D 144469 (Pages : 14) Name.....

Reg. No.....

# CALICUT UNIVERSITY COMMON ENTRANCE TEST (CU-CET), APRIL 2026

M.Sc. Physics/M.Sc. Radiation Physics/M.Sc. Physics (Nano Science)

Time : Two Hours Maximum : 400 Marks

*Each question carries 4 marks.*
*One mark will be deducated for each wrong answer.*

1. A force of 10 N is applied to a 2 kg. block at rest on a frictionless surface. What will be its acceleration ?

   (a) 20 m/s.$^2$ (b) 10 m/s.$^2$

   (c) 5 m/s.$^2$ (d) 2 m/s.$^2$

2. A passenger standing in a moving bus suddenly falls forward when the brakes are applied. This is an example of :

   (a) Newton's First law. (b) Newton's Second law.

   (c) Newton's Third law. (d) Conservation of Momentum.

3. A gun recoils when a bullet is fired due to :

   (a) Newton's First law. (b) Newton's Second law.

   (c) Newton's Third law. (d) Law of energy conservation.

4. A body is moved 10 m. by a force of 5N acting in the direction of displacement. What is the work done ?

   (a) 50 J. (b) 5 J.

   (c) 0 J. (d) 500 J.

5. Which of the following has the highest kinetic energy ?

   (a) A 1 kg. object moving at 10 m/s.

   (b) A 2 kg. object moving at 5 m/s.

   (c) A 0.5 kg. object moving at 20 m/s.

   (d) A 3 kg. object moving at 4 m/s.

6. If the power output of a machine is 500 W, how much work done it do in 10 seconds ?

   (a) 5000 J. (b) 50 J.

   (c) 500 J. (d) 5 J.

7. A body of mass 2 kg. is moving in a circular path of radius 3 m. with a velocity of 4 m/s. What is its angular momentum ?

   (a) 12 $kg \cdot m^2/s$. (b) 24 $kg \cdot m^2/s$.

   (c) 6 $kg \cdot m^2/s$. (d) 48 $kg \cdot m^2/s$.

8. The angular velocity of a rotating body increases when :

   (a) Its moment of inertia increases. (b) A torque is applied in the direction of motion.

   (c) It moves in a straight line. (d) The external force is zero.

9. A skáter spins faster when they pull their arms in. This is an example of :

   (a) Conservation of Angular Momentum.

   (b) Newton's First Law.

   (c) Work-Energy Theorem.

   (d) Rotational Inertia.

10. The SI unit of angular momentum is :

    (a) $kg \cdot m/s$. (b) $kg \cdot m^2/s$.

    (c) $N \cdot m$. (d) rad/s.

11. The speed of a wave on a string depends on :

    (a) The amplitude of the wave.

    (b) The tension in the string and its linear mass density.

    (c) The frequency of the wave.

    (d) The wavelength of the wave.

12. The fundamental frequency of a stretched string is doubled when :

    (a) The tension is doubled.

    (b) The length is doubled.

    (c) The mass per unit length is doubled.

    (d) The amplitude is doubled.

13. In a standing wave, the points of zero displacement are called :

    (a) Antinodes. (b) Nodes.

    (c) Crests. (d) Troughs.

14. Which of the following is not a characteristic of a wave ?

(a) Frequency. (b) Wavelength.

(c) Amplitude. (d) Mass.

15. The total energy of a simple harmonic oscillator is proportional to :

(a) The square of the amplitude. (b) The frequency.

(c) The displacement. (d) The time period.

16. The time period of a simple pendulum of length L is given by :

(a) $T = 2\pi\sqrt{L/g}$. (b) $T = 2\pi\sqrt{g/L}$.

(c) $T = \frac{1}{2\pi}\sqrt{L/g}$. (d) $T = 2\pi\sqrt{L}$.

17. In simple harmonic motion, acceleration is :

(a) Constant.

(b) Proportional to displacement and directed towards mean position.

(c) Proportional to velocity.

(d) Independent of displacement.

18. A mass-spring system executes simple harmonic motion with amplitude A. The total energy of the system is :

(a) $\frac{1}{2}kA^2$. (b) $kA$.

(c) $mA^2$. (d) $\frac{1}{2}mA^2$.

19. The motion of a simple pendulum is approximately simple harmonic for :

(a) Small angles of oscillation. (b) Large angles of oscillation.

(c) Any angle of oscillation. (d) When the bob is heavy.

20. A point charge $q$ is placed at the center of a spherical Gaussan surface. The electric flux through the surface is :

(a) $q/4\pi\varepsilon_0$. (b) $q/\varepsilon_0$.

(c) Zero. (d) $4\pi q/\varepsilon_0$.

21. The electrostatic potential inside a charged spherical shell is :

(a) Zero.

(b) Constant.

(c) Varies with distance from center.

(d) Infinity.

22. The unit of permittivity of free space $\varepsilon_0$ is :

(a) $C^2N^{-1}m.^{-2}$ (b) $C^2m^{-2}N^{-1}$.

(c) $Nm^2C^{-2}$. (d) $NC^{-2}$.

23. The magnetic field inside an ideal solenoid is :

(a) Zero. (b) Uniform.

(c) Varies with radius. (d) Infinite.

24. Gauss's law for magnetism states that :

(a) Magnetic monopoles exist.

(b) Magnetic flux through a closed surface is zero.

(c) Magnetic field lines form open loops.

(d) The curl of the magnetic field is always zero.

25. The force per unit length between two parallel current-carrying wires is given by :

(a) $\frac{\mu_0 I_1 I_2}{2\pi r}$. (b) $\frac{\mu_0 I_1 I_2}{4\pi r^2}$.

(c) $\frac{I_1 I_2}{4\pi\varepsilon_0 r}$. (d) $\frac{I_1 I_2}{2\pi r}$.

26. A charged particle moves parallel to a uniform magnetic field. The force acting on it is :

(a) Maximum. (b) Minimum.

(c) Zero. (d) Perpendicular to velocity.

27. The divergence of an electric field in free space is :

(a) $\rho/\varepsilon_0$. (b) $q/4\pi\varepsilon_0$.

(c) Zero. (d) $4\pi q/\varepsilon_0$.

28. The Biot-Savart law is used to determine :

(a) Electric field due to a charge.

(b) Magnetic field due to a current.

(c) Electric potential due to a charge distribution.

(d) Electrostatic force between two charges.

29. What is the correct way to print "Hello, World" in Python ?

(a) Print ("Hello, World"). (b) Echo "Hello, World".

(c) Printf ("Hello, World"). (d) Console.log ("Hello, World").

30. What will be the output of the following Python code ?

```
x = 5
y = "5"
print(x + int(y))
```

(a) 55. (b) "55".

(c) 10. (d) Error.

31. What keyword is used to define a function in Python ?

(a) func. (b) define.

(c) def. (d) function.

32. The wave function $\psi(x, t)$ in quantum mechanics represents :

(a) The exact position of a particle.

(b) The probability of finding a particle at a point.

(c) The probability amplitude.

(d) The kinetic energy of a particle.

33. The Heisenberg uncertainty principles states that :

(a) Position and velocity of a particle can be measured precisely.

(b) Energy and momentum cannot be measured simultaneously.

(c) Position and momentum cannot be measured precisely at the same time.

(d) The uncertainty is due to instrumental limitations.

34. The time-independent Schrödinger equation is given by :

(a) $i\hbar\frac{\partial\psi}{\partial t} = H\psi$.

(b) $H\psi = E\psi$.

(c) $p\psi = -i\hbar\nabla\psi$.

(d) $E = mc^2$.

35. A quantum particle in a one-dimensional box has energy levels given by :

(a) $E_n = \frac{n^2h^2}{8mL^2}$.

(b) $E_n = \frac{nh}{2mL}$.

(c) $E_n = \frac{nh}{4mL^2}$.

(d) $E_n = \frac{h^2}{2mL^2}$.

36. The probabiilty of finding a quantum particle in a certain region is given by :

(a) $|\psi|^2$.

(b) $\psi$.

(c) $\nabla\psi$.

(d) $\int\psi dx$.

37. The commutator $[x, p]$ is :

(a) 0.

(b) $i\hbar$.

(c) $-i\hbar$.

(d) $h^2$.

38. The normalization condition of a wave function states that :

(a) $\int|\psi(x)|\,dx = 1$.

(b) $\int|\psi(x)|^2\,dx = 1$.

