) Excess pressure in a soap bubble is directly proportional to surface tension

4. A hole is drilled on a copper sheet. The diameter of the hole at room temperature is 4.25 cm. The diameter of the hole when the sheet is heated to 70°C will be

    (A) 4.25 cm only
    (B) more than 4.25 cm
    (C) less than 4.25 cm
    (D) data insufficient to predict

5. A monoatomic gas at a certain pressure P_1 and volume V_1 is compressed adiabatically to one-eighth of its original volume. What is the final pressure of the gas? Given the γ of an ideal monatomic gas $= \dfrac{5}{3}$

   (A) P_1

   (B) $\dfrac{P_1}{8}$

   (C) $64\,P_1$

   (D) $32\,P_1$

6. If V_{rms} is the root mean square value of velocity, V_{av} is the average velocity and V_{mp} velocity of the molecules of a gas, which one of the following is true?

   (A) $V_{rms} = V_{av} \neq V_{mp}$
   (B) $V_{rms} < V_{av} < V_{mp}$
   (C) $V_{rms} > V_{av} > V_{mp}$
   (D) $V_{rms} \neq V_{av} = V_{mp}$

7. An electron of mass of the order of 10^{-31} kg carries a charge of the order of 10^{-19} Coulomb. Then the charge carried by 1 kg of electrons will be of the order of

   (A) 10^{12} Coulomb
   (B) 10^{-12} Coulomb
   (C) 10^{-50} Coulomb
   (D) 10^{50} Coulomb

8. Angle between equipotential surface and lines of force of an electric field is

   (A) zero
   (B) 90°
   (C) 180°
   (D) 45°

9. The magnetic susceptibility of a certain paramagnetic substance at $-73°C$ is 6×10^{-3}. Its susceptibility at $-173°C$ will be

   (A) 1.2×10^{-2}

   (B) 1.8×10^{-3}

   (C) 3×10^{-3}

   (D) 4.5×10^{-3}

10. Match List - I (Electromagnetic wave type) with List - II (its association/application) and select the correct match option from the choices given below:

	List - I		List - II
(a)	Infrared waves	(i)	To treat muscular strain
(b)	Radio waves	(ii)	For broadcasting
(c)	X-rays	(iii)	To detect fracture of bones
(d)	Ultraviolet rays	(iv)	Absorbed by the ozone layer of the atmosphere

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

11. In hydrogen atom, an electron makes a transition from orbit $n = 4$ to $n = 2$. The wave number of the emitted radiation will be (R = Rydberg's constant)

   (A) $\dfrac{16}{3R}$

   (B) $\dfrac{2R}{16}$

   (C) $\dfrac{3R}{16}$

   (D) $\dfrac{4R}{16}$

12. An electric iron box of rating 1000 W was used for 5 hours per day for 20 days. The electrical energy utilized is then

   (A) 200 kWh
   (B) 120 kWh
   (C) 100 kWh
   (D) 500 kWh

13. The limit of resolution of a microscope is given by the formula (λ is wavelength, n is refractive index and θ is semi vertical angle)

(A) $\dfrac{\lambda}{2\sin\theta}$

(B) $\dfrac{1.22\lambda}{2\sin\theta}$

(C) $\dfrac{\lambda}{2n\sin\theta}$

(D) $\dfrac{1.22\lambda}{\sin\theta}$

14. A projectile thrown at an angle of 45° with horizontal attains a maximum height of h_1. Another projectile thrown with the same velocity, at an angle of 30° attains a maximum height h_2. The relation between h_1 and h_2 is
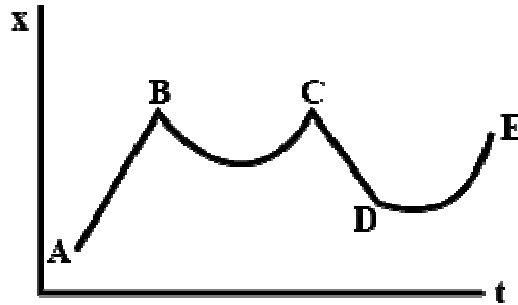
(A) $h_1 = \dfrac{h_2}{\sqrt{2}}$

(B) $h_1 = h_2$

(C) $h_1 = \dfrac{h_2}{2}$

(D) $h_1 = 2h_2$

15. Which of the following quantities does **NOT** change periodically for a particle performing SHM?

(A) Velocity
(B) Acceleration
(C) Displacement
(D) Total energy

16. The following figure shows the displacement of a particle along the *x*-axis as a function of time. The force acting on the particle is zero in the regions

   (A) AB, DE
   (B) BC, CD
   (C) AB, CD
   (D) BC, DE

17. A square frame of each side *L* is dipped in a soap solution and taken out. If *T* is surface tension of soap solution, the force acting on the film formed is

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

18. An unpolarised beam of intensity I_o is incident on a pair of Nicol prisms making an angle of 60° with each other. The intensity of light emerging from the pair is

   (A) I_o

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

   (C) $\dfrac{I_o}{4}$

   (D) $\dfrac{I_o}{8}$

19. If the temperature of a black body increases from 27°C to 327°C, then the rate of energy radiation increases by

(A) $\left(\dfrac{327}{27}\right)^4$

(B) 4
(C) 16
(D) 2

20. Pressure of an ideal gas is doubled keeping the temperature constant. The kinetic energy of the molecules

(A) becomes double
(B) becomes half
(C) remains the same
(D) may increase or decrease depending on the nature of gas

21. The smallest resistance that can be obtained by combining n resistors, each of resistance R is

(A) nR

(B) $\dfrac{R}{n}$

(C) $n^2 R$

(D) $\dfrac{R}{n^2}$

22. The Power factor of R-L circuit is $\dfrac{1}{\sqrt{5}}$. What is the value of resistance if inductive reactance is 4 Ω?

(A) 2 Ω
(B) $\sqrt{2}$ Ω
(C) 4 Ω
(D) $\sqrt{5}$ Ω

23. If *L*, *C* and *R* represent inductance, capacitance and resistance respectively, which of the following combinations has the dimension of frequency?

(A) $\dfrac{C}{L}$

(B) $\dfrac{L}{R}$

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

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

24. The threshold wavelength for a metal whose work function *W* is λ. What is the threshold wavelength of a wave function whose work function is $\dfrac{2W}{3}$?

(A) $\dfrac{2}{3}\lambda$

(B) $\dfrac{3}{4}\lambda$

(C) $\dfrac{1}{3}\lambda$

(D) $\dfrac{3}{2}\lambda$

25. How many NAND gates are used in an OR gate?

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

26. The value of Bohr magneton is

(A) 9.27×10^{24} Am^2

(B) 9.27×10^{-24} Am^2

(C) 6.27×10^{-34} Am^2

(D) 6.27×10^{34} Am^2

27. The SI unit of luminous intensity (I) is

   (A) Candela
   (B) Weber
   (C) Henry
   (D) Gauss's

28. Photo cells are used to measure the …………… of light.

   (A) intensity
   (B) wavelength
   (C) wave-number
   (D) speed

29. The existence of discrete energy levels in an atom was directly verified in 1914 by

   (A) James Franck and Gustav Hertz
   (B) Stern Gerlach
   (C) Heisenberg
   (D) Langevin

30. Sonar technology works based on the principle of

   (A) Photoelectric effect
   (B) Total internal reflection of light
   (C) Magnetic confinement of plasma
   (D) Reflection of ultrasonic waves

31. Which law of Thermodynamics states that "Two systems in thermal equilibrium with a third system separately are in thermal equilibrium with each other"?

