

### 374 PU M Sc Physics

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145 PU\_2016\_374\_E

Given that the Bohr energy of a hydrogen atom is proportional to the reduced mass of the system. Then the ground state energy of the positronium (positron-electron system) is approximately equal to:-

- ☐ -13.6 eV
- ☐ -6.8 eV
- ☐ -27.2 eV
- ☐ -3.4 eV

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The diameter of nitrogen molecule is  $3.2 \times 10^{-10}$  m. The number of molecules at  $0^\circ\text{C}$  and 1 atm. pressure is  $2.69 \times 10^{25}$  per  $\text{m}^3$ . The mean free path for nitrogen molecules is:-

- ☐  $0.005786 \times 10^{-7}$  m
- ☐  $0.007785 \times 10^{-6}$  m
- ☐  $0.001785 \times 10^{-5}$  m
- ☐  $0.008175 \times 10^{-5}$  m

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If Silicon (Si) is doped with  $10^{19}$  trivalent impurity atoms, the position of the Femi level is:-

- ☐ Position of the Femi level is below the Conduction band
- ☐ Position of the Femi level is above the Conduction band
- ☐ Position of the Femi level is below the Valence band
- ☐ Position of the Femi level is above the Valence band

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Cube roots of unity are:-

- ☐  $i, \frac{1 \pm i\sqrt{3}}{2}$
- ☐  $i, \frac{-1 \pm i\sqrt{3}}{2}$
- ☐  $1, \frac{-1 \pm i\sqrt{3}}{2}$
- ☐  $1, \frac{1 \pm i\sqrt{3}}{2}$

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Clipper circuit can be used for:-

- ☐ Removing and Shifting part of a signal
- ☐ Shifting part of a signal
- ☐ Removing and Shifting the complete signal
- ☐ Removing part of a signal

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Viscosity of a gas is directly proportional to:-

- ☐ Temperature
- ☐ Density of gas
- ☐  $T^2$
- ☐  $T^{1/2}$

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With the rise of temperature, the velocity of sound:-

- ☐ remains the same
- ☐ is independent of temperature
- ☐ decreases
- ☐ increases

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What are biasing conditions for transistor to be an amplifier:-

- ☐ Emitter junction should be reverse bias and collector junction should be forward bias
- ☐ Both the emitter and collector junctions should be reverse bias
- ☐ Both the emitter and collector junctions should be forward bias
- ☐ Emitter junction should be forward bias and collector junction should be reverse bias

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A mass M is moving with a constant velocity parallel to x-axis. Its angular momentum with respect to origin is:-

- ☐ zero
- ☐ Increasing
- ☐ constant
- ☐ Decreasing

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The distance between two successive nodes is:-

- ☐  $2\lambda$
- ☐  $\lambda$
- ☐  $\lambda/2$
- ☐  $\lambda/4$

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If the distance between two masses is doubles, gravitational attraction between them is:-

- ☐ reduced to quarter
- ☐ Tripled
- ☐ reduced to half
- ☐ Doubled

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If  $F(t) = t^{-1/2}$ , then Laplace transform of  $F(t)$  is:-

- ☐  $\frac{\pi}{s^{3/2}}$
- ☐  $\sqrt{\frac{s}{\pi}}$
- ☐  $\sqrt{\frac{\pi}{s}}$
- ☐ s

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Which of the following conditions would lead to non-stationary interference pattern:-

- ☐ Sources have slightly different frequencies
- ☐ Sources have different amplitudes
- ☐ Sources are partially coherent
- ☐ Sources have different polarizations

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In p-n junction rectifier, the observed small reverse current at 300 K is due to:-

- ☐ Doping of pentavalent and trivalent impurity atoms
- ☐ Doping of pentavalent impurity atoms
- ☐ Doping of trivalent impurity atoms
- ☐ Increase of temperature above 0 K

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If  $u=f(x, y)$  then with usual notations,  $u_{xy}=u_{yx}$  if:-

- ☐  $u_x$  is continuous
- ☐  $u, u_x, u_y$  are continuous
- ☐  $u_y$  is continuous
- ☐  $u$  is continuous

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What is the working principle of light emitting diode:-

- ☐ light emitting diode works under forward bias with radiative transition
- ☐ light emitting diode works under reverse bias with non-radiative transition
- ☐ light emitting diode works under forward bias with non-radiative transition
- ☐ light emitting diode works under reverse bias with radiative transition

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Given that  $\Psi(x,t)$  is the wave function of a quantum mechanical particle,  $\alpha$  is an arbitrary complex constant and  $A$  is the expectation value of a physical quantity. Which of following is the expectation value of the same physical quantity when the new wave function  $\alpha \Psi(x,t)$  is used instead of  $\Psi(x,t)$ ?

- ☐  $A / (\alpha \alpha^*)$
- ☐  $\alpha A$
- ☐  $A$
- ☐  $\alpha \alpha^* A$

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When a star is approaches the earth, the lines are shifted towards the end of:-

- ☐ yellow
- ☐ green
- ☐ blue
- ☐ red

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A Carnot's engine has an efficiency of 30 % when the temperature of the sink is 27 °C. What must be the change in temperature of the source to make its efficiency 50%:-

- ☐ 428. 57 K
- ☐ 300 K
- ☐ 128.57 K
- ☐ 171.43 K

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The independent solutions of the equation:  $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 0$  are:-

- ☐  $\exp(2x)$  and  $\exp(x)$
- ☐  $1/x$  and  $x^2$
- ☐  $\sin(2x)$  and  $\cos(x)$
- ☐  $\exp(2x)$  and  $\exp(-x)$

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Bernoulli's principle is based on the law of conservation of:-

- ☐ mass
- ☐ both mass and momentum
- ☐ energy
- ☐ momentum

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Consider the following processes: The temperatures of two identical gases are increased from the same initial temperature to the same final temperature. Reversible processes are used in both cases. For gas A, the process is carried out at constant volume while for gas B it is carried out at constant pressure. The change in entropy is:

- ☐ same for A and B
- ☐ greater for B
- ☐ greater for A only if the initial temperature is high
- ☐ greater for A

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A moving body is covering the distance directly proportional to the square of the time. The acceleration of the body is:-

- ☐ Increasing

- ☐ zero
- ☐ constant
- ☐ Decreasing

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A circular  $r_0$  disc of radius moves, with respect to an observer, at relativistic speed along the direction of a diameter of the circle. To the observer, the disc would now appear to be:-

- ☐ an ellipse with semi-major axis  $b = r_0$
- ☐ a circle of radius  $0 < r < r_0$
- ☐ a circle of radius  $0 < r > r_0$
- ☐ an ellipse with semi-major axis  $a = r_0$

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The set of positive even numbers, with usual multiplication forms:-

- ☐ an infinite group
- ☐ only a monoid
- ☐ a finite group
- ☐ only a semi group

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The value of the integral  $I = \frac{1}{2\pi i} \oint_C \frac{e^z}{z-2} dz$ , where  $C$  is the circle  $|z| = 3$  is:-

- ☐  $e^{-2}$
- ☐  $e^2$
- ☐  $-e^2 / 2$
- ☐  $e^2 / 2$

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If  $A$  is a singular matrix, then  $A \text{ adj}(A)$ :-

- ☐ is an orthogonal matrix
- ☐ is a zero matrix
- ☐ is a scalar matrix
- ☐ is an identity matrix

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Name the following differential equation  $\frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} + 2\lambda y = 0$ , where  $\lambda$  is a constant:-

- ☐ Laguerre Differential Equation
- ☐ Legendre's differential equation
- ☐ Bessel's differential equation
- ☐ Hermite's differential equation

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A pendulum of length L supporting mass M swings back and forth with period T . If the mass is doubled, the new period of the pendulum is:-

- ☐  $\sqrt{2}T$
- ☐ 2T
- ☐  $\sqrt{T}$
- ☐ T

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Two tuning forks A and B vibrating simultaneously produces 15 beats. Frequency of B is 512 Hz. If one arm of A is fixed (filed), then the no. of beats increases. Frequency of A will be:-

- ☐ 507
- ☐ 502
- ☐ 522
- ☐ 517

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Which of the following functions obey the time-dependent Schrödinger equation for a free particle?

- ☐  $\exp(i\vec{k} \cdot \vec{r} - i\omega t)$
- ☐  $\sin(\vec{k} \cdot \vec{r} - \omega t)$
- ☐  $\cos(\vec{k} \cdot \vec{r} - \omega t)$
- ☐  $\exp(\vec{k} \cdot \vec{r} - \omega t)$

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A wave function of a quantum mechanical particle obeys the property  $\Psi(-x) = \pm \Psi(x)$ . If the particle can move from  $x = -\infty$  to  $x = +\infty$ , then the expectation value of the position of the particle is equal to:-

- ☐  $\pm \infty$

- ☐ 0
- ☐  $\pm 1$
- ☐  $\infty$

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Given that the mass and size of a hypothetical particle can be measured only when it is in motion. This particle is assumed to be born with an imaginary rest mass. Which one of the following is NOT true about this particle?

- ☐ The particle can travel only at speed greater than that of light.
- ☐ Its observable mass increases as its speed decreases.
- ☐ The energy of the particle decreases as its speed increases.
- ☐ The energy of the particle increases as its mass decreases.

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Physical quantities in quantum mechanics are represented by Hermitian matrices because:-

- ☐ they are square matrices.
- ☐ their diagonal elements are real.
- ☐ their eigenvalues are real.
- ☐ their determinants are real.

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In a hydrogen atom, the energy of the second excited state is equal to:-

- ☐ -1.51 eV
- ☐ -3.4 eV
- ☐ -13.6 eV
- ☐ -6.8 eV

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Meniscus of mercury in capillary is:-

- ☐ convex
- ☐ plane
- ☐ cylindrical
- ☐ concave

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A canon after firing recoils due to:-



- ☐ Newton's first law of motion
- ☐ Newton's second law of motion
- ☐ Newton's third law of motion
- ☐ Backward thrust of gases produced

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The vectors A and B are such that  $A + B = A - B$ , then the angle between the vectors will be:-

- ☐  $180^\circ$
- ☐  $0^\circ$
- ☐  $60^\circ$
- ☐  $90^\circ$

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The order and degree of the differential equation are  $\frac{d^2y}{dx^2} = \left[ 4 + \left( \frac{dy}{dx} \right)^2 \right]^{3/4}$  :-

- ☐ 2,1
- ☐ 2,4
- ☐ 4,2
- ☐ 1,2

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If the distance between the sounding body and the observer is doubled, then the intensity of sound becomes:-

- ☐  $1/4$
- ☐  $1/8$
- ☐  $1/10$
- ☐  $1/2$

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In a cyclic process the change in internal energy is:-

- ☐ can not be determined
- ☐ equal to area of cycle
- ☐ infinity
- ☐ zero

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A particle P moving in a circle of radius  $r$  with a uniform speed  $u$ . C is the center of the circle and AB is a diameter, the angular velocity of P about A and C are in the ratio:-

- ☐ 1 : 4
- ☐ 4 : 1
- ☐ 2 : 1
- ☐ 1 : 2

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A particle at rest with respect to a laboratory frame is represented in a Minkowski's space-time corresponding to the laboratory frame by:-

- ☐ a straight line parallel to time-axis.
- ☐ a straight line at  $45^\circ$  to the time-axis.
- ☐ a point.
- ☐ a hyperbola with its vertex at the origin.