(c) $\psi(x) = 1$.

(d) $\int\psi^2 dx = 0$.

39. In quantum mechanics, a Hermitian operator represents :

(a) Probability.

(b) Observable physical quantities.

(c) Wave function.

(d) Eigenvalues.

40. The ground state energy of a quantum harmonic oscillator is :

(a) 0.

(b) $\frac{1}{2}\hbar w$.

(c) $\hbar w$.

(d) $2\hbar w$.

41. The expectation value of an operator $\hat{O}$ in quantum mechanics is given by :

(a) $\langle\psi|\hat{O}|\psi\rangle$.

(b) $\psi\hat{O}\psi$.

(c) $\int\psi^*\hat{O}\psi dx$.

(d) $\hat{O}\psi$.

42. In Young's double-slit experiment, the fringe width is given by :

(a) $\frac{\lambda D}{d}$.

(b) $\frac{dD}{\lambda}$.

(c) $\frac{\lambda d}{D}$.

(d) $\frac{D}{\lambda d}$.

43. The condition for constructive interference in thin film interference is :

(a) $2\mu t = n\lambda$.

(b) $2\mu t = (n + 1/2)\lambda$.

(c) $2t = n\lambda$.

(d) $2t = (n + 1/2)\lambda$.

44. The resolving power of a diffraction grating is proportional to :

(a) The number of slits.

(b) The slit width.

(c) The wavelength of light.

(d) The distance between slits.

45. A Michelson interferometer is used to measure :

(a) Small displacements.

(b) The speed of light.

(c) The wavelength of X-rays.

(d) The index of refraction of metals.

46. The central maximum in single-slit diffraction is :

(a) Twice as wde as the other maxima.

(b) Half as wide as the other maxima.

(c) The same width as the other maxima.

(d) Not present.

47. Huygens' principle states that :

(a) Each point on a wavefront acts as a source of secondary wavelet.

(b) Light travels in straight lines only.

(c) Light does not diffract.

(d) Light consists of particles only.

48. The intensity of light in an interference pattern is maximum when the phase differenc is :

(a) 0 or an integer multiple of $2\pi$. (b) $\pi$.

(c) $\pi/2$. (d) Any value.

49. In diffraction, the spreading of light waves is more pronounced when :

(a) The aperture is smaller than the wavelength.

(b) The aperture is much larger than the wavelength.

(c) The light intensity is high.

(d) The light speed is high.

50. The phase difference between two waves for destructive interference is :

(a) $\pi$. (b) 0.

(c) $2\pi$. (d) $\pi/2$.

51. Which of the following is a unipolar device ?

(a) BJT. (b) MOSFET.

(c) SCR. (d) TRIAC.

52. In an Ideal op-amp, the input impedance is :

(a) Zero. (b) Infinite.

(c) Very low. (d) Equal to output impedance.

53. A flip-flop is used for :

(a) Amplification. (b) Oscillation.

(c) Storage of binary data. (d) Rectification.

54. The Boolean expression for an OR gate with two inputs A and B is :

(a) AB. (b) A + B.

(c) $A \oplus B$. (d) $A'B + AB'$.

55. A Schmitt trigger is used to :

(a) Convert analog signals to digtal.

(b) Amplify weak signals.

(c) Rectify AC signals.

(d) Store binary information.

56. The maximum output voltage swing in an op-amp is limted by :

(a) Power supply voltage.
(b) Gain bandwidth product.
(c) Input impedance.
(d) Feedback resistance.

57. The primary function of a rectifier is to :

(a) Convert AC to DC.
(b) Amplify signals.
(c) Generate oscillations.
(d) Store charge.

58. Which logic gate gives a HIGH output only when both inputs are different ?

(a) AND.
(b) OR.
(c) XOR.
(d) NOR.

59. The clock frequency of a digital circuit is usually measured in :

(a) Hertz (Hz).
(b) Joules (J).
(c) Volts (V).
(d) Ohms (Ω)

60. The number of distinct states in a 4-bit binary counter is :

(a) 8.
(b) 16.
(c) 4.
(d) 32.

61. The first law of thermodynamics is a statement of :

(a) Conservation of energy.
(b) Conservation of mass.
(c) Conservation of momentum.
(d) Conservation of entropy.

62. Which thermodynamic process occurs at constant pressure ?

(a) Isothermal.
(b) Adiabatic.
(c) Isobaric.
(d) Isochoric.

63. The efficiency of a Carnot engine depends on :

(a) The type of working substance.
(b) The pressure of the system.
(c) The temperatures of the hot and cold reservoirs.
(d) The volume of the system.

64. Entropy is a measure of :

(a) Energy conservation.
(b) Disorder in a system.
(c) Work done by the system.
(d) Internal energy.

65. Which of the following is an extensive property ?

(a) Temperature. (b) Pressure.

(c) Volume. (d) Density.

66. The specific heat capacity at constant pressure $(C_p)$ is greater than at constant volum $(C_v)$ because :

(a) Work is done in the constant pressure process.

(b) No heat is lost at constant volume.

(c) Volume changes during constant pressure process.

(d) Internal energy decreases.

67. The change in internal energy of an ideal gas in an isothermal process is :

(a) Positive. (b) Negative.

(c) Zero. (d) Infinity.

68. The second law of thermodynamics states that :

(a) Energy can neither be created nor destroyed.

(b) Heat always flows from a hotter body to a colder body.

(c) Work done is independent of path.

(d) Entropy remains constant in all processes.

69. The thermodynamic temperature scale is based on :

(a) Boyle's law. (b) Charles's law.

(c) Carnot cycle. (d) Ideal gas law.

70. The relation between enthalpy (H), internal energy (U), pressure (P) and volume (V) i

(a) $H = U - PV$. (b) $H = U + PV$.

(c) $H = U/PV$. (d) $H = U \times PV$.

71. The phenomenon where light is absorbed and then re-emitted at a longer wavelength is called :

(a) Rayleigh scattering. (b) Raman scattering.

(c) Fluorescence. (d) Phosphorescence.

72. The energy of a photon is given by :

(a) $E = mc^2$. (b) $E = hv$.

(c) $E = \frac{1}{2} mv^2$. (d) $E = kT$.

73. Which of the following spectroscopy techniques is based on the vibrational modes of molecules ?

(a) UV-Vis Spectroscopy. (b) Raman Spectroscopy.

(c) NMR Spectroscopy. (d) X-ray Spectroscopy.

74. The resolving power of a spectrometer depends on :

(a) The wavelength of light used. (b) The numerical aperture.

(c) The dispersion and slit width. (d) The intensity of light.

75. Which of the following is a key principle of laser operation ?

(a) Spontaneous emission. (b) Stimulated emission.

(c) Absorption only. (d) Thermal radiation.

76. The wavelength of visible light ranges approximately between :

(a) 100-400 nm. (b) 400-700 nm.

(c) 700-1000 nm. (d) 1-10 nm.

77. In fiber optics, the condition for total internal reflection is met when :

(a) The light travels from a medium of lower to higher refractive index.

(b) The angle of incidence is greater than the critical angle.

(c) The refractive indices of both media are equal.

(d) Light propagates along the normal.

78. Which type of spectroscopy is commonly used for analyzing atomic structure ?

(a) Infrared Spectroscopy. (b) UV-Visible Spectroscopy.

(c) X-ray Spectroscopy. (d) Mass Spectroscopy.

79. The phenomenon where two or more waves superimpose to form a resultant wave of greater, lower, or the same amplitude is called :

(a) Diffraction. (b) Polarization.

(c) Interference. (d) Scattering.

80. The atomic nucleus is held together by :

(a) Electromagnetic force. (b) Strong nuclear force.

(c) Weak nuclear force. (d) Gravitational force.

81. The rest mass energy of an electron is approximately :

(a) 511 keV. (b) 1 MeV.

(c) 938 MeV. (d) 140 MeV.

82. A neutron decays into a proton, an electron, and :

(a) A photon. (b) A neutrino.

(c) A meson. (d) A positron.

83. The antiparticle of an electron is called :

(a) Proton. (b) Neutrino.

(c) Positron. (d) Meson.

84. The most stable nucleus has a mass number close to :

(a) 4. (b) 56.

(c) 238. (d) 1.

85. The Higgs boson is responsible for :

(a) Electromagnetic force. (b) Gravitational interaction.

(c) Mass of fundamental particles. (d) Strong nuclear force.