   (A) Zeroth
   (B) First
   (C) Second
   (D) Third

32. The electromagnetic force between charged particles arise due to the exchange of particles called

   (A) Gravitons
   (B) Vector Bosons
   (C) Electrons
   (D) Photons

33. A ball is kicked at an angle of 30° with the vertical. If the horizontal component of its velocity is 19.6 m/sec then the maximum height ball reached is

   (A) 58.8 m
   (B) 68.8 m
   (C) 48.8 m
   (D) 72.3 m

34. A ball is dropped from a spacecraft revolving around the earth at a height of 120 km. What will happen to the ball?

   (A) It will continue to move with the same speed along the original orbit of the spacecraft
   (B) It will move with the same speed, tangentially to the spacecraft
   (C) It will fall down to the earth gradually
   (D) It will go very far in the space

35. The sum of all electromagnetic forces between different particles of a system of charged particles is zero.

   (A) only if all the particles are positively charged
   (B) only if all the particles are negatively charged
   (C) only if half the particles are positively charged and half are negatively charged
   (D) irrespective of the signs of the charges

36. Water flows in a horizontal tube as shown in figure. The pressure of water changes by 600 N/m^2 between A and B where the areas of cross section are 30 cm^2 and 15 cm^2 respectively. Then the rate of flow of water through the tube is
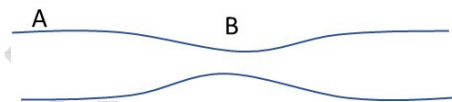
   (A) $2300 \text{ cm}^3 \text{s}^{-1}$
   (B) $1890 \text{ cm}^3 \text{s}^{-1}$
   (C) $3200 \text{ cm}^3 \text{s}^{-1}$
   (D) $1000 \text{ cm}^3 \text{s}^{-1}$

37. Consider the following two statements.

    (I) Line spectra contain information about atoms
    (II) Band spectra contain information about molecules

    (A) Both (I) and (II) are wrong
    (B) (I) is correct but (II) is wrong
    (C) (II) is correct but (I) is wrong
    (D) Both (I) and (II) are correct

38. When deuterium and helium are subjected to an accelerating field simultaneously then

    (A) both acquire same energy
    (B) deuterium accelerates faster
    (C) helium accelerates faster
    (D) neither of them accelerated

39. If the polarizing angle for air-glass interface is 56.3°, the angle of refraction in glass is

    (A) 45°
    (B) 123.7°
    (C) 90°
    (D) 33.7°

40. The maximum intensity in case of interferences of n identical coherent waves each of intensity I_o is

    (A) nI_o

    (B) $n^2 I_o$

    (C) $n(n+1)I_o$

    (D) $(2n-1)I_o$

41. A proton has kinetic energy $E = 100$ eV which is equal to that of a photon. The wavelength of photon is λ_2 and that of proton is λ_1. The ratio of $\dfrac{\lambda_2}{\lambda_1}$ is proportional to

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

42. The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than the 2480 nm is incident on it. The band gap (in eV) for the semiconductor is

    (A) 0.9
    (B) 0.7
    (C) 0.5
    (D) 1.1

43. A thin rod of length L and mass M is bent at its midpoint into two halves so that the angle between them is 90°. The moment of inertia of the bent rod about an axis passing through the bending point and perpendicular to the plane defined by the two halves of the rod is

    (A) $\dfrac{ML^2}{24}$

    (B) $\dfrac{ML^2}{12}$

    (C) $\dfrac{ML^2}{6}$

    (D) $\dfrac{\sqrt{2}ML^2}{24}$

44. The potential energy of a conservative system is given by $PE = ay^2 - by$, where y represents the position of the particle and a as well as b are constants. What is the force acting on the system?

    (A) $b - 2ay$
    (B) $ay - b$
    (C) $-by$
    (D) $-ay$

45. A cricket ball of mass 250 g collides with a bat with velocity 10 ms^{-1} and returns with the same velocity with in 0.01 second. The force acting on the bat is

    (A) 25 N
    (B) 50 N
    (C) 250 N
    (D) 500 N

46. If the amplitude of sound is doubled and frequency reduced to one-fourth, the intensity of sound at the same point will be

    (A) increasing by a factor of 2
    (B) decreasing by a factor of 2
    (C) decreasing by a factor of 4
    (D) unchanged

47. If n_1, n_2 and n_3 are the fundamental frequencies of three segments into which a string is divided, then the original fundamental frequency n of the string is given by

    (A) $\dfrac{1}{n} = \dfrac{1}{n_1} + \dfrac{1}{n_2} + \dfrac{1}{n_3}$

    (B) $n = n_1 + n_2 + n_3$

    (C) $\dfrac{1}{\sqrt{n}} = \dfrac{1}{\sqrt{n_1}} + \dfrac{1}{\sqrt{n_2}} + \dfrac{1}{\sqrt{n_3}}$

    (D) $\sqrt{n} = \sqrt{n_1} + \sqrt{n_2} + \sqrt{n_3}$

48. A wire of resistance R is cut into n equal parts. These parts are then connected in parallel. The equivalent resistance of the combination will be

    (A) nR

    (B) $\dfrac{R}{n}$

    (C) $\dfrac{n}{R}$

    (D) $\dfrac{R}{n^2}$

49. The powers of two electric bulbs are 100 W and 200 W. Both of them are connected to 220 V main. The ratio of resistance of 100 W and 200 W filaments will be

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

50. A ray of light from air is incident in water. Then, which property of light will not change in water?

    (A) Velocity
    (B) Frequency
    (C) Colour
    (D) Amplitude

51. Einstein's work on the photoelectric effect provided support for the equation

    (A) $E = mc^2$

    (B) $E = h\nu$

    (C) $E = \dfrac{-Rhc}{n^2}$

    (D) $KE = \dfrac{1}{2}mv^2$

52. Zener breakdown will occur if impurity level is

    (A) low
    (B) high
    (C) less in n side
    (D) less in p side

53. The force on a particle of mass 10 g is (10 i + 5 j) N. If it starts from rest, what would be its position at time $t = 5s$?

    (A) (12500 i + 6250 j) m
    (B) (1250 i + 625 j) m
    (C) (12.5 i + 62.5 j) m
    (D) (12.5 i − 62.5 j) m

54. A uniform sphere of mass 2000 g rolls without slipping on a plane surface so that its centre moves at a speed of 2.00 cm/s. Find its kinetic energy.

    (A) 5.6×10^{-4} J

    (B) 5.6×10^{-1} J

    (C) 8×10^{-4} J

    (D) 8×10^{-1} J

55. A load of 4.0 kg mass is suspended from a ceiling through a steel wire of radius 2.0 mm. Find the tensile stress developed in the wire when equilibrium is achieved.

(A) $2.00 \times 10^6 \text{ N/m}^2$
(B) $3.18 \times 10^6 \text{ N/m}^2$
(C) $8.00 \times 10^6 \text{ N/m}^2$
(D) $16.18 \times 10^6 \text{ N/m}^2$

56. In a Young's double slit experiment, the separation between the slits is 0.10 mm, the wavelength of light used is 600 nm and the interference pattern is observed on a screen 1.0 m away. Find the separation between the successive bright fringes

(A) 6.00 cm
(B) 6.00 mm
(C) 30.00 cm
(D) 3.00 cm

57. The light from the sun is found to have a maximum intensity near the wavelength of 470 nm. Assuming that the surface of a sun emits as a blackbody, calculate the temperature of the surface of the sun.

(A) 470 K
(B) 840 K
(C) 4128 K
(D) 6128 K

58. A beam of protons with a velocity of 4×10^5 m/s enters a uniform magnetic field of 0.3 T. The velocity makes an angle of 60° with the magnetic field. Find the radius of the helical path taken by the proton beam.

(A) 0.3 cm
(B) 1.2 cm
(C) 2.4 cm
(D) 9.6 cm

59. A player in a ground throws a cricket ball with a speed of 12.0 m/s at an angle of 45° with the horizontal. At what distance will it hit the ground?

