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ROLL No.

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TEST BOOKLET No.

1015

TEST FOR POST GRADUATE PROGRAMMES

PHYSICS

Maximum Marks: 450

Time: 2 Hours

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 corresponding to the correct response fully by a **Ball Point Pen** 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 happening, 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.

**PHYSICS**

1. The radius of the orbit of a planet is 2 times that of the Earth. The time period of the planet is
 - (A) 2.8 years
 - (B) 4.2 years
 - (C) 5.6 years
 - (D) 7 years

2. A rope of 1 cm dia breaks if the tension exceeds 500 N. What will be the tension that breaks the rope of 2 cm dia?
 - (A) 250 N
 - (B) 1000 N
 - (C) 500 N
 - (D) 2000 N

3. A wooden square block with a metal coin placed on its top floats in a beaker and the length of the block immersed into the water is L . The height of the water level is H . If the coin falls in the water, then
 - (A) L increases and H decreases
 - (B) both L and H decrease
 - (C) both L and H increase
 - (D) L decreases and H increases

4. A Carnot engine has the same efficiency between 200 K and 500 K and T and 900 K. Find T .
 - (A) 450 K
 - (B) 360 K
 - (C) 180 K
 - (D) 200 K

5. A body executing SHM has maximum acceleration 24 m^{-2} and maximum velocity 16 m^{-2} . The amplitude of SHM is
 - (A) $(3/32) \text{ m}$
 - (B) $(1024/9) \text{ m}$
 - (C) $(32/3) \text{ m}$
 - (D) $(64/9) \text{ m}$



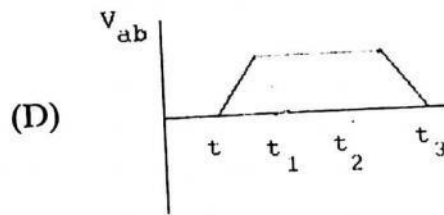
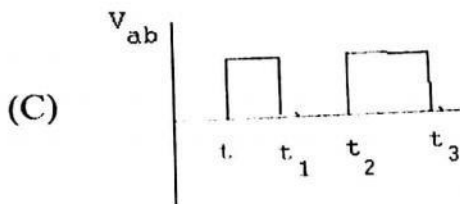
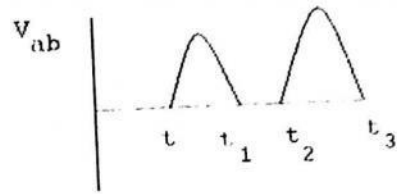
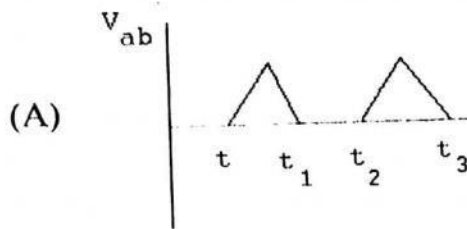
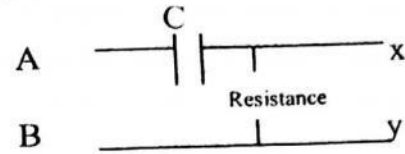
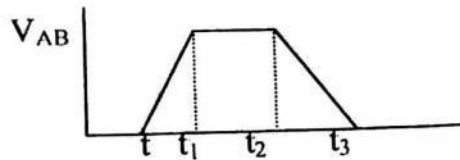
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6. The equation of a standing wave produced on a string fixed at both the ends is $y = 0.4 \sin(0.314x) \cos(600\pi t)$ (where x is in cm, t is in seconds). The smallest length of the string would be
- (A) 30 cm (B) 40 cm
(C) 10 cm (D) None of the above
7. The phenomenon of beats can take place
- (A) for sound waves only
(B) for transverse waves only
(C) for longitudinal waves only
(D) for both longitudinal and transverse waves
8. Two identical spheres each of radius r and charge q are separated by a distance d ($d \gg r$). If a copper block of thickness $l \leq r$ is placed between the two spheres, the force between the two spheres is
- (A) $q^2 / 4\pi\epsilon_0 r^2$ (B) $q^2 / 4\pi\epsilon_0 (r-1)^2$
(C) $q^2 / 4\pi\epsilon_0 (r-1)$ (D) None of the above
9. 4×10^{20} eV energy is required to move a charge of 0.25 C from x to y . The potential difference between x and y is
- (A) 256 V (B) 20 V
(C) 356 V (D) None of the above

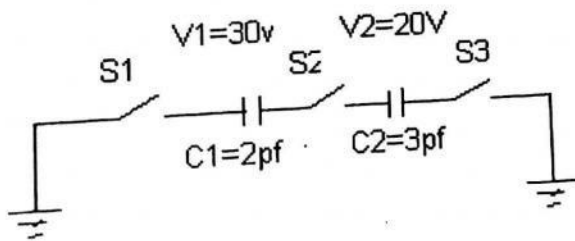


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10. Varying voltage as shown in the figure is applied to AB terminal of the RC circuit shown. The output across XY will be