86. The interaction responsible for beta decay is :

(a) Strong nuclear force. (b) Electromagnetic force.

(c) Weak nuclear force. (d) Gravitational force.

87. Quarks combine to form :

(a) Electrons. (b) Photons.

(c) Hadrons. (d) Neutrinos.

88. The fundamental force responsible for holding protons and neutrons together in a nucleus is :

(a) Weak nuclear force. (b) Strong nuclear force.

(c) Gravitational force. (d) Electromagnetic force.

89. The total number of quarks in a proton and a neutron combined is :

(a) 3. (b) 6.

(c) 9. (d) 12.

90. According to Einstein's special theory of relativity, the speed of light in a vacuum is :

(a) Constant for all observers.

(b) Varies with the observer's motion.

(c) Depends on the source's velocity.

(d) Infinite.

91. The phenomenon where time slows down for a moving observer is called :

(a) Length contraction. (b) Time dilation.

(c) Gravitational redshift. (d) Doppler effect.

92. The Schwarzschild radius is associated with :

(a) White dwarfs. (b) Neutron stars.

(c) Black holes. (d) Galaxies.

93. The general theory of relativity explains :

(a) Motion at constant velocity.

(b) The wave nature of light.

(c) Gravity as the curvature of spacetime.

(d) The uncertainty principle.

94. What is the primary source of energy in stars ?

(a) Chemical reactions. (b) Nuclear fission.

(c) Nuclear fusion. (d) Gravitational collapse.

95. The cosmic microwave background radiation is evidence for :

(a) The steady-state theory. (b) The Big Bang theory.

(c) The existence of black holes. (d) Dark matter.

96. Gravitational waves were first directly detected by :

(a) Hubble Space Telescope. (b) LIGO.

(c) CERN. (d) Kepler Space Observatory.

97. The escape velocity from a celestial body depends on :

(a) Its temperature. (b) Its mass and radius.

(c) Its rotation speed. (d) Its surface composition.

98. The redshift of light from distant galaxies indicates that the universe is :

(a) Contracting.
(b) Static.
(c) Expanding.
(d) Rotating.

99. The equivalence principle states that :

(a) Mass and energy are equivalent.
(b) Gravity and acceleration are indistinguishable.
(c) All reference frames are equivalent.
(d) The speed of light is variable.

100. Which of the following planets has the largest known volcano in the Solar system ?

(a) Earth.
(b) Mars.
(c) Jupiter.
(d) Venus.

**D 123864** (Pages : 16) Name.....

Reg. No.....

# CALICUT UNIVERSITY CENTRALIZED ENTRANCE TEST (CU–CET)
## APRIL 2025

INTEGRATED M.Sc. CHEMISTRY/INTEGRATED M.Sc. PHYSICS

Time : Two Hours Maximum : 400 Marks

*Each question carries 4 marks.*
*1 Mark will be deducted for each wrong answer.*

1. Who is known as the father of modern experimental physics ?

   (A) Issac Newton. (B) Galileo Galilei.

   (C) Albert Einstein. (D) Nikola Tesla.

2. Two waves of slightly different frequencies $f_1$ and $f_2$ interfere to produce beats. The beat frequency is given by :

   (A) $f_1 - f_2$. (B) $f_1 + f_2$.

   (C) $\frac{f_1 + f_2}{2}$. (D) $\sqrt{f_1 f_2}$.

3. In an AC circuit containing a resistor only, the phase difference between voltage and current is :

   (A) 180°. (B) 90°.

   (C) 45°. (D) 0°.

4. The ratio of velocities of electrons in the first and third Bohr orbits of Hydrogen atom is :

   (A) 1 : 3 (B) 3 : 1.

   (C) $1 : \sqrt{3}$. (D) $\sqrt{3} : 1$.

5. The bulk modulus B of an ideal gas at constant temperature is :

   (A) Equal to its pressure. (B) Zero.

   (C) Infinite. (D) Half of its pressure.

6. The electric field at a point due to a point charge is E. if both the charge and the distance from the charge are doubled, the new electric field will be :

(A) 2E. (B) E.

(C) E/2. (D) E/4.

7. The average kinetic energy of a gas molecule at temperature T is :

(A) KT (B) 1/2 KT.

(C) 3/2 KT. (D) 5/2 KT.

8. A plane electromagnetic wave has a peak electric field of 100 V/m. determine the corresponding peak magnetic field (speed of light, $c = 3 \times 10^8$ m/s)

(A) $1.33 \times 10^{-6}$ T. (B) $3.33 \times 10^{-7}$ T.

(C) $2.67 \times 10^{-6}$ T. (D) $5.00 \times 10^{-7}$ T.

9. A copper wire and an iron wire of the same length and same cross-sectional area are connected in series. Which of the following statement is true ?

(A) More currcnt flows through the copper wire.

(B) More current flows through the iron wire.

(C) The resistance of copper is higher than that of iron.

(D) Both wires carry the same current.

10. A particle moves in a circle of radius $r$ with a constant speed $v$. Then the acceleration of the particle will be :

(A) Zero.

(B) $\frac{v^2}{r}$ directed along velocity.

(C) $\frac{v^2}{r}$ directed towards the center.

(D) $\frac{v^2}{r}$ directed radially outwards.

11. In frequency modulation (FM), the frequency of the carrier wave varies with :

(A) The phase of the modulating signal.

(B) The instantaneous amplitude of the modulating signal.

(C) The amplitude of the modulating signal.

(D) The frequency of the modulating signal.

12. A satellite moves around the Earth in a circular orbit under the influence of Earth's gravity. The work done by the gravitational force over one complete revolution is :

(A) Depends on the mass of the satellite.

(B) Positive.

(C) Negative.

(D) Zero.

13. The SI unit of pressure is :

(A) Pascal. (B) Bar.

(C) Newton. (D) Joule.

14. If a particle has an initial velocity of $u$ and moves with uniform acceleration $a$, then the time taken to cover the $n^{th}$ second is given by :

(A) $u+(n-1)$. (B) $u+nu$.

(C) $u+\frac{1}{2}(2n-1)$. (D) $u+(2n-1)$.

15. The approximate size of a nucleus with mass number A is given by :

(A) $R=R_0A$. (B) $R=R_0A^{1/3}$.

(C) $R=R_0A^{2/3}$. (D) $R=R_0A^2$.

16. If two soap bubbles of radii $R_1$ and $R_2$ ($R_1 > R_2$) are connected by a tube, then :

(A) The pressure in both bubbles become equal.

(B) Air flows from larger bubble to the smaller one.

(C) Air flows from smaller bubble to the larger one.

(D) No air flow occurs.

17. A capacitor is charged to a potential V and then disconnected from the battery. If the plates are pulled apart, the potential difference between the plates will :

(A) First increase then decrease. (B) Remains the same.

(C) Decrease. (D) Increase.

18. A block of mass $m$ is placed on a rough inclined plane making an angle $\theta$ with the horizontal. The co-efficient of static friction is $\mu_s$. Then the condition for which the block will remain at rest is :

(A) $\tan\theta = \mu_s$ (B) $\tan\theta \neq \mu_s$.

(C) $\tan\theta > \mu_s$. (D) $\tan\theta < \mu_s$.

19. A concave mirror forms an image of an object at infinity. Then the object must be located at :

(A) Infinity. (B) Center of curvature.

(C) Between focus and pole. (D) Focus.

20. Which of the following materials has the highest permeability ?

(A) Non-magnetic materials. (B) Ferromagnetic materials.

(C) Paramagnetic materials. (D) Diamagnetic materials.

21. A spring of force constant $k$ is compressed by a displacement $x$. The potential energy stored in the spring is given by :

(A) $\frac{1}{2}kx^2$. (B) $kx^2$.

(C) $kx$. (D) $2kx^2$.

22. The work function of material is 2 eV. If a light of wavelength 400 nm falls on it the maximum kinetic energy of the emitted electrons will be :

(A) 1.1 eV. (B) 2.2 eV.

(C) 3.1 eV. (D) 0.1 eV.

23. A conducting loop is moved in a uniform magnetic field. The induced emf in the the loop will be maximum when :

(A) The loop is stationary.

(B) The loop moves parallel to the field.

(C) The loop moves perpendicular to the field.

(D) The loop is rotated about an axis parallel to the field.

24. The internal energy of an ideal gas depends on :

(A) Pressure only. (B) Temperature only.