(A) 6.6 m
(B) 8.3 m
(C) 11.2 m
(D) 14.4 m

60. In a coil, when the current is changed from 10.0 A in one direction to 10.0 A in the opposite direction in 0.5 s, the average induced emf is 0.4 V. The self inductance of the coil is

   (A) 10.0 mH
   (B) 5.0 mH
   (C) 2.0 mH
   (D) 0.5 mH

61. The dimensions of Planck's constant is same as that of

   (A) angular momentum
   (B) linear momentum
   (C) work
   (D) coefficient of viscosity

62. A nucleus $_z X^A$ emits a α-particle. The resultant nucleus emits a β^+ particle. The respective atomic and mass numbers of the final nucleus will be

   (A) $z - 3, A - 4$
   (B) $z - 1, A - 4$
   (C) $z - 2, A - 4$
   (D) $z, A - 2$

63. The resistivity of certain metals or alloys drops to zero when they are cooled below a certain temperature, this phenomenon is known as

   (A) Conductivity
   (B) Partial conductivity
   (C) Superconductivity
   (D) Non-conductivity

64. Which among the following materials display higher magnetic susceptibility?

   (A) Ferromagnetic material
   (B) Paramagnetic material
   (C) Diamagnetic material
   (D) None of the above

65. Phase difference between voltage and current in a capacitor in an ac circuit is

(A) π

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

(C) 0

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

66. The radii of first three Bohr orbits is in the ratio

(A) 1 : 2 : 3
(B) 2 : 4 : 6
(C) 1 : 4 : 9
(D) 1 : 3 : 5

67. The Earth revolves around the Sun in an elliptical orbit. Its speed

(A) goes on decreasing continuously
(B) is greatest when it is closest to the Sun
(C) is constant at the all the points on the orbit
(D) is greatest when it is farthest from the Sun

68. For the resultant of two vectors to be maximum. What must be the angle between them?

(A) 0°
(B) 60°
(C) 90°
(D) 180°

69. According to Hooke's law of elasticity, if stress is increased, the ratio of stress to strain

(A) becomes zero
(B) remains constant
(C) decreases
(D) increases

70. In semiconductor the forbidden energy gap lies

(A) just below the conduction band
(B) just above the conduction band
(C) either above or below the conduction band
(D) between the valence band and conduction band

71. The energy gap is much more in silicon than in germanium because

   (A) it has less number of electrons
   (B) it has high atomic mass number
   (C) its crystal has much stronger bonds called ionic bonds
   (D) its valence electrons are more tightly bound to their parent nuclei

72. If the volume of a gas is doubled at constant pressure, the average translational kinetic energy of its molecules will

   (A) be doubled
   (B) remain the same
   (C) increase by a factor
   (D) increase 4 times

73. Young's modulus of a material has the same unit as

   (A) Pressure
   (B) Strain
   (C) Compressibility
   (D) Force

74. When a stationary wave is formed by superposition, then its frequency is

   (A) same as that of the individual waves
   (B) twice that of the individual waves
   (C) half that of the individual waves
   (D) three fourth of the individual waves

75. The motion of planets in the solar system is an example of the conservation of

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

76. Which of the following units of concentration is temperature dependent?

    (A) Mole fraction
    (B) Molality
    (C) Normality
    (D) Weight percentage

77. If the mean free path of atoms is doubled then the pressure of the gas will become

    (A) $\dfrac{P}{4}$

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

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

    (D) P

78. **In what manner will increase of pressure affect the following equation?**

    $C(s) + H_2O \rightarrow CO(g) + H_2(g)$

    (A) Shift in the reverse direction
    (B) Shift in the forward direction
    (C) Increase in the yield of Hydrogen
    (D) No effect

79. Silver halides generally show

    (A) Schottky defect
    (B) Frenkel defect
    (C) Both Frenkel and Schottky defects
    (D) Cation excess defect

80. To get n-type of semiconductor, Germanium should be doped with

    (A) Gallium
    (B) Arsenic
    (C) Aluminium
    (D) Boron

81.   **If the dispersed phase is a liquid and the dispersion medium is solid, the colloid is known as**

(A)   foam
(B)   sol
(C)   emulsion
(D)   gel

82.   Coordination number of FCC crystal is

(A)   4
(B)   8
(C)   12
(D)   16

83.   What is the frequency of light having a wavelength of 4.50×10^{-6} cm?

(A) $2.84 \times 10^{-12} \, s^{-1}$

(B) $2.10 \times 10^{4} \, s^{-1}$

(C) $4.29 \times 10^{14} \, s^{-1}$

(D) $6.67 \times 10^{15} \, s^{-1}$

84.   Which statement about the four quantum numbers that describe electrons in atoms is **INCORRECT**?

(A) n = principal quantum number, n = 1, 2, 3, ...
(B) l = subsidiary (or azimuthal) quantum number, l = 1, 2, 3, ... , $(n + 1)$
(C) m_l = magnetic quantum number, m_l = $(-l)$, ... , 0, ... , $(+l)$
(D) m_s = spin quantum number, m_s = $+1/2$ or $-1/2$

85.   Which of the following statement is **NOT** true regarding the effect of increasing temperature on the distribution of molecular motion in a gas?

(A)   Most probable speed increases
(B)   Distribution curve become broader
(C)   The fraction of molecule with higher velocity increases
(D)   Distribution is independent of temperature

86. The total pressure exerted by a number of non reacting gases is equal to the sum of the partial pressures of the gases under the same conditions is known as

    (A) Boyle's law
    (B) Charle's law
    (C) Avogadro's law
    (D) Dalton's law

87. $\dfrac{PV}{nRT}$ is known as

    (A) Pressure factor
    (B) Temperature factor
    (C) Volume factor
    (D) Compressibility factor

88. In which of the following thermodynamics process there is no flow of heat between the system and the surroundings?

    (A) Isobaric
    (B) Isochoric
    (C) Adiabatic
    (D) Isothermal

89. For an ideally dilute binary solution Raoult's law is valid for

    (A) solute only
    (B) solvent only
    (C) both of the solute and the solvent
    (D) none of the solute and the solvent

90. Stability of dispersion is associated with magnitude of

    (A) asymmetry effect
    (B) Coulomb repulsion
    (C) zeta potential
    (D) Yukawa potential

91. Addition of catalyst to a reaction at a particular temperature lowers

    (A) the value of equilibrium constant
    (B) the value of activation energy for the forward reaction
    (C) the value of free energy change of reaction
    (D) the value of frequency factor in Arrhenius equation
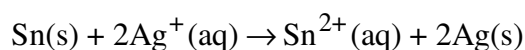
92. Which one is a correct relation?

(A) $\left(\dfrac{\partial P}{\partial V}\right)_T \left(\dfrac{\partial V}{\partial T}\right)_P \left(\dfrac{\partial T}{\partial P}\right)_V \geq 0$

(B) $\left(\dfrac{\partial P}{\partial V}\right)_T \left(\dfrac{\partial V}{\partial T}\right)_P \left(\dfrac{\partial T}{\partial P}\right)_V = 1$

(C) $\left(\dfrac{\partial P}{\partial V}\right)_T \left(\dfrac{\partial V}{\partial T}\right)_P \left(\dfrac{\partial T}{\partial P}\right)_V = -1$

(D) $\left(\dfrac{\partial P}{\partial V}\right)_T \left(\dfrac{\partial V}{\partial T}\right)_P \left(\dfrac{\partial T}{\partial P}\right)_V \leq 0$

93. Which of the following will increase the voltage of the cell with the cell reaction?

$$Sn(s) + 2Ag^+(aq) \rightarrow Sn^{2+}(aq) + 2Ag(s)$$

(A) Increase in concentration of both Sn^{2+} and Ag^+
(B) Increase in amount of Sn metal
(C) Increase in concentration of Sn^{2+}
(D) Increase in concentration of Ag^+ ions

