Examination: **M.Sc Physics**

SECTION 1 - SECTION 1

Question No.1

An inertial frame of referecnce is defined using

- Newton's first law
- Conservation of energy
- Newton's second law
- Conservation of momentum

Question No.2

Light passes from water to glass.The refractive indices of water and glass are 1.33 and 1.52. If the light is incident at an angle of 60^{O}, what is the angle refraction in glass?

- 24.6^{O}
- 14.6^{O}
- 38.2^{O}
- 49.3^{O}

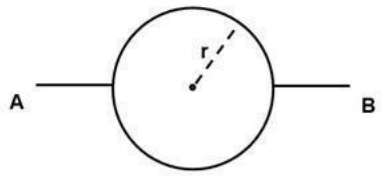
Question No.3

An atom is excited to its excited state which has the energy of 3 eV. When it makes a transition to ground state, the wavelength of the ligth emitted is

- 414 nm
- 210 nm
- 1240 nm
- 620 nm

Question No.4

A conducting wire of resistivity ρ, length L and cross-section area A is used to make the pattern shown in figure. The radius of the circle shown in figure is *r*. The resistance between terminals A and B is



- $3\rho\pi r/2A$
- $\rho L/A$
- Zero
- $\rho(2L-3\pi r)/2A$

Question No.5

When a cylinder rolls down without slipping on a plane, the degrees of freedom of it will be

- 3
- 1
- 4
- 2

Question No.6

The gain of a transistor amplifier was - 150. If negative feedback of -0.1 is introduced, what will be the gain of the feedback amplifier?

- ~ -150
- ~ -10
- ~ -15
- ~ -100

Question No.7

Repeatable entity of a crystal structure is known as

- Lattice
- Crystal
- Miller indices
- Unit cell

Question No.8

In an experiment involving sonometer, a mass of 500 g is hung on the third slot of the tension lever. What is the tension in the string attached to it ?

- 14.7 N
- 0.51N
- 0 N
- 1.63 N

Question No.9

The energy transported per unit time per unit area by a electromagnetic wave is proportional to -

- EB^2
- E.B
- E×B
- E^2

Question No.10

The forced harmonic oscillations have equal displacement amplitudes at frequencies $\omega_1 = 400\ s^{-1}$ and $\omega_2 = 600\ s^{-1}$. Find the resonance frequency at which the displacement amplitude is maximum.

- 2.8 X 102 s^{-1}
- 5.1 X 102 s^{-1}
- 25.1 X 102 s^{-1}
- 12.5 X 102 s^{-1}

Question No.11

The moment inertia of a solid sphere of radius R and mass M is

- $\frac{2}{5}MR^2$
- $\frac{1}{2}MR^2$
- $\frac{2}{3}MR^2$
- MR^2

Question No.12

A mass of 1 kg at rest is subjected to two simultaneous forces , $(3\hat{\imath} + 4\hat{\jmath})N$ and $(-3\hat{\imath} + 4\hat{\jmath})N$.If the initial position of the mass was at (0,0), where will it be located after 1 s ?

- (3m,4m)
- (0,4m)
- (3m,0)
- (0,8m)

Question No.13

The value of the integral $\oint \frac{e^2 \sin z}{z^2} dz$, where the integral is over an unit circle $|z - 2| = 1$ is:

- 2πi
- 0
- πi
- 4πi

Question No.14

All three phase of matter can co-exist at

- Critical point
- Equilibrium point
- Dual point
- Triple point

Question No.15

The real part of the complex function, f (z) = z^2+3z , at z=x+iy=1+3i is

- -5
- -15
- 5
- 15

Question No.16

The nature of bonding for a crystal with alternate and evenly spaced positive and negative ions

- Dipole
- Ionic
- Covalent
- Metallic

Question No.17

A system of N non-interacting classical point particles is constrained to move on the two-dimensional surface of a sphere. The internal energy of the system is

- NkBT
- $\frac{3N}{2}$kBT
- $\frac{5N}{2}$kBT
- $\frac{N}{2}$kT

Question No.18

A person is standing near a swimming pool filled with water. The depth seen by him is

