61313

ROLL No. | | | | | |

TEST BOOKLET No. 1396

TEST FOR POST GRADUATE PROGRAMMES

PHYSICS

Time: 2 Hours | Maximum Marks: 450

INSTRUCTIONS TO CANDIDATES

1. You are provided with a Test Booklet and an Optical Mark Reader (OMR) Answer Sheet to mark your responses. Do not soil the Answer Sheet. Read carefully all the instructions given on the Answer Sheet.

2. Write your Roll Number in the space provided on the top of **this page.**

3. Also write your Roll Number, Test Code, and Test Subject in the columns provided for the same on the **Answer Sheet.** Darken the appropriate bubbles with a **Ball Point Pen.**

4. The paper consists of 150 objective type questions. All questions carry equal marks.

5. Each question has four alternative responses marked **A, B, C** and **D** and you have to **darken** the bubble fully by a **Ball Point Pen** corresponding to the correct response as indicated in the example shown on the Answer Sheet.

6. Each correct answer carries **3** marks and each wrong answer carries **1** minus mark.

7 Space for rough work is provided at the end of this Test Booklet.

8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However, you can retain the Test Booklet.

9. Every precaution has been taken to avoid errors in the Test Booklet. In the event of any such unforeseen happenings, the same may be brought to the notice of the Observer/Chief Superintendent in writing. Suitable remedial measures will be taken at the time of evaluation, if necessary.

61313

PHYSICS

1. The corpuscular nature of light can be illustrated through

   (A) polarisation of light
   (B) diffraction of light
   (C) compton scattering
   (D) wave front of light

2. Nuclei having same number of neutrons but different number of protons are called

   (A) isotopes
   (B) isotones
   (C) isomers
   (D) mirror nuclei

3. The elementary particle muon belongs to the family of

   (A) mesons
   (B) baryons
   (C) leptons
   (D) hyperons

4. Two thin parallel wires carry currents along the same direction. The force experienced by the two wires each other becomes

   (A) zero
   (B) perpendicular to the lines and repulsive
   (C) parallel to the lines
   (D) perpendicular to the lines and attractive

5. A charged particle moving in a magnetostatic field

   (A) can gain energy
   (B) can gain energy but not momentum
   (C) cannot gain energy
   (D) can gain momentum only

6. The penetrating power of β particles with respect to the α - particles is about

   (A) 1/100
   (B) 1000
   (C) 100
   (D) 1

7 The law that relates to the half life time and range of α – particles for large number of α – emitters is the

(A) Mosley's law
(B) Fermi-Golden Law
(C) Curie-Weiss law
(D) Geiger-Nuttal law

8. The nuclear reaction ${}^{9}_{4}Be + {}^{4}_{2}He \rightarrow {}^{13}_{6}C$ is possible through the emission of

(A) alpha rays
(B) gamma rays
(C) beta rays
(D) double β rays

9. The complex conjugate of the spherical harmonics, $Y_{lm}(\theta,\varphi)$ is given by

(A) $(-)^{m} Y_{l\,m}(\theta,\varphi)$
(B) $Y_{l-m}(\theta,\varphi)$
(C) $(-)^{m} Y_{l-m}(\theta,\varphi)$
(D) $(-)^{m+1} Y_{l-m}(\theta,\varphi)$

10. The total energy of N number of an ideal diatomic gas at temperature T is equal to

(A) $\frac{3}{2}NkT$
(B) $\frac{5}{2}NkT$
(C) NkT
(D) $\frac{7}{2}NkT$

11. When you stand on a railway platform a suction effect will be experienced at the time when a fast moving train is nearer to your platform. It is a direct experience of

(A) Bernoulli's principle
(B) Newton's third law
(C) Lorentz contraction
(D) Einstein's principle of relativity

12. The phase space trajectory of a simple pendulum looks like

(A) a semicircle (B) an ellipse
(C) parabola (D) hyperbola

13. The hydro-magnetic ion waves propagating along the direction of the external magnetic field is the

(A) magnetosonic wave (B) Alfe`n wave
(C) lower hybrid wave (D) ordinary plasma wave

14. The quantity $\frac{e^2}{4\pi\varepsilon_0}$ is equal to

(A) 1.44×10^{-9} (B) 1.69×10^{-9}
(C) 1.35×10^{-9} (D) 1.48×10^{-9}

15. The energy flux transported by an electromagnetic wave is specified by the

(A) electric field (B) magnetic field
(C) Poynting vector (D) power

16. A single crystal of KCl is irradiated with a beam of X-rays of wavelength 0.250nm and the first Bragg reflection is observed at an angle 30^0 Find the atomic spacing in the crystal.