94. The quantity of electricity required to deposit 1.15 g of sodium from molten NaCl [given atomic weight : Na = 23, Cl = 35.5] is

(A) 1 F
(B) 0.5 F
(C) 0.05 F
(D) 1.5 F

95. The specific conductance of a 0.1 M KCl solution at 23°C is 0.012 ohm^{-1}cm^{-1}. The resistance of cell containing the solution at the same temperature was found to be 55 ohm. The cell constant is

(A) 6.6 cm^{-1}
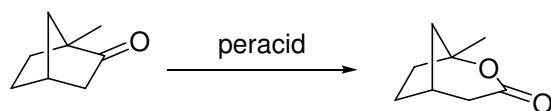(B) 0.66 cm^{-1}
(C) 0.066 cm^{-1}
(D) 0.12 cm^{-1}

96. Following reaction is an example for

- (A) Baeyer-Villiger oxidation
- (B) Epoxidation
- (C) Fischer esterification
- (D) Claisen reaction

97. Nitration of *t*-butylbenzene gives

- (A) 2-nitro derivative exclusively
- (B) 3-nitro derivative predominantly
- (C) a 2:1 mixture of 2- and 4-nitro derivatives
- (D) 4-nitro derivative almost exclusively

98. A simple Allene is a compound with the following chemical structure

$$H_2C=C=CH_2$$
*
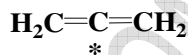
What is the state of hybridization of the starred carbon (middle carbon)?

- (A) sp^3
- (B) sp^2
- (C) alternates between sp^2 and sp
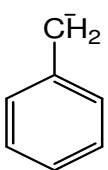- (D) sp

99. Adipic acid can be written as

$$HOOC-(CH_2)_n-COOH$$
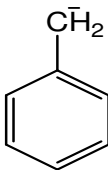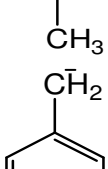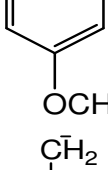
where **n** equals to

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

100. Which of the following, in aqueous solutions of equal concentration, has the lowest pH?

(A) $ClCH_2CO_2H$
(B) CH_3CO_2H
(C) CF_3CO_2H
(D) C_2H_5OH

101. Nucleic acids are biopolymers containing

(A) phosphite linkers
(B) hexoses
(C) amino acids
(D) purine and pyrimidine bases

102. Which statement about the intermediate $[C_6H_6NO_2]^+$, formed during the mononitration of benzene, is correct?

(A) It retains aromaticity
(B) It contains only one sp^3 hybridized carbon atom
(C) It is antiaromatic in nature
(D) It is nonaromatic, but planar in nature

103. Which among the following carbanions is most stable?

(A)
$\overset{\ominus}{C}H_2$

benzyl carbanion

(B)
$\overset{\ominus}{C}H_2$

CH_3

4-methylbenzyl carbanion

(C)
$\overset{\ominus}{C}H_2$

OCH_3

4-methoxybenzyl carbanion

(D)
$\overset{\ominus}{C}H_2$

NO_2

4-nitrobenzyl carbanion

104. In the following sequence B and C are

$CaC_2 \xrightarrow{H_2O} A \xrightarrow{\text{Red hot iron tube}} B \xrightarrow[CH_3Cl]{AlCl_3} C$
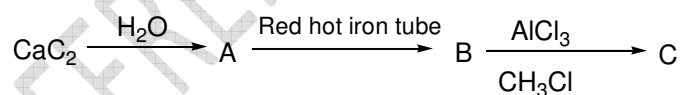
(A) Benzene and acetylene respectively
(B) Toluene and benzene respectively
(C) Benzene and toluene respectively
(D) Toluene and acetylene respectively

105. In order to distinguish between $C_6H_{13}NH_2$ and $C_6H_5NH_2$, which of the following reagents is useful?

(A) Hinsberg reagent
(B) Bromine water
(C) Solubility test in dilute acid
(D) Lucas reagent

106. Which among the following Vitamins helps to release energy from food?

   (A) K
   (B) A
   (C) B
   (D) D

107. Teflon coated cookware is losing popularity because

   (A) Teflon is very expensive
   (B) Teflon is highly carcinogenic
   (C) PFOA used in creating Teflon coating is not good for human health
   (D) Bakelite is a now emerging as a more economical alternative

108. Which among the following name reactions will give a hydrocarbon as the end product?

   (A) Hunsdiecker reaction
   (B) Meerwein-Verley-Ponndorf reduction
   (C) Wurtz-Fittig reaction
   (D) Reformatzky reaction

109. The foul smelling compound formed by the action of alcoholic caustic potash on chloroform and aniline is

   (A) Phenyl isocyanide (C_6H_5NC)

   (B) Benzotrichloride ($C_6H_5CCl_3$)

   (C) Benonitrile (C_6H_5CN)

   (D) Phenyl isocyanate (C_6H_5NCO)

110. Identify the product 'Z' in the following sequence of reactions
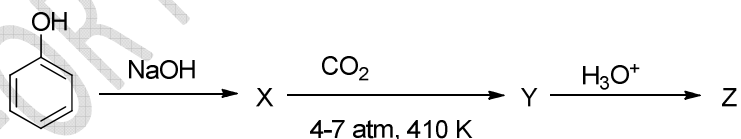
   (A) Aspirin
   (B) Salicylaldehyde
   (C) Benzoic acid
   (D) Salicylic acid

111. The reaction given below is a typical example for

$$C_6H_5COCl \quad + \quad H_2 \xrightarrow[\text{Catalyst}]{\text{Lindlar}} \quad C_6H_5CHO \quad + \quad HCl$$
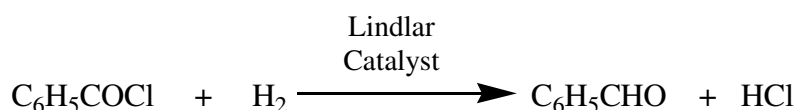
    (A) Meerwein-Verley-Ponndorf reduction
    (B) Clemmenson reduction
    (C) Rosenmund reduction
    (D) Wolff-Kishner reduction

112. An organic compound that readily undergoes Cannizaro reaction but does not give a positive test with Fehling's solution is

    (A) methanal
    (B) 2,2-dimethylpropanal
    (C) benzaldehyde
    (D) acetone

113. Selective method to convert pent-1-ene to pentan-1-ol is

    (A) Acid catalyzed addition of water
    (B) Oxymercuration-demercuration
    (C) Hydroboration-oxidation
    (D) Addition of HBr followed by treatment with NaOH in water

114. Oxidation state of Fe in cytochrome is/are

    (A) +2 and +4 only
    (B) +3 and +4 only
    (C) +2, +3, and +4 in catalytic intermediates
    (D) +4 only

115. Which among the following methods is best suited for the selective preparation of methyl *tert*-butyl ether?

    (A) Acid catalyzed addition of methanol to propyne
    (B) Williamson ether synthesis involving *tert*-butyl bromide and sodium salt of methanol
    (C) Williamson ether synthesis involving sodium salt of *tert*-butanol and methyl iodide
    (D) Selective methylation of dimethyl ether

116. $'A' + H_2O \rightarrow NaOH;$ $'A' \xrightarrow[400°C]{O_2} 'B' \xrightarrow[\text{at } 25°C]{H_2O} NaOH + O_2$

'B' is used for oxygenating in submarine. 'A' and 'B' are respectively

(A) Na_2O_2 and Na_2O
(B) Na_2O and Na_2O_2
(C) Na_2O_2 and O_2
(D) NaO and O_2

117. The formation of atomic hydrogen from molecular hydrogen is favoured under what conditions of temperature and pressure?

