61314

ROLL No. | | | | | |

TEST BOOKLET No. 1421

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.

SEAL

61314

PHYSICS

1. Which of the following quantities has the same dimensions as the latent heat?

   (A) Work per unit mass
   (B) Specific heat per unit mass
   (C) Force per unit velocity
   (D) Acceleration per unit displacement

2. A pebble is dropped in a well of depth h. The splash is heard after time t. If v is velocity of sound, then

   (A) $t = \sqrt{gv/2h}$
   (B) $t = v + vh$
   (C) $t = v - vh$
   (D) $t = \sqrt{\frac{2h}{g}} + \frac{h}{v}$

3. A body falls freely under gravity. The distances covered in the first, second and third second of motion are in the ratio

   (A) 1: 2: 3
   (B) 1: 4: 9
   (C) 1: 3: 5
   (D) 2: 4: 6

4. If $\vec{A} = 2\hat{i} + 3\hat{j} - \hat{k}$ and $\vec{B} = 4\hat{i} + 6\hat{j} - 2\hat{k}$, then the angle between $\vec{A}$ and $\vec{B}$ will be

   (A) π
   (B) $\frac{\pi}{3}$
   (C) $\frac{\pi}{2}$
   (D) 0°

5. Angular momentum is

(A) Scalar
(B) Axial vector
(C) Polar vector
(D) None of the above

6. If $\vec{A}.\vec{B} = \vec{A} \times \vec{B}$, then the resultant vector of $\vec{A}$ and $\vec{B}$ is

(A) $\sqrt{A^2 + B^2 + \sqrt{2AB}}$
(B) $(A - B)$
(C) $\sqrt{A^2 + B^2}$
(D) $(A + B)$

7. A parachutist of weight 'W' strikes the ground with his legs fixed and comes to rest with an upward acceleration of magnitude 2g. Force exerted on him by ground during landing is

(A) W
(B) 2W
(C) 3W
(D) 4W

8. Which of the following force is conservative?

(A) Gravitational force
(B) Frictional force
(C) Air resistance
(D) Viscous force

9. A car and a bus are moving with the same kinetic energy. They are brought to rest by applying brakes which provide equal retarding forces. The distances covered by them before coming to rest will be

(A) inversely proportional to the square of their masses
(B) inversely proportional to their masses
(C) directly proportional to their masses
(D) equal

10. If the Earth shrinks to half of its radius without change in mass, the duration of the day will be

(A) 24 hr
(B) 48 hr
(C) 13 hr
(D) 6 hr

11. The nature of the interatomic force is

(A) electrical
(B) nuclear
(C) gravitational
(D) magnetic

12. Solids which break just above the elastic limit are called

(A) brittle
(B) ductile
(C) plastic
(D) malleable

13. When two tubes of different diameters are dipped vertically in a liquid, the rise of liquid is

(A) same in both tubes
(B) more in tube of larger diameter
(C) more in tube of smaller diameter
(D) None of the above

14. If the Earth stops rotating, the weight of the body will

(A) increase
(B) decrease
(C) become zero
(D) remain unaffected

15. A pendulum suspended at the ceiling of the train has a period t when the train is at rest. If the train is accelerated uniformly, the period will

(A) increase
(B) decrease
(C) remain the same
(D) become infinite

16. The human ear is most sensitive to sound in the frequency range

(A) 20 to 20000 Hz
(B) 200 to 400 Hz
(C) 1000 to 2000 Hz
(D) 10000 to 20000 Hz

17. Longitudinal waves cannot be propagated through

(A) a gas
(B) a liquid
(C) vacuum
(D) a solid

18. Two persons cannot hear each other on the surface of moon because the moon has

(A) craters
(B) no atmosphere
(C) rocks which absorb sound
(D) dust suspended all around

19. A closed organ pipe is excited to support the third overtone. It is found that air in the pipe has

(A) three nodes and three antinodes
(B) three nodes and four antinodes
(C) four nodes and three antinodes
(D) four nodes and four antinodes

20. A closed organ pipe and an open organ pipe have their first overtone identical in frequency. Their lengths are in the ratio

(A) 1 : 2
(B) 2 : 3
(C) 3 : 4
(D) 4 : 5

21. If the temperature of the source and sink is increased by the same amount, the efficiency of the engine

(A) decreases
(B) increases
(C) remains unchanged
(D) may increase or decrease

22. A sphere, a cube and a thin circular plate of same material and mass are heated to 200°C. Which one will cool slowest under similar conditions?

