Question Booklet Series

A

PHYSICS CODE :- 14

Time Allowed: Two Hours Marks: 100

Name: _____ Roll No. _____

Read instructions given below before opening this booklet:

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

1. Use only **BLUE Ball Point** Pen.

2. In case of any defect - Misprint, Missing Question/s Get the booklet changed. No complaint shall be entertained after the examination.

3. Before you mark the answer, read the instruction on the OMR Sheet (Answer Sheet) also before attempting the questions and fill the particulars in the ANSWER SHEET carefully and correctly.

4. There are FOUR options to each question. Darken only one to which you think is the right answer. There will be no Negative Marking.

5. Answer Sheets will be collected after the completion of examination and no candidate shall be allowed to leave the examination hall earlier.

6. The candidates are to ensure that the Answer Sheet is handed over to the room invigilator only.

7. Rough work, if any, can be done on space provided at the end of the Question Booklet itself. No extra sheet will be provided in any circumstances.

8. Write the BOOKLET SERIES in the space provided in the answer sheet, by darkening the corresponding circles.

9. Regarding incorrect questions or answers etc. Candidates kindly see NOTE at the last page of the Booklet.

SEAL

Q.1. The dimensional formula for Planck's constant and angular momentum are respectively
(A) $[ML^2T^{-2}]$ and $[MLT^{-1}]$ (B) $[ML^2T^{-1}]$ and $[ML^2T^{-1}]$
(C) $[ML^3T^{-1}]$ and $[ML^2T^{-2}]$ (D) $[MLT^{-1}]$ and $[MLT^{-2}]$

Q.2. Which of the following implies the greatest precision?
(A) 10.1 (B) 10.10
(C) 10.100 (D) 10.1000

Q.3. Which of the following is NOT one of the fundamental quantities in physics?
(A) time (B) length
(C) weight (D) mass

Q.4. SI unit of the power of a lens is
(A) diopter (B) horse power
(C) metre (D) watt

Q.5. In physics, a radian per second is a unit of
(A) angular displacement (B) angular velocity
(C) angular acceleration (D) angular momentum.

Q.6. Dimensions of coefficient of viscosity is:
(A) $[M^2L^2T^2]$ (B) $[M^2LT^2]$
(C) $[ML^{-1}T^{-1}]$ (D) $[MLT^2]$

Q.7. A body of mass m moving with velocity u collides with a stationary body of mass 2 m and coalesce to form one body. The speed of the system after collision, is
(A) 3u (B) u/3 (C) 2u (D) u/4

Q.8. For an object moving in uniform circular motion with constant speed, the direction of The instantaneous acceleration vector is
(A) tangent to the path of motion (B) equal to zero
(C) directed radially outward (D) directed radially inward

Q.9. The acceleration due to gravity on the moon is 1.6 meters per second square. On the moon, the time period of a pendulum whose length is 6.4 meters will be
(A) π seconds (B) 2π seconds
(C) 4π seconds (D) 8π seconds

Q.10. Bernoulli's Principle is a statement of
(A) energy conservation in dynamic fluids.
(B) momentum conservation in dynamic fluids.
(C) hydrostatic equilibrium.
(D) thermal equilibrium in fluids.

Q.11. The velocity of a body depends on time as $v = 20 + 0.1t^2$. The body is undergoing
(A) uniform acceleration (B) uniform retardation.
(C) non-uniform acceleration (D) non-uniform retardation

Q.12.In any collision, the parameter which is conserved is

(A) kinetic energy
(B) angular momentum
(C) linear momentum
(D) potential energy

Q.13. The work done by any friction force is:

(A) always positive
(B) always negative
(C) always zero
(D) either positive or negative depending upon the situation.

Q.14. A person moves 3m towards East and then 4m towards North. The resultant displacement from the initial position to final position is

(A) 7m
(B) 5m
(C) 4m
(D) 1m

Q.15. A student goes from his house to school on his bicycle .The distance traveled by him is given by the relation $x= (4t+6t^2+3)$, where distance x is in metres and time t is in seconds. The acceleration of his bicycle after 30 seconds is

(A) $360 m/s^2$
(B) $120 m/s^2$
(C) $36 m/s^2$
(D) $12 m/s^2$

Q.16. Two physical quantities having the same dimensions are

(A) force and energy
(B) work and torque
(C) pressure and power
(D) impulse and momentum

Q.17. The viscous force acting on on a solid ball moving in air with terminal velocity v is directly proportional to