(A) Low temperature and low pressure
(B) High temperature and low pressure
(C) Low temperature and high pressure
(D) High temperature and high pressure

118. In a sealed nickel vessel, Xe and F_2 taken in 1 : 20 volume ratio were heated to 400°C. The product obtained is

(A) XeF
(B) XeF_2
(C) XeF_4
(D) XeF_6

119. The number of P-O-P bonds in cyclic metaphosphoric acid is

(A) zero
(B) two
(C) three
(D) four

120. The maximum possible number of hydrogen bonds that can be formed by a water molecule is

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

121. Which is the correct increasing order of lone pair of electrons on the central atom?

    (A) $IF_7 < XeF_2 < ClF_3 < IF_5$

    (B) $IF_7 < IF_5 < ClF_3 < XeF_2$

    (C) $IF_7 < ClF_3 < XeF_2 < IF_5$

    (D) $IF_7 < XeF_2 < IF_5 < ClF_3$

122. The actinides which exhibit the +7 oxidation state are

    (A) Pu, Am
    (B) U, Np
    (C) Am, Cm
    (D) Np, Pu

123. The correct order of ionic radii of Y^{3+}, La^{3+}, Eu^{3+} and Lu^{3+} is

    (A) $Y^{3+} < Lu^{3+} < Eu^{3+} < La^{3+}$

    (B) $Y^{3+} < La^{3+} < Eu^{3+} < Lu^{3+}$

    (C) $Lu^{3+} < Eu^{3+} < La^{3+} < Y^{3+}$

    (D) $La^{3+} < Eu^{3+} < Lu^{3+} < Y^{3+}$

124. Maximum oxidation state is presented by

    (A) CrO_2Cl_2 and MnO_4

    (B) MnO_2

    (C) $[Fe(CN)_6]^{3-}$ and $[Co(CN)_6]^{3-}$

    (D) MnO

125. How much volume of CO_2 will be obtained by thermal decomposition of 25 g of calcium carbonate (molar mass of calcium carbonate = 100 g) ?

    (A) 1.0 L
    (B) 5.6 L
    (C) 11.2 L
    (D) 22.4 L

126. The number of radial nodes for the 4f orbital

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

127. Equanil is

    (A) artificial sweetener
    (B) tranquilizer
    (C) antihistamine
    (D) antifertility drug

128. What type of orbital is designated by $n = 4$, $l = 2$, $ml = -2$?

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

129. Balmer series of lines in the hydrogen spectrum are observed in

    (A) UV region
    (B) visible region
    (C) infrared region
    (D) far infrared region

130. Which of the following metal hydroxide is least basic?

    (A) $Ca(OH)_2$
    (B) $Mg(OH)_2$
    (C) $Sr(OH)_2$
    (D) $Ba(OH)_2$

131. Permanent hardness of water is due to the presence of

    (A) sulphates of Na and K
    (B) sulphates of Ca and Mg
    (C) hydrogen carbonates of Ca and Mg
    (D) carbonates of alkali metals in water

132. For the element with the electronic configuration $[Xe]4f^{14}5d^{10}6s^{2}6p^{1}$, which is most stable oxidation state?

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

133. A surface ejects electrons when it is hit by green light; but does not eject electron when it is hit by yellow light. Will electrons be ejected if the surface is hit by red light?

   (A) Yes
   (B) No
   (C) Yes if the red beam is quite intense
   (D) Yes if the red beam continues to fall upon

134. Stable ionic solid MX is formed with

   (A) metal having high electron affinity
   (B) metal having high ionisation potential
   (C) X having high electron affinity
   (D) metal having low ionisation potential and X having high electron affinity

135. With respect to periodic properties the correct statement is

   (A) Electron affinity order is: $F > O > Cl$
   (B) First ionisation energy order is: $Al > Mg > K$
   (C) Atomic radius order is: $N > P > As$
   (D) Ionic radius order is: $K^+ > Ca^{2+} > Mg^{2+}$

136. The rank of the diagonal matrix $\begin{bmatrix} 2 & & & & \\ & -1 & & & \\ & & 0 & & \\ & & & 4 & \\ & & & & 0 \end{bmatrix}$ is

    (A) 1
    (B) 3
    (C) 5
    (D) 2

137. Let $\Delta = \begin{vmatrix} 1 & -4 & 20 \\ 1 & -2 & 5 \\ 1 & 2x & 5x^2 \end{vmatrix}$. The solution set of $\Delta = 0$ is

    (A) $\{-2,3\}$
    (B) $\{-3,4\}$
    (C) $\{4,-6\}$
    (D) $\{-2,-1\}$

138. If $f'(3) = 2$, then $\lim\limits_{h \to 0} \dfrac{f\left(3+h^2\right) - f\left(3-h^2\right)}{2h^2}$ is

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

139. What is the sum of all two digit numbers?

    (A) 4900
    (B) 4895
    (C) 4905
    (D) 4985

140. For any real x, the range of the function $f(x) = 3x^2 + 5x + 7$ is

(A) $\left[\dfrac{59}{2}, \infty\right)$

(B) $\left[\dfrac{59}{12}, \infty\right)$

(C) $\left[-\infty, \dfrac{59}{12}\right)$

(D) $\left[-\infty, \dfrac{12}{59}\right)$

141. If a vertex of a triangle is (1, 1) and the mid points of two sides through this vertex are (−1, 2) and (3, 2) ,then the centroid of the triangle is

(A) $\left(1, \dfrac{7}{3}\right)$

(B) $\left(\dfrac{1}{3}, \dfrac{7}{3}\right)$

(C) $\left(-1, \dfrac{7}{3}\right)$

(D) $\left(\dfrac{-1}{3}, \dfrac{7}{3}\right)$

142. If $f(x) = 2x^2 - 2x + 4$ and $f(2\alpha) = 4f(\alpha)$, then α is equal to

(A) 4
(B) 3
(C) 0
(D) −2

143. The value of $\dfrac{d}{dx}\left(\log_e (ax)^x\right)$ where a is a constant is equal to

(A) 1

(B) $\log_e ax$

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

(D) $\log_e(ax) + 1$

144. The period of the function $f(x) = [x] + [2x] + [3x] + ... [nx] - \dfrac{n(n+1)x}{2}$, where $n \in N$ and $[\ ]$ denotes the greatest integer function, is

(A) 1

(B) n

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

(D) $2n$

145. If one root of the equation $x^2 + px + 12 = 0$ is 4 and the equation $x^2 + px + q = 0$ has equal roots, then the value of q is

(A) 3

(B) 12

(C) $\dfrac{49}{4}$

(D) $\dfrac{39}{4}$

146. The points $(a, b+c), (b, c+a)$ and $(c, a+b)$ are

(A) vertices of an equilateral triangle
(B) concyclic
(C) vertices of a right angled triangle
(D) collinear

147. If $f(x) = \dfrac{3x+1}{3x-1}$, then the roots of the equation $f(x) + f\left(\dfrac{1}{x}\right) = 0$ are

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

(B) $-3, \dfrac{1}{3}$

(C) $3, \dfrac{1}{3}$

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

148. Let $\Delta = \begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix}$. Then Δ is equal to

(A)   0

(B) $a + b + c$

(C) $\dfrac{1}{2}\left(a^2 + b^2 + c^2\right)$

(D)   3

149. $\lim\limits_{x \to 0} \left(\dfrac{1^x + 2^x + 3^x + \ldots + n^x}{n} \right)^{\!1/x}$ is

(A) $n!$
(B) $(n-1)!$
(C) n
(D) $(n\ !)^{1/n}$

150.   The set onto which the derivative of the function $f(x) = x(\log x - 1)$ maps the ray $[1, \infty)$ is

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

151.   A point P (other than origin) on $y = 4x^3 - 2x^5$ such that the tangent at P passes through the origin is

(A) $(1, 3)$
(B) $(1, 2)$
(C) $(-1, 2)$
(D) $(2, -32)$

152. In a network of railways, a small island has 15 stations. The number of different types of tickets to be printed for each class, if every station must have tickets for other station, is