(A) Sphere
(B) Cube
(C) Thin plate
(D) All cool at same rate

23. Wein's 'displacement law' fails at

(A) short wavelengths
(B) long wavelengths
(C) low temperature
(D) high temperature

24. A point charge Q is moved along a circle around another fixed point charge. The work done is zero

(A) only if Q returns to its initial point
(B) if two charges have same magnitude
(C) only if two charges are equal and opposite
(D) in all cases

25. A piece of copper and another of germanium are cooled from room temperature to 80 K. The resistance of

(A) each of them increases
(B) each of them decreases
(C) copper increases while germanium decreases
(D) copper decreases while germanium increases

26. Two identical resistors are connected in parallel, then in series. The effective resistances are in the ratio

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

27. If H^+, He^+, O^{++} all having same kinetic energies pass through a region of magnetic field perpendicular to their velocity, then

(A) H^+ will be deflected most
(B) O^{++} will be deflected most
(C) He^+, O^{++} will have equal deflection
(D) None of the above

28. A charge moving with velocity v in X direction is subjected to a field of magnetic induction in the negative X direction. As a result the charge will

(A) remain unaffected
(B) start moving in a circular path Y-Z plane
(C) retard along X-axis
(D) move along a helical path around X-axis

29. If a bar magnet is placed with its north-pole pointing towards north of Earth, the neutral points are located

(A) on the axial line
(B) on the equatorial line
(C) on the line making an angle θ with axis where θ can have any value
(D) on the line making an angle of 45° with axis

30. The diamagnetic material has susceptibility

(A) $\chi = 0$ (B) $\chi < 1$
(C) $\chi > 1$ (D) $\chi < 0$

31. The r.m.s. value of e.m.f. given by $E = 8 \sin\omega t + 6 \sin 2\omega t$ volt is

(A) 7.07 V (B) 5.2 V
(C) 3.3 V (D) 2.9 V

32. The equivalent inductance of two inductors is 2.4 H when connected in parallel and 10 H when connected in series. Then the individual inductances have values

(A) 6H, 4H (B) 5H, 5H
(C) 7H, 3H (D) 8H, 3H

33. A prism of refractive index $\sqrt{2}$ has a refracting angle 60°. At what angle a ray must be incident on it so that it suffers minimum deviation?

(A) 30° (B) 35°
(C) 40° (D) 45°

34. The image formed by the objective of a compound microscope is

(A) real and diminished (B) real and enlarged
(C) virtual and enlarged (D) virtual and diminished

35. A seed is placed in front of two thin symmetrical coaxial lenses with focal lengths $f_1 = +24$ cm and $f_2 = +9$ cm respectively and with lens separation $L = 10$ cm. The seed is 6 cm from the first lens. Where does the system of two lenses produce an image of the seed?

(A) +18 cm
(B) −18 cm
(C) 8 cm
(D) −8 cm

36. To demonstrate the phenomenon of interference, we require two sources which emit radiations

(A) of same frequency
(B) of different wavelength
(C) of the same frequency and having a definite phase relationship
(D) of different frequencies

37. Which one of the following groups of electromagnetic waves is in order of increasing frequency?

(A) Microwaves, ultraviolet rays, X-rays
(B) Radiowaves, visible light and infrared radiation
(C) Gamma rays, visible light, ultraviolet rays
(D) Gamma rays, ultraviolet rays, radio waves

38. An electromagnetic radiation of frequency ν, wavelength λ, travelling with velocity c in air, enters a glass slab of refractive index μ. The frequency, wavelength and velocity of the radiation in the glass slab will be respectively

(A) $\frac{\nu}{\mu}, \frac{\lambda}{\mu}$ and $\frac{c}{\mu}$
(B) $\nu, \frac{\lambda}{\mu}$ and $\frac{c}{\mu}$
(C) $\nu, 2\lambda$ and $\frac{c}{\mu}$
(D) $\frac{2\nu}{\mu}, \frac{\lambda}{\mu}$ and c

39. Ozone layer blocks the radiation of wavelength

(A) less than $3\times10^{-7}m$ (B) equal to $3\times10^{-7}m$
(C) more than $3\times10^{-7}m$ (D) None of the above

40. The specific charge for positive rays is much less than that for cathode rays, because

(A) positive rays are positively charged
(B) charge on positive rays is less
(C) positive rays consist of massive ions
(D) experimental method of determination is wrong

41. An X-ray tube operated at 40 kV emits a continuous X-ray spectrum with a short wavelength limit λ_{min}=0.310 A°. Calculate the Plank's constant.