11. Find the correct statement for the circuit shown in the figure

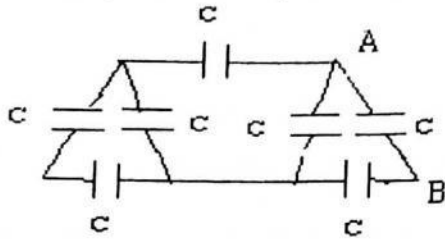


- (A) With S1 closed, $V_1=15\text{ V}$, $V_2=20\text{ V}$
- (B) With S3 closed, $V_1 = V_2=25\text{ V}$
- (C) With S1 and S2 closed, $V_1=V_2=0$
- (D) With S1 and S3 closed, $V_1=30\text{ V}$, $V_2=20\text{ V}$



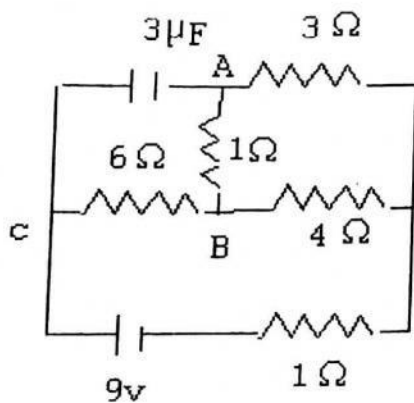
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12. The equivalent capacitance across AB is



- (A) $21c/13$ (B) $7c/8$
(C) $8c/13$ (D) $13c/21$

13. Find the potential drop across the capacitor in the given circuit.



- (A) 6 V (B) 6.5 V
(C) 7 V (D) 5 V

14. A wire of length l and resistance R is doubled by stretching. The new resistance is

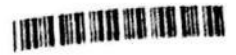
- (A) $4R$ (B) $2R$
(C) $8R$ (D) $R/2$

15. An ammeter reads up to 1 A. Its internal resistance is 0.81Ω . To increase the range to 10 A, the value of the required shunt is

- (A) 0.3Ω (B) 0.9Ω
(C) 0.09Ω (D) 0.03Ω

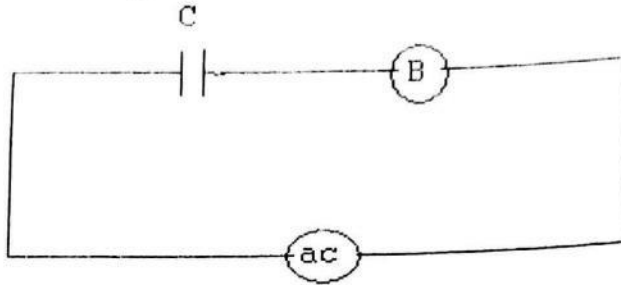
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16. A charged particle moves along a circle under the action of possible electric and magnetic fields. Which of the following is possible?
- (A) $E = 0, B = 0$ (B) $E \neq 0, B = 0$
(C) $E = 0, B \neq 0$ (D) $E \neq 0, B \neq 0$
17. The force experienced by charged particle in a magnetic field is maximum when the particle moves in a direction
- (A) making an angle 45° with the magnetic field
(B) parallel to the magnetic field
(C) is at rest
(D) perpendicular to the magnetic field
18. A proton and an α particle enter a magnetic field with same KE. Then the ratio of radius described by them is
- (A) 2:1 (B) 4:1
(C) 1:4 (D) 1:1
19. A paramagnetic substance is kept in a magnetic field. Which of the statements is correct?
- (a) If magnetic field is increased magnetisation increases
(b) If temperature increases magnetization increases
- (A) Both (a) and (b) are true (B) (a) is true but (b) is false
(C) (b) is true and (a) is false (D) Both (a) and (b) are false
20. If relative permeability of a substance is 0.89, then it is
- (A) ferromagnetic (B) paramagnetic
(C) antiferromagnetic (D) diamagnetic
21. An electric bulb is designed to operate at 12 V DC. It is connected to AC and gives same brightness. Then peak AC voltage is
- (A) 12 V (B) 24 V
(C) $12\sqrt{2}$ V (D) $12/\sqrt{2}$ V



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22. If a dielectric of relative permittivity k is introduced in the capacitor C in the figure, then