(C) Volume only. (D) Both temperature and volume.

25. The resolving power of a telescope is proportional to :

(A) The focal length of the objective lens.

(B) The diameter of the objective lens.

(C) The wavelength of light used.

(D) The magnifying power of eyepiece.

26. With an increasing temperature, the electrical conductivity of an intrinsic semiconductor :

(A) Becomes zero. (B) Remains constant.

(C) Decreases. (D) Increases.

27. The work done by a constant torque $\tau$ acting on a rotating body to increase its angular displacement from $\theta_1$ to $\theta_2$ is :

(A) $W = \tau(\theta_1 - \theta_2)$. (B) $W = \tau(\theta_1 + \theta_2)$.

(C) $W = \tau(\theta_1 - \theta_2)^2$. (D) $W = \tau(\theta_1/\theta_2)$.

28. According to the Stephan-Boltzmann law, the energy radiated per unit area by a black body is :

(A) Proportional to $T^2$. (B) Proportional to $T^3$.

(C) Proportional to $T^4$. (D) Proportional to $T^5$.

29. A pendulum has a period T in a lift rest. If the lift accelerates upward with acceleration $a$, determine the new time period :

(A) $T' = T$. (B) $T' = T\sqrt{\frac{g}{a}}$.

(C) $T' = T\sqrt{\frac{g}{g+a}}$. (D) $T' = T\sqrt{\frac{g+a}{a}}$.

30. The drift velocity of electrons in a conductor is directly proportional to :

(A) Applied voltage. (B) Square of the applied voltage.

(C) Reciprocal of the applied voltage. (D) Independent of applied voltage.

31. The measured temperature on Fahrenheit scale is 200 °F. What will this reading be on Celsius scale ?

(A) 40 °C. (B) 94°C.

(C) 93.3 °C. (D) 30°C.

32. Principal, Azimuthal and magnetic quantum numbers are respectively related to :

(A) Size, shape and orientation. (B) Shape, size and orientation.

(C) Size, orientation and shape. (D) Orientation, size and shape.

33. Gradual addition of electronic shells in their the noble gases causes a decrease in their _____.

(A) Atomic radius. (B) Density.

(C) Boiling point. (D) Ionization energy.

34. Atoms obtain octet configuration when linked with other atoms'. The statement is given by _____.

(A) Sidgwick. (B) Lewis.

(C) Kossel. (D) Langmuir.

35. At 25 °C and 730 mm pressure, 380 ml of dry oxygen was collected. If the temperature is constant, what volume will oxygen occupy at 760 mm pressure ?

(A) 621 ml. (B) 730 m.

(C) 365 ml. (D) 449 ml.

36. The temperature at which a system goes through a reversible isothermal process without transferring heat is _____.

(A) Triple point. (B) Critical point.

(C) Boiling point. (D) Absolute zero.

37. When equal volumes of 0.1 M NaOH and 0.1 m HCl are mixed, the hydroxide ion concentration is _____.

(A) 12.65. (B) 7.00.

(C) 2.00. (D) 1.05.

38. The process of rusting of iron is ———————.

(A) A physical and reversible change.

(B) A chemical and reversible change.

(C) A physical and irreversible change.

(D) A chemical and irreversible change.

39. Permanent hardness from water can be removed by adding ———————.

(A) $Na_2CO_3$. (B) alums.

(C) $CaOCl_2$. (D) $Cl_2$.

40. When dissolved in liquid ammonia, the colour of alkali metals are turn to ———————.

(A) Crimson red. (B) Deep blue.

(C) Dark green. (D) Colourless.

41. Chalcogen elements are the elements from the ——————— family.

(A) Fluorine, chlorine, bromine. (B) Nitrogen, phosphorus, arsenic.

(C) Helium, neon, argon. (D) Oxygen, sulfur, selenium.

42. In Lassaigne s test, if sulphur and nitrogen are present, the organic compound is changed into ———————.

(A) $Na_2S$ and NaCN. (B) $Na_2SO_4$ and NaCN.

(C) NaCN and NaCNO. (D) $Na_2S$ and NaCNO.

43. Wurtz reaction cannot be used to prepare ———————.

(A) Propane. (B) Butane.

(C) Ethane. (D) Methane.

44 The gas released in the Bhopal gas tragedy was ———————.

(A) Methyl thiocyanate. (B) Methyl isocyanate.

(C) Methyl cyanide. (D) Methyl cyanate.

45. Among the following compounds, Schottky defect is observed in ———————.

(A) ZnS. (B) $SrCl_2$.

(C) KBr. (D) NaCl.

46. The osmotic pressure of a solution at a temperature of 300 K is 0.0821 atm. The concentration of the solution in moles/lit is ————————.

(A) 0.033. (B) 0.33.

(C) 0.0033. (D) 3.30.

47. The electrolysis of fused NaCl gives ———————— on cathode.

(A) Sodium. (B) Chlroine.

(C) Hydrogen. (D) Oxygen.

48. For a given rate, the unit of rate and the rate constant are the same for ———————— order reaction.

(A) Third. (B) Second.

(C) First. (D) Zero.

49. When a liquid dispersion in another liquid, it is called ————————.

(A) Aerosol. (B) Foam.

(C) Emulsion. (D) Gel.

50. The metal extracted from Cinnabar ore is :

(A) Iron. (B) Zinc.

(C) Copper. (D) Mercury.

51. Colour of transition metal ions are due to absorption of the same wavelength. This results in ————————.

(A) d-s transition. (B) d-p transition.

(C) d-d transition. (D) p-d transition.

52. A co-ordination compound $CrCl_3.4H_2O$ gives a white precipitate of AgCl with $AgNO_3$. The molar conductance of the compound corresponds to two ions. The structural formula of the compound is ————————.

(A) $\left[Cr(H_2O)_4\,Cl\right]Cl_2$. (B) $\left[Cr(H_2O)_4\,Cl_2\right]Cl$.

(C) $\left[Cr(H_2O)_3\,Cl_3\right]H_2O$. (D) $\left[Cr(H_2O)_4\,Cl_3\right]$.

53. When ethanol combines with $PCl_5$, it produces three products: chloroethane, hydrochloric acid, and ————————.

(A) Phosphoric acid. (B) Phosphorus acid.

(C) Phosphorus trichloride. (D) Phosphoryl chloride.

54. Lucas reagent consists of ————————.

(A) conc. HCl + anhydrous $ZnCl_2$. (B) conc. $HNO_3$ + hydrated $ZnCl_2$.

(C) conc. HCl + hydrated $ZnCl_2$. (D) conc. $HNO_3$ + anhydrous $ZnCl_2$.

55. Penta-2-one and penta-3-one can be be differentiated by ————————.

(A) Fehling's test. (B) Iodoform test.

(C) Benedict's test. (D) Aldol condensation test.

56. As a result of Wolff-Kishner reduction, the following conversions can be made :

(A) Cyclohexanol into Cyclohexane.

(B) Cyclohexanone into Cyclohexanol.

(C) Benzophenone into diphenylmethane.

(D) Benzaldehyde into Benzyl alcohol.

57. Hoffmann bromamide degradation reaction is used for the preparation of ————————.

(A) Tertiary amines. (B) Secondary amines.

(C) Primary amines. (D) Amides.

58. Among the followings, which nutrient provides the maximum energy on breakdown ?

(A) Carbohydrates. (B) Fats.

(C) Proteins. (D) Fibres.

59. The synthetic polymer prepared by using caprolactam is known as ————————.

(A) Nylon 6,6. (B) Teflon.

(C) Terylene. (D) Nylon 6.

60. Chloramine-T is an ————————.

(A) Disinfectant. (B) Antiseptic.

(C) Analgesic. (D) Antipyretic.

61. The number of circular arrangements of $n$ things is _____.

(A) $(n-1)!$. (B) $n!$.

(C) $(n+1)!$. (D) $2(n-1)!$.

62. If A, B and C are three sets such that $A \cap B = A \cap C$ and $A \cup B = A \cup C$, then _____.

(A) $A = C$. (B) $B = C$.

(C) $A = B$. (D) None of these.

63. If $f(x) = -5x - 4$, then $f^{-1}(x) =$ _____.

(A) $\left(\frac{x+5}{4}\right)$. (B) $-\left(\frac{x+5}{4}\right)$.

(C) $\left(\frac{x+4}{5}\right)$. (D) $-\left(\frac{x+4}{5}\right)$.