- Same as the actual depth
- Depends on the person who is observing

- More than the actual depth
- Less than the actual depth

Question No.19

The image formed on the human retina

- is real
- Depends on the brightness
- is virtual
- Depends on the object distance

Question No.20

A plane electromagnetic wave $E = E_m \cos(\omega t - kr)$ propagates in vacuum. Assuming the vectors E_m and k to be known, c is velocity of wave in vacuum find the vector H (magnetic field) as a function of time t at the point with radius vector r = 0. ($\varepsilon = \varepsilon_0$ & $\mu = \mu_0$)

- $\frac{1}{k}\sqrt{\varepsilon/\mu}\ [kE_m]\ \sin(ckt)$
- $\frac{1}{k}\sqrt{\varepsilon/\mu}\ [kE_m]\ \cos(ckt)$
- $2k\sqrt{\varepsilon/\mu}\ [kE_m]\ \sin(ckt)$
- $k\sqrt{\varepsilon/\mu}\ [kE_m]\ \cos(ckt)$

Question No.21

Germanium having a forbidden gap of 0.72 eV is irradiated with monochromatic radiation. The wavelength required that would be sufficient to create an electron hole pair will be

- 17,250 A^0
- 17,500 A^0
- 17,100A^0
- 17000 A^0

Question No.22

During free expansion of an ideal gas under adiabatic condition, the internal energy of thegas

- Increases
- Remains constant
- Decreases
- Initially increases and then decreases

Question No.23

A long solenoid is embedded in a conducting medium and is insulated from the medium. If the current through the solenoid is increased at a constant ra the induced current in the medium as a function of radial distance r from the axis of the solenoid is proportional to:

- r^2 inside the solenoid and $\frac{1}{r^2}$ outside
- r inside the solenoid and $\frac{1}{r}$ outside
- r inside the solenoid and $\frac{1}{r^2}$ outside
- r^2 inside the solenoid and $\frac{1}{r}$ outside

Question No.24

Which of the following is a unit vector ?

- $0.6\hat{\imath}+0.8\hat{\jmath}$
- $3\hat{\imath}+4\hat{\jmath}$
- $6\hat{\imath}+8\hat{\jmath}$
- $3\hat{\imath}+5\hat{\jmath}$

Question No.25

In projectile motion,

- Horizontal accelaration is constant and vertical speed is constant
- Both Horizontal and vertical accelartation are constant
- Both Horizontal and vertical speed are constant
- Horizontal speed is constant and vertical accelartation is constant

Question No.26

The quantity *h/mc* has the units of

- Energy
- Momentum
- Length
- Time

Question No.27

The average translational energy of n moles of ideal gas is

- $\frac{3}{2}nRT$
- $\frac{4}{5}nRT$
- $\frac{1}{3}nRT$
- $\frac{1}{2}nRT$

Question No.28

sinh z =

- $(e^z - e^{-z})$
- $\frac{(e^z+e^{-z})}{2}$
- $(e^z + e^{-z})$
- $\frac{(e^z-e^{-z})}{2}$

Question No.29

Buoyancy force acts -

- Left-side
- Upward
- Right-side

- Downward

Question No.30

The capacitance of a parallel plate capacitor of plate area A and distance d will be:

- ϵ_0/2 Ad
- ϵ_0A/d
- ϵ_0A/2d
- ϵ_0A/5d

Question No.31

A planet of mass m moves in a circular orbit of radius r_0 in the gravitational potential V(r) = $-\frac{k}{r}$, where k is a positive constant. The orbital angular momentum of the planet is:

- $\sqrt{r_0 km}$
- $r_0 km$
- $\sqrt{2r_0 km}$
- $2r_0 km$

Question No.32

A string fixed at both ends undergoes normal mode oscillation and has five nodes. It is oscillating in

- Tenth harmonic
- fourth harmonic
- fifth harmonic
- third harmonic

Question No.33

The function of wave vector in case of free particle motion is given by:

- $E=\hbar^2k^2/2m$
- $E=\hbar k/2m$
- $E=\hbar k^2/m$
- $E=\hbar k^2/2m$

Question No.34

The terminal speed of a body mass moving in a fluid is proportional to -

- $\sqrt{1/m^2}$
- $\sqrt{m^3}$
- $\sqrt{m^2}$
- $\sqrt{m}$

Question No.35

Determine the focal length of a concave spherical mirror which is manufactured in the form of a thin symmetric biconvex glass lens one of whose surfac is silvered. The curvature radius of the lens surface is R = 40 cm.