(A) 5.6×10^{-34} Js (B) 7.8×10^{-34} Js
(C) 6.61×10^{-34} Js (D) 9.6×10^{-34} Js

42. In photoelectric effect, the photoelectric current

(A) increases when frequency of incident photons increases
(B) decreases when frequency of incident photons increases
(C) does not depend on photon of frequency but only on intensity of incident beam
(D) depends both on intensity and frequency of incident beam

43. If we consider electrons and photons of the same wavelength, then they will have the same

(A) velocity (B) angular momentum
(C) energy (D) momentum

44. Half-life of a substance is 20 minutes. What is the time between 33% decay and 67% decay?

(A) 20 minutes (B) 25 minutes
(C) 30 minutes (D) 40 minutes

45. When an electron jumps from the fourth orbit to the second orbit, one gets the

(A) second line of Paschen series
(B) second line of Balmer series
(C) first line of Pfund series
(D) second line of Lymen series

46. As the mass number A increases, which of the following quantities related to the nucleus doesn't change?

(A) Binding energy
(B) Density
(C) Volume
(D) Mass

47. Strontium oxide coating is used on tungsten for good thermionic mission because

(A) it can be heated to very high temperature
(B) it has a low work function
(C) it protects tungsten from being evaporated
(D) it has high conductivity

48. At low temperatures, the specific heat of solids can be expressed in the form

(A) $C_V = aT$
(B) $C_V = aT + bT^2$
(C) $C_V = aT + bT^3$
(D) $C_V = bT^3$

49. Pyrometers are devices by which one measures

(A) solar constant
(B) low temperature
(C) very high temperature
(D) None of the above

50. The volume of a gas expands isothermally to 4 times its initial volume. The change in entropy in terms of gas constant R is

(A) R ln 2
(B) R ln 4
(C) 2 R ln 2
(D) None of the above

51. A charged particle ($q=1.6\times10^{-19}$ Coul) with velocity of 10^4 m/s moving in a direction perpendicular to a magnetic field B=0.1 Weber/m^2. The frequency of revolution of the charge particle is

(A) 2.8×10^9 rps
(B) 2.8×10^8 rps
(C) 2.8×10^{10} rps
(D) 2.8×10^3 rps

52. From Thomson's parabolic method with the formula $y=(k\ e/m)\ z^2$ specific charge (e/m) can be found out. The positive ray parabola due to singly ionized Ne(=mass 20) atoms is represented by the equation $y=10\ z^2$. The equation of the parabola due to the other isotope of neon of mass 22 is

(A) $y=11\ z^2$
(B) $y=z^2$
(C) $y=22\ z^2$
(D) None of the above

53. Bose Einstein condensation temperature T_C refers to the temperature below which

(A) an assembly of Bose gas condenses to the liquid state
(B) there is an appreciable occupation of the ground state in an electron system
(C) there is a significantly large occupancy of the ground state in a system of bosons
(D) the bosons essentially behave like fermions

54. The reciprocal lattice to a *bcc* lattice is

(A) *bcc* lattice
(B) simple cubic lattice
(C) *fcc* lattice
(D) None of the above

55. The wave function of a system obeying Fermi-Dirac statistics is

(A) symmetric
(B) anti-symmetric
(C) pseudo-symmetric
(D) None of the above

56. A tiger chases a horse 30 m ahead of it and gains 3 m in 5 s after the chase started. After 10 s, the distance between them is

(A) 18 m
(B) 14 m
(C) 24 m
(D) 6 m

57. A particle of mass m is projected with a velocity v making an angle 45° with the horizontal. The magnitude of the angular momentum of the particle at its maximum height h is

(A) zero
(B) $\frac{mv^3}{\sqrt{2}g}$
(C) $m^2\sqrt{2gh^3}$
(D) $\frac{mv^3}{4\sqrt{2}g}$

58. Drums of oil are carried in a truck. If constant acceleration is applied on the truck, then the surface of the oil in the drum will