- (A) brightness of bulb increases
(B) brightness decreases
(C) brightness remains same
(D) None of the above
23. The relative permittivity of a material is 3.24. The speed of light in it is
- (A) $0.91 \times 10^8 \text{ ms}^{-1}$ (B) $1.67 \times 10^8 \text{ ms}^{-1}$
(C) $2.8 \times 10^7 \text{ ms}^{-1}$ (D) $1.67 \times 10^7 \text{ ms}^{-1}$
24. A lens has focal length 10cm. An object is placed 15 cm in front of it. Where should a convex mirror be placed so that image is formed at the object itself? (Focal length of the convex mirror is 12 cm)
- (A) 6 cm from lens (B) 8 cm from lens
(C) 5 cm from lens (D) 4 cm from lens
25. The wavelength of sodium light in air is 5890 \AA and the velocity of light in air is $3 \times 10^8 \text{ m/s}$. The wavelength of sodium light in glass ($\mu = 1.6$) is
- (A) 5890 \AA (B) 3680 \AA
(C) 9424 \AA (D) None of the above



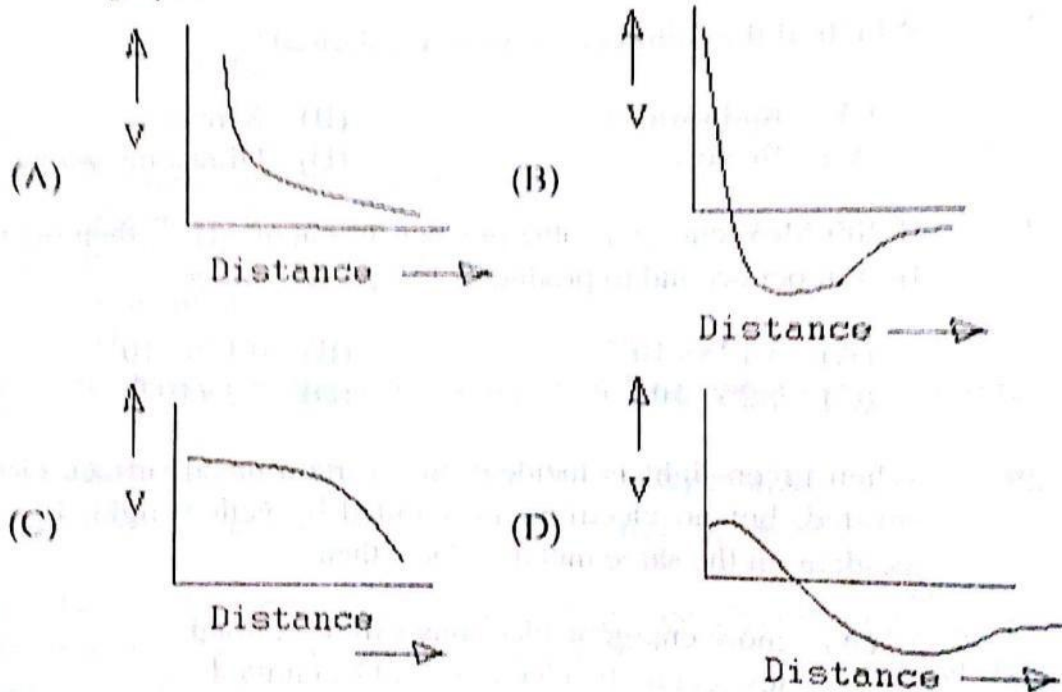
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26. A double slit experiment is performed with $\lambda = 500 \text{ nm}$. A thin film of thickness $2 \mu\text{m}$, and refractive index of 1.5 is introduced in the path of upper beam. The location of central maxima
- (A) will remain unshifted
 - (B) shifts downward by nearly 2 fringes
 - (C) shifts upward by nearly 2 fringes
 - (D) shifts downward by 10 fringes
27. Which of the following cannot be polarised?
- (A) Radiowaves
 - (B) X-rays
 - (C) IR rays
 - (D) Ultrasonic waves
28. If 200 MeV energy is obtained per fission of ${}_{92}\text{U}^{235}$, then the number of fission per second to produce 1 kW power will be
- (A) 3.125×10^{13}
 - (B) 0.125×10^{13}
 - (C) 1.25×10^{18}
 - (D) 3.2×10^{-8}
29. When green light is incident on a certain metal surface electrons are emitted, but no electrons are emitted by yellow light. If red light is incident on the same metal surface, then
- (A) more energetic electrons will be emitted
 - (B) less energetic electrons will be emitted
 - (C) emission of electrons will depend on the intensity of light
 - (D) no electrons will be emitted
30. In a double slit experiment, instead of taking slits of equal widths, one slit is made twice as wide as the other. Then in the interference pattern
- (A) the intensities of the maxima and the minima increase
 - (B) the intensity of the maxima increases and the minima has zero intensity
 - (C) the intensity of the maxima decreases and that of the minima increases
 - (D) the intensity of the maxima decreases and the minima has zero intensity