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Light source of power 1W with wavelength of 500nm will emit:-

- ☐  $6.0 \times 10^{18}$  photons per second
- ☐  $3.0 \times 10^{18}$  photons per second
- ☐  $6.0 \times 10^{15}$  photons per second
- ☐  $3.0 \times 10^{15}$  photons per second

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Find the distance between two points having a phase difference of  $2\pi$  for a wave of frequency 1600 Hz travelling with velocity of 400m/s:-

- ☐ 0.5 m
- ☐ 4.0 m
- ☐ 0.25 m
- ☐ 2.0 m

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203 PU\_2016\_374\_E

If  $F(t) = 1$ , then Laplace transform of  $F(t)$  is:-

- ☐  $1/s$
- ☐ 0

- ☐ does not exist
- ☐ s

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135 PU\_2016\_374\_E

Physical quantities in quantum mechanics are represented by matrices because:-

- ☐ the product of two matrices in general do not give the same result when the order of matrices is reversed.
- ☐ the matrix elements of an operator are all the possible values that the physical quantity can have.
- ☐ the observable value of a physical quantity is the average of the matrix elements.
- ☐ the matrix elements are the probabilities of a particular value of the physical quantity can have

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What are the required important parameters to design Zener diode:-

- ☐ Low doping concentration of p type and n type of impurity atoms, absorption of heat and forward bias
- ☐ High doping concentration of p type and n type of impurity atoms, dissipation of heat and reverse bias
- ☐ Low doping concentration of p type and n type of impurity atoms, absorption of heat and reverse bias
- ☐ High doping concentration of p type and n type of impurity atoms, dissipation of heat and forward bias

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Fringe visibility of interference fringes produced by two interacting light sources does not depends on the:-

- ☐ Linewidth of the sources
- ☐ Distance between the sources if they are emitting plane waves
- ☐ Intensity of the light sources
- ☐ Polarization of the light sources

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What are reasons to get the constant Zener voltage ( $V_z$ ), even if there is a change in the line voltage ( $V_{in}$ ):-

- ☐ High doping concentration of p type and n type of impurity atoms and reverse bias
- ☐ Low doping concentration of p type and n type of impurity atoms and dissipation of heat
- ☐ Low doping concentration of p type and n type of impurity atoms and forward bias
- ☐ High doping concentration of p type and n type of impurity atoms and dissipation of heat

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Energy is not carried by:-

- ☐ Stationary waves
- ☐ Transverse progressive waves
- ☐ Longitudinal progressive waves
- ☐ Electromagnetic waves

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Which of the following function is path independent:-

- ☐ Internal energy
- ☐ Heat
- ☐ Temperature
- ☐ Work

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Using the second approximation, calculate the output voltage and current, through the 10 Kilo Ohms load, for the diode circuit having input voltage (  $V_{in}$ ) 15V and the voltage drop across the diode is 0.7V:-

- ☐ Output voltage = 13.3V and Output current = 1.34 mA
- ☐ Output voltage = 12.3V and Output current = 1.13 mA
- ☐ Output voltage = 14.3V and Output current = 1.43 mA
- ☐ Output voltage = 11.3V and Output current = 1.23 mA

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For an open organ pipe of length  $l$ , the wavelength of the fundamental node is:-

- ☐  $l/4$
- ☐  $2l$
- ☐  $l$
- ☐  $l/2$

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What are orders of size of emitter, base and collector for a transistor design:-

- ☐ Emitter should be moderate size, base should be smallest size and collector should be largest size
- ☐ Emitter should be largest size, base should be smallest size and collector should be moderate size
- ☐ Emitter should be largest size, base should be moderate size and collector should be smallest size
- ☐ Emitter should be moderate size, base should be moderate size and collector should be largest size

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A spiral spring is stretched by a weight attached to it, the strain is:-

- ☐ tensile
- ☐ bulk
- ☐ elastic
- ☐ shear

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A monoatomic ideal gas initially at  $17^\circ\text{C}$  is suddenly compressed to one eighth of its original volume. The temperature after compression is:-

- ☐  $887^\circ\text{C}$
- ☐  $136^\circ\text{C}$
- ☐  $17^\circ\text{C}$
- ☐ None of above

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100 PU\_2016\_374\_E

If the sum of all the forces acting on a moving object is zero, the object will:-

- ☐ slow down and stop
- ☐ continue moving with constant velocity
- ☐ accelerate uniformly
- ☐ decelerate uniformly

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113 PU\_2016\_374\_E

The period of a simple pendulum is doubled when its:-

- ☐ length is doubled
- ☐ length and mass is doubled
- ☐ mass is doubled,
- ☐ length is made four times

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103 PU\_2016\_374\_E

An elevator P moving vertically up with an acceleration  $a$ , then the force exerted on the floor by a passenger of mass  $M$  travelling in the elevator is:-

- ☐  $Mg$
- ☐  $M(g-a)$
- ☐  $Ma$
- ☐  $M(g+a)$

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A non-conducting solid sphere of radius  $R$  has a total charge  $Q$  with uniform charge distribution. The potential difference between the center of the sphere to its surface is:-

- ☐ Inversely proportional to  $R^2$
- ☐ Inversely proportional to  $R^3$
- ☐ Inversely proportional to  $R$
- ☐ A constant, independent of  $R$

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A microscope has an objective of 3.8cm focal length and an eyepiece of 5 cm focal length. If the distance between the lenses is 16.4 cm, the magnification of the microscope is:-

- ☐ -11.6
- ☐ -21.5
- ☐ -10
- ☐ -33.2

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Common collector transistor amplifier has the following properties:-

- ☐ Unit voltage gain, same phase and high in put impedance
- ☐ Low voltage gain, reverse phase and low in put impedance
- ☐ Unit voltage gain, reverse phase and low in put impedance
- ☐ High voltage gain, same phase and high in put impedance

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220 PU\_2016\_374\_M

What are orders of impurity doping level of emitter, base and collector for a transistor design:-

- ☐ Emitter should be largest, base should be smallest and collector should be moderate
- ☐ Emitter should be moderate, base should be moderate and collector should be largest
- ☐ Emitter should be largest, base should be moderate and collector should be smallest
- ☐ Emitter should be moderate, base should be smallest and collector should be largest

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Astable multivibrator generates:-

- ☐ Sine wave
- ☐ Triangle wave
- ☐ Saw-tooth wave

- ☐ Square wave

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231 PU\_2016\_374\_M

Operational amplifier has the following properties:-

- ☐ Low band width, high voltage gain, high in put high impedance and high output impedance
- ☐ High band width, low voltage gain, high in put high impedance and high output impedance
- ☐ High band width, high voltage gain, high in put high impedance and low output impedance
- ☐ High band width, high voltage gain, low in put high impedance and high output impedance

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In a certain region, there are a uniform electric field  $\vec{E}$  and a uniform magnetic field  $\vec{B}$  both directed along the  $z$ -axis. A particle of charge  $Q$  and mass  $m$  enters in this field region at time  $t = 0$  with initial velocity  $v_0$  along the  $x$ -axis. Then, the electron will perform a \_\_\_\_\_ motion in the \_\_\_\_\_ plane with its acceleration in \_\_\_\_\_ direction.

- ☐ Elliptical , xy-plane, z-axis
- ☐ Circular , xy-plane, z-axis
- ☐ Circular , yz-plane, x-axis
- ☐ Circular , xz-plane, y-axis

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Fraunhofer diffraction due to 2 parallel slit having slit width of 0.25mm with 0.5mm separation distance having the following missing order:-

- ☐ 2, 4, 6, 8.
- ☐ 1, 2, 3, 4
- ☐ There are no missing orders
- ☐ 3,6,9,12

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Two interfering beams with parallel electric fields are given by

$$E_1 = 2 \cos(\vec{k} \cdot \vec{r} - \omega t + \pi/3) \text{ kV/m and } E_2 = 2 \cos(\vec{k} \cdot \vec{r} - \omega t + \pi/3) \text{ kV/m.}$$

The interference term at a point where their path difference is zero is

- ☐ 33.2kW/m<sup>2</sup>
- ☐ 1.28kW/m<sup>2</sup>
- ☐ 5.3kW/m<sup>2</sup>

- ☐ 2.56kW/m<sup>2</sup>

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A metallic ring of cross sectional area  $A$  with mean radius  $R$  having a relative permeability  $\mu_r$  is uniformly wound with  $N$  turns of wire. If an uniform current  $I$  passes through the wire, then, the average magnetization  $M$  in the ring is

- ☐  $\frac{NI}{\pi R^2}(\mu_r \mu_0)$
- ☐  $\frac{NI \mu_r}{2\pi R}$
- ☐  $\frac{NI}{2\pi R}(\mu_r - 1)$
- ☐  $\frac{NI}{2\pi R}$

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The SI Unit of capacitance is equivalent to:-

- ☐ J / C
- ☐ C / J
- ☐ C<sup>2</sup> / J
- ☐ V / C

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Common base transistor amplifier has the following properties:-

- ☐ High voltage gain, low in put impedance and high output impedance
- ☐ High voltage gain, high in put impedance and high output impedance
- ☐ High voltage gain, high in put impedance and low output impedance
- ☐ low voltage gain, High in put impedance and high output impedance

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Output (Y) of the two in puts (A & B) of AND gate:-

- ☐  $Y = A / B$
- ☐  $Y = A + B$
- ☐  $Y = A.B$
- ☐  $Y = A - B$



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SI unit of electric flux density  $\vec{E}$  is :-

- ☐ Ampere/m
- ☐ Ampere/m<sup>2</sup>
- ☐ C/m<sup>2</sup>
- ☐ N / C

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225 PU\_2016\_374\_M

Field effect transistor (FET) amplifier has the following properties:-

- ☐ Unipolar, high noisy, good thermal stability and high in put impedance
- ☐ Unipolar, high noisy, bad thermal stability and low in put impedance
- ☐ Unipolar, less noisy, good thermal stability and high in put impedance
- ☐ Unipolar, less noisy, bad thermal stability and high in put impedance

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Differential amplifier has the following properties:-

- ☐ It attenuates the differential inputs and amplifies the common mode signals
- ☐ It amplifies the differential inputs and also the common mode signals
- ☐ It amplifies the differential inputs and attenuates the common mode signals
- ☐ It attenuates the differential inputs and also the common mode signals

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Phase shift oscillator generates:-

- ☐ Square wave
- ☐ Saw-tooth wave
- ☐ Triangle wave
- ☐ Sine wave

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222 PU\_2016\_374\_M

Common emitter transistor amplifier has the following properties:-

- ☐ Unit voltage gain, same phase and high in put impedance
- ☐ Low voltage gain, reverse phase and low in put impedance
- ☐ High voltage gain, reverse phase and medium in put impedance

- ☐ High voltage gain, same phase and high input impedance

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If an electric field  $|\vec{E}|$  is applied to an atom, it gets polarized with polarization  $|\vec{P}|$ . The relation between  $P$  and  $E$  is

- ☐  $P = \epsilon_o \epsilon_r E$
- ☐  $P = \epsilon_o (\epsilon_r - 1) E^2$
- ☐  $P = \frac{1}{4\pi\epsilon_o} E$
- ☐  $P = \epsilon_o (\epsilon_r - 1) E$

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228 PU\_2016\_374\_M

Output (Y) of the two inputs (A & B) of OR gate:-

- ☐  $Y = A + B$
- ☐  $Y = A.B$
- ☐  $Y = A - B$
- ☐  $Y = A / B$

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294 PU\_2016\_374\_D

A mobile phone has a mass of 100g. Find its weight if  $g$  is  $10 \text{ N kg}^{-1}$  :-

- ☐ 1000 N
- ☐ 0 N
- ☐ 1 N
- ☐ 90 N

82 of 100

299 PU\_2016\_374\_D

A very small current flow in a reverse biased condition is due to:-

- ☐ Zero charge carrier
- ☐ Majority charge carrier
- ☐ Minority charge carrier
- ☐ Both majority and minority carriers

83 of 100

298 PU\_2016\_374\_D

Color of light emitted by LED depends on:-

- ☐ its reverse bias
- ☐ forward current
- ☐ its forward bias
- ☐ semiconductor material

**84 of 100**

297 PU\_2016\_374\_D

Two inputs A and B of NAND gate has 0 output when:-

- ☐ A = 0, B = 1
- ☐ A = 1, B = 1
- ☐ A = 0, B = 0
- ☐ A = 1, B = 0

**85 of 100**

268 PU\_2016\_374\_D

The Hall effect in a conducting strip is due to the motion of charge carriers\_\_\_\_\_.

- ☐ perpendicular to the direction of applied magnetic field but parallel to the direction of the current.
- ☐ along the direction of the applied magnetic field
- ☐ perpendicular to the direction of both applied current and the magnetic field.
- ☐ along the direction of the applied current.

**86 of 100**

284 PU\_2016\_374\_D

Which instrument is used to measure pressure of liquids or gases?