(A) remain unaffected
(B) rise towards backward direction
(C) rise towards forward direction
(D) Nothing is certain

59. A thin circular ring of mass M and radius R is rotating about its central axis with angular velocity. Four point objects each of mass m are attached gently to the opposite ends of two $\perp$ diameters, the angular velocity of the ring is given by

(A) $\frac{M}{M+m}\omega$
(B) $\frac{M}{M+4m}\omega$
(C) $\frac{M+4m}{M}\omega$
(D) $\frac{M-4m}{M+4m}\omega$

60. What remains constant when the Earth revolves round the Sun?

(A) Linear K.E.
(B) Angular K.E.
(C) Linear momentum
(D) Angular momentum

61. Which of the following interactions is the weakest?

(A) Gravitational
(B) Electrostatic
(C) Nuclear
(D) None of the above

62. To an astronaut in the spaceship, the sky appears pitch dark. This is due to

(A) the absence of atmosphere in neighborhood
(B) the light from sky is absorbed by medium surrounding him
(C) the fact that at height, the sky radiations are only infrared and ultraviolet
(D) the fact that human eye becomes blind from blue colour

63. Brownian motion has played a convincing role in establishing

(A) kinetic theory of gases
(B) mechanical equivalence of heat
(C) elastic nature of molecular collisions
(D) None of the above

64. An artificial satellite is orbiting the Earth at an altitude 400 km. A bomb is released from the satellite. The bomb will

(A) reach the Earth in 10 minutes
(B) reach the Earth in 30 minutes
(C) orbit the Earth along with the satellite
(D) None of the above

65. A force of 200 N makes an angle of 30° with the spokes of the wheel. If the radius of rim is 25 cm, find the torque.

(A) 25 Nm
(B) 32.1 Nm
(C) 40 Nm
(D) None of the above

66. A particle undergoes S.H.M. having time period T. The time taken in $\frac{3}{8}^{th}$ oscillation is

(A) $\frac{3}{8}T$ (B) $\frac{5}{8}T$

(C) $\frac{5}{12}T$ (D) $\frac{7}{12}T$

67. The intensity of plane progressive wave of frequency 100 Hz is 10 watt/m^2. Given that speed of sound is 330 m/s and density of air is 1.293 kg/m^3. Then maximum change in pressure in N/m^2 is

(A) 3×10^{-4} (B) 3×10^{-5}

(C) 3×10^{-3} (D) 3×10^{-2}

68. Ultrasonic waves are used for stirring liquid solutions in order to produce

(A) soundless stirring
(B) perfectly homogeneous solution
(C) chemical reactions in them
(D) None of the above

69. Compressed air coming out of punctured football becomes cooler because of

(A) adiabatic process (B) Joule-Thomson effect

(C) isothermal expansion (D) energy dissipation

70. To keep correct time, watches are fitted with a balance wheel made of

(A) Platinum (B) Tungsten

(C) Invar (D) Stainless steel

71. The ideal gas equation PV = RT is true for

(A) isothermal process only
(B) adiabatic process only
(C) both isothermal and adiabatic processes only
(D) All processes

72. Which of the following is the best conductor of heat?

(A) Water
(B) Alcohol
(C) Wood
(D) Mercury

73. With sound waves one cannot observe the phenomenon of

(A) refraction
(B) diffraction
(C) interference
(D) polarisation

74. The absolute temperature of a perfectly black body is doubled. How many times the heat radiated from it will become?

(A) 4 times
(B) 8 times
(C) 16 times
(D) 32 times

75. Calculate the self-potential energy of a charge q distributed over the surface of a hollow sphere of radius R

(A) $\frac{q^2}{8\varepsilon_0 R}$
(B) $\frac{q^2}{4\varepsilon_0 R}$
(C) $\frac{q^2}{4\pi\varepsilon_0 R}$
(D) $\frac{q^2}{8\pi\varepsilon_0 R}$

76. An ammeter has resistance R_0 and range I. What resistance should be connected in parallel to it to increase the range to nI?