(A) 0.125 nm (B) 0.250 nm
(C) 0.50 nm (D) 0.725 nm

17. Continuous X-rays are produced in

(A) atomic transition
(B) Bremstrahlung processes
(C) molecular transitions
(D) cyclotron motion of electrons

18. Certain ocean waves travel with a phase velocity $v_p = \sqrt{\frac{g}{k}}$, where g is the acceleration due to gravity. The group velocity of the wave is equal to

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

(C) $2\sqrt{\frac{g}{k}}$ (D) $\frac{1}{2}\sqrt{gk}$

19. A sample of a material of molecular weight 197g/mole has the density of 19.3 g/cm^3 How many atoms per m^3 are there in the sample?

(A) 6×10^{28} (B) 19×10^{24}
(C) 8×10^{16} (D) 6×10^{22}

20. Cobalt crystal has its structure

(A) bcc (B) hcp
(C) fcc (D) fc

21. The element whose isotope has mass number 116 and contains 66 neutrons is

(A) Zn (B) Sn
(C) Mn (D) Sb

22. PT 100 is a device used to measure

(A) heart beats of a critically ill patient
(B) temperature in terms of the resistance
(C) the solar flux on Earth
(D) flow rate of crude oil through underground pipe

23. The wave nature of electron is demonstrated through the phenomenon of

(A) electron diffraction (B) pair production
(C) Zeeman effect (D) photo electric effect

24. The inventor of lightning rod is

(A) Benjamin Franklin (B) Stephen Gray
(C) Thomas Alva Edison (D) Henry Cavendish

25. Holography is invented by

(A) Dennis Gabor (B) T. Young
(C) W L Bragg (D) J Strutt

26. The class of particles respond to all the four known forces of nature are called

(A) Leptons (B) Hadrons
(C) Excitons (D) Mesons

27 The intermediate gauge particle responsible for the beta decay is

(A) Neutrino (B) Photon
(C) Gluons (D) W- mesons

28. Maxwell's displacement current density is given by

(A) $\vec{D}$ (B) $\frac{1}{\varepsilon_0}\vec{E}$

(C) $\frac{\partial \vec{D}}{\partial t}$ (D) $\sigma \vec{E}$

29. A fully charged capacitor of capacitance C is discharging through a resistor of resistance R. The time it takes to discharge half of its initial charge is equal to

(A) $0.5RC$ (B) $0.69RC$
(C) $0.5\frac{R}{C}$ (D) $0.69\frac{R}{C}$

30. The counting distribution of beta particles using the GM tube follows

(A) Normal distribution (B) Binomial distribution
(C) Poisson distribution (D) Rayleigh's distribution

31. As per the standard model, the matter domination over the antimatter in our Universe may be attributed to

(A) charge nonconservation (B) CP violation
(C) parity violation (D) CPT conservation

32. The antineutrino is emitted along with the electrons in a beta decay is the illustration of

(A) Strangeness conservation
(B) Baryon number conservation
(C) Lepton number conservation
(D) Isospin conservation

33. The activity of a sample decreases 17.3% in 30 minutes. What is the half life of the sample?

(A) 100 min (B) 109 min
(C) 175 min (D) 125 min

34. While at rest, an electron has a mass of 9.11×10^{-28}gms. What will be its mass when it is moving at a speed of 0.950c?

(A) 2.9×10^{-27} gms (B) 2.9×10^{-29} gms
(C) 2.9×10^{-26} gms (D) 3.9×10^{-27} gms

35. If the tuning circuit of a radio receiver contains a 20 mH coil in series with a variable capacitor, what value of the capacity is required to tune the set to a broadcast station with a frequency of 800 kHz?

(A) 1.98×10^{-12}F (B) 1.98×10^{-9}F
(C) 1.98×10^{-15}F (D) 1.98×10^{-11}F

36. At a distance of 4.50 cm from a long straight wire the magnetic field due to the current is 0.3gauss. What is the current flowing in the wire?

(A) 6.50 A (B) 6.75 mA
(C) 6.75 A (D) 6.50 mA

37 The spraying device like perfume spray, insecticide spray etc. is an example for

(A) Bernouolli's principle (B) surface tension
(C) Archimedes principle (D) Pascal's law

38. Mass of the Earth is 5.98×10^{24} kg and that of Moon is 0.0123 times the Earth's mass. The distance between the two is 3.84×10^{5} km. The force of attraction between them is

(A) 1.97×10^{20} Newtons (B) 1.97×10^{20} kg
(C) 1.97×10^{20} Tons (D) 1.97×10^{20} gms

39. If an electron has an initial velocity in the direction different from that of an electric field, the path of the electron is