31. If shortest wavelength of Lyman series is 911\AA , then that of Paschen series is

- (A) 4600\AA (B) 5500\AA
 (C) 7300\AA (D) 8200\AA

32. Which of the following represents the interatomic distance versus potential graph?



33. As mass number increases, which of the following does not change?

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

34. The transition of electron from $n = 4, 5, 6, \dots$ to $n = 3$ corresponds to

- (A) Lyman series (B) Balmer series
 (C) Paschen series (D) None of the above



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35. For the expression $P = X + XY$, how many gates are required for its implementation?
- (A) 2 (B) 3
(C) 1 (D) None
36. A unit cell defined by sides $a \neq b \neq c$ and angles $\alpha \neq \beta \neq \gamma$ is
- (A) triclinic (B) monoclinic
(C) orthorhombic (D) hexagonal
37. Which of the following is not correct?
In Bohr model of hydrogen atom,
- (A) the radius of n^{th} orbit is proportional to n^2
(B) the total energy of electron in n^{th} orbit is proportional to n .
(C) the angular momentum of an electron in an orbit is an integral multiple of $h/2\pi$
(D) the magnitude of the potential energy of an electron in any orbit is greater than its kinetic energy
38. A truck is moving with a velocity 36 km/h. On seeing red light, it decelerates at 2 m/s. The reflex time of the driver is 0.4 s. How much distance the truck will travel before coming to a stop?
- (A) 25 m (B) 29 m
(C) 35 m (D) None of the above
39. Lithium metal has a body-centered cubic unit cell. How many lithium atoms are there in a unit cell?
- (A) 2 (B) 1
(C) $\frac{1}{2}$ (D) 3



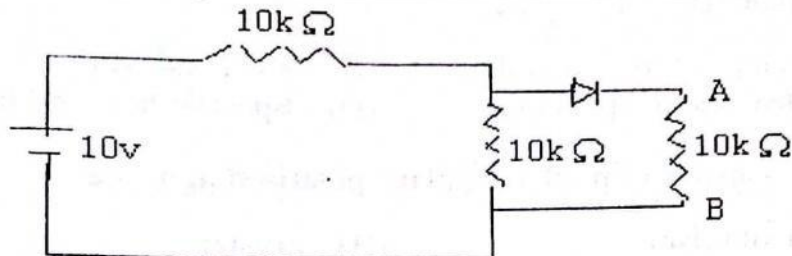
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40. A ball is thrown horizontally and another is just dropped from the top to down. Which will reach the ground first?
- (A) First ball
 - (B) Second ball
 - (C) Both will reach at same time
 - (D) Depends upon the masses of the balls
41. Particle nature and wave nature of electromagnetic waves and electrons can be shown by
- (A) deflection of electrons by metal sheet
 - (B) diffraction and reflection of x-rays by a thick metal sheet
 - (C) diffraction and refraction of light
 - (D) photo electricity and electron microscopy
42. Gases begin to conduct electricity at low pressure because
- (A) at low pressure, gases turn into plasma
 - (B) colliding electrons can acquire higher kinetic energy due to increased mean free path leading to ionization of atoms.
 - (C) atom break up into electrons and protons
 - (D) the electrons in atoms can move freely at low pressure
43. Source of the Sun's energy is
- (A) burning of hydrogen
 - (B) fission reactions involving hydrogen
 - (C) fusion reactions involving hydrogen
 - (D) some other source
44. A proton beam is moving parallel. Then the nature of force between them is
- (A) attractive
 - (B) repulsive
 - (C) attractive or repulsive depends upon the magnitude of velocity
 - (D) None of the above



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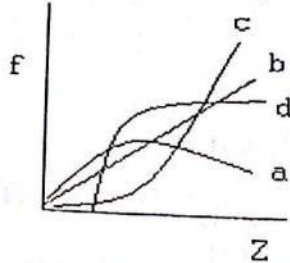
45. In the figure, potential difference between A and B is



- (A) 0
(B) 5 V
(C) 10V
(D) 15V
46. GaAs is
(A) element semiconductor
(B) alloy semiconductor
(C) bad conductor
(D) metallic semiconductor
47. If the electron in He^+ is in 2nd excited state, then the KE is
(A) 13.6eV
(B) -13.6eV
(C) -6.04eV
(D) 6.04eV
48. If in an AC circuit $X_L = X_C$, then the value of power factor will be
(A) 0
(B) $\frac{1}{2}$
(C) 1
(D) α
49. Which of the following is not an electromagnetic radiation?
(A) Heat rays
(B) X-rays
(C) γ ray
(D) β ray
50. Find the work required to compress adiabatically 1 g of air initially at NTP to half its volume. Density of air at NTP = $0.001129 \text{ gcm}^{-3}$ and $(C_p/C_v) = 1.4$
(A) 62.64J
(B) 32.64J
(C) -32.64J
(D) -62.64 J



58. Which of the following graphs best represents Moseley's Law? In other words, which graph best represents the frequency of characteristic X-ray with atomic number Z ?