- ☐ Manometer
- ☐ Multimeter
- ☐ Barometer
- ☐ Thermometer

**87 of 100**

293 PU\_2016\_374\_D

Heat applied to a piece of metal will cause:-

- ☐ increase in its mass
- ☐ increase in its internal energy
- ☐ increase in its volume
- ☐ increase in its density

**88 of 100**

281 PU\_2016\_374\_D

A drop of liquid (surface tension=75 dyne/cm) of diameter 2.8mm breaks into 125 identical drops. The change in energy is nearly:-

- ☐ 19 erg
- ☐ Zero
- ☐ 74 erg
- ☐ 46 erg

**89 of 100**

289 PU\_2016\_374\_D

In gases, diffusion occurs because molecules of gases:-

- ☐ move in random motion
- ☐ attract each other
- ☐ that are present in a higher concentration exert a higher pressure
- ☐ repel each other

**90 of 100**

291 PU\_2016\_374\_D

If car tires are hot, pressure of gas molecules in them would be:-

- ☐ same as before heating
- ☐ may be low or high
- ☐ high
- ☐ low

**91 of 100**

265 PU\_2016\_374\_D

The ratio between the thermal and electrical conductivities of all metals is \_\_\_\_\_.

- ☐ proportional to square of the temperature
- ☐ a constant at all temperature
- ☐ inversely proportional to temperature.
- ☐ proportional to temperature.

**92 of 100**

292 PU\_2016\_374\_D

Random motion of smoke or gas particles in air is termed as:-

- ☐ Bruneian motion
- ☐ Brownian motion
- ☐ Blackian motion
- ☐ Randomium motion

**93 of 100**

286 PU\_2016\_374\_D

The presence of impurities in a substance:-

- ☐ raises its melting point
- ☐ lowers its boiling point
- ☐ raises its boiling point
- ☐ lowers its melting point

94 of 100

285 PU\_2016\_374\_D

When net force acting on a droplet becomes zero its constant speed is known as:-

- ☐ Terminal velocity
- ☐ Friction
- ☐ Gravity
- ☐ Viscosity

95 of 100

296 PU\_2016\_374\_D

The thickness of base of a transistor is:-

- ☐  $10^{-3}$  m
- ☐  $10^{-4}$  m
- ☐  $10^{-6}$  m
- ☐  $10^{-5}$  m

96 of 100

290 PU\_2016\_374\_D

Three states of matter depend on:-

- ☐ potential energy
- ☐ biomass
- ☐ temperature
- ☐ force

97 of 100

272 PU\_2016\_374\_D

Shear stress produces a change in:-

- ☐ Angle of shear
- ☐ Deforming force
- ☐ Deforming torque
- ☐ Shape

98 of 100

295 PU\_2016\_374\_D

The superposition theorem is used when the electric circuit contains which of the following?

- ☐ Active elements
- ☐ Single voltage source
- ☐ Number of voltage sources
- ☐ Reactive elements

**99 of 100**

274 PU\_2016\_374\_D

A copper wire and steel wire of same diameter and length connected end to end and force is applied, which stretches their combined length by 1 cm. The wire will have:-

- ☐ Different strain and same stress
- ☐ Different stress and strain
- ☐ Same stress and different strain
- ☐ Same stress and strain

**100 of 100**

264 PU\_2016\_374\_D

A water molecule is called polar because:-

- ☐ The electrons tend to clump together more near oxygen than near hydrogen.
- ☐ The electrons tend to clump together more near hydrogen than near oxygen.
- ☐ The hydrogen and oxygen atoms form a triangle
- ☐ The electrons clump together equally near hydrogen and oxygen.

Sr No.	MSc Physics
1	Find the missing term in the following series: 3,10,29,66,127...?
Alt1	164
Alt2	187
Alt3	216
Alt4	218

2	Choose word from the given options which bears the same relationship to the third word, as the first two bears: Flower : Butterfly :: Dirt :?
Alt1	Rats
Alt2	Fly
Alt3	Bugs
Alt4	Sweeper

3	Tiff is to Battle as Frugal is to .....?.....
Alt1	Sprint
Alt2	Vague
Alt3	Miserly
Alt4	Vital

4	Select the lettered pair that has the same relationship as the original pair of words: Expend: Replenish
Alt1	Exhort: Encourage
Alt2	Formant: Rebellion
Alt3	Defect: Rejoin
Alt4	Encroachment: Occupy

5	Choose the set that has the same relationship as in the original: Bone : Skeleton : Nerve
Alt1	House: Door: Window
Alt2	Spoke: Wheel: Handle
Alt3	Retina: Eye: Pupil
Alt4	Snow: Cloud: Ice

6	Spot the defective segment from the following:
Alt1	Only with your help
Alt2	I passed the test
Alt3	though you helped me
Alt4	at the last minute

7	The government proposes to ----- hanging.
Alt1	cancel
Alt2	nullify
Alt3	invalidate

Alt4	abolish
------	---------

8	The burglar was hit -----.
Alt1	on head
Alt2	on his head
Alt3	on the head
Alt4	in the head

9	Choose the option closest in meaning to the given word: COGENT
Alt1	consistent
Alt2	acceptable
Alt3	convincing
Alt4	weak

10	Choose the antonymous option you consider the best: PROVIDENT
Alt1	careful
Alt2	worldly
Alt3	prodigal
Alt4	frugal

11	Ravi's brother is 3 years senior to him. His father was 28 years of age when his sister was born while his mother was 26 years of age when he was born. If his sister was 4 years of age when his brother was born, what was the age of Ravi's father and mother respectively when his brother was born ?
Alt1	32 years, 23 years
Alt2	32 years, 29 years
Alt3	35 years, 29 years
Alt4	35 years, 33 years

12	<p>In each of the following questions some statements are followed by two conclusions (i) and (ii). Read the statements carefully and then decide which of the conclusions follow beyond a reasonable doubt. Mark your answer as</p> <p>Statement: All my films are copies. I am happy to inform of the source when I copy – a producer</p> <p>Conclusions:</p> <p>(i) The producer does not make even a single film based on his own idea</p> <p>(ii) The producer copies domestic and foreign films</p>
Alt1	If only conclusion (i) follows
Alt2	If only conclusion (ii) follows
Alt3	If neither conclusion (i) nor (ii) follows
Alt4	If both the conclusions follow



13	3. What value should come in place of question mark (?) in the following number series? 14, 28, 46, ?, 94, 124
Alt1	64
Alt2	68
Alt3	72
Alt4	76

14	In a certain code ADVENTURES is written as TDRESAUVEN. How is SURPRISING written in that code ?
Alt1	IUIPGSRNR
Alt2	IUINGSSRRP
Alt3	IUIPGSSNR
Alt4	IRIPGSSNRR

15	Wax is related to Grease in the same way as Milk is related to
Alt1	Drink
Alt2	Ghee
Alt3	Curd
Alt4	Protein

16	The following information is given: Six persons A, B, C, D, E and F are sitting in two rows, three in each. E is not at the end of any row. D is second to the left of F. C, the neighbour of E, is sitting diagonally opposite to D. B is the neighbour of F. After interchanging seat with E, who will be the neighbours of D in the new position ?
Alt1	C and A
Alt2	F and B
Alt3	Only B
Alt4	Only A

17	If 30 students occupy $\frac{2}{3}$ of the seats in a classroom, how many students would occupy $\frac{4}{5}$ of the seats in the classroom?
Alt1	36
Alt2	32
Alt3	40
Alt4	48

18	Mean of the first 10 odd numbers is
Alt1	10
Alt2	13
Alt3	15
Alt4	9

19	Two numbers are in the ratio 2:3, If 4 be subtracted from each, they are in the ratio 3:5, Find the numbers.
----	--

Alt1	16,24
Alt2	20,30
Alt3	0.341666667
Alt4	None

20	It takes 30 seconds to cut the woodlock into 3 pieces.How much time does it takes to cut the same block into 4 pieces?
Alt1	40secs
Alt2	45secs
Alt3	50secs
Alt4	60secs

21	Lissajous' figures obtained by combining $x=a \sin \omega t$ & $x=a \sin(\omega t - \pi/4)$ will be:-
Alt1	ellipse
Alt2	parabola
Alt3	straight line
Alt4	Circle

22	If Silicon (Si) is doped with 1019 pentavalent impurity atoms, the position of the Femi level is:-
Alt1	Position of the Femi level is below the Valence band
Alt2	Position of the Femi level is above the Valence band
Alt3	Position of the Femi level is above the Conduction band
Alt4	Position of the Femi level is below the Conduction band

23	Which the following is incorrect?
Alt1	$\operatorname{Re}(z) \geq  z $
Alt2	$\operatorname{Re}(z) \leq  z $
Alt3	$\operatorname{Im}(z) \leq  z $
Alt4	$z\bar{z} =  z ^2$

24	A vector is a tensor of rank _____, and a scalar is a tensor of rank _____.
Alt1	0 and 1
Alt2	1 and 1
Alt3	1 and 0
Alt4	0 and 0

25	Pulse broadening due to material dispersion(21.5ps/km-nm)in optical fiber of length 10 km for light pulse centred around 1550 nm and spectral width of 2 nm:-
Alt1	430ps
Alt2	0.33microseconds
Alt3	43ps
Alt4	215ps

26	Fresnel number used to differentiate between near field and far field diffraction pattern for aperture having linear dimension of 'a' at a distance 'd' for the incident light of wavelength 'λ' is given by:-
Alt1	$\lambda / d$
Alt2	$d/\lambda$
Alt3	$(\lambda d)/ a^2$
Alt4	$a^2/(\lambda d)$

27	If $x_1$ is the distance of the object from the first principal focus $F_1$ and $x_2$ is the distance of the image from the second principal focus $F_2$ then (under thin lens approximation ) the following is true:-
Alt1	$x_1 x_2 = f^2$
Alt2	$x_1 / x_2 = f^2$
Alt3	$x_2 / x_1 = f^2$
Alt4	$x_1 x_2 = -f^2$

28	The Principle of Equipartition of Energy states that internal energy of a gas is shared equally:-
Alt1	Between translational and vibrational kinetic energy
Alt2	Among the relevant degrees of freedom
Alt3	Between temperature and pressure
Alt4	Among the molecules

29	For the Fourier series which represents $f(x) = x^2$ in the interval $-\pi < x < \pi$ , the sum of the series $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots$ is:-
Alt1	$\frac{\pi}{8}$
Alt2	$\frac{\pi^2}{4}$

Alt3	$\frac{\pi}{12}$
Alt4	$\frac{\pi^2}{12}$

30	In producing cooling by adiabatic demagnetization we use:-
Alt1	Paramagnetic substance
Alt2	Diamagnetic substance
Alt3	Insulator
Alt4	Ferromagnetic substance

31	The order and degree of the differential equation are $\frac{d^2y}{dx^2} + x = \sqrt{y + \frac{dy}{dx}}$ :-
Alt1	2,1
Alt2	2,1/2
Alt3	1,2
Alt4	2,2

32	If $A = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$ then $AA^T$ is:-
Alt1	Hermitian
Alt2	Skew-symmetric
Alt3	Orthogonal
Alt4	Symmetric

33	Two sound waves are $y=a \sin(\omega t - kx)$ and $y=a \cos(\omega t - kx)$ is the Phase shift between them is:
Alt1	$\pi/4$
Alt2	$\pi/2$
Alt3	$\pi$
Alt4	0

34	The band gap ( $E_g$ ) value of Silicon (Si) at 300 K is:-
Alt1	1.1 eV
Alt2	0.91 eV
Alt3	0.815 eV
Alt4	0.785 eV

35	An ideal gas has certain root mean square velocity $v$ at certain temperature. If we consider another ideal gas of atoms with double the atomic mass compared to the first one, then under the same temperature and pressure conditions, the root mean square velocity of the second ideal gas is equal to:-
Alt1	$\frac{v}{\sqrt{2}}$
Alt2	$\frac{v}{\sqrt{2}}$
Alt3	$\frac{v}{\sqrt{2}}$
Alt4	$v$

36	The heat energy radiated by an object is found to be equal to that of a perfect blackbody only if the temperature of the object is doubled than that of the blackbody. Then the emissivity of the object is approximately equal to:-
Alt1	0.05
Alt2	0.03
Alt3	0.04
Alt4	0.06

37	For the light passing through a pinhole along the axis will suffer from:-
Alt1	Astigmatism
Alt2	Spherical aberration
Alt3	Distortion
Alt4	Coma

38	Ultrasonic waves produced in a medium can be detected by a:-
Alt1	Telephone
Alt2	Hebbs Method
Alt3	Quineus tube
Alt4	Kundt's tube