(A) straight line (B) parabola
(C) circle (D) ellipse

40. A magnetic needle is kept in a non uniform magnetic field. It experiences

(A) a force and a torque (B) a torque but not a force
(C) a force but not a torque (D) neither force nor torque

41. In an N type semiconductor, the Fermi level

(A) is lower than the centre of the energy gap
(B) is at the centre of the energy gap
(C) is higher than the centre of the energy gap
(D) can be anywhere depending on the doping concentration

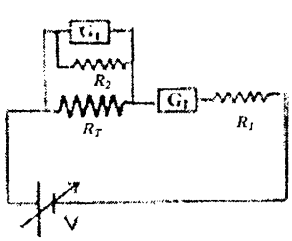
42. The cloud formation in dust free ionised gas in Wilson's technique is due to

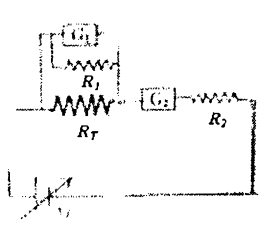
(A) adiabatic expansion (B) isothermal expansion
(C) adiabatic compression (D) isothermal compression

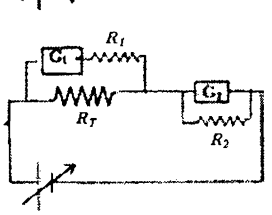
43. An a.c. voltage source of variable angular frequency ω and fixed amplitude V_0 is connected in series with a capacitor C and electric bulb of resistance R (inductance is zero). When ω increases

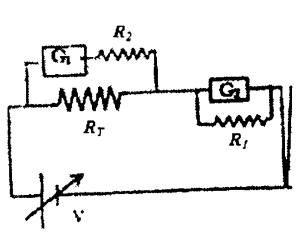
(A) the bulb glows dimmer
(B) impedence of the circuit increases
(C) the bulb glows brighter
(D) it does not affect the brightness of the glow

44. To verify Ohm's law, a student is given a test resistance R_T, high resistance R_1, low resistance R_2, two identical galvanometers G_1 and G_2, and a variable voltage source V The best circuit to carry out this experiment is

(A) 

(B) 

(C) 

(D) 

45. A real gas behaves like an ideal gas when its

(A) pressure and temperature are high
(B) pressure and temperature are low
(C) pressure is high and temperature is low
(D) pressure is low and temperature is high

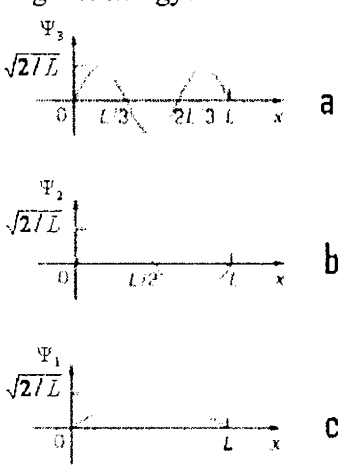
46. For an infinite sheet of positive charge, the electric field lines

(A) run parallel to the sheet
(B) run perpendicular to the sheet and point toward the sheet
(C) run perpendicular to the sheet and point away from the sheet
(D) fall off as per inverse square law

47. A standing wave is formed on a tightly stretched string. The distance between a node and an antinode is

(A) ⅛ of wavelength
(B) ¼ of wavelength
(C) ½ of wavelength
(D) 1 wavelength

48. Below are three wave functions for a particle in a box. Which one has the highest energy?



(A) a and b equal and highest
(B) c
(C) b and c equal and highest
(D) a

49 Which of the following colours has highest energy?

(A) Violet (B) Green
(C) Red (D) Blue

50. An X-ray photon collides with a free electron and the photon is scattered. During the collision, there is conservation of

(A) momentum but not energy
(B) both momentum and energy
(C) energy but not momentum
(D) neither energy nor momentum

51. In order for fiber optics to work, the incident light inside the fiber must hit the wall of the fiber at

(A) 90 degrees
(B) 45 degrees
(C) an angle less than critical angle
(D) an angle greater than the critical angle

52. A Newton is expressed as

(A) Kilogram.metre/sec (B) Kilogram/metre/sec
(C) Kilogram.metre/sec^2 (D) Kilogram/metre/sec^2

53. A pendulum suspended from the ceiling of a car is observed to hang at an angle of 10 degrees to the right of the vertical. Which of the following explains this phenomenon?