- (A) a (B) b
(C) c (D) d
59. A free atom of iron emits X-ray of energy 6.4 keV. Mass of iron atom is 9.3×10^{-26} kg. The recoil energy of the atom is
- (A) 3.9×10^{-4} eV (B) 3.9×10^4 eV
(C) 2.13×10^{-24} eV (D) 3.9×10^{-19} eV
60. The kinetic energy of a particle increases by 44%. Find the increase in momentum.
- (A) 40% (B) 12%
(C) 32% (D) 20%
61. If a dancer on a turn table suddenly folds her hands, then the speed of the turn table
- (A) decreases (B) remain unchanged
(C) increases (D) None of the above
62. The density of water is greater than density of air. Even then clouds containing water float. Because
- (A) clouds have large amount of air
(B) clouds actually come down with a very small terminal velocity
(C) clouds actually move up with a very small terminal velocity
(D) the droplets in clouds are in the form of bubbles

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63. Two metal strips constituting a thermostat must differ in
- (A) mass
 - (B) length
 - (C) resistivity
 - (D) coefficient of linear expansion
64. Which of the following is used to make half adder?
- (A) AND
 - (B) XOR
 - (C) OR
 - (D) NOT
65. The diffusion current in a pn junction is
- (A) from n to p side
 - (B) from p to n side
 - (C) n to p side if forward biased and p to n if reverse biased
 - (D) p to n side if forward biased and n to p side if reverse biased
66. While viewing distant object with a telescope, suddenly a housefly sits on the objective lens. Which of the following is a correct statement?
- (A) Housefly will be seen enlarged in image
 - (B) Housefly will be seen reduced in image
 - (C) Intensity of image will be decreased
 - (D) Intensity of image will be increased
67. The wave function for the matter wave associated with a particle of well-defined momentum p and energy E is
- (A) $\psi(r, t) = Ae^{-1/\hbar(Et-p.r)}$
 - (B) $\psi(r, t) = -Ae^{-1/\hbar(Et-p.r)}$
 - (C) $\psi(r, t) = Ae^{1/\hbar(Et-p.r)}$
 - (D) $\psi(r, t) = Ae^{1/\hbar(-Et-p.r)}$



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68. The time dependent Schrodinger's wave equation is

$$\begin{array}{ll} \text{(A)} \quad ih \frac{\partial \psi}{\partial t} = -\frac{h^2}{2m} \frac{\partial^2 \psi}{\partial x^2} + V\psi & \text{(B)} \quad ih \frac{\partial \psi}{\partial t} = \frac{h^2}{2m} \frac{\partial^2 \psi}{\partial x^2} + V\psi \\ \text{(C)} \quad ih \frac{\partial \psi}{\partial t} = -\frac{h^2}{2m} \frac{\partial^2 \psi}{\partial x^2} - V\psi & \text{(D)} \quad ih \frac{\partial \psi}{\partial t} = \frac{h^2}{2m} \frac{\partial^2 \psi}{\partial x^2} - V\psi \end{array}$$

69. The functions Ψ_n and Ψ_k corresponding to unequal Eigen values E_n and E_k that satisfy the condition $\int_{-a}^{+a} \Psi_k \Psi_n dx = 0$ and this represents

- (A) normalisation
(B) probability current density
(C) expectation value
(D) orthogonality

70. Although a photon has no rest mass, yet it behaves in collisions as though it has an inertial mass of

- (A) $h^2\nu/c^2$
(B) $h\nu/c^3$
(C) $h\nu/c^2$
(D) $h\nu/c$

71. A proton of rest mass 1.67×10^{-27} kg is moving with a velocity of 0.9 C. Then its mass is

- (A) 5.41×10^{-27} kg
(B) 3.83×10^{-27} kg
(C) 5.41×10^{-30} kg
(D) 3.83×10^{-30} kg

72. The energy equivalent to 1 g of matter is

- (A) 9×10^{12} J
(B) 9×10^{13} J
(C) 9×10^{14} J
(D) 9×10^{15} J

73. Light coming directly from the Sun through the Earth's atmosphere is

- (A) Linearly polarised
(B) Unpolarised
(C) Circularly polarised
(D) Scattered

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74. The refractive indices of crown glass prism are 1.540, 1.532 and 1.528 for violet, yellow and red colour respectively. Then its dispersive power is
- (A) 1.533 (B) 1.512
(C) 0.022 (D) 0.041
75. A heat engine extracts heat from a source at 327°C , does some external work, and dumps the remaining energy into a heat sink at 127°C . If 600 J of heat is taken from the heat source, how much work does the engine do? (ie. how much heat is dumped into the heat sink?)
- (A) 200 J (B) 400 J
(C) 100 J (D) 300 J
76. The energy of one photon of wavelength 500 nm is ($h = 6.626 \times 10^{-23}$)
- (A) 2.976×10^{-19} J (B) 4.976×10^{-19} J
(C) 3.976×10^{-19} J (D) 1.976×10^{-19} J
77. In a pn junction at the middle of the depletion layer the is maximum
- (A) electric field intensity (B) space charge density
(C) electrostatic potential (D) electro motive force
78. A semiconductor has an electron concentration of 8×10^{13} per m^3 and a hole concentration of 3×10^{14} per m^3 . It is a semiconductor.
- (A) n type (B) p type
(C) intrinsic (D) extrinsic
79. Which one of the following amplifier has highest power gain?
- (A) CE amplifier (B) CB amplifier
(C) CC amplifier (D) Push-pull amplifier