- 5 cm
- 10 cm
- 20 cm
- 40 cm

Question No.36

A spring with k = 200 N/m is attached to a mass of 0.5 kg.It is stretched by 0.02 m and released from rest. What is the maximum speed attained by the osscilating mass ?

- 0.4 m/s
- 2.1 m/s
- 0.04m/s
- 8.2 m/s

Question No.37

Two particles each of rest mass m collide head on and stick together. Before collision, the speed of each mass was 0.6 times the speed of light in free space. The mass of the final entity is:

- $\frac{25m}{4}$
- 2m
- $\frac{5m}{2}$
- $\frac{5m}{4}$

Question No.38

AC current of amplitude 2 mA and frequency 2 KHz is passing through an ideal capacitor of capacitance 0.5 μF. The power dissipated by this capacitor

- $(4/\pi^2)$ mW
- $(\pi/2)$ mW
- Zero
- $(2/\pi)$ mW

Question No.39

In a photoelectric-effect experiment a reverse potiential difference of 1.25 V is required to reduce the current to zero.What is the maximum kinetic energ of the electrons?

- 18.5 eV
- 5.16 eV
- 1.25 eV
- 11.1 eV

Question No.40

The speed of sound in a solid material is

- Almost same as compared to that in air
- same as that in air
- more as compared to that in air
- less as compared to that in air

Question No.41

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

- 0.92 V
- 0.46 V
- 4 V
- 0.8 V

Question No.42

For strongly degenerate fermi gas the specific heat

- is proportional to the square of the absolute temperature
- is proportional to cube of absolute temperature
- is proportional to absolute temperature
- is independent of temperature

Question No.43

In a scattering experiment, involving a stationary and a moving charge, the minimum distance of approach is known as

- Mean free path
- critical distance
- Impact parameter
- critical length

Question No.44

Mass M is fixed to the end of a rod of length L and negligible mass that is pivoted to swing from the end of a hub that rotates at constant angular frequency ω. The mass moves with steady speed in a circular path of constant radius. Then the angle α it makes with the vertical will be:

- $\alpha = Cos^{-1}(g/L\ \omega^2)$
- $\alpha = Cos^{-1}(1/L\ \omega^2)$
- $\alpha = Cos^{-1}(g/L\ \omega)$
- $\alpha = Cos^{-1}(1/L\ \omega)$

Question No.45

An AC voltage source, a resistor and a capacitor are connected in series. An a.c. voltmeter is used to measure the voltage across these elements. It reads a voltage of 3 V across the resistor and 4 V across the capacitor. Then the voltage of the source is

- 5 V
- 10 V
- 7 V
- 1 V

Question No.46

A car is pushed by a person with a force of 210 N. The truck moves in a straight line at an angle of 30^O with respect to the force for 18 m. What is the approximate work done by the person?

- 3760 J
- 180 J
- 90 J
- 3300 J

Question No.47

A solid object has a density ρ, mass M and coefficient of linear expansion α. At pressure p the relation between heat capacities C_p and C_v will be:

- $(C_p - C_v) = 3Mp/\alpha\rho$
- $(C_p - C_v) = 3\ \alpha Mp/\rho$
- $(C_p - C_v) = \alpha Mp/\rho$
- α/ρ

Question No.48

A concave mirror has a radius of curvature of -40 cm. If an object is placed at 20 cm from its vertex , the image will form at -

- 20cm
- 10 cm
- 40 cm
- Infinity

Question No.49

The Bragg's angle for first order reflection from (1 1 1) planes in a crystal is 30^O when x-rays of wavelength 1.75 A^0 are used, the interatomic spacing

- 3.31 A^O

- 3.33 A^O
- 3.03 A^O
- 3.13 A^O

Question No.50

An atom with one outer electron having orbital angular momentum *'l'* is placed in weak magnetic field. The number of energy levels into which the highe total angular momentum splits is:

- 2*l*-1
- 2*l*+1
- 2*l*+2
- 2*l*

Question No.51

For a moving electron the mass is twice its rest mass. Then the velocity of the electron is :