(A) Car is at rest
(B) Car is turning to the right
(C) Car is turning to the left
(D) Car is moving with constant velocity to the left

54. A satellite of mass "M" is in orbit around the Earth. If a second satellite of mass "2M" is to be placed in the same orbit, the second satellite must have a velocity which is

(A) half the velocity of the first satellite
(B) same as the velocity of the first satellite
(C) twice the velocity of the first satellite
(D) four times the velocity of the first satellite

55. A girl throws a 0.1 kilogram ball at a wall. The ball hits the wall perpendicularly with a velocity of 5 metres per second and then bounces straight back with a velocity of 4 metres per second. The change in the momentum of the ball is

(A) 1 kilogram.metre/sec
(B) 0.9 kilogram.metre/sec
(C) 0.1 kilogram.metre /sec
(D) 0.5 kilogram.metre /sec

56. How many times more intense is an 80 decibel sound than a 40 decibel sound?

(A) 2
(B) 40
(C) 1000
(D) 10000

57. Two point masses, M1 and M2, are 14 centimetres apart. M1 has a mass of 2 grams. M2 has a mass of 5 grams. The center-of-mass of this system will be at

(A) 4 cm from M1
(B) 5 cm from M2
(C) 4 cm from M2
(D) 7 cm from M1

58. The expression for decimal number 57 in binary is

(A) 110011
(B) 111011
(C) 111001
(D) 110010

59. If a signal passing through a gate is inhibited by sending a LOW into one of the inputs, and the output is HIGH, the gate is a/an

(A) NAND (B) NOR
(C) OR (D) AND

60. What unit is used to represent the level of a diode forward current I_F?

(A) pA (B) nA
(C) mA (D) μA

61. What is the power dissipation of a silicon diode with I_d of 40 mA?

(A) 28 W (B) 28 mW
(C) 280 mW (D) Insufficient data

62. To operate properly, a transistor's base-emitter junction must be forward biased with reverse bias applied to which junction?

(A) Collector-base (B) Base-emitter
(C) Collector-emitter (D) Base-collector

63. A transistor may be used as a switching device or as a

(A) fixed resistor (B) tuning device
(C) diode (D) variable resistor

64. The voltage follower has a

(A) closed loop gain of unity
(B) closed loop bandwidth of zero
(C) small open loop voltage gain
(D) large closed loop output impedance

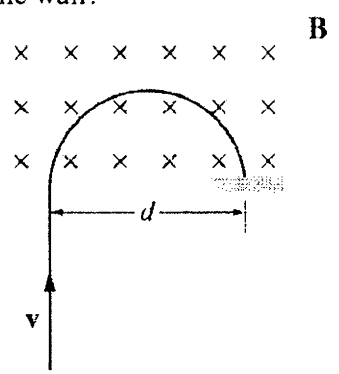
65. An ideal operational amplifier has

(A) infinite bandwidth (B) zero input impedance
(C) infinite output impedance (D) All of the above

66. An electron moves continuously up and down in a corner of a room. An experimenter in the opposite corner of the room finds

(A) that there is an electromagnetic wave
(B) an unchanging electric field
(C) an unchanging magnetic field
(D) a charge

67. A particle with mass m and charge q, moving with a velocity **v**, enters a region of uniform magnetic field **B**, as shown in the figure below. The particle strikes the wall at a distance d from the entrance slit. If the particle's velocity stays the same but its charge-to-mass ratio is doubled, at what distance from the entrance slit will the particle strike the wall?



(A) 2d
(B) $\sqrt{2}$d
(C) d
(D) d/2

68. The bomb calorimeter is used for the precise determination of the heat change accompanying a reaction. This calorimeter operates at

(A) constant volume
(B) constant temperature
(C) constant pressure
(D) constant volume and constant pressure

69. If a heat engine attains 100% thermal efficiency, then it violates

(A) Zeroth law of thermodynamics
(B) First law of thermodynamics
(C) Second law of thermodynamics
(D) Law of conservation of energy

70. Bernoulli's equation deals with the law of conservation of

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

71. What is a varistor?

(A) A voltage dependent resistor
(B) A current dependent resistor
(C) A voltage dependent diode
(D) A current dependent diode

72. The d.c. current in each of the diodes in a bridge rectifier circuit equals

(A) the load current
(B) twice the load current
(C) half the load current
(D) one fourth of the load current

73. The energy gap is defined as

(A) the space between two orbital shells
(B) the energy equal to the energy acquired by an electron in crossing 1 V electric field
(C) the energy band in which the electrons can move freely
(D) the energy level at which an electron can exist

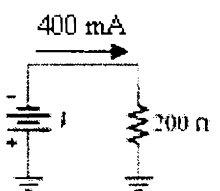
74. A P-N junction mimics a closed switch when it

(A) has low junction resistance
(B) cannot overcome its barrier voltage
(C) is reverse biased
(D) has wide depletion region