80. In an operational amplifier, when $R_i = 10 \text{ k ohms}$ and $R_f = 10,000 \text{ ohms}$ and an input voltage of 2 mV is connected to the inverting terminal, then the output will be
- (A) $+2 \text{ mV}$ (B) -2 mV
(C) $+20 \text{ mV}$ (D) -20 mV
81. A constant source supplies a current of 300 mA to a load of $1 \text{ k}\Omega$. When the load is changed to 100Ω , the load current will be
- (A) 3 A (B) 30 mA
(C) 300 mA (D) 600 mA
82. Thevenin's equivalent of a circuit consists of
- (A) single current source and a single voltage source
(B) voltage source with a series resistance
(C) current source with a parallel resistance
(D) voltage source with a parallel resistance
83. When a constant current of 1 ampere flows through a self inductance of 10 milli henry , the back e.m.f. produced in the coil is
- (A) 1 volt (B) $1/10 \text{ volt}$
(C) 10^{-2} (D) zero
84. The input control parameter of JFET is
- (A) gate voltage (B) source voltage
(C) drain voltage (D) gate current
85. The racing problem in JK flip flop can be avoided by using at the input clock
- (A) an integrator (B) a differentiator
(C) a multivibrator (D) an AND gate



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86. The maximum clock frequency that can be used with a logic gate having a propagation delay of 75 ns is
- (A) 13.3 MHz (B) 7.5 MHz
(C) 75 GHz (D) 13.3 GHz
87. Modification of light intensity due to superposition of light waves is known as
- (A) interference (B) diffraction
(C) polarisation (D) dispersion
88. The speed of yellow light in a certain liquid is measured to be 1.29×10^8 m/s. Then the refractive index of the liquid is
- (A) 1.56 (B) 1.65
(C) 1.92 (D) 1.78
89. Electron microscope has higher resolving power than ordinary optical microscope, because
- (A) electrons are particles
(B) wave length of electron wave is much larger
(C) wavelength of electron wave is much smaller
(D) electrons are easily reflected by the object
90. To achieve higher dispersion with grating, one must work with
- (A) higher order of diffraction and smaller grating spacing
(B) higher order of diffraction and larger grating spacing
(C) smaller order of diffraction and larger grating spacing
(D) smaller order of diffraction and smaller grating spacing
91. For an optical fibre, if the refractive index of core is 1.55 and the refractive index of cladding is 1.5, then its numerical aperture is
- (A) 0.39 (B) 0.22
(C) 0.45 (D) 0.62



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92. What is the frequency of the fundamental note of a string of 1 meter long and weighing 2×10^{-3} kg when stretched by a weight of 400 kg?
- (A) 500 Hz (B) 300 Hz
(C) 700 Hz (D) 600 Hz
93. The ratio of the volume of atoms to the total volume available in a simple cubic lattice is
- (A) 68% (B) 52%
(C) 74% (D) 100%
94. Coordination number for face centered cubic structure is
- (A) 12 (B) 8
(C) 6 (D) 4
95. In three dimension, there are crystal systems, Bravais lattices and point groups
- (A) 7,14,32 (B) 5,7,14
(C) 5,7,21 (D) 7,12,14
96. The crystalline bonding in diamond is
- (A) covalent (B) ionic
(C) metallic (D) van der Waals
97. For the plane whose intercepts are $4a$, $2b$ and $3c$ along the axes x , y and z , the Miller indices are
- (A) (111) (B) (1 2 4)
(C) (3 6 4) (D) (4 6 3)
98. The polarisation P in a solid dielectric is related to the dielectric field E and the electric flux density D by the relation
- (A) $E = \epsilon_0 D + P$ (B) $D = E + \epsilon_0 P$
(C) $D = E \epsilon_0 + P$ (D) $D = \epsilon_0 (E + P)$



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99. Superconductors when cooled below T_c undergo a transition to the following state
- (A) Paramagnetic
(B) Ferromagnetic
(C) Diamagnetic
(D) Ferrimagnetic
100. In superconducting state
- (A) entropy and thermal conductivity decreases
(B) entropy and thermal conductivity increases
(C) entropy increases and thermal conductivity decreases
(D) entropy decreases and thermal conductivity increases
101. In the case of ferrimagnetic materials the spin moments associated with two sets of atoms are aligned
- (A) parallel but of unequal magnitude
(B) antiparallel but of equal magnitude
(C) antiparallel but of unequal magnitude
(D) parallel but of equal magnitude
102. The conductivity of semiconductors is in the order of
- (A) 10^3 to 10^{-3} mho cm^{-1}
(B) 10^5 to 10^{-3} mho cm^{-1}
(C) 10^2 to 10^{-5} mho cm^{-1}
(D) 10^6 to 10^{-6} mho cm^{-1}
103. The intensity of a laser beam of 5 mW power having a diameter of 1.2 mm is (assuming uniform intensity across the beam)
- (A) 4.42×10^3 W/m²
(B) 6.42×10^3 W/m²
(C) 8.42×10^3 W/m²
(D) 10.42×10^3 W/m²
104. Hall effect is useful in determining
- (A) neither the number density of charge carriers nor their type
(B) the number density of charge carriers but not their type
(C) not the number of charge carriers but their type
(D) the number density of charge carriers and also their type