(A) 210
(B) 230
(C) 310
(D) 340

153. The differential equation representing a curve passing through (1, 2) is $\dfrac{dy}{dx} = \dfrac{2y}{x}$.

Then the equation of the curve is

(A) $y = 2x^2$

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

(C) $y = 2x$

(D) $x = 2y - 3$

154. The points with position vectors $60\vec{i} + 3\vec{j}$, $40\vec{i} - 8\vec{j}$, $a\vec{i} - 52\vec{j}$ are collinear if

(A) $a = -40$
(B) $a = 40$
(C) $a = 20$
(D) $a = -20$

155. The value of the integral $\displaystyle\int_{0}^{1}\left(\dfrac{2-x}{1+x}\right)dx$ is

(A) $3 \log 2$
(B) $2 \log 2 - 1$
(C) $3 \log 2 + 1$
(D) $3 \log 2 - 1$

156. If $\omega(\neq 1)$ is a complex cube root of unity, the least value of $n \in \mathbb{N}$ for which

$\left(1+\omega^2\right)^n = \left(1+\omega^4\right)^n$ is

(A) 6
(B) 5
(C) 3
(D) 2

157. If $\int_{0}^{\infty} \dfrac{x^2}{\left(x^2+a^2\right)\left(x^2+b^2\right)\left(x^2+c^2\right)}\,dx = \dfrac{\pi}{2(a+b)(b+c)(c+a)}$, then the value of

$\int_{0}^{\infty} \dfrac{1}{\left(x^2+4\right)\left(x^2+9\right)}\,dx$ is

(A) $\dfrac{\pi}{60}$

(B) $\dfrac{\pi}{16}$

(C) $\dfrac{\pi}{12}$

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

158. Let $f(x) = \dfrac{\log\left(1+x+x^2\right)+\log\left(1-x+x^2\right)}{\sec x - \cos x}$, $x \neq 0$. Then the value of $f(0)$ so that f is continuous at $x = 0$ is

(A) 1
(B) 0
(C) 2
(D) −1

159. The equation of the line passing through (3, 3) and making an angle of 60° with the positive direction of the x-axis is

(A) $x - \sqrt{3}y + 3 - 3\sqrt{3} = 0$

(B) $x + \sqrt{3}y + 3 - 3\sqrt{3} = 0$

(C) $\sqrt{3}x - y + 3 - 3\sqrt{3} = 0$

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

160. Identify the function for the given below:
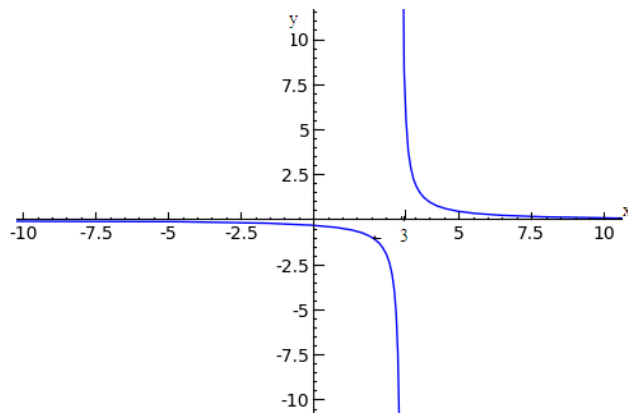
(A) $y = \dfrac{1}{x}$

(B) $y = \dfrac{1}{x-3}$

(C) $y = \dfrac{1}{x+3}$

(D) $y = \dfrac{1}{x^2}$

161. The least value of n so that $y_n = y_{n+1}$ where $y = x^2 + e^x$ and y_n denotes the nth order derivative of y, is

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

162. The ratio in which the line segment joining $(2, -3)$ and $(5, 6)$ is divided by the x-axis is

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

163. Sum of the roots of the equation $4^x - 3\left(2^{x+3}\right) + 128 = 0$ is

(A) 5
(B) 6
(C) 7
(D) 8

164. Let $\Delta = \begin{vmatrix} b+c & q+r & y+z \\ c+a & r+p & z+x \\ a+b & b+q & x+y \end{vmatrix}$ and $\Delta_1 = \begin{vmatrix} x & a & b \\ y & b & q \\ z & c & r \end{vmatrix}$. Then

   (A) $\Delta = 2\Delta_1$
   (B) $\Delta = -2\Delta_1$
   (C) $\Delta = 4\Delta_1$
   (D) $\Delta = -4\Delta_1$

165. If the area of triangle formed by the line $4x + 3y + c = 0$ and the axes of co-ordinates is 6, then c is equal to

   (A) ± 18
   (B) ± 16
   (C) ± 12
   (D) ± 8

166. If a, b, c are in A.P., then the line $ax + by + c = 0$ will always pass through the point

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

167. The difference between the greatest and the least value of the function
   $F(x) = \int_{0}^{x} (t+1)\,dt$ on [2, 3] is

   (A) 3
   (B) 2
   (C) $\dfrac{7}{2}$
   (D) $\dfrac{3}{2}$

168. The point(s), at which the function given by $f(x)=\begin{cases} \dfrac{x}{|x|}, & x<0 \\ -1, & x\geq 0 \end{cases}$ is continuous

(A) $x\in R$
(B) $x=0$
(C) $x\in R-\{0\}$
(D) $x=-1$ and 1

169. If $E=\dfrac{1}{4}\cdot\dfrac{2}{6}\cdot\dfrac{3}{8}\cdots\dfrac{30}{62}\cdot\dfrac{31}{64}=8^x$, then the value of x is

(A) -7
(B) -9
(C) -10
(D) -12

170. If $u=e^{\left(\frac{x^2}{y^2}\right)}+e^{\left(\frac{y^2}{x^2}\right)}$, then $x\dfrac{\partial u}{\partial x}+y\dfrac{\partial u}{\partial y}=$

(A) u

(B) $\dfrac{\partial^2 u}{\partial x\partial y}$

(C) $\dfrac{1}{x}+\dfrac{1}{y}$

(D) 0

171. The area of the figure bounded by the lines $x=0$, $x=\dfrac{\pi}{2}$, $f(x)=\sin x$, $g(x)=\cos x$ is

(A) $2\left(\sqrt{2}-1\right)$
(B) $\sqrt{3}-1$
(C) $2\left(\sqrt{3}-1\right)$
(D) $2\left(\sqrt{2}+1\right)$

172. The point on the y-axis whose perpendicular distance from the line $4x - 3y - 12 = 0$ is

    (A) (0, 1)
    (B) (0, 3)
    (C) (0, −9)
    (D) Both (A) and (C)

173. If A and B are two skew symmetric matrices of order n, then

    (A) AB is a skew symmetric matrix
    (B) AB is a symmetric matrix
    (C) AB is a symmetric matrix if A and B commute
    (D) AB is a singular matrix

174. The latus rectum of an ellipse is equal to half of its minor axis. Its eccentricity is

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

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

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

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

175. The number of subsets of the set $A = \{a_1, a_2, ..., a_n\}$ which contain even number of elements is

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

176. A set of direction cosines of the normal to the plane $6x - 3y - 2z = 10$ is

(A) $\left(\dfrac{6}{7}, \dfrac{-3}{7}, \dfrac{-2}{7}\right)$

(B) $(6, -3, -2)$

(C) $\left(\dfrac{6}{49}, \dfrac{-3}{49}, \dfrac{-2}{49}\right)$

(D) $\left(\dfrac{-6}{49}, \dfrac{3}{49}, \dfrac{2}{49}\right)$

177. Six boys and six girls sit in a row randomly. The probability that boys and girls sit alternatively is

(A) $\dfrac{1}{231}$

(B) $\dfrac{5}{462}$

(C) $\dfrac{1}{462}$

(D) $\dfrac{7}{101}$

178. A particular solution of $\log \dfrac{dy}{dx} = 3x + 4y$, $y(0) = 0$ is

(A) $e^{3x} + 3e^{-4y} = 4$
(B) $4e^{3x} - e^{-4y} = 3$
(C) $3e^{3x} + 5e^{4y} = 7$
(D) $4e^{3x} + 3e^{-4y} = 7$