39	If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ , then $\nabla r^n$ is:-
Alt1	$n(n-1)r^{n-2}\vec{r}$

Alt2	$nr^n - 2\vec{r}$
Alt3	$nr^n - 1\vec{r}$
Alt4	$nr^n \vec{r}$

40	The relation between Brewsters angle ( $\theta_B$ ) and Critical angle ( $\theta_C$ ) corresponding to external and internal reflection is:-
Alt1	$\theta_B = \theta_C$
Alt2	$\theta_B - \theta_C = 90^\circ$
Alt3	$\theta_B + \theta_C = 90^\circ$
Alt4	$\theta_B > \theta_C + 90^\circ$

41	Two thin lens of focal length $f_1$ and $f_2$ separated by distance $t$ would have minimum chromatic aberration when:-
Alt1	$t = (f_1 - f_2)/2$
Alt2	$1/t = 1/f_1 + 1/f_2$
Alt3	$t = (f_1 + f_2)/2$
Alt4	$1/t = 1/f_1 - 1/f_2$

42	Superposition of a plane wave and a spherical wave at a finite distance from the point source will result is interference pattern which is:-
Alt1	Vertical Straight line fringes
Alt2	Horizontal Straight Line Fringes
Alt3	Hyperboloid shape of Fringes with Straight line parallel along the line joining the two sources
Alt4	Concentric Ring of fringes

43	In a silver atom, the outer most orbit is labelled as $5s_1$ . If a beam of silver atoms are sent through an inhomogeneous magnetic field, then the beam
Alt1	does not split.
Alt2	is split into 5 beams
Alt3	is split into 4 beams
Alt4	is split into 2 beams

44	For a given eyepiece having $f_1$ and $f_2$ are focal length of the field lens and eye lens respectively with $d$ as the separation distance between them, the condition for minimum chromatic aberration and minimum spherical aberration are:-
Alt1	$d = (f_1 - f_2)$ and $d = (f_1 + f_2)/2$
Alt2	$d = (f_1 - f_2)/2$ and $d = (f_1 + f_2)$
Alt3	$d = (f_1 + f_2)/2$ and $d = (f_1 - f_2)$

Alt4	$d = (f_1 + f_2)$ and $d = (f_1 - f_2)/2$
------	---

45	Two frames of references move with a constant relative velocity. Which of the following quantity changes from one frame to another?
Alt1	The magnetic field.
Alt2	The space-time interval.
Alt3	The rest mass of a particle.
Alt4	The divergence of a magnetic field.

46	The residue of $\cot z$ at $z = 0$ is:-
Alt1	-1
Alt2	$1/4$
Alt3	$\pi$
Alt4	1

47	Use of Fermats principle for tracing the reflected light from the ellipsoidal mirror would require:-
Alt1	The emerging light to travel in maximum amount of time
Alt2	The emerging light to travel in least distance
Alt3	The paths travel by emerging light to be stationary
Alt4	The emerging light to travel in least amount of time

48	If $A = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ , $B = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$ , $C = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ , then $A^2 + B^2 + C^2$ is given by:-
Alt1	3I
Alt2	2I
Alt3	-2I
Alt4	-3I

49	A passenger is sitting in a fast moving train. The engine of the train blows a whistle of frequency $n$ . if the apparent frequency of the sound heard by the passenger is $n'$ , then:-
Alt1	$n' > n$
Alt2	$n' < n$
Alt3	$n' = 1/n$
Alt4	$n' = n$

50	A particle of mass $m$ moves in the +ve $x$ direction in a frame of reference with certain speed relative to the origin of this frame, where $c$ is the speed of light. This frame itself is moving along the same direction with respect to another frame with speed $0.5c$ . What is the speed of the particle with respect to the second frame?
Alt1	$c$
Alt2	$0.25c$
Alt3	$0.8c$
Alt4	$0.4c$

51	If $ \vec{a} + \vec{b}  = 60$ , $ \vec{a} - \vec{b}  = 40$ , and $ \vec{b}  = 46$ then $ \vec{a} $ is:-
Alt1	18
Alt2	21
Alt3	22
Alt4	11

52	If the degrees of freedom of a gas are 'f' then the ratio of its two specific heats $C_p/C_v$ is given by:-
Alt1	$1+(2/f)$
Alt2	$1-(1/f)$
Alt3	$1+(1/f)$
Alt4	$1-(2/f)$

53	According to kinetic theory of gases the relation between pressure P density $\rho$ and root-mean square velocity C is:-
Alt1	$P=(1/2)\rho C$
Alt2	$P=(1/3)\rho C^2$
Alt3	$P=(1/3)\rho C$
Alt4	$P=(1/2)\rho C^2$

54	At what Celsius temperature will oxygen molecules have the same root mean square velocity as that of hydrogen molecules at $-100^\circ\text{C}$ :-
Alt1	$175^\circ\text{C}$
Alt2	$100^\circ\text{C}$
Alt3	$1495^\circ\text{C}$
Alt4	$2495^\circ\text{C}$

55	As an empty vessel is filled with water, its resonant frequency:-
Alt1	decreases
Alt2	constant
Alt3	zero
Alt4	increases

56	Two events are observed with respect to one frame of reference. The same events are observed from another frame of reference which is moving at a constant relative velocity with respect to the first frame. If the two events are spatial separated and simultaneous in the first frame, then they:-
Alt1	cannot occur at the same spatial point in the second frame.
Alt2	are also simultaneous in the second frame.
Alt3	are separated by a space-time interval in the second frame.
Alt4	necessarily occur at the same spatial point in the second frame



57	It is found that the energy density of the radiation spectrum emitted by a black-body reaches its maximum at certain wavelength $\lambda$ at a certain temperature $T$ . At a higher temperature, the energy density would:-
Alt1	reach its maximum at a lower wavelength
Alt2	reach its maximum at a higher wavelength
Alt3	reach its maximum at the same wavelength.
Alt4	have the same maximum at the same wavelength.

58	In a reversible process, the entropy of the system:-
Alt1	Decreases
Alt2	Remains constant
Alt3	Increases
Alt4	Remains zero

59	Let $\vec{u}, \vec{v}$ and $\vec{w}$ be vectors such that $\vec{u} + \vec{v} + \vec{w} = \vec{0}$ . If $ \vec{u}  = 3,  \vec{v}  = 4$ and $ \vec{w}  = 5$ then $\vec{u} \cdot \vec{v} + \vec{v} \cdot \vec{w} + \vec{w} \cdot \vec{u}$ is:-
Alt1	25
Alt2	5
Alt3	$\sqrt{5}$
Alt4	-25

60	If $ \vec{a}  = 2,  \vec{b}  = 7$ and $ \vec{a} \times \vec{b}  = 3\vec{i} - 2\vec{j} + 6\vec{k}$ then the angle between $\vec{a}$ and $\vec{b}$ is:-
Alt1	$\frac{\pi}{4}$
Alt2	$\frac{\pi}{3}$
Alt3	$\frac{\pi}{6}$

Alt4	$\frac{\pi}{2}$
------	-----------------

61	Internal energy of a real gas depends upon:-
Alt1	Only on pressure of the gas
Alt2	Size of the molecule
Alt3	Only on volume of the gas
Alt4	Only on temperature of the gas

62	For a human eye with pupil diameter of 3mm, it would be able to resolve the two points at 10m separated by a distance of (assume wavelength of 600nm):-
Alt1	2mm
Alt2	$5 \times 10^2$ m
Alt3	$5 \times 10^4$ m
Alt4	20 microns

63	The displacement of wave is given as $20 \sin (200t - 0.01x)$ . The amplitude of the particle velocity is given as (All quantities are in SI Units):-
Alt1	4000 m/s
Alt2	40 m/s
Alt3	20 m/s
Alt4	10 m/s

64	If $\vec{A}$ is an orthogonal matrix, then $A^T$ is:-
Alt1	A
Alt2	A-
Alt3	-A-1
Alt4	A-1

65	Which of the following are the Eigen values of the matrix $\begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$ :-
Alt1	1,3,4
Alt2	1,2,3
Alt3	2,3,4
Alt4	2,3,5

66	If $m\vec{i} + 2\vec{j} + \vec{k}$ and $4\vec{i} - 9\vec{j} + 2\vec{k}$ are perpendicular then $m$ is:-
Alt1	8
Alt2	-4
Alt3	4
Alt4	12

67	In the Levi-civita tensor $\varepsilon_{\mu\nu\lambda}$ , if $\mu, \nu$ , and $\lambda$ are odd-permuting, then $\varepsilon_{\mu\nu\lambda}$ is equal to
Alt1	-1
Alt2	1
Alt3	2
Alt4	0

68	The space craft of mass $M$ moves with velocity $v$ in free space, at first. Then it explodes breaking into two pieces. After the explosion, a piece of mass $m$ remains stationary, the other piece of space craft will have a velocity:-
Alt1	$Mv/(M+m)$
Alt2	$mv/(M+m)$
Alt3	$mv/(M-m)$
Alt4	$Mv/(M-m)$

69	A long straight copper wire of circular cross section of radius $R$ contains $N$ electrons per unit volume, moving at velocity $v$ . If the charge of each electron is $q$ then, the current in the wire is equal to
Alt1	$qv\pi R^2 N$
Alt2	$qv$
Alt3	$qvN$
Alt4	$q\pi R^2 N$

70	An air-filled parallel plate capacitor has square plates of side $L$ that are separated by distance $D$ . The capacitor is filled with a dielectric slab with relative permittivity $\epsilon_r$ . What is the change in the stored energy of the system due to filling of dielectric, if the plates have a constant charge $Q$ ?
Alt1	$\frac{Q^2 D}{2\epsilon_0 L^2} \left( \frac{1}{\epsilon_r} - 1 \right)$
Alt2	$\frac{Q^2 D}{2\epsilon_0 L^2} \left( \frac{1}{\epsilon_r} \right)$
Alt3	$\frac{Q^2 D}{2\epsilon_0 L^2} (\epsilon_r - 1)$
Alt4	$\frac{Q^2 L}{2\epsilon_0 D^2} \left( \frac{1 - \epsilon_r}{\epsilon_r} \right)$

71	A capacitor of capacitance $C$ is connected across a dc battery of potential difference $V$ . How much work must be done in order to double the plate separation with the battery connected?
Alt1	Zero
Alt2	$\frac{CV^2}{4}$
Alt3	$\frac{CV^2}{2}$
Alt4	$\frac{CV^2}{8}$

72	Two point charges $q_1$ and $q_2$ are restricted to move along the $x$ - and the $y$ -axes respectively. At time $t = 0$ , both charges are at origin, and start with the same uniform speed $v$ . Then, at any time $t > 0$ the Lorentz force on $q_2$ due to the magnetic field of $q_1$ will be
Alt1	Parallel to $z$ -axis
Alt2	Parallel to $x$ -axis
Alt3	Parallel to $y$ -axis
Alt4	Zero

73	A straight long wire of circular cross-section of radius $R$ carries a uniform current density $J$ . Let $r$ be the radial distance (perpendicular distance) measured from the axis of the wire. Then,
Alt1	Magnetic field varies like $r$ for $r < R$ .
Alt2	Magnetic field varies like $r$ for $r > R$ .
Alt3	Magnetic field varies like $r^{-2}$ for $r < R$ .
Alt4	Magnetic field varies like $r^{-1}$ for $r > R$ .