(A) $\sqrt{v}$ (B) v (C) $1/\sqrt{v}$ (D) v^2

Q.18.A particle of mass m_o moves with speed 0.8c, where c is the speed of light in vacuum. The relativistic kinetic energy of the particle is nearly

(A) $1.66m_oc^2$
(B) m_oc^2
(C) $0.32 m_oc^2$
(D) $0.66 m_oc^2$

Q.19.In a uniform circular motion

(A) velocity and acceleration both are constant
(B) acceleration and speed are constant but velocity changes
(C) acceleration and velocity both change
(D) acceleration and speed both are constant

Q.20.A motor cyclist moving with a velocity of 72km/hr on a flat road takes a turn at a point where the radius of curvature of the rod is $20m(g=10m/s^2)$.In order to avoid sliding, he must not bend with respect to the vertical by an angle θ greater than

(A) $\tan^{-1} 2$
(B) $\tan^{-1} 4$
(C) $\tan^{-1} 6$
(D) $\tan^{-1} 25.92$

Q.21. A particle of mass 0.5 kg is moving in a circle of radius 0.1m with a constant speed of 2.0m/s. Its acceleration at any moment is

(A) zero
(B) $10m/s^2$
(C) $25\ m/s^2$
(D) $40m/s^2$

Q.22. If the kinetic energy of a body becomes four times its initial value, the new momentum will be

(A) three times the initial value
(B) four times the initial value
(C) two times the initial value
(D) unchanged

Q.23. A ship of mass $3x10^7$ kg initially at rest, can be pulled through a distance of 3m by means of force $5x\ 10^4$ N. The water resistance is negligible. The speed attained by the ship is

(A) 0.1m/s (B) 0.5m/s (C) 1.0m/s (D)5.0m/s

Q.24.If the radius of the earth were to shrink, its mass remaining the same, the value of acceleration due to gravity at the pole and at the equator will

(A) increase and decrease respectively
(B) decrease and increase respectively
(C) increase at both places
(D)decrease at both places

Q.25.Lorentz transformation equations hold for

(A) non-relativistic velocities only
(B) relativistic velocities only
(C) all velocities: relativistic & non-relativistic
(D) photons only

Q.26. A particle is dropped from a point above the earth. The ratio of the distance travelled in the first two seconds and in the next two seconds is

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

Q.27. A mass M when attached to the lower end of a mass less spring, whose upper end is fixed, extends it by L. In the extended equilibrium state of the spring, the restoring force exerted by the spring on the mass is

(A) Mg (B) Mg/2 (C) 2/Mg (D) Zero

Q.28. Under the influence of a transverse magnetic field, an electron moves in a circle with constant speed v. The time period of revolution is

(A) proportional to v
(B) proportional to v^2
(C) proportional to $\sqrt{v}$
(D) independent of v

Q.29. The maximum velocity of a particle, executing simple harmonic motion with an amplitude 7 mm, is 4.4 m/s. The period of oscillation is

(A) 100.00 s
(B) 10.00 s
(C) 0.10 s
(D) 0.01 s

Q.30. The equation, x = a cos (wt + f) represents

(A) accelerator due to gravity
(B) uniform straight line motion
(C) dc current
(D)simple harmonic motion

Q.31. Relative to its period on the earth, the period of a pendulum on the moon is

(A) shorter
(B) longer
(C) the same as on the earth
(D) varies with time

Q.32. The phenomenon that cannot take place in sound waves is

(A) reflection
(B) interference
(C) diffraction
(D) polarization

Q.33.A semiconductor is cooled from 339K to 302K. Its resistance will

(A) decrease
(B) increase
(C) remain unchanged
(D) first increase then decreases

Q.34.The speed of sound in air is v, the fundamental frequency of the air column in a pipe of length L closed at one end is

(A) v/4L (B) v/2L (C) 3v/4L (D) v/L

Q.35.A particle executes S.H.M of amplitude a. Its kinetic energy is equal to potential energy when the displacement of the particle from the mean position is

(A) 0.512a
(B) 0.709a
(C) 0.827a
(D) 0.983a

Q.36.Ultrasonic waves are used in SONAR with greater advantage because ultrasonics

(A) have low frequency
(B) have short wavelength
(C) are electromagnetic waves
(D) can be easily produced

Q.37. The equation of a S.H.M is y=8 sin (2x-40t),where the distances and time are in centimeter and second respectively. The speed of the wave is