64. Domain of definition of the function

$$f(x) = \sqrt{\sin^{-1}(2x) + \frac{\pi}{6}}$$

for real valued $x$, is _____.

(A) $\left[-\frac{1}{4}, \frac{1}{4}\right]$. (B) $\left[-\frac{1}{3}, \frac{1}{2}\right]$.

(C) $\left[-\frac{1}{4}, \frac{1}{2}\right]$. (D) $\left[-\frac{1}{2}, \frac{1}{2}\right]$.

65. The eccentricity of the hyperbola $3x^2 - 4y^2 = 5$ is _____.

(A) $\sqrt{\frac{7}{4}}$. (B) $\sqrt{\frac{9}{4}}$.

(C) $\sqrt{\frac{13}{4}}$. (D) $\sqrt{\frac{15}{4}}$.

66. If $\sec x = -\frac{13}{5}$ and $x$ lies in the second quadrant, then $\cot x$ = _____.

(A) $\frac{3}{12}$. (B) $-\frac{3}{12}$.

(C) $\frac{5}{12}$. (D) $-\frac{5}{12}$.

67. The complex number $\sin x + i \cos 2x$ and $\cos x - i \sin 2x$ are conjugate to each other, for _____.

(A) $x = n\pi$. (B) $x = 0$.

(C) $x = 2n\pi$. (D) No value of $x$.

68. If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix} = x + iy$,

then _____.

(A) $x = 3, y = 1$. (B) $x = 1, y = 3$.

(C) $x = 0, y = 3$. (D) $x = 0, y = 0$.

69. $\lim_{x \to 0} \frac{x \tan 2x - 2x \tan x}{(1 - \cos 2x)^2}$ = _____.

(A) $\frac{1}{2}$. (B) $-\frac{1}{2}$.

(C) $\frac{1}{3}$. (D) $-\frac{1}{3}$.

70. The equations of lines passing through the point $(2, 2)$ and cutting off intercepts on the axes whose sum is 9 are _____.

(A) $3x + y - 6 = 2$ and $x + 3y - 6 = 2$.

(B) $2x + y - 6 = 0$ and $x + 2y - 6 = 0$.

(C) $x + y - 4 = 0$ and $x - y = 0$.

(D) None of the above.

71. If $f(xy) = \frac{f(x)}{y}$ $\forall x, y \in \mathbb{R}$ and if $f(6) = 21$, then $f(14) =$ _____.

(A) 15. (B) 16.

(C) 18. (D) 9.

72. If the direction cosines of a line are $l$, $m$ and $n$ then which of the following is true ?

(A) $l + m + n = -1$. (B) $l + m + n = 0$.

(C) $l^2 + m^2 + n^2 = 1$. (D) $lmn = 1$.

73. If the points $(5, 4, 2), (8, k, -7)$ and $(6, 2, -1)$ are collinear, then $k =$ _____.

(A) $-1$. (B) 1.

(C) $-2$. (D) 2.

74. $\int_0^{1.5} \left[x^2\right] dx$ where $[\cdot]$ represents greatest integer function, is _____.

(A) $\sqrt{2}$. (B) $2 - \sqrt{2}$.

(C) $2 + \sqrt{2}$. (D) $1 + \sqrt{2}$.

the axes

75. The derivative of $f(x) = \frac{x^3 + 5}{x}$ is _____.

(A) $2x - 5x^{-1}$.
(B) $2x + 5x^{-1}$.
(C) $2x - 5x^{-2}$.
(D) $2x + 5x^{-2}$.

76. $1 + \frac{5}{1!} + \frac{5^2}{2!} + \frac{5^3}{3!} + .... + \frac{5^n}{n!} + ... =$ _____.

(A) $e^5$.
(B) $e^{-5}$.
(C) $e^3$.
(D) $e^{-3}$.

77. The marks obtained by a student of Class XI in first and second terminal examinations are 62 and 48, respectively. Then the minimum marks he should get in the annual examination to have an average of at least 60 marks is _____.

(A) 50.
(B) 60.
(C) 70.
(D) 80.

78. The two vectors $\hat{j} + \hat{k}$ and $3\hat{i} - \hat{j} + 4\hat{k}$ represent the two sides $\overline{AB}$ and $\overline{AC}$ respectively of triangle ABC. The length of the median through A is _____.

(A) $\sqrt{\frac{17}{2}}$.
(B) $\sqrt{\frac{13}{2}}$.
(C) $\sqrt{\frac{7}{2}}$.
(D) $\sqrt{\frac{3}{2}}$.

79. The order and the degree of the differential equation

$$x^2 \frac{d^2y}{dx^2} = \left[1 + \left(\frac{dy}{dx}\right)^2\right]^{10}$$

are _____.

(A) Order 1 and degree 1.
(B) Order 2 and degree 1.
(C) Order 2 and degree 2.
(D) Order 2 and degree 4.

80. The sixth term in $\left(\frac{2x}{3}+\frac{3y}{2}\right)^9$ is _____.

(A) $189x^5y^3$. (B) $189x^4y^5$.

(C) $89x^4y^5$. (D) $78x^3y^6$.

81. Darwin's theory of natural selection to explain organic evolution was based on :

(A) Modifications in organs through use and disuse.

(B) Prodigality of reproduction, struggle for existence and survival of the fittest.

(C) Inheritance of acquired character.

(D) Appearance of sudden large variations, their inheritance and survival of those having these variations.

82. "There is a mesodermally derived rod-like structure formed on the dorsal side during embryonic development in some animals". The animals are :

(A) Echinoderms. (B) Annelids.

(C) Arthropods. (D) Chordates.

83. In human beings sex is determined :

(A) Before fertilization sex is determined.

(B) During $6^{th}$ week of foetal life when androgen are produced.

(C) At the time of fertilization of ovum.

(D) During $7^{th}$ and $8^{th}$ week of foetal life when gonads differentiates into testis and ovary.

84. DNA strands are antiparallel because of the presence of :

(A) H-bonds. (B) Peptide bonds.

(C) Disulfide bonds. (D) Phosphate diester bonds.

85. The measure by which water potential decrease due to presence of solutes is called :

(A) Pressure potential. (B) Matric potential.

(C) Osmotic potential. (D) Gravitational potential.

86. The $CO_2$ transport, $HCO_3^-$ diffuses from RBC to plasma and in turn to keep the ionic T balance an equal number of $Cl^-$ ions pass into the RBC. This process in known as

(A) Hamburger phenomenon. (B) Bicarbonate Shift.

(C) Carbonation. (D) Carbo-chlorosis.

87. The morphological nature of the edible part ot coconut is :

(A) Cotyledon. (B) Endosperm.

(C) Pericarp. (D) Perisperm.

88. In the annual ring of a plant, the light coloured part is :

(A) Heart wood. (B) Soft wood.

(C) Sap wood. (D) Hard wood.

89. Bolting in rosette plants is due to :

(A) Auxin. (B) Gibberellin.

(C) Cytokinin. (D) Abscissic accid.

90. Which among the following is true about photosynthesis :

(A) Reductive, exergonic and anabolic.

(B) Oxidative, exergonic and catabolic.

(C) Redox reaction,endergonic and anabolic.

(D) Reductive, energonic and catabolic.

91. What data structure is best suited for implementing a Last-In-First-Out (LIFO) mechanism ?

(A) Queue. (B) Stack.

(C) Linked List. (D) Tree.

92. What is the purpose of an algorithm in programming ?

(A) To store data.

(B) To solve a specific problem.

(C) To perform complex calculations.

(D) To manage memory.

93. What is the significance of the "cout" statement in C++ ?

(A) It reads input from the user.
(B) It declares a variable.
(C) It displays output to the console.
(D) It performs arithmetic operations.

94. Which protocol is commonly used for retrieving emails from a mail server ?

(A) HTTP.
(B) FTP.
(C) SMTP.
(D) $POP_3$.

95. Which control statement is used for decision-making in programming ?

(A) Loop.
(B) Switch.
(C) If.
(D) Break.

96. Which HTML tag is used to create an ordered list ?

(A) <ul>.
(B) <ol>.
(C) <li>.
(D) <list>.

97. "SQL" stand for ?

(A) Structured Query Language.
(B) Sequential Question Logic .
(C) System Query Level.
(D) Server Quality Language.

98. How are devices connected in a bus topology ?

(A) In a circle.
(B) In a straight line.
(C) In a star pattern.
(D) In a random order.