(A) R_0/n
(B) $R_0/(n-1)$
(C) $R_0/(n+1)$
(D) None of the above

77. Out of the following pairs, which one does not have identical dimensions?

(A) Moment of inertia and moment of force
(B) Angular momentum and Planck's constant
(C) Work and torque
(D) Impulse and momentum

78. If the unit of length and force be increased four times, then the unit of energy is

(A) increased 4 times
(B) increased 16 times
(C) increased 8 times
(D) decreased 16 times

79. In the study of Physics, a theory

(A) is a proven law that all phenomena must obey
(B) is a collection of ideas that explain and predict a natural phenomenon
(C) is a set of observations of the behaviour of a phenomenon
(D) is an explanation that never changes

80. What are the variables that will affect the period of vibration of a pendulum, if air resistance can be ignored?

(A) The length of the pendulum and the mass of the pendulum bob
(B) The length of the pendulum and the amplitude of the swing
(C) The length of the pendulum and the value of the acceleration due to gravity
(D) The mass of the pendulum bob, the amplitude of the swing, and the length of the pendulum

81. When should a student calculate percent difference to indicate precision?

(A) Percent difference is used when two or more measurements are made of the same quantity and one wishes to compare the precision of these values
(B) Percent difference is used when one wishes to compare the precision of an experimentally measured value to an accepted theoretical value
(C) Percent difference is only used when the measured values are identical
(D) Percent difference is only used when just two experimental measurements have been made

82. If car A passes car B, then car A must be

(A) accelerating
(B) accelerating at a greater rate than car B
(C) moving faster than car B and accelerating more than car B
(D) moving faster than car B, but not necessarily accelerating

83. A baseball pitcher delivers a fast ball. During the throw, the speed of the ball increases from 0 to 30.0 m/s over a time of 0.100 seconds. The average acceleration of the baseball is

(A) 3.00 m/s^2
(B) 30.0 m/s^2
(C) 300 m/s^2
(D) 3000 m/s^2

84. The average speed of an object which moves 10 kilometers in 30 minutes is

(A) 10 km/hr
(B) 20 km/hr
(C) 30 km/hr
(D) more than 30 km/hr

85. How far will a brick starting from rest fall freely in 3.0 seconds?

(A) 15 m
(B) 29 m
(C) 44 m
(D) 88 m

86. A car travels 90 metres due north in 15 seconds. Then the car turns around and travels 40 metres due south in 5.0 seconds. What is the magnitude of the average velocity of the car during this 20 second interval?

(A) 2.5 m/s
(B) 5.0 m/s
(C) 6.5 m/s
(D) 7.0 m/s

87. Which of the following statements correctly states Newton's first law of motion?

(A) Every object retains its state of rest or its state of accelerated straight-line motion unless acted upon by an unbalanced force
(B) Every object retains its state of rest or its state of uniform straight-line motion unless acted upon by a balanced force
(C) Every object retains its state of rest or its state of uniform straight-line motion unless acted upon by an unbalanced force
(D) None of the above

88. A jet engine works on the principle of

(A) conservation of mass
(B) conservation of linear momentum
(C) conservation of energy
(D) conservation of angular momentum

89. In doubling the mass and acceleration of the mass, the force acting on the mass with respect to the previous value

(A) decreases to half
(B) increases two times
(C) remains unchanged
(D) increases four times

90. A spring balance is attached to the ceiling of a lift. A man hangs his bag on the spring and the spring reads 49 N, when the lift is stationary. If the lift moves downward with an acceleration of 5 m/s^2, the reading of the spring balance will be

(A) 49 N
(B) 74 N
(C) 24 N
(D) 15 N

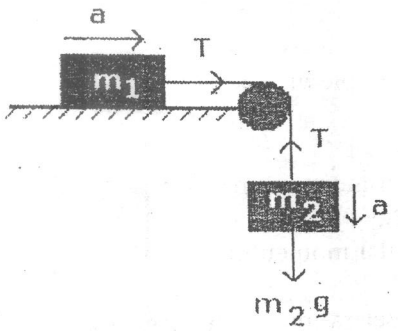
91. Swimming is possible on account of

(A) first law of motion
(B) third law of motion
(C) second law of motion
(D) Newton's law of gravitation

92. Which form of energy does the flowing water possess?

(A) Gravitational energy (B) Potential energy
(C) Electrical energy (D) Kinetic energy

93. As shown in the following figure a block of mass m_1 rests on horizontal table. A string tied to this block is passed over a frictional pulley fixed at one end of the table and another block of mass m_2 is hung to the other end of string. The acceleration (a) of the system is