(A) 2.0cm/sec
(B) 20cm/sec
(C) 30cm/sec
(D) 40cm/sec

Q.38. The velocity of sound in air is 330m/s. The velocity of an observer who observes drop of 10% in the sound from a stationary source is

(A) 30 m/s
(B) 33m/s
(C) 297m/s
(D) 330m/sec

Q.39. The displacement y of a particle as a function of time t is given by $y = e^{i\alpha t}$, where α is a constant and $i = \sqrt{-1}$. From amongst the following, the correct statement is

(A) the motion is not simple harmonic motion

(B) the motion is simple harmonic motion only if α is positive

(C) the motion is simple harmonic motion only if α is negative

(D) the motion is simple harmonic motion for all values of α

Q.40. Spherical aberration in a thin lens can be reduced by

(A) using monochromatic light

(B) using a doublet combination

(C) using a circular annular mask over the lens

(D) increasing the size of the lens

Q.41. The equation of a wave propagating in a medium is $y = a \sin k(x-\alpha t)$, where y is the displacement of the particle in the medium at a distance x at any instant t. The correct statement is

(A) The velocity of the wave is α.

(B) The wave is advancing in the negative direction of the x-axis.

(C) The wavelength is $k/2\pi$.

(D) The frequency of the wave is α.

Q.42. The speed of a wave is 360 m/s and the frequency is 5 hertz. The phase difference between two points is 60^0. The path difference between them will be

(A) 0.72 m (B) 1.20m (C) 12.00 m (D) 120.00 m

Q.43. The ratio of intensities of two waves is 1.: 9. If these waves produce interference, the ratio of maximum to minimum intensities will be

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

Q.44. A thin transparent plate of polaroid is placed on another similar plate such that the angle between their pass axes is 30^0. The ratio of intensities of emergent and unpolarised incident light will be

(A) 1 : 4 (B) 1 : 3 (C) 3 : 4 (D) 3 : 8

Q.45. The velocity of light emitted from a source S as measured by a stationary observer O is c. If the observer moves with a velocity v towards S, then velocity of light as seen by him will be

(A) c+v (B) c-v (C) c (D) $\sqrt{1 - v^2/c^2}$

Q.46. The concept that each point on a wave front may be considered as a new wave source is given by

(A) Snell's Law

(B) Huygen's Principle

(C) Young's Law

(D) Hertz's Law

Q.47. A light ray of wavelength $5895A^0$ travelling in vacuum enters a medium of refractive index 1.5. The wavelength of the ray in the medium is

(A) $3930\ A^0$ (B) $4200\ A^0$

(C) $5495\ A^0$ (D) $7893\ A^0$

Q.48. A point object is placed at the focus A of a double concave lens of focal length f. Its image will be formed at a point

(A) between the point A and the lens

(B) at a distance between f and 2f from the lens

(C) at a distance more than 2f from the lens

(D) infinity

Q.49. The resolving power of a plane transmission grating (having 15000 rulings on the grating surface) in the second order is

(A) 15,000 (B) 30,000

(C) 45.000 (D) 60,000

Q.50. The speed of light in a medium of refractive index 1.5 is nearly

(A) $4.5x10^8$m/s (B) $3.0\ x10^8$m/s

(C) $2.0\ x10^8$m/s (D) $1.0\ x10^8$m/s

Q.51. In Young's double slit experiment, the separation between the slit is halved and the distance between the slit and the screen is doubled. The fringe width will

(A) remain unchanged (B) be halved

(C) be doubled (D) increase four times

Q.52. Carnot engine works between temperatures 727°C and 27° C. The efficiency of the engine is

(A) 70% (B) 30% (C) 10% (D) 01%

Q.53. Which of the following terms refer to the amount of heat needed to raise the temperature of a unit mass of a substance through one degree?

(A) Heat of fusion (B) Liquification heat

(C) Internal heat (D) Specific heat

Q.54. At what point is the temperature the same on the Celsius and Fahrenheit scales?

(A) absolute zero (B) zero

(C) negative 40 degrees (D) never

Q.55. Heat from the sun reaches the earth by

(A) conduction (B) convection

(C) radiation (D) All of the above

Q.56. The principle that energy may be converted from one form to another but it cannot be either created or destroyed is

(A) first law of thermodynamics. (B) second law of thermodynamics.

(C) third law of thermodynamics. (D) principle of photo electricity.