99. What is the result of adding 1101 and 1011 in binary ?

(A) 10110.
(B) 11000.
(C) 11010.
(D) 11100.

100. Regarding functions in programming, which statement is false ?

(A) Functions help in code modularity.
(B) Functions can return values.
(C) Functions cannot be reused
(D) Functions can take parameters.

C 41702 (Pages : 16) Name.....

Reg. No.....

# PG/INTEGRATED PG ENTRANCE EXAMINATION, APRIL 2023

## INTEGRATED M.Sc. PHYSICS/INTEGRATED M.Sc. CHEMISTRY

Time : Two Hours Maximum : 400 Marks

*Each question carries 4 marks.*
*1 mark will be deducted for each wrong answer.*

### Section A (Physics)

1. In the travelling wave equation $y = a \sin(\omega t - kx)$, the dimensions $k$ are :

   (A) $M^0 L^1 T^1$.

   (B) $M^0 L^{-1} T^0$.

   (C) $M^0 L^0 T^{-1}$.

   (D) $M^0 L^1 T^{-1}$.

2. A body weighs 22.42 g and has a measured volume of 4.7 cc. The possible errors in the measurements of mass and volume are 0.01 g and 0.1 cc. Then the maximum error in the density will be :

   (A) 22 %.

   (B) 2 %.

   (C) 0.2 %.

   (D) 0.02 %.

3. A particle moves along a straight line OX. At a time $t$ (in seconds),the distance $x$ (in metre) of the particle from O is given by $x = 40 + 12t - t^3$. How long would the particle travel before coming to rest ?

   (A) 24 m. (B) 40 m.

   (C) 56 m. (D) 16 m.

4. A stone tied to the end of a string of 1 m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolutions in 44 seconds, what is the magnitude and direction of acceleration of the stone ?

(A) $\pi^2/4\ ms^{-2}$ and direction along the radius towards the centre.

(B) $\pi^2\ ms^{-2}$ and direction along the radius away from the centre.

(C) $\pi^2\ ms^{-2}$ and direction along the radius towards the centre.

(D) $\pi^2\ ms^{-2}$ and direction along the tangent to the circle.

5. When forces $F_1$, $F_2$, $F_3$ are acting on a particle of mass $m$ such that $F_2$ and $F_3$ are mutually perpendicular, then the particle remains stationary. If the force $F_1$ is now removed, then the acceleration of the particle is :

(A) $\frac{F_1}{m}$.

(B) $\frac{F_2F_3}{mF_1}$.

(C) $\frac{F_2 - F_3}{m}$.

(D) $\frac{F_2}{m}$.

6. A body of mass 1 kg begins to move under the action of a time dependent force $F = \left(2t\,i + 3t^2\,j\right)$ N, where $i$ and $j$ are unit vectors along X and Y axes. What power will be developed by the force at the time ($t$) ?

(A) $\left(2t^2 + 4t^4\right)$ W.

(B) $\left(2t^3 + 3t^4\right)$ W.

(C) $\left(2t^3 + 3t^5\right)$ W.

(D) $\left(2t + 3t^3\right)$ W.

7. A wheel has angular acceleration of 3 rad/s$^2$ and initial angular speed of 2 rad/s. In a time of 2s. It has rotated through an angle (in radian) of :

(A) 6.

(B) 10.

(C) 12.

(D) 4.

8. Two satellites A and B go round on a planet P in circular orbits having radii 4R and R respectively. If the speed of satellite is A is 3V, the speed of satellite B will be :

(A) 12V. (B) 6V.

(C) 4V/3. (D) 3V/2.

9. A copper wire and a steel wire of the same diameter and length are connected end to end and a force is applied which stretches their combined length by 1 cm. Then the two wires will have :

(A) The same stress and strain.

(B) The same stress but different strains.

(C) The same strain but different stresses.

(D) Different stresses and strains.

10. A liquid drop of surface tension $o$ and diameter D breaks up into 125 small droplets of identical size. The total change insurface energy is :

(A) $\pi D^2\sigma$. (B) $2\pi D^2\sigma$.

(C) $4\pi D^2\sigma$. (D) $5\pi D^2\sigma$.

11. The molecules of a given mass of a gas have r.m.s velocity of 200 m/s at 27 °C and $1.0 \times 10^5$ N/m$^2$ pressure. When the temperature and pressure of the gas are respectively, 127 °C and $0.05 \times 10^5$ N/m$^2$, the r.m.s velocity of its molecule in m/s is :

(A) $\frac{400}{\sqrt{3}}$. (B) $\frac{100\sqrt{2}}{3}$.

(C) $\frac{100}{\sqrt{3}}$. (D) $\frac{100}{\sqrt{2}}$.

12. A Carnot engine working between 300 K and 600 K has a work output of 800 joule per cycle. The amount of heat energy supplied from the source to the engine in each cycle is :

(A) 800 joule. (B) 1600 joule.

(C) 3200 joule. (D) 6400 joule.

13. The total KE of all the molecules of Helium having a volume V exerting a pressure P is 1500 J. The total KE in joule of all the molecules of $N_2$ having the same volume V and exerting a pressure 2P is :

(A) 3000. (B) 4000.

(C) 5000. (D) 6000.

14. The motion of a particle varies with time according to the relation $X = A[\text{Sin } \omega t + \text{Cos } \omega t]$. Then :

(A) The motion is oscillatory but not S.H.M.

(B) The motion is S.H.M with amplitude 2A.

(C) The motion is S.H.M with amplitude A.

(D) The motion is S.H.M with amplitude $\sqrt{2}A$.

15. The second overtone of an N open organ pipe has the same frequency as the first overtone of a closed pipe L meter long. The length of the open pipe will be :

(A) L. (B) 2L.

(C) L/2. (D) 4L.

16. Two point charges $q$ and $-5q$ are placed at some distance apart. If the electric field at the location of $q$ is E, thenthe electric field at the location of the other charge is :

(A) $-E$. (B) $\frac{-E}{5}$.

(C) $-\sqrt{E}$. (D) $\frac{E}{5}$.

17. A point charge $q$ is placed at one corner of a cube of edge $a$. The flux through each cube face is :

(A) $\frac{q}{\varepsilon_0}$. (B) $\frac{q}{16\varepsilon_0}$.

(C) $\frac{q}{24\varepsilon_0}$. (D) $\frac{q}{48\varepsilon_0}$.

18. In to how many equal parts is it necessary to cut a 64 Ω resistor so as to obtain a resistance of 1 Ω by connecting these parts in parallel :

(A) 8. (B) 16.

(C) 32. (D) 64.

19. A particle of charge $q$ and mass $m$ moves in a circular orbit of radius $r$ with angular speed $\omega$. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

(A) $\omega$ and $q$. (B) $\omega$, $m$ and $q$.

(C) $m$ and $q$. (D) $\omega$ and $m$.

20. Points A and B are situated along the extended axis of a 2 cm long bar magnet at distances $x$ cm and $2x$ cm respectively from the pole nearer to the points. The ratio of magnetic fields at A and B will be :

(A) 2. (B) $\sqrt{2}$.

(C) 4. (D) 8.

21. A player carrying 3 m long iron rod runs towards east with a speed of 30 km/hr. Horizontal component of earth's magnetic field is $4 \times 10^{-5}$ wbm$^{-2}$. If he is running with the rod in horizontal and vertical positions, the potential difference induced between the two ends of the rod in two cases will be :

(A) Zero in vertical position and $10^{-3}$ V in horizontal position.

(B) $10^{-3}$ V in vertical position and zero in horizontal position.

(C) Zero in both cases.

(D) $10^{-3}$ V in both cases.

22. In an electrical circuit, resister, inductor, capacitor and an A.C. voltage source are all connected in series. When the inductor is removed from the circuit, the phase difference between the voltage and current in the circuit is $\frac{\pi}{3}$. If instead the capacitor is removed, the phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is :

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

(C) 1. (D) $\frac{\sqrt{3}}{2}$.

23. Out of the following options, which one can be used to produce a propagating electromagnetic wave :

(A) A stationary charge.

(B) A moving chargeless particle.

(C) An accelerating charge.

(D) A charge moving at constant velocity.

24. In a concave mirror an object is placed at a distance $x$ from the focus and the image is formed at a distance $y$ from the focus. The focal length of the mirror is :

(A) $xy$. (B) $\sqrt{xy}$.