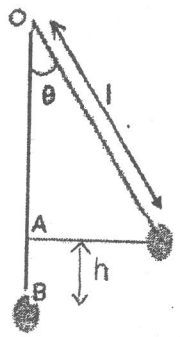


(A) m_1m_2g / m_1-m_2 (B) m_2g / m_1+m_2
(C) m_1g / m_1+m_2 (D) g

94. Which of the following is not an example of perfectly inelastic collision?

(A) A bullet fired into a block if bullet gets embedded into block
(B) Capture of electrons by atom
(C) A man jumping on to a moving boat
(D) A ball bearing striking another ball bearing

95. In simple pendulum of length l the bob is pulled aside from its equilibrium position through an angle θ and then released. The bob passes through the equilibrium position with a speed of



(A) $\sqrt{(2gl(1+cos\theta))}$ (B) $\sqrt{(2glsin\theta)}$

(C) $\sqrt{(2gl)}$ (D) $\sqrt{(2gl(1-cos\theta))}$

96. Ionic solids with Schottky defects contain in their structures

(A) equal number of cation and anion vacancies
(B) interstitial anions and anion vacancies
(C) cation vacancies only
(D) cation vacancies and interstitial cations

97. A compound formed by elements A and B crystallises in cubic structure, in which atoms of A are at the corners while that of B are at the face centre. The formula of the compound is

(A) AB_3 (B) AB

(C) A_3B (D) None of the above

98. Frenkel defect is caused due to

(A) an ion missing from the normal lattice site creating a vacancy
(B) an extra positive ion occupying an interstitial position in the lattice
(C) an extra negative ion occupying an interstitial position in the lattice
(D) the shift of a positive ion from its normal lattice site to an interstitial site

99. A crystalline solid

(A) changes abruptly from solid to liquid when heated
(B) has no definite melting point
(C) undergoes deformation of its geometry easily
(D) has an irregular 3-dimensional arrangements

100. Permeability is the inverse equivalent of which electrical term?

(A) Voltage
(B) Current
(C) Resistance
(D) Conductance

101. A Hall Effect sensor

(A) exists only in theory
(B) is a non-contacting magnetic sensor
(C) can operate only a few times before failure
(D) produces very large voltages

102. Which two values are plotted on a B-H curve graph?

(A) Reluctance and flux density
(B) Permeability and reluctance
(C) Magnetising force and permeability
(D) Flux density and magnetising force

103. Which of the following statement is wrong?

(A) Rough surfaces are better radiators than smooth surfaces
(B) Highly polished mirror surfaces are very good radiators
(C) Black surfaces are better absorbers than white ones
(D) Black surfaces are better radiators than white ones

104. Co-efficient of reflection, coefficient of absorption and coefficient of transmission are related as

(A) $a + r + t = 1$
(B) $a + r + t \neq 1$
(C) $a + r = -t$
(D) $a \neq r + 1$

105. The wave theory of light and the quantum theory of light

(A) are in direct contradiction to one another
(B) together show that X-rays really are an unknown (hence the "X") phenomenon
(C) complement each other
(D) are both necessary to explain the interference patterns of light

106. Emission spectra and absorption spectra

(A) for a single element complement each other
(B) can be used to identify elements in unknown samples, but only if the element is already known by classical chemical means
(C) when combined together forms a series of bright lines
(D) for certain pairs of closely-related elements are identical

107. When an atom absorbs a photon, one of its orbital electrons

(A) jumps from a higher to a lower energy level
(B) gains energy
(C) is absorbed by the nucleus
(D) turns into gamma radiation

108. NaCl is an example of

(A) ionic solid
(B) covalent solid
(C) metallic solid
(D) molecular solid

109. Kepler's second law regarding constancy of arial velocity of a planet is a consequence of the law of conservation of

(A) energy
(B) angular momentum
(C) linear momentum
(D) None of the above

110. The period of geostationary artificial satellite of Earth is

(A) 6 hours
(B) 12 hours
(C) 24 hours
(D) 365 days

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

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

112. If the escape velocity of a rocket from the surface of the Earth is v_e, then the escape velocity of the same rocket from the surface of a planet whose acceleration due to gravity as well as radius are 5 times that of the Earth is