- $\sqrt{3c/2}$
- $\sqrt{3}$ c/2
- c/2
- 2c

Question No.52

A system of N non interacting classical point particles is constrained to move on the two dimensional surface of a sphere. The internal energy of the system is:

- $\frac{1}{2}$NkT
- NkT
- $\frac{5}{2}$NkT
- $\frac{3}{2}$NkT

Question No.53

Entropy provides a quantitative measure of

- Temperature
- Disorder
- Volume
- Pressure

Question No.54

For a mole of gas at t=0^OC, the work done W (in joules) in an isothermal expansion from V_0 to $10V_0$in volume will be:

- 6.2×10^3J
- 5.2×10^3J
- 5×10^3J
- 6×10^3J

Question No.55

The lowest energy possible for a particle in a potential box is 2eV. The next higher energy of the particle can have value:

- 4eV
- 32 eV
- 8eV
- 16 ev

Question No.56

The uncertainty principle applies to

- any pair of dynamical variables
- only to energy and time
- A pair of dynamical variables, the operator corresponding to which commute
- A pair of dynamical variables, the operator corresponding to which does not commute

Question No.57

To detect trace amounts of gaseous species in a mixture of gases, the preferred probing tool is

- NMR spectroscopy
- Laser spectroscopy
- ESR spectroscopy
- Ionization spectroscopy with X-rays

Question No.58

Magnetic vector potential satisfies

- Poission's equation
- Laplace's equation
- it does not satisfies any equation
- both laplace and poission's equation

Question No.59

For a scalar function Φ satisfying the Laplace equation grad(Φ) has

- Non zero curl and non-zero divergence
- zero curl and non-zero divergence
- Zero curl and zero divergence
- Non-zero curl and zero divergence

Question No.60

The splitting of atomic energy levels in the presence of electric field is known as

- Zeeman effect
- Electric effect
- Stark effect
- Kerr effect

Question No.61

For a freely falling object, the displacement in the first one second is

- Can be more or less than subsequent interval of one second depending on mass
- Equal to displacement in any subsequent interval of one second
- Less than displacement in any subsequent interval of one second
- More than displacement in any subsequent interval of one second

Question No.62

The (-1 -1 -1) plane is parallel to

- (-1 1 -1)
- (1 1 -1)
- (-1 -1 1)
- (1 1 1)

Question No.63

If an electron is confined to a region of width 10^{-10} m, what is the minimum uncertainity in the momentum

- 3.8×10^{-24} Kg.m/s
- 2.2×10^{-24} Kg.m/s
- 22×10^{-24} Kg.m/s

- 1.1×10^{-24} Kg.m/s

Question No.64

A spring mass-system is immersed in a liquid and is driven by a external sinusoidal driving force. The electronic analogue of this system is

- LR circuit
- RC circuit
- LC circuit
- LCR circuit

Question No.65

The time vs displacement graph for an object is straight line with positive slope. The object is moving with

- A constant decelartion
- Zero speed
- A constant accelaration
- A constant speed

Question No.66

Laplace transform of f(t)=Cos2t will be

- $\frac{s^2}{s+1}$
- $\frac{s}{s^2+4}$
- $\frac{s}{s+1}$
- $\frac{2s}{s+1}$

Question No.67

The eigen values of the matrix $\begin{pmatrix} 2 & 3 & 0 \\ 3 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

- -5, -1, -1
- 5, 2, -2
- -5, 1, 1
- 5, 1, -1

Question No.68

The volume of one mole of an ideal gas with the adiabatic exponent Υ is varied according to the law $V = a/T$, where a is a constant. Find the amount of heat obtained by the gas in this process if the gas temperature increased by ΔT.

- $R\Delta T(2 - \Upsilon)/(\Upsilon - 1)$
- $(\Upsilon - 1)/ R\Delta T (2 - \Upsilon)$
- $R\Delta T(\Upsilon - 1)/(2 - \Upsilon)$
- $R\Delta T(2 - \Upsilon)$

Question No.69

Which of the following processes is responsible for sun's energy?