179. If $x > 1$, $y > 1$, $z > 1$ are in Geometric Progression, then $\dfrac{1}{1+\ln x}, \dfrac{1}{1+\ln y}, \dfrac{1}{1+\ln z}$ are in

(A) Arithmetic Progression
(B) Geometric Progression
(C) Harmonic Progression
(D) both Arithmetic Progression and Harmonic Progression

180. The population $p(t)dt$ time 't' of a certain mouse species satisfies the differential equation $\dfrac{d}{dt}p(t) = 0.5\,p(t) - 450$. If $p(0) = 850$, then the time at which the population becomes zero is

    (A) $\log 9$

    (B) $\dfrac{1}{2}\log 18$

    (C) $\log 18$

    (D) $2\log 18$

181. The equation of the plane through $(3, 4, -1)$ which is parallel to the plane $\vec{r} \cdot \left(2\vec{i} - 3\vec{j} + 5\vec{k}\right) + 7 = 0$ is

    (A) $\vec{r} \cdot \left(2\vec{i} - 3\vec{j} + 5\vec{k}\right) + 11 = 0$

    (B) $\vec{r} \cdot \left(3\vec{i} + 4\vec{j} - \vec{k}\right) + 11 = 0$

    (C) $\vec{r} \cdot \left(3\vec{i} + 4\vec{j} - \vec{k}\right) + 7 = 0$

    (D) $\vec{r} \cdot \left(2\vec{i} - 3\vec{j} + 5\vec{k}\right) - 7 = 0$

182. The function $f(x)$, where $f(x) = \int e^{x}(x-1)(x-2)dx$ decreases in the interval

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

183. The reflection of the point $A(1,0,0)$ in the line $\dfrac{x-1}{2} = \dfrac{y+1}{-3} = \dfrac{z+10}{8}$ is

    (A) $(3, -4, -2)$
    (B) $(5, -8, -4)$
    (C) $(1, -1, -10)$
    (D) $(2, -3, 8)$

184. The sum $\displaystyle\sum_{i=0}^{m}\binom{10}{i}\binom{20}{m-i}$ (where $\binom{p}{q}=0$ if $p<q$) is maximum when m is

 (A) 5
 (B) 10
 (C) 15
 (D) 20

185. The number of distinct real values of λ for which the lines $\dfrac{x-1}{1}=\dfrac{y-2}{2}=\dfrac{z+3}{\lambda^2}$

 and $\dfrac{x-3}{1}=\dfrac{y-2}{\lambda^2}=\dfrac{z-1}{2}$ are coplanar is

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

186. If $f(x)=\displaystyle\lim_{n\to\infty}\left[2x+4x^3+...+2nx^{2n-1}\right](0<x<1)$, then $\int f(x)dx$ is equal to

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

 (B) $\dfrac{1}{\sqrt{1-x^2}}$

 (C) $\dfrac{1}{x^2-1}$

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

187. Six dice are thrown simultaneously. Then the probability that all of them show the different faces is

 (A) $\dfrac{1}{6^5}$

 (B) $\dfrac{6!}{6^6}$

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

 (D) $\dfrac{5!}{6^6}$

188. Two tangents are drawn from the origin to a circle with centre at $(2,-1)$. If the equation of one of the tangents is $3x + y = 0$, the equation of the other tangent is

(A) $3x - y = 0$
(B) $x + 3y = 0$
(C) $x - 3y = 0$
(D) $x + 2y = 0$

189. If $P(A) = \dfrac{1}{4}$, $P(B) = \dfrac{1}{2}$, $P(A \cup B) = \dfrac{5}{8}$, then $P(A \cap B) =$

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

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

(C) $\dfrac{2}{8}$

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

190. The point on the curve $y = x^2$ which is closest to the point $\left(4, \dfrac{-1}{2}\right)$ is

(A) $(1, 1)$

(B) $(2, 4)$

(C) $\left(\dfrac{2}{3}, \dfrac{4}{9}\right)$

(D) $\left(\dfrac{4}{3}, \dfrac{16}{9}\right)$

191. If A and B are independent events of a random experiment such that $P(A\cap B)=\dfrac{1}{6}$ and $P(\bar{A}\cap\bar{B})=\dfrac{1}{3}$, then $P(A)$ is equal to

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

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

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

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

192. Let S be the set of integers. For $a,\ b \in S$, define aRb iff $|a-b| < 1$. Then

(A) R is not reflexive
(B) R is not symmetric
(C) R is an equivalence relation
(D) R is not an equivalence relation

193. There are four machines and it is known that exactly two of them are faulty. They are tested, one by one, in a random order till both the faulty machines are identified. Then the probability that only two tests are needed is

(A) $\dfrac{1}{3}$

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

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

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

194. If $\int f(x)dx = -2\cos\sqrt{x} + c$, then $f(x)$ is equal to

    (A) $\sin\sqrt{x}$

    (B) $\dfrac{\sin\sqrt{x}}{\sqrt{x}}$

    (C) $2\cos\sqrt{x}$

    (D) $\cos\sqrt{x}$

195. $\displaystyle\int_{-2}^{2}|x-1|\,dx =$

    (A) 0
    (B) 5
    (C) 1
    (D) 4

196. If letters of the word SACHIN are arranged in all possible ways and are written out as in a dictionary, then the word SACHIN appears at serial number

    (A) 603
    (B) 602
    (C) 601
    (D) 600

197. If $\displaystyle\int_{0}^{1}\dfrac{\sqrt{e^x}}{\sqrt{e^x+e^{-x}}}\,dx = \log\left(\dfrac{e+A}{1+\sqrt{2}}\right)$, then A is equal to

    (A) e^2+1

    (B) $\sqrt{e^2+1}$

    (C) e^2

    (D) e^2-1

198. Let f be a nonzero continuous function satisfying $f(x+y)=f(x)f(y)$ for all $x,y \in \mathbb{R}$. If $f(2)=9$. Then $f(3)$ is

    (A) 1
    (B) 27
    (C) 9
    (D) 26

199. If $f(x) = (1 + \tan x)\left(1 + \tan\left(\dfrac{\pi}{4} - x\right)\right)$ and $g(x)$ is a function with domain R, then

$$\int_0^1 x^3 (g \circ f)(x)\,dx \text{ is}$$

    (A) $\dfrac{1}{2} g\left(\dfrac{\pi}{2}\right)$

    (B) $\dfrac{1}{4} g(2)$

    (C) $\dfrac{1}{4} g(1)$

    (D) $g(1)$

200. If the product of the roots of the equation $x^2 - 5kx + 2e^{4\ln k} - 1 = 0$ is 31, then the sum of the roots is

    (A) -10
    (B) 5
    (C) -8
    (D) 10

201. $\displaystyle\int_{-1}^{1} e^{-x^2}\,dx = k$, then $\displaystyle\int_{-1}^{0} e^{-x^2}\,dx =$

    (A) $-k$

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

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

    (D) $2k$

202. Let $x = \dfrac{-1}{3}\left(1 + i\sqrt{7}\right)$ and $y = \cos\dfrac{\pi}{4} + i\sin\dfrac{\pi}{4}$. Let $\Delta = \begin{vmatrix} 1 & x & x \\ 1 & x+y & y \\ 1 & x & x+y \end{vmatrix}$. Then Δ is

equal to

(A) $-\sqrt{7}$

(B) $\sqrt{7}$

(C) i

(D) -1

203. The number of ways in which six '+' and four '−' signs can be arranged in a line so that no two '−' signs occur together is

(A) 30

(B) 35

(C) 6!5!

(D) 10!