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105. If $\vec{r} = (\vec{i}x + \vec{j}y + \vec{k}z)$, then $\nabla \cdot \vec{r}$ is
- (A) r (B) 0
(C) 3 (D) 1
106. Stokes theorem is valid for
- (A) any surface of unit area (B) open surface
(C) closed surface (D) None of the above
107. The center of mass of a system of particles does not depend on
- (A) mass of the particles
(B) position of the particles
(C) forces on the particles
(D) relative distance between particles
108. Kepler's second law regarding the constancy of areal velocity of planet is a consequence of
- (A) energy (B) distance
(C) linear momentum (D) angular momentum
109. Dispersion is said to be normal, if the refractive index
- (A) increases monotonically with frequency
(B) decreases monotonically with frequency
(C) is independent of frequency
(D) increases for low frequency but decreases for higher frequency
110. Michelson's Morley experiment proved that
- (A) light velocity depends on the velocity of the source
(B) light travels with different velocities in different inertial frames
(C) light velocity is independent of the velocity of source
(D) None of the above



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111. The de Broglie wavelength of an electron of mass m and velocity v is
- (A) mvh (B) h/mv
(C) mv^2/h (D) m/hv
112. Under Lorentz transformation, the velocity of photon
- (A) increases (B) remains constant
(C) decreases (D) becomes zero
113. For which rays do crystals act as three dimensional grating?
- (A) Light rays (B) X-rays
(C) Cathode rays (D) Gamma rays
114. Which one of the following is a Fermion?
- (A) Photon (B) Meson
(C) Electron (D) He^4 particle
115. The linear momentum of the photon of frequency ν is
- (A) Zero (B) $h\nu/c$
(C) $h\nu$ (D) $h/2\pi$
116. Optical spectrum arises from the excitation of
- (A) Core electrons (B) Free electrons
(C) Conduction electrons (D) Valance electrons
117. The splitting of the spectral lines when the radiating source is placed in a magnetic field is called
- (A) Raman effect (B) Stark effect
(C) Meissner effect (D) Zeeman effect



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118. Two monochromatic light beams of intensities I and $4I$ are superposed. The maximum and minimum possible intensities in the resulting beam are
- (A) $5I$ and I (B) $5I$ and $3I$
(C) $9I$ and I (D) $9I$ and $3I$
119. Colour in a thin soap film seen during day time is due to
- (A) reflection of light (B) interference of light
(C) diffraction of light (D) refraction of light
120. Numerical aperture of an optical fiber is a measure of
- (A) attenuation of light signals in the fiber
(B) difference between the refractive indices of core and the cladding
(C) light gathering power of the fiber
(D) signal distortion in the fiber
121. The half life of Po^{218} is 3 minutes. What fraction of 10 gm of the sample of Po^{218} will remain after 15 minutes?
- (A) $1/5$ (B) $1/32$
(C) $1/64$ (D) $1/25$
122. After 2 hours $1/16$ of the initial amount of a certain radioactive isotope remains unchanged. The half-life of the isotope is
- (A) 15 minutes (B) 45 minutes
(C) 30 minutes (D) 3 minutes
123. There are 3 lamps of a given radioactive substance. Their activities are in the ratio of $1:2:3$ now. What will be the ratio of their activities at any future date?
- (A) $1:2:3$ (B) $3:2:1$
(C) $2:1:3$ (D) $2:3:1$

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124. The decay of artificial radioactive isotopes is accompanied by the emission of
- (A) alpha particle
(B) beta particle
(C) meson
(D) positron
125. The size of the atomic nucleus is of the order of
- (A) 10^{-8} cm
(B) 10^{-10} cm
(C) 10^{-13} cm
(D) 10^{-14} cm
126. The function of graphite in a nuclear reactor is to
- (A) reduce the energy of the neutrons
(B) slow down the reaction
(C) produce neutrons
(D) absorb neutrons
127. Dulong and Petit's law breaks down seriously at
- (A) room temperature
(B) low temperature
(C) high temperature
(D) triple point of water
128. Relaxation time of free electrons in a metal
- (A) increases with temperature
(B) decreases with temperature
(C) is independent of temperature
(D) increases at low temperature but decreases at higher temperature
129. The output from a full wave rectifier is
- (A) an ac voltage
(B) a dc voltage
(C) a pulsating voltage
(D) zero