75. If the input to a comparator is a sine wave, then the output will be

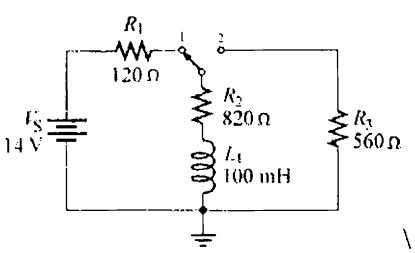
(A) ramp voltage
(B) sine wave
(C) rectangular wave
(D) saw tooth wave

76. What is the power in the given circuit?



(A) 32 W
(B) 2 W
(C) 200 W
(D) 0.5 W

77 In the given circuit, what will be the voltage across R_3, 25 μs after the switch is moved to position 2?



(A) 2.88 V
(B) 5.9 V
(C) 8.34 V
(D) 14 V

78. If you want to decrease the inductance of a coil, you would

(A) increase the number of turns
(B) increase the gap between the turns
(C) increase permeability of the core
(D) increase cross sectional area of the coil

79. In the Compton effect, a photon of wavelength λ collides with a stationary electron. The wavelength of the emitted photon is

(A) longer than λ
(B) the same as λ
(C) shorter than λ
(D) No photon is emitted

80. A bottle dropped from a balloon reaches the ground in 20 s. Determine the height of the balloon if (a) it was at rest in the air and (b) it was ascending with a speed of 50 m/s when the bottle was dropped.

(A) (a) 98 km, (b) 2960 km
(B) (a) 0.49 km, (b) 1000 km
(C) (a) 196 km, (b) 1960 km
(D) (a) 2.0 km, (b) 0.96 km

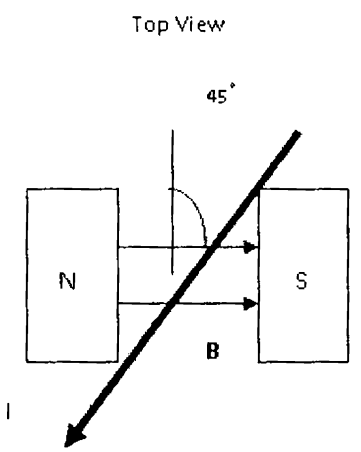
81. Which of the following is an example of para magnetic materials?

(A) Super conductors
(B) Transition metals
(C) Alkali metals
(D) Ferrites

82. The polarity of induced voltage while a field is collapsing is

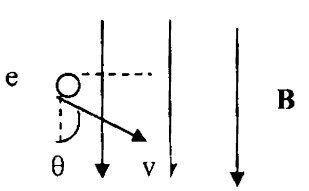
(A) independent of the force creating the field
(B) opposite to the force creating the field
(C) identical to the force creating the field
(D) present only if the force is stationary

83. A wire carrying a 20 A current and having a length L = 0.10 m is placed between the poles of a magnet at an angle of 45°, as shown. The magnetic field is uniform and has a value of 0.8 T. The magnitude and direction of the magnetic force acting on the wire are $\left(\sin 45^\circ = \cos 45^\circ = 0.7\right)$



(A) 1.13 N and out of page
(B) 1.13 N and into the page
(C) 1.13 Tesla and out of page
(D) 1.13 Tesla and into the page

84. An electron enters the magnetic field as shown below. The magnitude of the force acting on electron is



(A) evB
(B) $evB\cos\theta$
(C) $evB\sin\theta$
(D) $vB\sin\theta$

85. When a bar magnet is broken into two, then each of the piece is

(A) as magnetic as the original magnet
(B) stronger than the original magnet
(C) half as strong as the original magnet
(D) non magnetic

86. The current through an infinitely long solenoid is increased linearly as a function of time. The electric field inside the solenoid is

(A) zero
(B) in the form of circles centered on the axis of the solenoid
(C) parallel to the axis of the solenoid
(D) radially directed outward from the axis of the solenoid

87. A cylindrical bar magnet is kept along the axis of a circular coil. On rotating the magnet about its axis, the coil will have induced in it

(A) current
(B) an emf
(C) no current
(D) both emf and current

88. An electron and a proton having same velocity enter a uniform magnetic field at an angle of 90° to the field direction. They will now move in circular orbits such that

(A) their time periods will be same
(B) the orbital radii will be same
(C) the time period of proton will be higher
(D) the time period of electron will be higher

89 Inversion temperature of a gas is the temperature above which

(A) the gas shows cooling effect while passing through a narrow orifice
(B) the temperature of the gas remains unaltered while passing through narrow orifice
(C) the gas shows heating effect while passing through a narrow orifice
(D) the gas can be liquefied

90. If A is the gain of an internal amplifier and B is the feedback coefficient, Barkhausen criterion of oscillations is

(A) AB<1 (B) AB=1
(C) AB>1 (D) AB=0

91. Twenty seven drops of mercury of equal size merge into a big drop. Assuming the drops to be spherical, the capacity of the bigger drop compared to each drop is