Q.57. The spectral energy distribution of a star at temperature 6050 K has a maximum at $4753A^0$. The temperature of the star for which this maximum is at $9506\ A^0$ is

(A) 6050K
(B) 3025K
(C) 12100K
(D) 24200K

Q.58. The rms speed of oxygen molecules at room temperature is 500m/s. The rms speed of hydrogen at the same temperature is nearly

(A) 31m/sec
(B) 125 m/sec
(C) 2000m/sec
(D) 8000m/sec

Q.59. The temperature of a body is increased from 27^0C to 127^0 C. The radiation emitted by the body increases by a factor

(A) 81/256
(B) 27/127
(C) 27/64
(D) 256/81

Q.60. Copper of mass 200gm is heated from 25^0 C to 75^0 C . The specific heat of the copper is 0.1cal/gm/^{0}C . Assuming the change in volume to be negligible, the change in internal energy of the copper block is

(A) 100 joule
(B) 420 joule
(C) 1000 joule
(D) 4200 joule

Q.61. Two electric bulbs have resistances in the ratio 1:2. If they are joined in parallel to a d.c. source, the energy consumed in them is in the ratio

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

Q.62. The path of a free electron in a metal is

(A) parabolic
(B) circular
(C) a straight line
(D) zig-zag

Q.63. When an electric fuse is rated 8 A, it means

(A) it will not work if current is less than 8 A
(B) it has a resistance of 8 Ω
(C) it will work only if current is 8 A
(D) it will melt if current exceeds 8 A

Q.64. Energy consumed, in joules, by a 100-watt light bulb operated for 10 minutes is

(A) 10
(B) 1000
(C) 36,000
(D) 60,000

Q.65. The relative orientation of the magnetic and electric fields associated with an electromagnetic wave is

(A) 180 degree
(B) 90 degree
(C) 45 degree
(D) 22.5 degree

Q.66. The magnetic lines of force produced by a linear current carrying conductor are

(A) in the direction of the current
(B) in a direction opposite to that of current
(C) perpendicular to the current
(D) concentric circles around the wire

Q.67. 30 coulomb of charge flowing through a wire per minute is

(A) 0.8×10^{-19} A
(B) 0.5A
(C) 1.0 A
(D) 30 A

Q.68. An electron is brought towards another electron. The electric potential energy of the system

(A) decreases
(B) increases
(C) does not change
(D) becomes zero

Q.69. The separation between the plates of a parallel plate capacitor is d. A metal sheet of thickness d/2 is inserted between the plates. The ratio of the capacitance after the insertion of the sheet to that before insertion is

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

Q.70. The resistivity of a wire varies with its

(A) length
(B) cross-section
(C) mass
(D) material

Q.71. A wire has a resistance 4 Ω. The resistance of another wire of the same length and material, but having double diameter will be

(A) 1 Ω (B) 4 Ω (C) 8 Ω (D) 16 Ω

Q.72. Kirchhoff's first law for analyzing electrical circuits is based on the conservation of

(A) energy
(B) mass
(C) momentum
(D) charge

Q.73. The number of turns in a coil is doubled. Its self-inductance becomes

(A) four times
(B) doubled
(C) halved
(D) squared

Q.74. In an a.c. circuit, power is consumed in

(A) inductance only
(B) capacitance only
(C) resistance only
(D) all the three

Q.75.A charge Q is placed at the centre of a cube. The flux of the electric field through the six surfaces of the cube is

(A) Q/ε_0 (B) $Q/2\varepsilon_0$ (C) $Q/6\varepsilon_0$ (D) $Q/24\varepsilon_0$

Q.76. The permanent magnetic moment of the atoms of a material is zero. The material is

(A) paramagnetic (B) diamagnetic
(C) ferromagnetic (D) ferrimagnetic

Q.77. An a.c. source supplies an emf given by $\xi = (30V) \sin (100s^{-1})t$. The average value over one cycle and rms value of the voltage are respectively

(A) 0 and $30/\sqrt{2}$ volt (B) 15 volt and $30/\sqrt{2}$ volt
(C) 0 and $30\sqrt{2}$ volt (D) 15 volt and $30\sqrt{2}$ volt

Q.78. In a series L-C-R circuit connected to an a.c supply, the power factor at resonance is

(A) 1.0 (B) 0.5 (C) 0.1 (D) zero

Q.79. The energy required to set up a dc current of 0.4 ampere in a coil of self-inductance 0.2 Henry is