(C) $\sqrt{\frac{x}{y}}$. (D) $\sqrt{\frac{y}{x}}$.

25. In a Young's double slit experiment, the spacing between two slits is 0.1 mm. If the screen is kept at a distance of one metre from the slits and the wave length of light is 5000 Å, the fringe width is :

(A) 1 cm. (B) 1.5 cm.

(C) 0.5 cm. (D) 2 cm.

26. The retarding potential necessary to stop the emission of photoelectrons, when a target material of work function 1.24eV is irradiated with light of wave length $4.36 \times 10^{-7}$ m is :

(A) 6.4 V. (B) 3.2 V.

(C) 4.8 V. (D) 1.6 V.

27. If the kinetic energy of a particle is increased to 16 times its previous value, the percentage change in the de-Broglie wavelength of the particle is :

(A) 25. (B) 75.

(C) 60. (D) 50.

28. The initial activity of a certain radioactive isotope was measured as 16000 counts per minute. If its activity after twelve hours was 2100 counts per minute, the approximate value of half life in hours is :

(A) 9. (B) 6.

(C) 4. (D) 2.

29. Which of the following transitions gives photons of maximum energy :

(A) $n = 1$ to $n = 2$.
(B) $n = 2$ to $n = 1$.
(C) $n = 2$ to $n = 6$.
(D) $n = 6$ to $n = 2$.

30. A $p$-$n$ photodiode is fabricated from a semiconductor of band gap 2.5 eV. Which of the following signals of wavelength can be detected using this photodiode :

(A) 4000 Å.
(B) 6000 Å.
(C) 4000 nm.
(D) 6000 nm.

## Section B (Chemistry)

31. Under similar conditions of pressure and temperature, 40 ml of slightly moist hydrogen chloride gas is mixed with 20 ml of ammonia gas, the final volume of gas at the same temperature and pressure will be :

(A) 100 ml.
(B) 20 ml.
(C) 40 ml.
(D) 60 ml.

32. The ionization enthalpy of hydrogen atom is $1.312 \times 10^6$ J mol $^{-1}$. The energy required to excite the electron in the atom from $n = 1$ to $n = 2$ is :

(A) $9.84 \times 10^2$ J mol $^{-1}$.
(B) $9.84 \times 10^3$ J mol $^{-1}$.
(C) $9.84 \times 10^4$ J mol $^{-1}$.
(D) $9.84 \times 10^5$ J mol $^{-1}$.

33. As we proceed from Li to F in period 2, the electro negativity :

(A) Increase regularly.
(B) Decrease regularly.
(C) Shows no variation.
(D) Increase irregularly.

34. An atom of an element A has three electrons in its outermost orbit and that of B has six electrons in its outermost orbit. The formula of the compound between these two will be :

(A) $A_2B$.
(B) $A_3B_2$.
(C) $A_2B_3$.
(D) $A_3B_6$.

35. At constant temperature the product of pressure and volume of a given amount of a gas is constant. This is called ——————.

(A) Boyle's law.
(B) Charles' law.
(C) Gay-Lussac law.
(D) Avogadro law.

36. The enthalpy change in a reaction does not depend upon ——————.

(A) The nature of the reactants and products.

(B) Different intermediate steps in the reaction.

(C) The state of reactions and products.

(D) Initial and final enthalpy of the reaction.

37. Ostwald's dilution law is applicable to :

(A) Strong electrolytes only. (B) Non-electrolytes.

(C) Strong and weak electrolytes. (D) Weak electrolyte only.

38. Which among the following is the strongest oxidizing agent ?

(A) $O_3$. (B) $KMnO_4$.

(C) $K_2Cr_2O_7$. (D) $H_2O_2$.

39. Water gas is a mixture of ——————.

(A) CO and $H_2O$. (B) $CO_2$ and $H_2$.

(C) CO and $H_2$. (D) $CO_2$ and $H_2O$.

40. The chemical formula of 'Slaked lime' is ——————.

(A) CaO. (B) $CaSO_4$.

(C) $CaCO_3$. (D) $Ca(OH)_2$.

41. Carborundum is obtained when silica is heated at high temperature with

(A) Carbon monoxide. (B) Carbon.

(C) Carbon dioxide. (D) Calcium carbonate.

42. During Lassaigne's test, if sulphur and nitrogen are present in an organic compound, the products obtained are :

(A) $Na_2SO_4$ and NaCN. (B) NaCN and NaCNO.

(C) $Na_2S$ and NaCN. (D) $Na_2S$ and NaCNO.

43. Benzene reacts with $CH_3Cl$ in the presence of anhydrous $AlCl_3$ to form :

(A) Benzyl chloride. (B) Xylene.

(C) Chlorobenzene. (D) Toluene.

44. The coldest region of the atmosphere :

(A) Mesosphere. (B) Stratosphere.

(C) Thermosphere. (D) Troposphere.

45. The total number of Bravais lattices in the crystal structures is _____.

(A) 14. (B) 10.

(C) 6. (D) 4.

46. The boiling point of an azeotropic mixture of water and ethanol is less than that of water and ethanol. The mixture shows :

(A) No deviation from Raoult's Law.

(B) Positive deviation from Raoult's Law.

(C) Negative deviation from Raoult's Law.

(D) Two boiling points.

47. To deposit one equivalent weight of silver at cathode, the charge required will be :

(A) $9.65 \times 10^2$ C. (B) $9.65 \times 10^3$ C.

(C) $9.65 \times 10^4$ C. (D) $9.65 \times 10^5$ C.

48. When the temperature rises, the peak of the curve in the Maxwell-Boltzmann distribution graph

(A) Shifts forward and upward. (B) Shifts forward and downward.

(C) Shifts backward and upward. (D) Shifts backward and downward.

49. An emulsifier is a substance which :

(A) Stabilizes the emulsion.

(B) Coagulates the emulsion.

(C) Retards the dispersion of liquid in liqui.

(D) Causes homogenesis of emulsion.

50. Malachite is an ore of _____.

(A) Silver. (B) Iron.

(C) Zinc. (D) Copper.

51. _____ is obtained on heating ammonium nitrate at 250°C.

(A) Nitric oxide. (B) Nitrous oxide.

(C) Nitrogen dioxide. (D) Dinitrogen tetraoxide.

52. The higher catalytic activity of the transition metals is due to the :

(A) High enthalpy of atomisation. (B) Paramagnetic behaviour.

(C) Variable oxidation states. (D) Colour of hydrate ions.

53. Mohr's salt is :

(A) $Fe_2(SO_4)_3(NH_4)_2SO_4\ 6H_2O$.

(B) $Fe_2(SO_4)_3(NH_4)_2SO_4\ 24H_2O$.

(C) $FeSO_4(NH_4)_2SO_4\ 24H_2O$.

(D) $FeSO_4(NH_4)_2SO_4\ 6H_2O$.

54. The synthesis of alkyl fluorides is best accomplished by :

(A) Swarts reaction. (B) Sandmayers's reaction.

(C) Free radical fluorination. (D) Finkelstein reaction.

55. The alcohol which does not react with Lucas reagent is

(A) Isobutyl alcohol. (B) n-butanol.

(C) Tert-butyl alcohol. (D) Sec-butyl alcohol.

56. The reaction of ethyl formate with an excess of $CH_3MgI$ followed by hydrolysis gives :

(A) Ethyl alcohol. (B) Propyl alcohol.

(C) n-propyl alcohol. (D) Isopropyl alcohol.

57. Secondary amines could be prepared by :

(A) Hoffmann bromamide reaction. (B) Reduction of nitriles.

(C) Reduction of isonitriles. (D) Reduction of amides.

58. The presence and absence of hydroxyl group on which carbon atom of sugar differentiates R and DNA ?

(A) $1^{st}$. (B) $2^{nd}$.

(C) $3^{rd}$. (D) $4^{th}$.

59. Low density polythene is prepared by :

(A) Free radical polymerization. (B) Ziegler - Natta polymerization.

(C) Cationic polymerization. (D) Anionic polymerization.

60. Narcotic analgesic is ?

(A) Aspirin.

(B) Paracetamol.

(C) Codeine.

(D) Cimetidine.

## Section C (Mathematics)

61. The relation S defined on the set of all real numbers by "$(x, y) \in S$ if and only if $1 + xy > 0$" is :

(A) Reflexive and transitive.

(B) Reflexive and symmetric but not transitive.