(A) $25\ v_e$
(B) v_e
(C) $5\ v_e$
(D) $v_e / 5$

113. The acceleration due to gravity is zero at

(A) the equator
(B) poles
(C) sea level
(D) the centre of the Earth

114. If radius of the Earth is R, then the height 'h' at which value of 'g' becomes one-fourth is

(A) R/4
(B) R
(C) 3R/4
(D) R/8

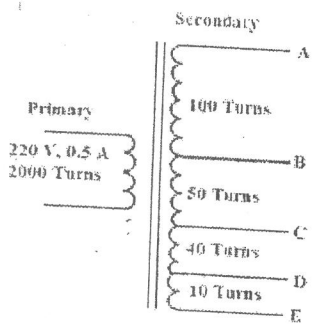
115. The value of 'g' at a particular point is 9.8 m/s^2. Suppose the Earth suddenly shrinks uniformly to half its present size without losing any mass. The value of 'g' at the same point (assuming that the distance of the point from the centre of Earth does not shrink) will now be

(A) 4.9 m/s^2
(B) 9.8 m/s^2
(C) 3.1 m/s^2
(D) 19.6 m/s

116. Two identical circular loops of metal wire are lying on a table without touching each other. Loop A carries a current which increases with time. In response the loop B

(A) remain stationary
(B) is repelled by the loop A
(C) is attracted by the loop A
(D) rotates about its CM with CM fixed

117. In the transformer shown in the figure, the secondary winding has taps A, B, C, D and E. The number of turns between taps A and B is 100. The number of turns between taps B and C is 50, the number of turns between C and D is 40 and that between D and E is 10. The primary has 2000 turns and is connected to 220 volt A.C. mains. Between which taps will you obtain 5.5 volt output?



(A) Between A and B
(B) Between A and B as well as B and E
(C) Between B and C as well as C and E
(D) Between C and D

118. Air-core coils are practically free from

(A) hysteresis losses
(B) eddy current losses
(C) Both (A) and (B)
(D) None of the above

119. Which of the following circuit elements will oppose the change in circuit current?

(A) Capacitance
(B) Inductance
(C) Resistance
(D) All of the above

120. A laminated iron core has reduced eddy-current losses because

(A) more wire can be used with less D.C. resistance in coil
(B) the laminations are insulated from each other
(C) the magnetic flux is concentrated in the air gap of the core
(D) the laminations are stacked vertically

121. The emf induced in a coil at time t = 0.5 s when the magnetic flux (Φ) linked with the coil changes as $\Phi = t2 - 4t + 2$ Weber is

(A) 3V
(B) 4V
(C) 5V
(D) 6.5V

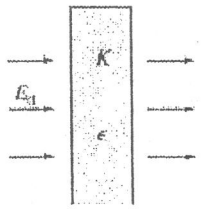
122. The magnetic field lines inside a long, current carrying solenoid are nearly

(A) straight
(B) circular
(C) parabolic
(D) elliptica

123. You are trying to design a motor for a hair dryer manufacturer. For the motor to work properly, a wire must be deflected upward. Which of the following principles could be used to produce this motor effect?

(A) Moving charges experience a force that is perpendicular to both their motion and the electric field they traverse
(B) Moving charges experience a force that is parallel to both their motion and the electric field they traverse
(C) Moving charges experience a force that is perpendicular to both their motion and the magnetic field they traverse
(D) Moving charges experience a force that is parallel to both their motion and the magnetic field they traverse

124. An infinite slab of insulating material with dielectric constant K and permittivity $\varepsilon = K\varepsilon_0$ is placed in a uniform electric field of magnitude E_0. The field is perpendicular to the surface of the material, as shown in the figure. The magnitude of the electric field inside the material is



(A) E_0/K
(B) $E_0/K\varepsilon_0$
(C) E_0K
(D) $E_0K\varepsilon_0$

125. One of the examples of an active device is a/an

(A) electric bulb
(B) transformer
(C) loudspeaker
(D) silicon controlled rectifier

126. A device whose characteristics are very close to that of an ideal current source is a

(A) transistor in common base mode
(B) crystal diode
(C) gas diode
(D) vacuum triode

127. When atoms are held together by the sharing of valence electrons

(A) they form a covalent bond
(B) the valence electrons are free to move away from the atom
(C) each atom becomes free to move
(D) each shared electron leaves a hole

128. In a semiconductor diode, the barrier potential offers opposition to only

(A) majority carriers in both regions
(B) minority carriers in both regions
(C) free electrons in the N regions
(D) holes in the P regions