74	The total internal reflection for glass-water interface ( $n_{\text{air}} = 1.00$ , $n_{\text{glass}} = 1.55$ and $n_{\text{water}} = 1.33$ ):-
Alt1	$41.8^\circ$
Alt2	$56.3^\circ$
Alt3	$62.7^\circ$
Alt4	$40.6^\circ$

75	Two Plano-convex lenses each of radius of curvature $R_1$ and $R_2$ are used to observe Newtons ring with their curved surfaces in contact with each other in light of wavelength ' $\lambda$ '. The radius of the 9th dark ring would be:-
Alt1	$\{(R_1 + R_2)/(9 \lambda R_1 R_2)\}^{1/2}$
Alt2	$9\{(\lambda R_1 R_2)/(R_1 + R_2)\}^{1/2}$
Alt3	$\{(\lambda R_1 R_2)/9(R_1 + R_2)\}^{1/2}$
Alt4	$\{(9 \lambda R_1 R_2)/(R_1 + R_2)\}^{1/2}$

76	A particle is moving under the potential $V(x) = [(x-1)^2 - 4]^2$ . At what values of $x$ , is the potential minimum?
Alt1	1 and 3
Alt2	-3 and 3
Alt3	-1 and 1
Alt4	-1 and 3

77	A refracting surface separates two medium with refractive index of $n_1$ and $n_2$ . All the rays parallel to major axis will focus onto one of the foci of the ellipse if the eccentricity of ellipse is equal to:-
Alt1	$(n_1/n_2)^{1/2}$
Alt2	$n_1/n_2$
Alt3	$n_1 \cdot n_2$
Alt4	$(n_1/n_2)^2$

78	<p>The electric potential at a perpendicular distance <math>r</math> from a long straight wire of cross-sectional radius <math>a</math> is given by</p> $V(r) = -K \log \frac{r}{a}$ <p>where <math>K</math> is a constant. Then, the charge per unit length of the wire is</p>
Alt1	$K$
Alt2	$2\pi K$
Alt3	$2\pi K \epsilon_0$
Alt4	$2\pi \epsilon_0$

79	A steady current $I$ flows in a circular loop of radius $R$ . The magnitude field at the center of the loop is:-
Alt1	$\mu_0 I / (2\pi R)$
Alt2	$\mu_0 I / (4\pi R)$
Alt3	Zero
Alt4	$\mu_0 I / (2R)$

80	A capacitor of capacitance $C$ is charged to $V$ volts using a battery. The battery is then disconnected, and an inductor of inductance $L$ is connected in series with the capacitor so that the LC oscillations occur. Assuming that the circuit contains no resistance, the maximum current in the coil is
Alt1	$V\sqrt{C/L}$
Alt2	$Q/LC$
Alt3	$V\sqrt{L/C}$
Alt4	$\sqrt{Q^2/LC}$

81	#####
Alt1	10/4
Alt2	10/8
Alt3	10
Alt4	10/2

82	Number of Fresnel zones in a radius of 2cm of zone plate for an object kept at a distance of 10cm has the brightest image at 40cm for the incident light of wavelength 500nm:-
Alt1	1000
Alt2	10000
Alt3	2500
Alt4	5000

83	What are the reasons for choosing the smallest size of base and smallest impurity doping level of base for designing transistor amplifier:-
Alt1	To increase the mobility of the carriers entering the base and also to reduce the more recombination of the carriers entering the base
Alt2	To increase the mobility of the carriers entering the base and also to increase the more recombination of the carriers entering the base
Alt3	To reduce the mobility of the carriers entering the base and also to increase the more recombination of the carriers entering the base
Alt4	To reduce the mobility of the carriers entering the base and also to reduce the more recombination of the carriers entering the base

84	The electric field $\vec{E}$ at the center of a charged solid cylindrical conductor is
Alt1	Zero
Alt2	$\frac{qr}{4\pi\epsilon_0 R^3}$
Alt3	Infinite
Alt4	$\frac{q}{4\pi\epsilon_0 R^2}$

85	Let R1 be the resistance of a conductor with length l and cross-sectional area A. Another conductor of same material has length 2l and cross-sectional area 2A. The resistance R2 of the second conductor is related to R1 by:-
Alt1	R1 = 4R2
Alt2	R1 = 2R2
Alt3	R2 = 2R1
Alt4	R1 = R2

86	At a given temperature, the ratio of the RMS velocity of hydrogen to the RMS velocity of oxygen is:-
Alt1	1/4
Alt2	8
Alt3	16
Alt4	4

87	A block with mass m and contact area 'a' slides down an inclined plane with friction, covering a distance l in time T. How much time does it take another block with the same mass and composition, but contact area '2a', to slide down the same length?
Alt1	T3
Alt2	T2
Alt3	T4
Alt4	T

88	Clouds float in the atmosphere on account of:-
Alt1	Low density
Alt2	Low viscosity
Alt3	Creation of low pressure
Alt4	Low temperature

89	The capacitance of a single isolated spherical conductor with radius R is proportional to:-
Alt1	R



Alt2	1 / R2
Alt3	1 / R
Alt4	R2

90	A copper wire has cross-sectional area A. Assume that a current I passes through the wire. If n is the number of electrons per unit volume, and e is the charge on the electron, then which of the following could be the correct expression for drift velocity $v_d$ of the electrons?
Alt1	$v_d = \frac{eI}{nA}$
Alt2	$v_d = \frac{I}{neA}$
Alt3	$v_d = \frac{IA}{ne}$
Alt4	$v_d = \frac{nI}{eA}$

91	The terminal velocity of small sized spherical body of radius r falling in a viscous liquid is:-
Alt1	$\mu r$
Alt2	$\mu r^2$
Alt3	$\mu 1/r^2$
Alt4	$\mu 1/r$

92	For two objects A and B, if mass of A is same as mass of B and speed of A is twice as much as that of B, which one of following statements is correct?
Alt1	Kinetic energy of A = (1/4) x Kinetic energy of B
Alt2	Kinetic energy of A = > Kinetic energy of B
Alt3	Kinetic energy of A = Kinetic energy of B
Alt4	Kinetic energy of A = 4 x Kinetic energy of B

93	Water raises in a capillary tube to a height of 4 cm. If the area of cross section is one-fourth, the water will rise to a height of:-
Alt1	2 cm
Alt2	8 cm
Alt3	4 cm
Alt4	16 cm

94	A dielectric slab is slowly inserted between the plates of a parallel plate capacitor, while the potential difference between the plates is held constant by a battery. As it is being inserted
----	---

Alt1	No change happens to any physical quantity.
Alt2	the potential difference between the plates increases, while the charge on the positive plate decreases, and the capacitance remains the same.
Alt3	the capacitance, the potential difference between the plates, and the charge on the positive plate will all increase.
Alt4	the capacitance and the charge on the positive plate will increase but the potential difference between the plates will remain the same.

95	An incompressible fluid flows steadily through a cylinder pipe which has radius $2R$ at a point A and radius $R$ at B further along the flow direction. If the velocity at point A is $v$ , its velocity at point B will be:-
Alt1	$4v$
Alt2	$v/2$
Alt3	$2v$
Alt4	$v$

96	The difference between Type-I and Type-II superconductors is:-
Alt1	that the Type-II superconductors are not perfectly diamagnetic in its superconducting state.
Alt2	that the Type-II superconductors do not exhibit Meissner effect in its superconducting state.
Alt3	the existence of two critical magnetic fields between which the Type-II is partially superconducting
Alt4	the existence of two critical temperatures between which the Type-II is partially superconducting

97	Energy stored in a stretched wire is:-
Alt1	$(1/2) \text{ load} \times \text{extension}$
Alt2	$(1/2) \text{ stress} \times \text{strain}$
Alt3	$\text{Load} \times \text{strain}$
Alt4	$\text{Stress} \times \text{strain}$

98	An electron of wavelength $\lambda$ undergoes Bragg reflection from one of the atomic planes in a crystal when it approaches the plane at a particular angle. Another crystal leads to the same order of scattered beam for the same angle of incidence only if the momentum of the electron is doubled. If the lattice spacing in the first case is $a$ , then the lattice spacing in the second case is equal to :-
Alt1	$2a$
Alt2	$a$

Alt3	$\lambda$
Alt4	$a / 2$

99	When the force applied by a person is 2 N and the moment of force is 16 N m, then the distance of pivot from effort is:-
Alt1	8 N
Alt2	18 N
Alt3	32 N
Alt4	14 N

100	Two water drops merge to form a large drop in this process:-
Alt1	Energy neither liberated nor absorbed
Alt2	Energy is absorbed
Alt3	Some mass is converted into energy
Alt4	Energy liberated

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Examination: M.Sc. Physics

## Section 1 - Section 1

## Question No.1

4.00

Bookmark ☐

A solid-state laser emits radiation of wavelength of  $6000 \text{ \AA}$  and the life time,  $\tau_{sp} = 10^{-6} \text{ s}$ . Assume that the refractive index of the medium is one and the co-efficient of stimulated emission is

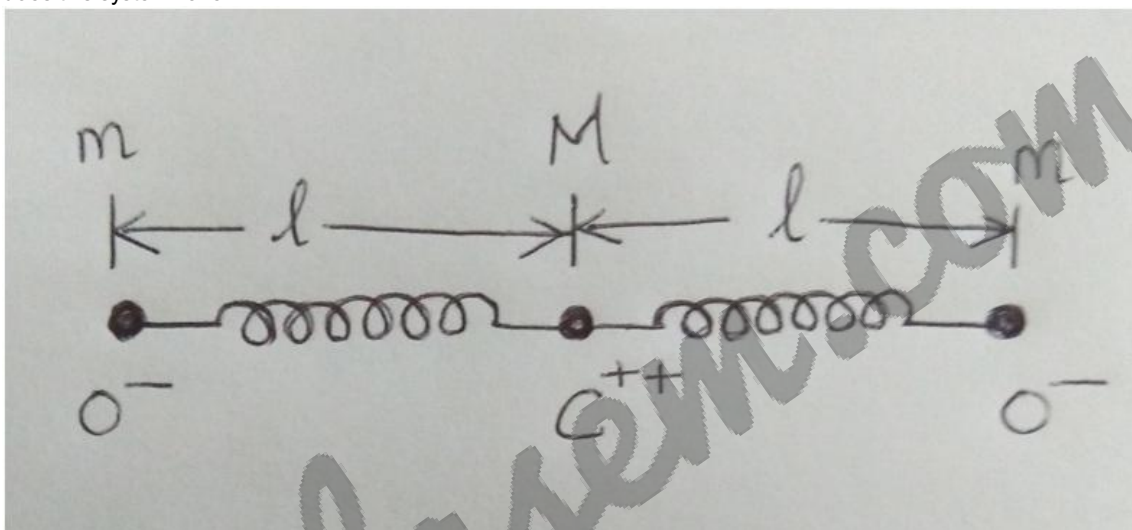
- ☐  $6.6 \times 10^{19} \text{ cm/kg}$
- ☐  $6.6 \times 10^{19} \text{ m/g}$
- ☐  $1.3 \times 10^{19} \text{ m/kg}$
- ☐  $1.3 \times 10^{19} \text{ m/g}$

## Question No.2

4.00

Bookmark ☐

A simple classical model of the  $\text{CO}_2$  molecule would be a linear structure of three masses with the electrical forces between the ions represented by two identical springs of equilibrium length  $l$  and force of constant  $k$ , as shown in Figure. Assume that only motion along the original equilibrium line is possible, that is, ignore rotations. How many vibrational degrees of freedom does this system have?



- ☐ 4
- ☐ 2
- ☐ 1
- ☐ No vibrational degrees of freedom

## Question No.3

4.00

Bookmark ☐

If three real numbers  $a$ ,  $b$ , and  $c$  are successive terms of an arithmetic sequence, then what is the value of

$$\frac{\sin(a) + \sin(b) + \sin(c)}{\cos(a) + \cos(b) + \cos(c)} ?$$

- ☐  $\tan(b)$
- ☐  $\operatorname{cosec}(a-b-c)$
- ☐  $\frac{\sin\left(\frac{b}{2}\right)}{\cos(c-a)}$

- ☐  $\cot(b+a-c)$

**Question No.4**

4.00

Bookmark ☐

Which of the following is used in atomic clocks?