- Nuclear fission
- Both fusion and fission

- Nuclear fusion
- Radioactivity

Question No.70

Four moles of radioactive material is decayed into 0.25 moles within 100 days. Determine the half life of this material.

- 50 days
- 37.5 days
- 23.44 days
- 25 days

Question No.71

A circularly polarized monochromatic plane wave is incident on a dielectric interface at Brewster angle. Which one of the following statements is correct

- The reflected light is plane polarized perpendicular to the plane of incidence and the transmitted light is plane polarized in the plane of incidence
- The reflected light is plane polarized perpendicular to the plane of incidence and the transmitted light is elliptically polarized.
- There will be no reflected light and the transmitted light is circularly polarized
- The reflected light is plane polarized in the plane of incidence and the transmitted light is circularly polarized.

Question No.72

The change in the nuclear spin between the parent and daughter nuclei in beta decay

- should necessarily be zero
- can assume any value
- should be a half integer
- should be an integer

Question No.73

The value of electron Bohr Magneton in units of eV/G is

- 1.2×10^{-11}
- 0.9 X 10-9>/SUP>
- 0.6×10^{-8}
- 0.3×10^{-11}

Question No.74

The effective mass of an electron

- depends on its effective charge only
- can never be infinity
- can never be negative
- can be positive, negative as well as infinity

Question No.75

The energy associated with a photon of 1000 nm wavelength in the units of ‘eV’ is

- 2.35
- 1.24
- 3.52
- 4.28

Question No.76

A double star is a system of two stars moving around the Centre of inertia of the system due to gravitation. Find the distance between the components o the double star, if its total mass equals M and the period of revolution T. (γ=universal gravitational constant)

- $\sqrt[3]{\gamma M(\frac{T}{2\pi})}$
- $\sqrt[3]{\gamma M(\frac{2\pi}{T})}$
- $\sqrt[3]{\gamma M(\frac{T}{2\pi})^2}$
- $\sqrt[3]{\gamma M(\frac{2\pi}{T})^2}$

Question No.77

The decimal equivalent of hexadecimal number 2D516 is _____

- 167
- 72510
- 72516
- 7258

Question No.78

For a two-dimensional free electron gas, the electronic density n, and the Fermi energy E, are related by

- $n = \frac{mE}{2\pi\hbar^2}$
- $n = \frac{(2mE)^3}{\pi\hbar}$
- $n = \frac{(2mE)^3}{3\pi^2\hbar^3}$
- $n = \frac{\sqrt{\{mE\}}}{\pi\hbar^2}$

Question No.79

The vector normal to the surface $x^2 + y^2 - z = 1$ at point (1,1,1) is

- $\frac{2\hat{\imath}+\hat{\jmath}-\hat{k}}{\sqrt{6}}$
- $\frac{2\hat{\imath}+2\hat{\jmath}-\hat{k}}{\sqrt{3}}$
- $\frac{\hat{\imath}+\hat{\jmath}-\hat{k}}{\sqrt{3}}$
- $\frac{\hat{\imath}+2\hat{\jmath}-\hat{k}}{\sqrt{6}}$

Question No.80

In a collision, if the initial and final kinetic energies are equal, it is known as

- First order collision
- Inelastic collision
- Elastic collision
- Newtonian collision

Question No.81

A nuetron is travelling with a speed of 1.98×103 m/s. What is its deBroglie wavelength ?

- 0.2 nm
- 0.2 mm
- 0.2 μm
- 0.2 cm

Question No.82

If U is an operator in certain coordinate system and V is the operator in a rotated coordinate system defined by rotation operator R then U and V related by:

- V=UR
- $V=U^2$
- $V = R^{-1}UR$
- $V = R^2U$

Question No.83

Consider a bridge full-wave rectifier circuit with one non-working diode. Predict the output voltage of the same circuit.

- One-fourth the amplitude of the input voltage
- A half-wave rectified voltage
- Twice the amplitude of the input voltage
- Zero volts

Question No.84

A steel measuring tape is exactly 50.000m at 20^{O} C and 50.009 m at 35^{O}C. What is the linear expansion co-efficient of the measuring tape ?