(A) 16×10^{-3} joules (B) 8×10^{-3} joules
(C) 4×10^{-3} joules (D) 1×10^{-3} joules

Q.80. A conducting hollow sphere of radius R meters is given a charge of Q coulomb. The electric potential at a point a distance R/2 from the centre of the sphere is

(A) $(Q/4\pi\varepsilon_0)(2/R)$ volt (B) $(Q/4\pi\varepsilon_0)(1/R)$ volt
(C) infinity (D) zero

Q.81. The plates of a parallel plate condenser C_1, each of area A, are a distance d apart. The medium between the plates is air. Another parallel plate condenser C_2 with area of plate 2A and plate separation d/2 has a medium of dielectric constant 2 between the plates. The ratio of the capacitance of C_1 and C_2 is

(A) 1:4 (B) 1:8 (C) 8:1 (D) 4:1

Q.82. If the dielectric constant of a material is 3, its permittivity is nearly

(A) 40.5×10^{-12} mks (B) 26.5×10^{-12} mks
(C) 10.5×10^{-12} mks (D) 1.5×10^{-12} mks

Q.83. The S.I unit of electric flux is

(A) volt/meter (B) meter/volt
(C) volt. meter (D) volt.m^2

Q.84. The energy of an X-ray photon is 2 keV. Its frequency, in units of hertz, is nearly:

(A) 3.2×10^{-17} (B) 2×10^{17}
(C) 5×10^{17} (D) 2×10^{18}

Q.85. The ratio of mass of a proton and that of an electron is approximately
(A) 200 (B) 2000
(C) 20,000 (D) 2,00,000

Q.86. Interference phenomenon of light demonstrates
(A) particle nature of light (B) wave nature of light
(C) transverse nature of light (D) dual nature of light

Q.87.How many quarks make up a neutron?
(A) 1 (B) 2 (C) 3 (D) 4

Q.88. For the hydrogen atom, the series which describes electron transitions to the N = 2 state is
(A) Lyman series (B) Paschen series
(C) Balmer series (D) Pfund series

Q.89. The photoelectric effect is a demonstration of:
(A) the wave nature of light (B) the particle nature of light
(C) inelastic collision of electrons (D) the continuous spectrum of radiation

Q.90. Two charges Q and 9Q are placed at a distance of 40cm from each other. From charge Q, the distance of the point on the line joining the two charges at which the value of electric field is zero is
(A) 5cm (B) 10cm (C) 20 cm (D) 30cm

Q.91. Among the below given wavelengths in A^0, the hardest x-rays correspond to
(A) $1x10^{2}$ (B) $1x10^{1}$ (C) 1 (D) $1x10^{-1}$

Q.92. What does the letter "s" stand for in the acronym laser?
(A) scientific (B) sinusoidal
(C) stimulated (D) solar

Q.93. The radioactivity of a material drops to $1/16^{th}$ of its initial value in a period of 16 years. The half-life period of the material is
(A) 2 years (B) 4 years
(C) 8 years d) 16 years

Q.94. The energy of hydrogen atom in the ground state is -13.6eV. In the energy level n = 5, its energy will be
(A) -0.54 Ev (B) -0.85Ev
(C) -2.72Ev (D) -5.4eV

Q.95. An α- particle is emitted by a nucleus of radium $_{88}Ra^{226}$.The atomic number and the mass number of the residual atom are respectively
(A) 84 and 224 (B) 86 and 224
(C) 84 and 226 (D) 86 and 222

Q.96. During a negative beta decay

(A) an atomic electron is ejected

(B) an electron which was already present within the nucleus is ejected

(C) a neutron in the nucleus decays emitting an electron

(D) a part of binding energy of the nucleus is converted into an electron

Q.97. The minimum wavelength of X-rays produced by electrons accelerated by a potential difference of V volt is

(A) eV/hc

(B) eh/cV

(C) hc/Ev

(D) h/V

Q.98. In a p-n-p transistor, the relation between emitter-current i_e, base-current i_b and collector-current i_c is

(A) $i_c = i_E - i_b$

(B) $i_b = i_E - i_c$

(C) $i_E = i_c - i_b$

(D) None of these

Q.99. A p-n junction diode can be used as

(A) modulator

(B) amplifier

(C) oscillator

(D) rectifier

Q.100. The NAND gate is an AND gate followed by

(A) NOT gate

(B) OR gate

(C) AND gate

(D) NAND gate