- ☐ Laser
- ☐ Quartz
- ☐ Helium
- ☐ Maser

**Question No.5**

4.00

Bookmark ☐Laplace transform of  $\{e^{-2t} - e^{-3t}\}$  is

- ☐  $1/(s+2)$
- ☐  $1/(s-2)$
- ☐  $-1/(s^2+5s+6)$
- ☐  $1/(s^2+3s+6)$

**Question No.6**

4.00

Bookmark ☐

The Doppler broadening of the emission wavelength takes place in

- ☐ Nd:glass laser
- ☐ He-Ne laser
- ☐ Nd:YAG laser
- ☐ Ruby laser

**Question No.7**

4.00

Bookmark ☐

The classical value of molar specific heat is

- ☐ R

- ☐ 3R/2
- ☐ 3R
- ☐ R/2

**Question No.8**

4.00

**Bookmark** ☐

If  $y = 2^{\frac{1}{2+x}}$ , find the value of  $\frac{dy}{dx}$

- ☐  $-\frac{(2+x)^2}{\ln 2} 2^{\frac{1}{2+x}}$
- ☐  $-\frac{\ln 2}{(2+x)^2} 2^{\frac{1}{2+x}}$
- ☐  $\frac{2^{\frac{x}{2+x}}}{(2+x)^2}$
- ☐  $\frac{\ln 2}{(2+x)^2}$

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**Question No.9**

4.00

**Bookmark** ☐

In terms of the basic units of mass (M), length (L), time (T) and charge (Q), the dimensions of magnetic permeability of vacuum ( $\mu_0$ ) are

- ☐  $ML^2T^{-1}Q^{-2}$
- ☐  $MLQ^{-2}$
- ☐  $LT^{-1}Q^{-1}$
- ☐  $LTQ^{-1}$

**Question No.10**

4.00

**Bookmark** ☐

A coin is placed on a horizontal platform that undergoes vertical simple harmonic motion of angular frequency  $\omega$ . The amplitude of oscillation is gradually increased. The coin will leave contact with the platform for the first time

- ☐ At the mean position of the platform

- ☐ At an amplitude of  $g/\omega^2$
- ☐ At an amplitude of  $g^2/\omega^2$
- ☐ At the highest position of the platform

**Question No.11**

4.00

**Bookmark** ☐

Study the following information carefully and answer the question below it (i) There is a group of five persons- A, B, C, D and E (ii) One of them is manual scavenger, one is sweeper, one is watchman, one is human scarecrow and one is grave-digger (iii) Three of them – A, C and grave-digger prefer tea to coffee and two of them – B and the watchman prefer coffee to tea (iv) The human scarecrow and D and A are friends to one another but two of these prefer coffee to tea. (v) The manual scavenger is C's brother Which of the following groups includes a person who likes tea but is not a grave-digger?

- ☐ BD
- ☐ DE
- ☐ BCE
- ☐ None of the above

**Question No.12**

4.00

**Bookmark** ☐

Sunil likes chocolates very much, \_\_\_\_\_?

- ☐ doesn't he?
- ☐ does he
- ☐ isn't it?
- ☐ is it?

**Question No.13**

4.00

**Bookmark** ☐

Evaluate the derivative of the function  $f(x) = \sqrt{1 + \sqrt{(x+1)}} = [1 + (x+1)^{\frac{1}{2}}]^{\frac{1}{2}}$  with respect to  $x$  at  $x=0$ .

- ☐ 0
- ☐  $\frac{1}{4\sqrt{3}}$
- ☐  $\frac{1}{4\sqrt{2}}$
- ☐ None of the above

**Question No.14**

4.00

**Bookmark** ☐

The freezing point of water

- ☐ decreases with decrease of pressure

- ☐ decreases with decrease of pressure
- ☐ increases with increase of pressure
- ☐ decreases with increase of pressure
- ☐ does not depends on pressure

**Question No.15**

4.00

**Bookmark** ☐

If 9 men working 6 hours a day can do a work in 88 days. Then 6 men working 8 hours a day can do it in how many days?

- ☐ 95
- ☐ 97
- ☐ 99
- ☐ 89

**Question No.16**

4.00

**Bookmark** ☐

The operating frequency of a Wien-bridge oscillator is given by

- ☐  $\frac{1}{4\pi\sqrt{LC}}$
- ☐  $\frac{1}{2\pi RC}$
- ☐  $\frac{1}{2\pi\sqrt{LC}}$
- ☐  $\frac{1}{2\pi\sqrt{RC}}$

**Question No.17**

4.00

**Bookmark** ☐

A mono-atomic ideal gas, initially at temperature  $T_1$ , is enclosed in a cylinder fitted with a frictionless piston. The gas is allowed to expand adiabatically to a temperature  $T_2$  by releasing the piston suddenly. If  $L_1$  and  $L_2$  are the lengths of the gas column before and after expansion respectively, then  $T_1/T_2$  is given by

- ☐  $\frac{L_2}{L_1}$
- ☐  $\left(\frac{L_1}{L_2}\right)^{2/3}$
- ☐  $\left(\frac{L_2}{L_1}\right)^{2/3}$
- ☐  $\frac{L_1}{L_2}$



## Question No.18

4.00

Bookmark ☐

Consider an ideal op-amplifier with infinite voltage gain. Let  $V_1$  and  $V_2$  be the values of independent voltage sources connected to the positive and negative input terminals, respectively, and let  $V_o$  be the output voltage. If  $V_1 \neq V_2$ , then  $V_o$  will be

- ☐ Unpredictable
- ☐ infinite
- ☐ zero
- ☐ finite

## Question No.19

4.00

Bookmark ☐

Find the value of

Find the value of  $\ln\left(\ln\left(\frac{x^{x^x}}{x^x}\right)\right)$

- ☐  $\ln x + \ln(x^{x-1} - \ln(\ln x))$
- ☐  $\ln x + \ln(x^{x-1} - 1) + \ln(\ln x)$
- ☐  $\ln x + \ln(x^{x-1} + 1) + \ln(\ln x)$
- ☐  $\ln(x) - \ln(x^x + x) + \ln(\ln x)$

## Question No.20

4.00

Bookmark ☐

Match the following:

List 1		List 2	
1	One dimensional heat equation	A	$\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$
2	Two dimensional heat equation	B	$\frac{\partial u}{\partial t} = \alpha^2 \left[ \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right]$
3	Laplace equation	C	$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$
4	Poisson's equation	D	$\nabla^2 \rho$

$$V^2 \phi = -\frac{1}{\epsilon_0}$$

- ☐ 1-C ; 2-D ; 3-A ; 4-B
- ☐ 1-A ; 2-B ; 3-C ; 4-D
- ☐ 1-D ; 2-C ; 3-B ; 4-A
- ☐ 1-B ; 2-A ; 3-D ; 4-C

**Question No.21**

4.00

Bookmark ☐

Fill in the blank with the correct form of the verb.

The International Women's Day \_\_\_\_\_ with great enthusiasm by our university last month.

- ☐ celebrated
- ☐ is celebrated
- ☐ was celebrated
- ☐ has celebrated

**Question No.22**

4.00

Bookmark ☐

The following type of laser can be used for generation of laser pulse

- ☐ Nd- YAG laser
- ☐ Carbon dioxide laser
- ☐ Helium neon laser
- ☐ Ruby laser

**Question No.23**

4.00

Bookmark ☐

The greater the quantum number, the closer the quantum physics approaches classical physics. This principle is known as

- ☐ Least action principle
- ☐ Complementary principle
- ☐ Correspondence principle
- ☐ Uncertainty principle

**Question No.24**

4.00

Bookmark ☐

Maxwell modified the Biot-Savart's law to

- ☐ Lenz's law
- ☐ Faraday's law
- ☐ Kirchoff's law
- ☐ Ampere's law

**Question No.25**

4.00

Bookmark ☐

If  $a^2=b^3=c^4=d^5$ , then the value of  $\log_a (bcd)$  is

- ☐  $\frac{81}{24}$
- ☐  $\frac{4}{3}$
- ☐  $\frac{33}{20}$
- ☐  $\frac{47}{30}$

**Question No.26**

4.00

Bookmark ☐

Statements: Buses are cars. Cycles are cars

Conclusion:

- I. Cars are buses
- II. Buses are Cycles

- ☐ If neither I nor II follows
- ☐ If only conclusion I follows
- ☐ If only conclusion II follows
- ☐ If either I or II follows

**Question No.27**

4.00

**Bookmark** ☐

Consider the two-level system with  $E_1 = -13.6 \text{ eV}$ ,  $E_2 = -3.4 \text{ eV}$  and the co-efficient  $A_{21} = 6 \times 10^8 \text{ s}^{-1}$ . The frequency of light emitted due to transition from  $E_2$  and  $E_1$  is

- ☐  $2.5 \times 10^{15} \text{ Hz}$
- ☐  $6.5 \times 10^{14} \text{ Hz}$
- ☐  $8.2 \times 10^{17} \text{ Hz}$
- ☐  $4.5 \times 10^{16} \text{ Hz}$

**Question No.28**

4.00

**Bookmark** ☐

A transistor has a collector current of 5 mA, when the emitter voltage is 20 mV. At 30 mV, the current is 30 mA. At 50 mV, it is

- ☐ 280 mA
- ☐ 80 mA
- ☐ 480 mA
- ☐ 1080 mA

**Question No.29**

4.00

**Bookmark** ☐

Calculate the wavelength of the radiative transition from  $n=3$  to  $n=2$  in the hydrogen atom. (where Rydberg constant  $R_H = 1.096778 \times 10^7 \text{ m}^{-1}$ )

- ☐ 536 nm
- ☐ 252.5 nm
- ☐ 658 nm
- ☐ 656.5 nm

**Question No.30**

4.00

**Bookmark** ☐

Three concentric metallic spherical shells of radii  $R$ ,  $2R$ ,  $3R$ , are given charges  $Q_1$ ,  $Q_2$ ,  $Q_3$ , respectively. It is found that the surface charge densities on the outer surfaces of the shells are equal. Then, the ratio of the charges given to the shells,  $Q_1 : Q_2 : Q_3$ , is

- ☐ 1 : 3 : 5
- ☐ 1 : 8 : 18
- ☐ 1 : 4 : 9
- ☐ 1 : 2 : 3

**Question No.31**

4.00

**Bookmark** ☐

One of the most efficient engines ever developed operates between 2100 K and 700 K. Its actual efficiency is 40%. Find the ratio of its actual efficiency to its maximum efficiency in percentage.

- ☐ 60%
- ☐ 55%
- ☐ 66.60%
- ☐ 40%

## Question No.32

4.00

Bookmark ☐

Two charges, one positive and one negative, of same magnitude,  $Q = 1.1 \times 10^{-10} \text{ C}$ , are located  $2 \times 10^6 \text{ m}$  apart. A third charge  $q = 10^{17} \text{ C}$  is located exactly between them. What is the magnitude of the total force acting on charge  $q$ ? (Coulomb constant,  $k = 8.98 \times 10^9 \text{ N}^2 \text{ m}^2 \text{ C}^{-2}$ ).

- ☐  $2 \times 10^{-10} \text{ N}$
- ☐  $2 \times 10^5 \text{ N}$
- ☐  $2 \times 10^{-5} \text{ N}$
- ☐  $2 \times 10^{10} \text{ N}$

## Question No.33

4.00

Bookmark ☐

*In the following question, the first two words (given in italics) have a definite relationship. Choose one word out of the given four alternatives which will fill the blank space and show the same relationship with the third word as between the first two.*

*Latex* is to *Rubber* as *Flax* is to .....?.....

- ☐ Cotton
- ☐ Linen
- ☐ Silk
- ☐ Jute

## Question No.34

4.00

Bookmark ☐

A pipe AB of circular cross section has radii 6 cm and 3 cm at the ends A and B respectively. The water is flowing from A to B. If the water flow rate at A is  $0.06 \text{ m}^3/\text{s}$ , what will be the approximate velocity of water at B?

- ☐ 96 m/s
- ☐ 67 m/s
- ☐ 21 m/s
- ☐ 85 m/s

## Question No.35

4.00

Bookmark ☐

A cinema theatre has a volume of  $750 \text{ m}^3$ . What should be the total absorption in the theatre if the reverberation time of 1.5 seconds is to be maintained?

- ☐ 750 open window units
- ☐ 835 open window units
- ☐ 500 open window units
- ☐ 1125 open window units

## Question No.36

4.00

Bookmark ☐

The potential energy of system of  $\text{Na}^+$  and  $\text{Cl}^-$  ions when they are at  $4 \text{ \AA}$  apart

- ☐ -5.5 eV
- ☐ -8.5 eV
- ☐ -2.5 eV
- ☐ -3.6 eV

## Question No.37

4.00

Bookmark ☐

An object is placed at a distance of 100 cm from a convex mirror; the magnification produced is  $1/2$ . Where the object should be placed to get a magnification of  $1/4$ ?

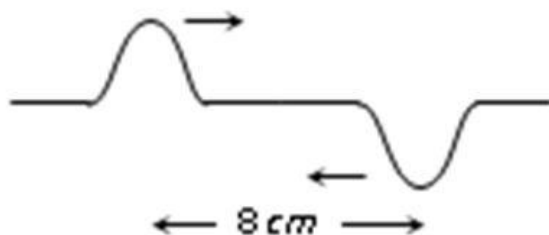
- ☐ 30 cm
- ☐ -300 cm
- ☐ -30 cm
- ☐ 300 cm

## Question No.38

4.00

Bookmark ☐

Two pulses in a stretched string whose centres are initially 8 cm apart are moving towards each other as shown in the figure. The speed of each pulse is 2 cm/s. What will be the total energy of the pulses after 2 seconds?