(A) 27 times (B) 3 times
(C) 9 times (D) 18 times

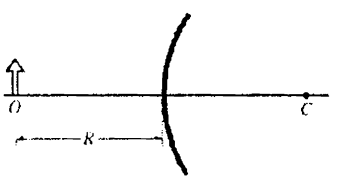
92. According to Kirchoff's current law

(A) no current can leave the junction without some current entering it
(B) net current flow at the junction is negative
(C) total sum of currents meeting at the junction is zero
(D) the algebraic sum of the currents at the junction is zero

93. Standing waves are produced by the superposition of two waves with

(A) the same amplitude, frequency, and direction of propagation
(B) the same amplitude and frequency, and opposite propagation directions
(C) the same amplitude and direction of propagation, but different frequencies
(D) the same amplitude, different frequencies, and opposite directions of propagation

94. The figure below shows an object *O* placed at a distance *R* to the left of a convex spherical mirror that has a radius of curvature *R*. Point *C* is the centre of curvature of the mirror. The image formed by the mirror is at



(A) a distance R to the right of the mirror and upright
(B) a distance R to the left of the mirror and inverted
(C) a distance R/3 to the right of the mirror and upright
(D) a distance R/3 to the left of the mirror and inverted

95. A single transistor can be used to build

(A) AND gate
(B) NOR gate
(C) NOT gate
(D) NAND gate

96. The function of a bleeder resistor in a power supply is

(A) the same as that of load resistor
(B) to ensure a minimum current drain in the circuit
(C) to increase the output d.c. voltage
(D) to increase the output current

97. RC time constant in an R-C circuit, is the time in seconds taken for the current to drop to of its original value.

(A) 0.368
(B) 0.632
(C) 0.500
(D) 0.750

98. The Laplace transform of $e^{-2t} \sin 2\omega t$ is

(A) $2s / (s+2)^2 + 2\omega^2$
(B) $2\omega / (s+2)^2 + 4\omega^2$
(C) $2\omega / (s-2)^2 + 4\omega^2$
(D) $2s / (s-2)^2 + 2\omega^2$

99. As a pendulum is raised to higher altitudes, its period

(A) increases
(B) remains the same
(C) decreases
(D) decreases, then remains the same

100. The Millikan experiment showed that electric charge was

(A) negative
(B) quantised
(C) positive
(D) unmeasurable

101. A balloon is filled with cold air and placed in a warm room. The balloon is not in thermal equilibrium with the air in the room until

(A) it sinks into the floor
(B) it starts to contract
(C) it stops expanding
(D) it rises to the ceiling

102. The zeroth law of thermodynamics allows us to define

(A) pressure
(B) internal energy
(C) temperature
(D) thermal equilibrium

103. Nuclear force is

(A) short range and charge dependent
(B) long range and charge dependent
(C) short range and charge independent
(D) long range and charge independent

104. A pendulum swings back and forth. At the top of the swing

(A) both potential energy and kinetic energy are greater than at the bottom
(B) both potential energy and kinetic energy are smaller than at the bottom
(C) potential energy is greater and kinetic energy is smaller than at the bottom
(D) potential energy is smaller and kinetic energy is greater than at the bottom

105. A quantum particle in a box is in the lowest energy (ground) state. If the size of the box is decreased, the energy of the particle

(A) becomes larger
(B) is unchanged
(C) becomes smaller
(D) cannot be measured

106. An astronaut travels to earth at a speed of 0.6c. Someone stationary on earth holds a metre stick. For the astronaut, the metre stick appears to be

(A) longer than a metre
(B) exactly one metre
(C) shorter than a metre
(D) longer than by a metre by 1.6 times

107. Which of the following best describes the principle of Magnetic Resonance Imaging (MRI) used in medical research?

(A) Mapping the magnetic field generated by the electron transitions in molecules
(B) Measuring the energy absorbed as nuclear magnetic moments flip between spin states
(C) Using magnetic field to focus the paths of emissions from a radio isotope
(D) Producing high energy electromagnetic waves using superconducting magnets

108. An n-type semiconductor is produced when silicon crystal is doped with small quantity of phosphorous. How will this doping affect the conductivity of the crystal?