204. If $z + 2|z| = \pi + 4i$, then $\mathrm{Im}(z)$ equals

(A) π

(B) $\sqrt{\pi}$

(C) $\sqrt{\pi^2 + 16}$

(D) 4

205. If three positive real numbers a, b, c are in Arithmetic Progression such that $abc = 4$, then the minimum possible value of b is

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

(B) $2^{\frac{2}{3}}$

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

(D) $2^{\frac{5}{2}}$

206. The inequality $|z-4| < |z-2|$ represents the region given by

(A) $\operatorname{Re}(z) \geq 0$
(B) $\operatorname{Re}(z) < 3$
(C) $\operatorname{Re}(z) \leq 0$
(D) $\operatorname{Re}(z) > 3$

207. If $x = -9$ is a root of $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0,$ then the other two roots are

(A) 3, 7
(B) 2, 7
(C) 3, 6
(D) 2, 6

208. If $|z| = 1$ and $z \neq \pm 1$, then all the values of $\dfrac{z}{1-z^2}$ lie on

(A) a line not passing through the origin
(B) $|z| = 2$
(C) the x-axis
(D) the y-axis

209. If $\displaystyle\int \frac{\sin x}{\sin(x-\alpha)}\, dx = Ax + B\log(x-\alpha) + c,$ then the value of (A, B) is

(A) $(-\sin\alpha, \cos\alpha)$
(B) $(\cos\alpha, \sin\alpha)$
(C) $(\sin\alpha, \cos\alpha)$
(D) $(-\cos\alpha, \sin\alpha)$

210. If $\dfrac{1}{3-4i}$ is a root of $ax^2 + bx + c = 0$, $(a, b, c \in \mathbb{R})$, then

(A) $b + 6c = 0$
(B) $b = 6c$
(C) $a + 25c = 0$
(D) $b^2 = c$

211. If ω is a complex cube root of unity, the matrix $A = \begin{pmatrix} 1 & \omega^2 & \omega \\ \omega^2 & \omega & 1 \\ \omega & 1 & \omega^2 \end{pmatrix}$ is a

    (A) singular matrix
    (B) non-singular matrix
    (C) skew symmetric matrix
    (D) symmetric matrix

212. The equation $e^{\sin x} - e^{-\sin x} = 4$ has

    (A) no real roots
    (B) exactly one real root
    (C) exactly four real roots
    (D) infinite number of real roots

213. If $7\sin^2\theta + 3\cos^2\theta = 4$ and $0 \le \theta \le \dfrac{\pi}{2}$, then the value of $\tan\theta$ is

    (A) $\sqrt{\dfrac{3}{7}}$

    (B) $\sqrt{\dfrac{2}{7}}$

    (C) $\sqrt{\dfrac{1}{3}}$

    (D) $\sqrt{\dfrac{1}{7}}$

214. For the equation $3x^2 + px + 3 = 0, p > 0,$ if one of the roots is square of the other, then p is equal to

    (A) $\dfrac{1}{3}$

    (B) 1

    (C) 3

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

215. The contrapositive of $p \to (q \to r)$ is logically equivalent to

  (A) $p \to (q \to r)$
  (B) $(q \to r) \to \sim p$
  (C) $p \vee q \to r$
  (D) $(q \to r) \to p$

216. If $z = \dfrac{7-i}{3-4i}$ then z^{14} equals

  (A) 2^7
  (B) 2_i^7
  (C) -2_i^7
  (D) -2^7

217. Let S be a non-empty subset of **R**. Consider the following statement:
      P : There is a rational number $x \in S$ such that $x > 0$.
      Then the negation of P is

  (A) Every rational number $x \in S$ satisfies $x \leq 0$
  (B) $x \in S$ and $x \leq 0 \Rightarrow x$ is not a rational number
  (C) There is a rational number $x \in S$ such that $x \leq 0$
  (D) There is no rational number $x \in S$ such that $x \leq 0$

218. If $\cos\theta + \sec\theta = 2$, then the value of $\cos^{68}\theta + \sec^{68}\theta$ equals

  (A) 1
  (B) 2
  (C) 3
  (D) 68

219. Value of $x = \sqrt{6+\sqrt{6+\sqrt{6+...\text{upto } \infty}}}$ is

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

220. The domain of the function $f(x) = \sin^{-1}\left(\log_3\left(\frac{x}{2}\right)\right)$ is

   (A) $[-1, 9]$
   (B) $[1, 9]$
   (C) $[-9, 1]$
   (D) $[3, 9]$

221. The equation $z^3 = \bar{z}$ has

   (A) no solution
   (B) two solutions
   (C) five solutions
   (D) infinite number of solutions

222. Which of the following functions is not 1-1?

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

223. The number of points at which the function $f(x) = \dfrac{1}{x - [x]}$ is not continuous is

   (A) 1
   (B) 2
   (C) 3
   (D) infinitely many

224. If A is a set with n elements, then the cardinality of
   $\{(x, y, z) : x, y, z \in A, x \neq y, y \neq z, z \neq x\}$ is

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

225. Let $\Delta(x) = \begin{vmatrix} \cos^2(x) & \cos x \sin x & -\sin x \\ \cos x \sin x & \sin^2 x & \cos x \\ \sin x & -\cos x & 0 \end{vmatrix}$. Then $\int_0^{\frac{\pi}{2}} [\Delta(x) + \Delta'(x)] dx$ equals

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

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

(C) 2π

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

FINAL ANSWER KEY
TEST FOR PHYSICS CHEMISTRY MATHEMATICS SHIFT V

SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	A	31	A	61	A	91	B	121	B
2	C	32	D	62	A	92	C	122	D
3	D	33	A	63	C	93	D	123	A
4	B	34	A	64	A	94	C	124	A
5	D	35	D	65	B	95	B	125	B
6	C	36	B	66	C	96	A	126	C
7	A	37	D	67	B	97	D	127	B
8	B	38	D	68	A	98	D	128	C
9	A	39	D	69	B	99	D	129	B
10	D	40	B	70	D	100	C	130	B
11	C	41	D	71	D	101	D	131	B
12	C	42	C	72	A	102	B	132	D
13	C	43	B	73	A	103	D	133	B
14	D	44	A	74	A	104	C	134	D
15	D	45	D	75	C	105	B	135	D
16	C	46	C	76	B	106	C	136	B
17	D	47	A	77	B	107	C	137	D
18	C	48	D	78	A	108	C	138	B
19	C	49	B	79	C	109	A	139	C
20	C	50	B	80	B	110	D	140	B
21	B	51	B	81	D	111	C	141	A
22	A	52	B	82	C	112	C	142	B
23	C	53	A	83	D	113	C	143	D
24	D	54	A	84	B	114	C	144	A
25	A	55	B	85	D	115	C	145	C
26	B	56	B	86	D	116	B	146	D
27	A	57	D	87	D	117	B	147	D
28	A	58	B	88	C	118	D	148	A
29	A	59	D	89	B	119	C	149	D
30	D	60	A	90	C	120	C	150	C

SI No.	Key	SI No.	Key	SI No.	Key
151	B	181	A	211	A
152	A	182	C	212	A
153	A	183	B	213	C
154	A	184	C	214	C
155	D	185	C	215	A
156	C	186	D	216	C
157	A	187	B	217	A
158	A	188	C	218	B
159	C	189	A	219	A
160	B	190	A	220	B
161	B	191	D	221	C
162	C	192	C	222	D
163	C	193	B	223	D
164	A	194	B	224	D
165	C	195	B	225	B
166	C	196	C		
167	C	197	B		
168	A	198	B		
169	D	199	B		
170	D	200	D		
171	A	201	C		
172	D	202	C		
173	C	203	B		
174	C	204	D		
175	A	205	B		
176	A	206	D		
177	C	207	B		
178	D	208	D		
179	C	209	B		
180	D	210	A		