- ☐ Zero
- ☐ Purely kinetic
- ☐ Purely potential
- ☐ Both kinetic and potential

## Question No.39

4.00

Bookmark ☐

A spring stretched by 'x' has a potential energy U. If it is stretched by 2x more, the increase in potential energy due to second stretching is

- ☐ 6U
- ☐ 4 U
- ☐ 8 U
- ☐ 2U

## Question No.40

4.00

Bookmark ☐

A battery of emf E and internal resistance r is used in a circuit with a variable external resistance R. Find the value of R for which the power consumed in R is maximum

- ☐ r

- ☐  $r/2$
- ☐  $2r$
- ☐  $0$

## Question No.41

4.00

Bookmark ☐

When forces  $F_1$ ,  $F_2$ , and  $F_3$  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

- ☐  $F_1 / m$
- ☐  $F_2 F_3 / m F_1$
- ☐  $F_2 / m$
- ☐  $(F_2 - F_3) / m$

## Question No.42

4.00

Bookmark ☐

Choose the correct meaning of the italicized idiom.  
The police *cordoned off* the area after the explosion.

- ☐ did not allow anyone to leave the area
- ☐ isolated the area
- ☐ checked everyone in the area
- ☐ filled the whole area

## Question No.43

4.00

Bookmark ☐

The laser action is mainly characterized by

- ☐ Spontaneous emission process
- ☐ Plasmonic process
- ☐ Stimulated emission process
- ☐ Thermionic emission process

## Question No.44

4.00

Bookmark ☐

Oxygen is 16 times heavier than hydrogen. Equal volumes of hydrogen and oxygen are mixed. Find out the ratio of speed of sound in the mixture to that in hydrogen.

- ☐  $\sqrt{\frac{1}{8.5}}$
- ☐  $\sqrt{8.5}$
- ☐  $\sqrt{\frac{8.5}{3}}$

☐  $\sqrt[8.5]{16}$

## Question No.45

4.00

Bookmark ☐

The reaction  $e^+ + e^- \rightarrow \gamma$  is forbidden because,

- ☐ linear momentum is not conserved
- ☐ charge is not conserved
- ☐ angular momentum is not conserved
- ☐ lepton number is not conserved

## Question No.46

4.00

Bookmark ☐

The pressure of a gas contained in a vessel is P. If mass of each molecule is reduced to half and root mean square (RMS) velocity doubled, the pressure will be

- ☐ P/4
- ☐ P/2
- ☐ 2P
- ☐ P

## Question No.47

4.00

Bookmark ☐

The most unique property of laser

- ☐ speed
- ☐ coherence
- ☐ directional
- ☐ wavelength

## Question No.48

4.00

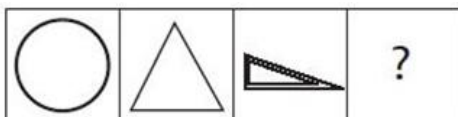
Bookmark ☐

For an intrinsic semiconductor,  $m_e^*$  and  $m_h^*$  are respectively the effective masses of electrons and holes near the corresponding band edges. At a finite temperature the position of the Fermi level

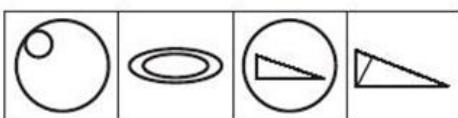
- ☐ depends on  $m_h^*$  but not on  $m_e^*$
- ☐ depends on  $m_e^*$  but not on  $m_h^*$
- ☐ depends neither on  $m_e^*$  nor on  $m_h^*$
- ☐ depends on both  $m_e^*$  and  $m_h^*$

## Question No.49

4.00

Bookmark ☐

A      B      C      D



(1)      (2)      (3)      (4)

- ☐ 1
- ☐ 4
- ☐ 3
- ☐ 2

## Question No.50

4.00

Bookmark ☐

A shell is fired upward from a Cannon with a velocity  $v$  (m/s) at an angle  $\theta$  with the horizontal direction. At the highest point in its path it explodes into two pieces of equal mass. If one of the pieces retraces its path to the cannon, what will be the speed (in m/s) of the other piece immediately after the explosion?

- ☐  $(3/2)v \cos\theta$
- ☐  $(\sqrt{3}/2)v \cos\theta$
- ☐  $2v \cos\theta$
- ☐  $3v \cos\theta$

## Question No.51

4.00

Bookmark ☐

What is the approximate optical length of a ring cavity synchronized to a laser of repetition rate of 80 MHz?

- ☐ 7.5 m
- ☐ 3.75 m
- ☐ 0.94 m
- ☐ 1.86 m

## Question No.52

4.00

Bookmark ☐

The electrical power output of a photodiode is maximum when a

- ☐ Small forward bias exists across it
- ☐ Large reverse bias exists across it
- ☐ Small forward current flows through it, irrespective of the bias
- ☐ Small reverse bias exists across it

## Question No.53

4.00

Bookmark ☐

The critical magnetic field for aluminium is  $7.9 \times 10^3$  A/m in which current flow through a long thin superconducting wire of diameter  $10^{-3}$  m. The critical current is found to be

- ☐ 24.81 A
- ☐ 34 A
- ☐ 35.46 A
- ☐ 15.55 A

## Question No.54

4.00

Bookmark ☐

The packing efficiency of diamond cubic unit cell is

- ☐ 0.52
- ☐ 0.68
- ☐ 0.34
- ☐ 0.74

## Question No.55

4.00

Bookmark ☐

The work done in the isothermal expansion of an ideal gas from its initial pressure ( $P_1$ ) and volume ( $V_1$ ) to final pressure ( $P_2$ ) and volume ( $V_2$ ) is



- ☐  $P_1 V_1 \ln (P_1 / P_2)$
- ☐  $P_2 V_2 \ln (V_1 / V_2)$
- ☐  $P_1 V_1 \ln (P_2 / P_1)$
- ☐ Zero

**Question No.56**

4.00

Bookmark ☐

Which number replaces the question mark?

6	7	2
13	9	
	22	
17	5	
13	4	?

- ☐ 2
- ☐ 4
- ☐ 3
- ☐ 1

**Question No.57**

4.00

Bookmark ☐

A wave traveling at  $5.0 \times 10^4$  meters per second has wavelength of  $2.5 \times 10$  meters. What is the frequency of the wave?

- ☐  $5.0 \times 10^3$  Hz
- ☐  $2.0 \times 10^3$  Hz
- ☐  $1.25 \times 10^6$  Hz
- ☐  $5.0 \times 10^{-4}$  Hz

**Question No.58**

4.00

Bookmark ☐

If the mobility of electrons in metal decreases, the resistivity

- ☐ increases
- ☐ fluctuate
- ☐ decreases
- ☐ remains constant

**Question No.59**

4.00

Bookmark ☐

Choose the most appropriate preposition to fill the blank:

The mathematics exam will be held between 2\_\_\_\_4pm.

- ☐ to
- ☐ from
- ☐ at
- ☐ and

**Question No.60**

4.00

Bookmark ☐

Coefficient of performance of refrigerator is( $Q_c$  is the heat removed from the refrigerator and  $Q_h$  is the heat delivered outside)

- ☐  $(Q_h - Q_c) / Q_h$
- ☐  $Q_c / (Q_h - Q_c)$
- ☐  $Q_h / (Q_h - Q_c)$
- ☐  $(Q_h - Q_c) / Q_c$

**Question No.61**

4.00

Bookmark ☐

A  $3 \times 3$  matrix has eigen values 0,  $2+i$  and  $2-i$ . Which of the following is a correct statement?

- ☐ The inverse of the matrix exists
- ☐ The matrix is Hermitian
- ☐  $\det A = 0$
- ☐ The matrix is unitary

## Question No.62

4.00

Bookmark ☐

If  $\varepsilon \ll 1$  and  $\eta \ll 1$  but both of them are positive, then find out the approximate value of  $\frac{1+\varepsilon}{1+\eta}$

- ☐  $1+\varepsilon-\eta$
- ☐  $\frac{\eta}{\varepsilon}$
- ☐  $1-\varepsilon+\eta$
- ☐  $\frac{\varepsilon}{\eta}$

## Question No.63

4.00

Bookmark ☐

Consider a beam of light of wavelength  $\lambda$  incident on a system of a polarizer and an analyzer. The analyzer is oriented at  $45^\circ$  to the polarizer. When an optical component is introduced between them, the output intensity becomes zero. (Light is incident normally on all components). The optical component is

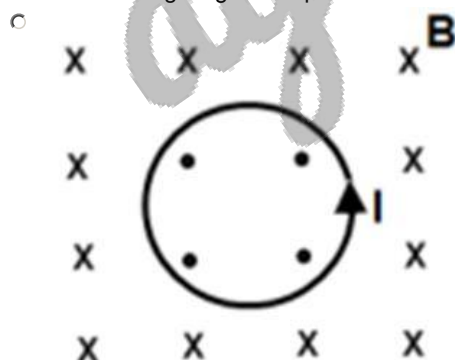
- ☐ a half-wave plate
- ☐ a quarter-wave plate
- ☐ a full-wave plate
- ☐ an ordinary glass plate

## Question No.64

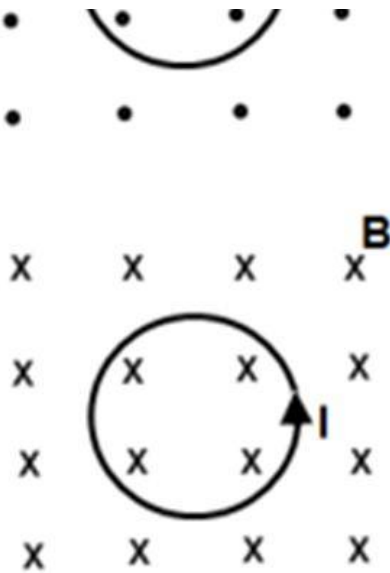
4.00

Bookmark ☐

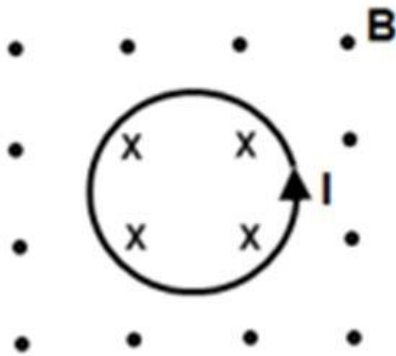
Which of the following diagrams represents the magnetic field due to a circular current?



○



○



## Question No.65

4.00

Bookmark ☐

Choose the synonym of the italicized word.

Some people are extremely *fastidious* in their choice of dress.

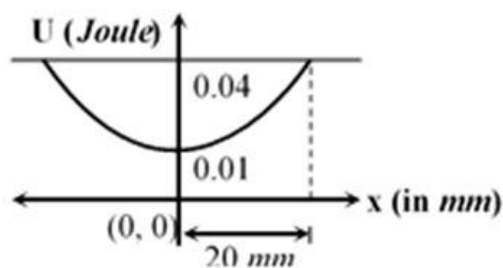
- ☐ fussy
- ☐ discriminating
- ☐ careless
- ☐ pompous

## Question No.66

4.00

Bookmark ☐

The variation of potential energy of harmonic oscillator is shown in figure. The force constant of the oscillator is



- ☐ 400 N/m
- ☐ 75 N/m
- ☐ 150 N/m
- ☐ 250 N/m

**Question No.67**

4.00

**Bookmark** ☐

The coefficient of performance of a refrigerator is 5. If the temperature inside freezer is  $-20^{\circ}\text{C}$ , the temperature of the surroundings to which it rejects heat is

- ☐  $31^{\circ}\text{C}$
- ☐  $41^{\circ}\text{C}$
- ☐  $21^{\circ}\text{C}$
- ☐  $11^{\circ}\text{C}$

**Question No.68**

4.00

**Bookmark** ☐

In photoelectric experiment both sodium (work function =  $2.3\text{eV}$ ) and tungsten (work function =  $4.5\text{eV}$ ) metals were illuminated by an ultraviolet light of same wavelength. If the stopping potential for tungsten is measured to be  $1.8\text{V}$ , the value of the stopping potential for sodium will be

- ☐  $2.2\text{ V}$
- ☐  $6.3\text{ V}$
- ☐  $6.8\text{ V}$
- ☐  $4\text{ V}$

**Question No.69**

4.00

**Bookmark** ☐

The equation of a wave is given by  $y = a \sin[\omega((x/v) - k)]$ , where  $\omega$  is the angular velocity,  $v$  is the linear velocity. The dimension of  $k$  will be

- ☐  $[L T]$
- ☐  $[T^{-1}]$
- ☐  $[T^2]$
- ☐  $[T]$

**Question No.70**

4.00

**Bookmark** ☐

Calculate the wavelength of the photon, which will be required to break a Cooper pair in a superconductor like zirconium whose  $T_c$  is  $0.56\text{ K}$

- ☐  $7.2 \times 10^{-3}\text{ m}$
- ☐  $3.8 \times 10^{-2}\text{ m}$
- ☐  $1.5 \times 10^{-4}\text{ m}$
- ☐  $4.3 \times 10^{-5}\text{ m}$

**Question No.71**

4.00

**Bookmark** ☐

**Statement:** Be humble even after being victorious.

**Assumptions:**

- I. Many people are humble after being victorious
- II. Generally People are not humble

- ☐ If neither I nor II is implicit
- ☐ If both I and II are implicit
- ☐ If only assumption II is implicit
- ☐ If only assumption I is implicit

**Question No.72**

4.00

**Bookmark** ☐

If black is called white, white is called red, red is called pink, pink is called green, green is called blue, what would be the colour of human blood?