(A) The conductivity will decrease because there are fewer holes in the valence band
(B) The conductivity will increase because there are more holes in the valence band
(C) The conductivity will decrease because there are fewer electrons in conduction band
(D) The conductivity will increase because there are more electrons in conduction band

109. For two waves to be in phase, the necessary condition is that the two waves have same

(A) amplitude
(B) instants in time at which their amplitudes are zero
(C) wavelength
(D) frequency

110. In a full wave rectifier circuit operating from 50Hz mains frequency, the fundamental frequency in the ripple would be

(A) 25Hz (B) 50Hz
(C) 70.7Hz (D) 100Hz

111. An ideal gas has volume 1litre at 1atm and $-20^{\circ}C$. To how many atmosphere pressure must it be subjected to be compressed to 0.5litre when the temperature is $40^{\circ}C$?

(A) 2.47 atm (B) 24.7 atm
(C) 3 atm (D) 30 atm

112. The absolute temperature of a gas is increased by three times. The root mean square velocity of the gas molecules will be

(A) 3 times
(B) 9 times
(C) 1/3 times
(D) $\sqrt{3}$ times

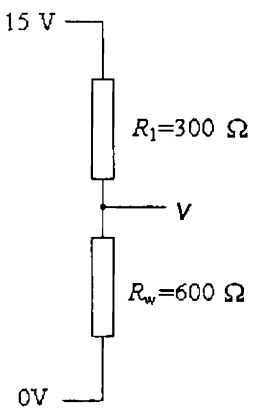
113. A variable parallel plate capacitor and an electroscope are connected in parallel to a battery. The reading of the electroscope would be decreased by

(A) increasing area of overlap of the plates
(B) placing a block of paraffin wax between the plates
(C) decreasing the distance between the plates
(D) decreasing the battery potential

114. Which of the following statements is false?

(A) In vacuum the velocity of red light is more than that of violet light
(B) A rod of flint glass when immersed in carbon disulphide of refractive index equal to that of flint glass becomes almost invisible
(C) The setting Sun appears higher in the sky than it really is
(D) The intensity of light at a distance r from the axis of a long cylindrical source is inversely proportional to r

115. What will be the value of output voltage V in the following circuit?



(A) 6 V
(B) 10 V
(C) 20 V
(D) 60 V

116. Which of the following effects could not be observed for sound waves in air?

(A) Interference
(B) Refraction
(C) Polarisation
(D) Diffraction

117 We desire to measure the current through and voltage across a resistor connected in a circuit. How should the ammeter and the voltmeter be connected?

(A) Both are connected parallel with the resistor
(B) Both are connected in series with the resistor
(C) Ammeter is connected in series and voltmeter is connected parallel with the resistor
(D) Ammeter is connected in parallel and voltmeter is connected in series with the resistor

118. The potential difference between two large parallel plates is 120V The plate separation is 3.0 mm. The electric field between the plates is

(A) 40 V/m towards the negative plate
(B) 40 V/m towards the positive plate
(C) 40 kV/m towards the positive plate
(D) 40 kV/m towards the negative plate

119. A long narrow pipe closed at one end does not resonate to a tuning fork having a frequency of 300Hz until the length of the air column reaches 28 cm. What is the speed of sound in air at that condition?

(A) 0.68 km/s (B) 0.27 km/s
(C) 0.34 km/s (D) 0.13 km/s

120. How fast must an object be moving if its apparent mass is to be 1 percent larger than its rest mass?

(A) 4.2×10^{7} m/s (B) 4.2×10^{5} m/s
(C) 4.2×10^{9} m/s (D) 4.2×10^{3} m/s

121. A substance evaporates when

(A) its temperature is higher than surrounding temperature
(B) its vapour pressure is higher than surrounding temperature
(C) its temperature is equal to its melting point
(D) its vapour pressure is less than surrounding pressure

122. Which of the following four h parameters of a transistor has small value?

(A) h_i (B) h_f
(C) h_o (D) h_r

123. If the sum of all forces acting on a moving object is zero, the object will

(A) slow down and stop its motion
(B) accelerate uniformly
(C) change direction of its motion
(D) continue moving with constant velocity

124. One Tesla of magnetic field is equal to

(A) 10^4 Gauss
(B) 10^3 Gauss
(C) 10^2 Gauss
(D) 10^6 Gauss

125. A satellite is moving around the Earth in a circular orbit with a velocity V If the gravitational force of the Earth suddenly disappears, then the satellite would

(A) spirally move away from the Earth with velocity V
(B) move radially outwards with a velocity V
(C) fall towards the surface of the Earth
(D) move with a velocity V, tangentially to its circular orbit

126. Which of the following is a scalar quantity?

(A) Electric current
(B) Electric field
(C) Acceleration
(D) Linear momentum

127. In a convex lens the defect due to the non coincidence of the primary image and the secondary image is called

(A) spherical aberration
(B) chromatic aberration
(C) astigmatism
(D) linear aberrations