- $6.7\times10^{-5}\ K^{-1}$
- $1.2\times10^{-5}\ K^{-1}$
- $2.3\times10^{-5}\ K^{-1}$
- $9.4\times10^{-5}\ K^{-1}$

Question No.85

The tempertaure in celsius where the Farenheit scale also show same reading is

- -40^{O} C
- -180^{O} C
- 100^{O} C
- 0^{O} C

Question No.86

Which one of the Maxwell's equation is NOT correct?

- Curl of electric field is not zero.
- Curl of magnetic field not zero.
- Divergence of magnetic field is not zero.
- Divergence of electric field is not zero

Question No.87

A phonon is the quantum of

- Magnetization wave
- Polarization wave
- Electromagnetic wave
- Elastic wave

Question No.88

Colours observed from the surface of a CD, are due to

- Diffraction
- Interference
- Polarization
- Double refraction

Question No.89

The non-existence of magnetic monopoles can be understood by

- Gauss's law for magnetism
- Ampere's law
- Faraday's law
- Gauss's law

Question No.90

A system consists of two springs connected in series and having the stiffness coefficients k1 and k2. Find the minimum work to be performed in order to stretch this system by Δl.

- $0.5\,\frac{k1k2}{k1+k2}\,(\Delta l)2$
-

- $\frac{k1k2}{k1+k2}$
- $\frac{k1k2}{(k1+k2)(\Delta l)}$
- $\frac{k1k2}{k1+k2}(\Delta l)2$

Question No.91

For two vectos A and B, A×B

- will be parallel to the plane of A and B
- will be parallel to B
- will be perpendicular to the plane of A and B
- will be parallel to A

Question No.92

Which of the following statements is correct?

- Voltage across an Inductor leads the current flowing through it by 90^O
- Voltage across a capacitor leads the current flowing through it by 90^O.
- Voltage across a Resistor leads the current flowing through it by 90^O
- Voltage across a capacitor and current flowing through it are always in phase.

Question No.93

A ship moves along the equator to the east with velocity V = 30 km/hour. The southeastern wind blows at an angle ϕ = 60° to the equator with velocity V = 15 km/hour. Find the wind velocity V' relative to the ship.

- 4 kmph
- 40 kmph
- 16 kmph
- 20 kmph

Question No.94

An electric field of strength E = 1.0 kV/cm produces polarization in water equivalent to the correct orientation of only one out of N molecules. Find N. Th electric moment of a water molecule equals p = 0.62×10^{-29} C-m.

- 3×10^3
- 3×10^5
- 2×10^3
- 2×10^5

Question No.95

A plane electromagnetic wave traveling in free space is incident normally on a glass plate of refractive index 3/2. If there is no absorption by the glass, it reflectivity is

- 4%
- 20%
- 16%
- 50%

Question No.96

In the ground state of the hydrogen atom most probable distance of the electron from the nucleus in the units of Bohr radius a_0 is:

- 1
- $\frac{3}{2}$
- $\frac{1}{2}$
- 2

Question No.97

Which among the following sets of Maxwell relations is correct? (U-internal energy, H-enthalpy, A-Helmholtz free energy and G-Gibbs free energy)

- $T = (\frac{\partial U}{\partial V})_s$ and $P = (\frac{\partial U}{\partial S})_v$
- $V = (\frac{\partial H}{\partial P})_s$ and $T = (\frac{\partial H}{\partial S})_p$
- $P = (-\frac{\partial A}{\partial S})_t$ and $S = (\frac{\partial A}{\partial P})_v$
- $P = (-\frac{\partial G}{\partial V})_t$ and $V = (\frac{\partial G}{\partial P})_s$

Question No.98

A car travels at a constant speed on a circle of radius 5m. It takes 4s to complete one full round. What is the accelaration ?

- $7.85 ms^{-2}$
- $12.30 ms^{-2}$
- $15.70 ms^{-2}$
- $6.15\ ms^{-2}$

Question No.99

A system that accepts instructions and data and perform operations to produce desired output information is known as

- Processor
- Accumulator
- Controller
- Program

Question No.100

The most probable speed of gas molecules according to the Maxwell-Boltzmann statistics is:

- $\sqrt{2KT/m}$
- $\sqrt{2KT/\pi m}$
- $\sqrt{8KT/\pi m}$
- $\sqrt{3KT/m}$