- ☐ Green
- ☐ Blue
- ☐ Pink
- ☐ White

**Question No.73**

4.00

**Bookmark** ☐

Study the following information carefully and answer the question below it:

Aasha, Bhuvnesh, Charan, Danesh, Ekta, Farhan, Ganesh and Himesh are sitting around a circle, facing the centre. Aasha sits fourth to the right of Himesh while second to the left of Farhan. Charan is not the neighbour of Farhan and Bhuvnesh. Danesh sits third to the right of Charan. Himesh never sits next to Ganesh.

Which is the position of Farhan with respect to Ekta?

- ☐ Fourth to the right
- ☐ Third to the left
- ☐ Second to the right
- ☐ Sixth to the left

**Question No.74**

4.00

**Bookmark** ☐

A Carnot engine working between 300 K and 400 K has 800 J of useful work. The amount of heat energy supplied to the engine from the source is

- ☐ 1200 J
- ☐ 3600 J
- ☐ 3200 J
- ☐ 2400 J

**Question No.75**

4.00

**Bookmark** ☐

The half-life of a radioactive nuclear source is 9 days. The fraction of nuclei which are left undecayed after 3 days is

- ☐  $\frac{2}{3}$
- ☐  $\frac{1}{3}$
- ☐  $\frac{7}{8}$
- ☐  $\frac{1}{2}^{\frac{1}{3}}$

**Question No.76**

4.00

**Bookmark** ☐

A body floats with  $\frac{1}{3}$  of its volume outside water. The same body floats with  $\frac{3}{4}$  of its volume inside another liquid. The density of the other liquid is

- ☐  $\frac{2}{9}$  gm/cc
- ☐  $\frac{9}{4}$  gm/cc
- ☐  $\frac{4}{9}$  gm/cc
- ☐  $\frac{8}{9}$  gm/cc

## Question No.77

4.00

Bookmark ☐

A combination of two thin convex lenses of equal focal lengths, is kept separated along the optic axes by a distance of 20 cm between them. The combination behaves as a lens system of infinite focal length. If an object is kept at 10 cm from the first lens, its image will be formed on the other side at a distance  $x$  from the second lens. The value of  $x$  is

- ☐ 6.67 cm
- ☐ 20 cm
- ☐ 10 cm
- ☐ infinite

## Question No.78

4.00

Bookmark ☐

The method of mining silver varies from place to place, \_\_\_\_\_?

- ☐ is it?
- ☐ doesn't it?
- ☐ does it?
- ☐ isn't it?

## Question No.79

4.00

Bookmark ☐

1, 4, 27, 16, ?, 36, 343

- ☐ 132
- ☐ 125
- ☐ 72
- ☐ 25

## Question No.80

4.00

Bookmark ☐

Suppose the gravitational force varies inversely as the  $n^{\text{th}}$  power of distance. Then the time period of a planet in circular orbit of radius  $R$  around the sun will be proportional to

- ☐  $R^{\left(\frac{n+1}{2}\right)}$
- ☐  $R^n$
- ☐  $R^{\left(\frac{n-2}{2}\right)}$
- ☐  $R^{\left(\frac{n-1}{2}\right)}$

## Question No.81

4.00

Bookmark ☐

The output of operational amplifier increases 5 V in 15  $\mu\text{s}$ . The slew rate is

- ☐ 30 V/ $\mu\text{s}$
- ☐ 5 V/ $\mu\text{s}$
- ☐ 0.333 V/ $\mu\text{s}$
- ☐ 90 V/ $\mu\text{s}$

## Question No.82

4.00

Bookmark ☐

Study the following information carefully and answer the question below it

In a family, Isha is the granddaughter of Acha. Deena is the mother of Haran. Charan is the son of Anand. Radha is the

In a family, Sha is the granddaughter of Asha. Deepa is the mother of Hansa. Charan is the son of Anand. Radha is the mother of Sha. Deepa is the sister of Vinod and Charan. Nagesh has two children, Gita and Hansa. Emesh is the only grandson in the family. Charan is not married. Radha is the daughter-in-law of Anand.

Who is married to Radha?

- ☐ Nagesh
- ☐ Charan
- ☐ Anand
- ☐ Vinod

#### Question No.83

4.00

Bookmark ☐

If  $y = \sqrt{\frac{1}{2} + \sqrt{\frac{1}{2} + \sqrt{\frac{1}{2} + \dots}}}$ , then find the value of  $y$

- ☐  $\frac{1+\sqrt{3}}{2}$
- ☐  $\frac{1+\sqrt{2}}{2}$
- ☐  $\frac{1-\sqrt{3}}{2}$
- ☐  $\frac{1-\sqrt{2}}{2}$

#### Question No.84

4.00

Bookmark ☐

For an n-channel silicon FET with channel width of  $3 \times 10^{-4}$  cm and the dopant concentration of  $10^{15}$  electrons/cm<sup>3</sup>. The relative dielectric constant of silicon is 12 and the pinch of voltage is

- ☐ 6.8 V
- ☐ 13.5 V
- ☐ 10 V
- ☐ 15.5 V

#### Question No.85

4.00

Bookmark ☐

The phase difference between the input and output voltages of a transistor connected in common emitter arrangement is

- ☐ 180°
- ☐ 360°
- ☐ 270°
- ☐ 90°

#### Question No.86

4.00

Bookmark ☐

For aluminium, the modulus of rigidity is  $2.1 \times 10^{10}$  N/m<sup>2</sup> and density is  $2.7 \times 10^3$  kg/m<sup>3</sup>. Find the speed of transverse waves in the medium.

- ☐  $25.14 \times 10^3$  m/s
- ☐  $27.9 \times 10^3$  m/s
- ☐  $2.79 \times 10^3$  m/s
- ☐  $24.1 \times 10^3$  m/s

## Question No.87

4.00

Bookmark ☐

For a given motion, the relationship between time  $t$  and distance  $x$  is found out to be  $t = \alpha x^2 + \beta x$ , where  $\alpha$  and  $\beta$  are constants. Considering  $v$  as velocity, the retardation will be given by,

- ☐  $2\beta^2 v^3$
- ☐  $2\alpha v^3$
- ☐  $2\alpha\beta v^3$
- ☐  $2\beta v^3$

## Question No.88

4.00

Bookmark ☐

Based on the information given answer the following question.

1. In a family of six persons, there are people from three generations. Each has separate professions and they like different colours. There are two couples.
2. Shyam is an Engineer and his wife is not a doctor and she does not like Red colour.
3. Chartered Accountant likes green colour and his wife is a teacher.
4. Manisha is the mother-in-law of Sunita and she likes orange colour.
5. Vimal is the grand father of Tarun and tarun is the Principal and likes black colour.
6. Nyna is the grand daughter of Manisha and she likes blue colour. Nyna's Mother likes white colour.

Which Colour is liked by the Sunita?

- ☐ White
- ☐ Green
- ☐ Black
- ☐ Cannot be determined

## Question No.89

4.00

Bookmark ☐

Choose the best antonym of the italicized word.

The principal *deprecated* the attitude of some student-leaders.

- ☐ ignored
- ☐ derided
- ☐ appreciated
- ☐ tolerated

## Question No.90

4.00

Bookmark ☐

A 200 turn coil having an axial length of 30 mm and a radius of 10mm is pivoted in a magnetic field having a flux density of 0.8

T. If the coil carries a current of 0.5A, the torque acting on the coil will be

- ☐ 0.0048 Nm
- ☐ 0.048 Nm
- ☐ 8 Nm
- ☐ 0.48 Nm

## Question No.91

4.00

Bookmark ☐

If  $3^{\frac{1}{3}}x - 2^{\frac{1}{2}}y = 0$  and  $2^{\frac{1}{3}}x - 3^{\frac{1}{2}}y = 1$ , find the value of  $x$  and  $y$ .



☐

$$x = \frac{2^{\frac{1}{2}}}{\frac{1}{2^6} + \frac{1}{3^6}},$$

$$y = \frac{3^{\frac{1}{3}}}{\frac{1}{2^6} + \frac{1}{3^6}}$$

Question No.92

4.00

☐
Bookmark ☐

The DC current gain of a common-base transistor is 0.956 and emitter current is 10 mA. The base current value is

☐ 0.38 mA

☐ 0.66 mA

☐ 0.44 mA

☐ 0.25 mA

Question No.93

4.00

☐
Bookmark ☐

Solar energy reaches the earth at the rate of about 1.4 kW per square meter of surface perpendicular to the direction of the sun (The mean radius of the earth's orbit is  $1.5 \times 10^{11}$  m). The mass of the sun decrease per second owing to this energy loss is

☐
☐  $4.4 \times 10^9 \text{ kg s}^{-1}$

- ☐  $4.4 \times 10^{-19} \text{ kg}$
- ☐  $2.0 \times 10^{19} \text{ kg}$
- ☐  $4.4 \times 10^{26} \text{ kg}$
- ☐  $2.0 \times 10^{30} \text{ kg}$

**Question No.94**

4.00

Bookmark ☐

A uniform metal disc with a small hole at the center is rotating at a constant period around an axis that passes through the center of mass of the disc. If the disc is heated uniformly, the period of rotation will

- ☐ decrease
- ☐ increase
- ☐ remain same
- ☐ first increase then decrease

**Question No.95**

4.00

Bookmark ☐

The proton proton chain reaction

- ☐ is the runaway reaction that produces the fission of iron during a supernova explosion
- ☐ is a three-step process which converts some mass to energy as helium nuclei are formed
- ☐ adds protons together until a massive carbon nucleus is produced at the core of the Sun
- ☐ produces chains of protons which are then broken apart to produce the Sun's energy

**Question No.96**

4.00

Bookmark ☐

The cosmic microwave background radiation comes from

- ☐ the solar nebula
- ☐ quasars
- ☐ the Big Bang
- ☐ radio galaxies

**Question No.97**

4.00

Bookmark ☐

The position vector of a particle is represented as  $\vec{r} = (a \cos \omega t)\hat{i} + (a \sin \omega t)\hat{j}$ . What is the direction of the velocity vector?

- ☐ Parallel to position vector
- ☐ Always directed away from the origin
- ☐ Perpendicular to position vector
- ☐ Always directed towards origin

**Question No.98**

4.00

Bookmark ☐

The efficiency of a full-wave rectifier is

- ☐ double the half-wave rectifier
- ☐ one-half of half-wave rectifier
- ☐ one-third of half-wave rectifier
- ☐ Same as half-wave rectifier

**Question No.99**

4.00

Bookmark ☐

You wouldn't tell them what happened, \_\_\_\_\_

- ☐ isn't it?
- ☐ would you?
- ☐ wouldn't you?
- ☐ won't you?

## Question No.100

4.00

Bookmark ☐

At certain place, the horizontal component of earth's magnetic field is 3.0 G and the angle dip at the place is  $30^\circ$ . The magnetic field of earth at that location

- ☐ 4.5 G
- ☐ 3.5 G
- ☐ 6.0 G
- ☐ 5.1 G

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