128. The wavelength produced in a He:Ne laser corresponds to transitions in

(A) He
(B) Ne
(C) both He and Ne
(D) neither He nor Ne

129. A current amplifier is characterized by

(A) low input impedance and high output impedance
(B) high input impedance and low output impedance
(C) low impedance at both input and output terminals
(D) high impedance at both input and output terminals

130. The reverse saturation current of a *pn* junction varies with temperature T as

(A) proportional to T
(B) proportional to T^2
(C) proportional to 1/T
(D) proportional to $\sqrt{T}$

131. Field Effect Transistors are

(A) voltage driven devices
(B) power driven devices
(C) current driven devices
(D) temperature driven devices

132. For an electron transition from excited state to ground state, which of the following is true?

(A) Its kinetic energy, potential energy and total energy decreases
(B) Its kinetic energy, potential energy and total energy increases
(C) Its kinetic energy increases, potential energy and total energy decreases
(D) Its kinetic energy decreases, potential energy increases and total energy remains same

133. Which of the following statements best describes the forces acting on a satellite in orbit around Earth?

(A) Although gravity has no effect, there is an outward force.
(B) The satellite is kept up by an outward force that balanced the gravitational force.
(C) Gravity is the only force acting on the satellite and this results in inward acceleration.
(D) The effect of gravity is negligible, the satellite is kept in orbit by its momentum and the net force acting on it is zero.

134. In a region, steady and uniform electric and magnetic fields are present. These two fields are parallel to each other. A charged particle is released from rest in this region. The path of the particle will be

(A) circle (B) ellipse
(C) straight line (D) helix

135. An inductor is in helical form and not a straight line form, because

(A) self inductance will be low
(B) mutual inductance will be high
(C) self inductance will be high
(D) mutual inductance will be low

136. The dimension of L/R is that of

(A) current (B) velocity
(C) magnetic induction (D) frequency

137. A Zener diode

(A) has forward voltage rating
(B) has a sharp breakdown at low reverse voltage
(C) is useful as an amplifier
(D) has high negative resistance

138. The emitter region in the *pnp* transistor is more heavily doped than the base region so that

(A) the flow across the base region will be mainly due to electrons
(B) the flow across the base region will be mainly due to holes
(C) recombination will be increased in the base region
(D) base current will be high

139. If v is the frequency and h is Planck's constant, the ground state energy of one dimensional quantum mechanical oscillator is

(A) 0 (B) $hv/3$
(C) $hv/2$ (D) hv

140. The longest wavelength X-ray that can undergo first order Bragg diffraction in a crystal for a given family of planes of spacing d is

(A) 2d (B) d/2
(C) d (D) 4d

141. The wave function for identical fermions is anti symmetric under particle interchange. Which of the following is the consequence of this property?

(A) Pauli exclusion principle
(B) Heisenberg uncertainty principle
(C) Bohr correspondence principle
(D) Fermi's golden rule

142. Which of the following is most useful to measure temperature of the order of 3500K?

(A) Optical pyrometer (B) Carbon resistor
(C) Gas bulb thermometer (D) Thermocouple

143. The ratio of speed of a body to the speed of sound is called

(A) Refractive index (B) Doppler ratio
(C) Mach number (D) Reynold number

144. The debate as to whether cathode rays are charged particles or electromagnetic waves continued for long. Which of the following observation resolved this issue?

(A) Cathode rays can turn a paddle wheel
(B) Cathode rays can be deflected by electric field
(C) Cathode rays can penetrate through metals
(D) Fluorescent screens glow when struck by cathode rays

145. The susceptibility of a diamagnetic material is about

(A) 10^{5} (B) 10^{-5}
(C) 10^{-1} (D) 10^{7}

146. The truth table given below is for (A and B are inputs, Y is output):

A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

(A) NAND gate (B) XOR gate
(C) AND gate (D) NOR gate

147 Gray is a unit of

(A) radiation dose (B) photon energy
(C) phonon energy (D) magnetic field

148. The ground state electron configuration for phosphorus, which has 15 electrons, is

(A) $1s^2\ 2s^2\ 2p^6\ 3s^1\ 3p^4$ (B) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3d^3$
(C) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$ (D) $1s^2\ 2s^2\ 2p^6\ 3s^1\ 3d^4$

149. There will be no force experienced if

(A) two parallel wires carry electric currents in the same direction
(B) two parallel wires carry electric currents in the opposite direction
(C) two wires carry currents in two perpendicular directions
(D) two wires are inclined at 45° and carry current in the same direction

150. All periodic waves may be broken down into constituent sine waves of different amplitudes and frequencies. The mathematical operation for doing this is called

(A) Fourier analysis
(B) Taylor analysis
(C) Newton's analysis
(D) Freeman analysis

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