(C) Reflexive but not symmetric and transitive.

(D) Transitive but not symmetric.

62. Let $f(x) = x^2$ and $g(x) = 3^x$ be functions on the set of all real numbers. Then the solution set of $(f \circ g)(x) = (g \circ f)(x)$ is :

(A) The set of all real numbers.

(B) $\{0, 3\}$.

(C) $\{0, 2\}$.

(D) $\{1, 2\}$.

63. Let $z = x + iy$ be a complex number where $x$ and $y$ are integers. Then the area of the triangle whose vertices are the roots of the equation $\bar{z}z^3 + z\bar{z}^3 = 350$ is :

(A) 36.

(B) 48.

(C) 40.

(D) 60.

64. The sum of first $n$ terms of the series $1 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + \ldots$ is :

(A) $\frac{n(n+1)}{2}$.

(B) $\frac{(n+1)(n+2)}{2}$.

(C) $\frac{n}{n+1}$.

(D) $\frac{-n(n+1)}{2}$.

65. The sum of all two digit numbers which when divisible by 4 produce unity as reminder is :

(A) 1201.

(B) 1212.

(C) 1210.

(D) 1012.

66. The number of ways in which 6 distinct toys can be distributed among 4 children is :

(A) $4^6$. (B) $6^4$.

(C) $6C_4$. (D) 24.

67. For any positive integer $n$, $nC_0 + nC_1 + nC_2 + ... + nC_n$ is equal to :

(A) 2. (B) $n + 1$.

(C) $n^2$. (D) $2^n$.

68. A die is rolled thrice, the probability of getting a larger number each time than previous number is :

(A) $\frac{15}{54}$. (B) $\frac{5}{54}$.

(C) $\frac{15}{216}$. (D) $\frac{5}{216}$.

69. $\lim_{x \to 0} \frac{\log(3+x) - \log(3-x)}{2x}$ equals :

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

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

70. The function $f(x) = x^2 - 2x$ is increasing in the interval :

(A) $(-2, -1)$. (B) $(-2, 0)$.

(C) $(0, 1)$. (D) $(1, 2)$.

71. The differential co-efficient of $e^{\sin^{-1}x}$ with respect to $\sin^{-1}x$ is :

(A) $x \sin^{-1}x$. (B) $\sin^{-1}x$.

(C) $e^{\sin^{-1}x}$. (D) $e^{\cos^{-1}x}$.

72. $\int \frac{dx}{\sqrt{2x - x^2}}$ is equal to :

(A) $\sin^{-1}(x-1) + c$. (B) $\sin^{-1}(1-x) + c$.

(C) $\tan^{-1}(1+x) + c$. (D) $\sin^{-1}(1+x) + c$.

73. The value of $\int_{-1}^{x} |t| dt$ is :

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

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

(C) $1+x^2$.

(D) $1-x^2$.

74. The solution of the differential equation $x\frac{dy}{dx} = x + 2y$ is :

(A) $x + y = c$.

(B) $x^2 + y = c$.

(C) $x^2 + y^2 = cy$.

(D) $x + y = cx^2$.

75. If $A = \begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$ then $A^{-1}$ is equal to :

(A) $\begin{bmatrix} \frac{1}{b} & & \\ 0 & \frac{1}{a} & 0 \\ & & \\ 0 & 0 & \frac{1}{c} \end{bmatrix}$.

(B) $\begin{bmatrix} \frac{1}{a} & & \\ 0 & \frac{1}{b} & 0 \\ & & \\ 0 & 0 & \frac{1}{c} \end{bmatrix}$.

(C) $\begin{bmatrix} \frac{1}{c} & & \\ 0 & \frac{1}{a} & 0 \\ & & \\ 0 & 0 & \frac{1}{b} \end{bmatrix}$.

(D) $\begin{bmatrix} \frac{1}{b} & & \\ 0 & \frac{1}{c} & 0 \\ & & \\ 0 & 0 & \frac{1}{a} \end{bmatrix}$.

76. For what value of $a$, the points with position vectors $i - j + k$, $i - 2j - k$ and $3i + aj + 5k$ are coplanar ?

(A) 7.

(B) 12.

(C) $-6$.

(D) 8.

77. The directrix of the parabola $x^2 - 4x - 3y + 10 = 0$ is :

(A) $4y = 5$.

(B) $4y = -5$.

(C) $4y = -7$.

(D) $4y = 7$.

78. If A and D are independent events so that $P(A \cup B) = 0.9$ and $P(B) = 0.2$, then $P(A)$ is equal to :

(A) $\frac{3}{7}$.
(B) $\frac{4}{7}$.
(C) $\frac{5}{7}$.
(D) $\frac{7}{12}$.

79. The area of the region bounded by the curve $y = x^3$ and the lines $y = 8$ and $x = 0$, is

(A) 12.
(B) 8.
(C) 16.
(D) 24.

80. The equation $x^2 + y^2 + 4x + 6y + 13 = 0$ represents :

(A) A circle.
(B) A pair of straight lines.
(C) A point.
(D) An ellipse.

## Section D (Biology)

81. Which of the following animal is a true fish ?

(A) Silver fish.
(B) Hag fish.
(C) Dog fish.
(D) Cuttle fish.

82. Embryological support for evolution was proposed by :

(A) Ernst von Baer.
(B) Hugo de Vries.
(C) Thomas Malthus.
(D) Ernst Heckel.

83. Identify the microbe, which is used for the production of a biood cholesterol lowering bioactive molecule :

(A) Trichoderma polysporun.
(B) Aspergillus niger.
(C) Monascus purpureus.
(D) Clostridium butylicum.

84. Promotor and terminator regions of DNA are involved in :

(A) Replication.
(B) Transcription.
(C) Translation.
(D) Transformation.

85. Which of the secondary metabolite is correctly matched ?

(A) Lectin- Codeine.
(B) Toxin- Ricin.
(C) Drug- Abrin.
(D) Terpenoid- Concanavalin A.

86. The minimum quantum requirement for photosynthesis is :

(A) 2. (B) 6.

(C) 4. (D) 7.

87. Triple response in pea is induced by :

(A) Auxin. (B) GA.

(C) ABA. (D) Ethylene.

88. Siphonogamous fertilization is NOT exclusive in :

(A) Cycas. (B) Selaginella.

(C) Solanum. (D) Funaria.

89. Select the Upright pyramid from the following :

(A) Pyramid of number for a tree ecosystem.

(B) Pyramid of biomass of pond ecosystem.

(C) Pyramid of number in a parasitic food chain.

(D) Pyramid of biomass in grass land ecosystem.

90. Whiptail disease in cauliflower occurs due to the deficiency of

(A) Mo. (B) Co.

(C) Mn. (D) Zn.

## Section E (Computer Science)

91. Which of the following is the latest supercomputer developed in India ?

(A) PARAM Sanganak. (B) PARAM Pravega.

(C) PARAM Siddhi-AI. (D) PARAM Shivay.

92. Which of the Object-oriented programming concept allows us to reuse the written code in C++ ?

(A) Inheritance. (B) Polymorphism.

(C) Abstraction. (D) Encapsulation.

93. The memory which is introduced in between CPU and main memory of a computer is known as _____.

(A) Virtual Memory. (B) Random Access Memory.

(C) Read Only Memory. (D) Cache Memory.

94. The Boolean expression Y = AB + BC + AC shows the _____ operation.

(A) EX-OR. (B) POS.

(C) SOP. (D) NOR.

95. Which of the following is the best description for an array ?

(A) A data structure that shows a hierarchical behaviour.

(B) Arrays are immutable once initialised.

(C) Container of objects of similar types.

(D) Array is not a data structure.

96. What is the base data type of a pointer variable by which the memory would be allocated to it ?

(A) Int.

(B) unsigned int.

(C) Depends upon the type of the variable to which it is pointing.

(D) None of the above.

97. Variable name in PHP starts with _____.

(A) ! (B) $

(C) & (D) #

98. Which of the following is not an example of Database Management Systems ?

(A) MySQL. (B) PgPlSql.

(C) IBM DB2. (D) Microsoft Edge.

99 . Bluetooth is an example of _____.

(A) Wide Area Network. (B) Virtual Private Network.

(C) Local Area Network. (D) Personal Area Network.

100. Which of the following usually stores all user-related data that is also relevant to GSM mobile systems ?

(A) SIM. (B) VLR.

(C) HMR. (D) CMR.