129. In a PNP transistor the electrons flow

(A) out of the transistor at the collector and base leads
(B) into the transistor at the emitter and base leads
(C) into the transistor at the collector and base leads
(D) out of the transistor at the emitter and base leads

130. The calibration signal usually available from the CRO is

(A) Sine wave voltage
(B) Square wave voltage
(C) Saw-tooth wave voltage
(D) D.C. voltage

131. Lissajous patterns obtained on a CRO can be used to determine

(A) phase shift
(B) voltage amplitude
(C) amplitude distortion
(D) None of the above

132. The digital logic family which has minimum power dissipation is

(A) TTL
(B) RTL
(C) DTL
(D) CMOS

133. How many address bits are required to represent 4K memory?

(A) 5 bits
(B) 12 bits
(C) 8 bits
(D) 10 bits

134. The format used to present the logic output for the various combinations of logic inputs to a gate is called a(n)

A) Boolean constant
(B) Boolean variable
(C) truth table
(D) input logic function

135. The Boolean expression for a 3-input AND gate is

(A) X = AB
(B) X = ABC
(C) X = A + B + C
(D) X = AB + C

136. An antenna is a device

(A) that converts electromagnetic energy into radio frequency signal
(B) that converts guided electromagnetic waves into free space electromagnetic waves and vice-versa
(C) that converts radio frequency signal into electromagnetic energy
(D) None of the above

137. Range of frequencies allotted for commercial FM radio broadcast is

(A) 88 to 108 kHz
(B) 88 to 108 MHz
(C) 8 to 88 MHz
(D) 88 to 108 GHz

138. Typical human voice is centered around

(A) 200-400 Hz
(B) 280-3000 Hz
(C) 400-6000 Hz
(D) 400-1800 Hz

139. In TV transmission

(A) AM is used for sound signal and FM for picture signal
(B) FM is used for sound signal and AM for picture signal
(C) FM is used for both sound signal and picture signal
(D) AM is used for both sound signal and picture signal

140. An AM wave is represented by the expression $v = 5(1+0.6\cos 6280t) \sin 221 \times 104t$ volts. What are the maximum and minimum amplitudes of the AM wave?

(A) 8, 2
(B) 5, 3
(C) 10, 2
(D) 10, 3

141. Which of the following can be used to generate a pulse whenever triggered?

(A) Flip-flop
(B) Monostable multivibrator
(C) Astable multivibrator
(D) Schmitt trigger

142. Give the decimal value of binary 10010

(A) 6_{10}
(B) 9_{10}
(C) 18_{10}
(D) 20_{10}

143. In a fiber-optic cable, the signal is propagated along the inner core by

(A) reflection
(B) refraction
(C) modulation
(D) None of the above

144. A convex lens is called

(A) converging lens
(B) diverging lens
(C) both converging and diverging lens
(D) refracting lens

145. SI unit of the power of a lens is

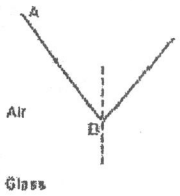
(A) dioptre
(B) cm
(C) metre
(D) watt

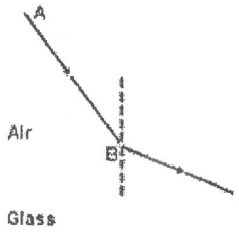
146. A candle is placed in front of a convex mirror. The image produced by the mirror is

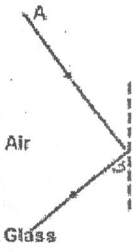
(A) real, inverted and magnified
(B) real, inverted and demagnified
(C) virtual, upright and magnified
(D) virtual, upright and demagnified

147. A light ray AB is incident obliquely on the surface of a glass block. Which of the following diagrams represents the refracted ray?

(A)


(B)


(C)


(D)


148. Compared to a proton an alpha particle has

(A) the same mass and twice the charge
(B) twice the mass and the same charge
(C) twice the mass and four times the charge
(D) four times the mass and twice the charge

149. What is conserved in a photon-particle collision?

(A) Momentum only
(B) Energy only
(C) Mass only
(D) Mass, energy and momentum

150. According to the exclusion principle, no two electrons in an atom can have the same

(A) spin direction
(B) speed
(C) orbit
(D) set of quantum numbers

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