130. Two identical fuses are rated at 10 A
- (A) in parallel, the combination acts as a fuse of rating 5 A
 - (B) in parallel, the combination acts as a fuse of rating 20 A
 - (C) in series, the combination acts as a fuse of rating 20 A
 - (D) in series, the combination acts as a fuse of rating 5 A
131. The maximum number of electrons that a shell of quantum number 3 can accommodate is
- (A) 02
 - (B) 06
 - (C) 18
 - (D) 32
132. The superconducting transition temperature in Mercury is
- (A) 100 K
 - (B) 68 K
 - (C) 0.86 K
 - (D) 4.2 K
133. The ionic binding in crystals is due to
- (A) electrostatic interaction between molecules
 - (B) electrostatic interaction between ions
 - (C) electromagnetic interaction between atoms
 - (D) van der Waal's interaction
134. Glass is a
- (A) Crystalline solid
 - (B) Amorphous solid
 - (C) Liquid crystalline material
 - (D) Polymeric material
135. Velocity of sound in air is independent of change in
- (A) temperature
 - (B) humidity
 - (C) pressure
 - (D) speed of wind

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136. The uncertainty relation cannot hold for the following pairs
- (A) position and momentum
 - (B) energy and time
 - (C) linear momentum and angle
 - (D) angular momentum and angle
137. The Poynting vector of a plane electromagnetic wave propagating in the direction \hat{k} is
- (A) perpendicular to \hat{k}
 - (B) parallel to \hat{k}
 - (C) antiparallel to \hat{k}
 - (D) at an angle $\pi/4$ to \hat{k}
138. According to Bohr's principle, the relation between principle quantum number n and radius of the orbit is
- (A) $r \propto \frac{1}{n}$
 - (B) $r \propto n$
 - (C) $r \propto n^2$
 - (D) $r \propto \frac{1}{n^2}$
139. The rate of emission by spontaneous transitions from state 2 to state 1 in an atomic system depends on
- (A) population of the state 2
 - (B) population of the state 1
 - (C) energy density
 - (D) life time of energy state
140. Life time of a metastable state involved in a lasing action is
- (A) of the order of seconds
 - (B) of the order of micro seconds
 - (C) of the order of milli seconds
 - (D) of the order of nano seconds

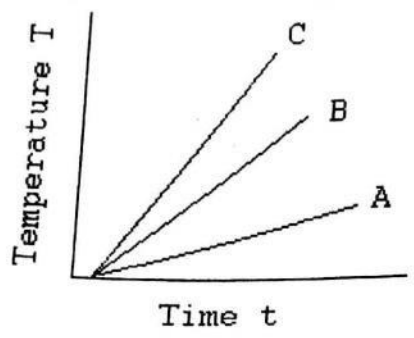


141. Bonding in HF_2^- molecule is
- (A) Ionic (B) Covalent
(C) van der Waals (D) Hydrogen bonding
142. If the entropy of a system remains constant in a thermodynamic process, then the process is
- (A) isobaric (B) isochoric
(C) isothermal (D) adiabatic
143. Dimension of gravitational constant G is
- (A) $\text{M}^{-1}\text{L}^3\text{T}^{-2}$ (B) ML^3T^{-2}
(C) $\text{M}^0\text{L}^3\text{T}^{-1}$ (D) $\text{M}^{-2}\text{L}^1\text{T}^3$
144. Lyman series of spectral lines of Hydrogen atom appears in the
- (A) infrared region (B) ultraviolet region
(C) visible region (D) microwave region
145. Visible region of the electromagnetic spectrum spans from
- (A) 4000 to 7000 A° (B) 5000 to 9000 A°
(C) 5000 to 9000 nm (D) 4000 to 7000 nm
146. Which of the following is true?
- (A) Neither momentum nor kinetic energy is conserved in inelastic collisions
(B) Momentum is conserved in all collisions but kinetic energy is conserved only in inelastic collisions
(C) Momentum is conserved in all collisions but not kinetic energy
(D) Both momentum and kinetic energy are conserved in all collisions



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147. Which of the substances A, B or C has the highest specific heat? The temperature v/s. time graph is shown



- (A) B
- (B) A
- (C) C
- (D) All have equal specific heat

148. Minimum energy required to release the electron from the atom of an element is called

- (A) static energy
- (B) Fermi energy
- (C) photon energy
- (D) work function

149. How many AND gates are required to realize $y = CD + EF + G$?

- (A) 4
- (B) 5
- (C) 3
- (D) 2

150. Which of the following produces the least ripple?

- (A) Single rectifier, half wave and single phase
- (B) Four rectifiers, full wave and single phase
- (C) Two rectifiers, full wave and single phase
- (D) Six rectifiers, full wave and three phase
