61311

ROLL No. | | | | | |

QN. BOOKLET No. **0040**

TEST FOR POST GRADUATE PROGRAMMES

PHYSICS

Time: 2 Hours | Maximum Marks: 450

INSTRUCTIONS TO CANDIDATES

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

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

3. Also write your Roll Number, Test Code, Test Centre Code, Test Centre Name, Test Subject and the date and time of the examination in the columns provided for the same on the **Answer Sheet.** Darken the appropriate bubbles with HB pencil.

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 **HB pencil** corresponding to the correct response as indicated in the example shown on the Answer Sheet. Also write the alphabet of your response with ball pen in the starred column against attempted questions and put an '×' mark by ball pen in the starred column against unattempted questions as given in the example in the OMR Sheet.

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

7. Please do your rough work only on the space provided for it at the end of this question booklet.

8. You should return the Answer Sheet to the Invigilator before you leave the examination hall. However Question Booklet may be retained with the Candidate.

9. Every precaution has been taken to avoid errors in the Question Booklet. In the event of such unforeseen happenings, suitable remedial measures will be taken at the time of evaluation.

10. Please feel comfortable and relaxed. You can do better in this test in a tension-free disposition.

WISH YOU A SUCCESSFUL PERFORMANCE

SEAL

PHYSICS

1. Two bodies of different masses *mx* and *my* are dropped from two different heights, viz., X and Y. The ratio of times taken by the two to drop through these distances is

(A) $X:Y$ (B) $\frac{m_X}{m_Y}:\frac{Y}{X}$

(C) $\sqrt{X}:\sqrt{Y}$ (D) $X^2:Y^2$

2. Which one of the force is non-conservative?

(A) Gravitational force (B) Electromagnetic force
(C) Lorentz force (D) Viscous force

3. For a body moving in a circular path, a condition for no skidding is ($\mu \rightarrow$ coefficient of friction)

(A) $\frac{mv^2}{r} \geq \mu mg$ (B) $\frac{mv^2}{r} \leq \mu mg$

(C) $\frac{mv^2}{r} = \mu mg$ (D) $\frac{v}{r} = \mu g$

4. Which of the vector notation is incorrect, where the notations have usual meanings?

(A) $\vec{V} = \vec{r} \times \vec{\omega}$ (B) $\vec{V} = \vec{\omega} \times \vec{r}$
(C) $\vec{\tau} = \vec{r} \times \vec{F}$ (D) $\vec{L} = \vec{r} \times \vec{\omega}$

5. When a torque acting upon a system is zero, which of the following will be constant?

(A) Force (B) Linear momentum
(C) Angular momentum (D) Linear impulse

6. The escape velocity of a body thrown vertically upwards from the surface of the Earth is

(A) 2.3 km/sec. (B) 11.2 km/sec.
(C) 6.467 km/sec. (D) 7.92 km/sec.

7. The maximum acceleration of S.H.M. is α and the maximum velocity is β. The amplitude of S.H.M. will be

(A) $\frac{\beta^2}{\alpha}$ (B) $\frac{\alpha^2}{\beta}$

(C) $\alpha\beta$ (D) $\frac{1}{\alpha\beta}$

8. The potential energy function for the force between two atoms in a diatomic molecule is expressed as $U(x)=\frac{a}{x^{12}}-\frac{b}{x^6}$ where a and b are positive constants and x is the distance between the atoms. If $U(x)$ is minimum, x is equal to

(A) $\left(\frac{a}{b}\right)^{1/2}$ (B) $\left(\frac{2a}{b}\right)^{1/6}$

(C) $(ab)^{1/6}$ (D) $(2ab)^{1/6}$

9. If the distance between the two masses is doubled, the gravitation between them

(A) remains constant (B) decreases by $\frac{1}{4}$

(C) decreases by $\frac{1}{2}$ (D) increases by $\frac{1}{4}$

10. The most characteristic property of a liquid is

(A) elasticity (B) fluidity
(C) formlessness (D) volume conservation

11. The excess pressure inside a soap bubble or a drop is proportional to

(A) square of the radius
(B) its radius
(C) reciprocal to its radius
(D) reciprocal of the square of the radius

12. Mean free path of the molecules of a gas depends on the molecular diameter (σ) as

(A) σ (B) σ^{-2}

(C) σ^{2} (D) σ^{-4}

13. The density of a gas is $6\times10^{-2}\,kg/m^{3}$ and the root mean square velocity of the gas molecules is $500\,m/s$. The pressure exerted by the gas on the walls of the vessel is

(A) $5\times10^{-3}\,N/m^{2}$ (B) $1.2\times10^{-4}\,N/m^{2}$

(C) $0.83\times10^{-4}\,N/m^{2}$ (D) $30\,N/m^{2}$

14. A nuclear fusion reaction will occur in a gas of deuterium nuclei when the nuclei have an average kinetic energy of at least $0.72MeV$. If $1eV=1.6\times10^{-19}\,J$, the temperature required for nuclear fusion to occur with deuterium is about

(A) $5\times10^{9}\,K$ (B) $5\times10^{11}\,K$

(C) $5\times10^{10}\,K$ (D) $5\times10^{8}\,K$

15. Entropy remains constant during an

(A) adiabatic reversible process
(B) isothermal reversible process
(C) adiabatic irreversible process
(D) isothermal irreversible process

16. The thermo-electric thermometer is based on the principle of

(A) Peltier effect
(B) Seebeck effect
(C) Thomson effect
(D) Change in susceptibility of a substance with temperature

17. The average energy of Plank's oscillator of frequency υ is

(A) $E\upsilon = \frac{(h\upsilon)}{e^{h\upsilon/KT} - 1}$ (B) $E\upsilon = \frac{(h\upsilon - 1)}{e^{h\upsilon/KT}}$

(C) $E\upsilon = \frac{h\upsilon}{e^{(h\upsilon+1)^2}}$ (D) $E\upsilon = \frac{(h\upsilon)^2}{e^{(h\upsilon+1)^2}}$

18. A phase difference of π between two waves reaching a point is equal to

(A) a path difference of $\lambda/2$ (B) a path difference of λ

(C) a path difference of 2λ (D) a path difference of $\lambda/4$

19. In biprism experiment the coherent sources are obtained

(A) by division of wavefront (B) by division of amplitude
(C) by diffraction (D) by reflection

20. How the interference pattern in Young's double slit experiment will be affected if the sodium (yellow) light is replaced by red light of the same intensity?

(A) The fringe width will increase
(B) The fringe width will decrease
(C) The fringes will disappear
(D) The fringes will become brighter

21. Optically active substances are those substances which

(A) produce double refraction
(B) produce polarised light
(C) rotate the plane of polarisation of polarised light
(D) converts a plane polarised light into circularly polarised light

22. In a compound microscope the final magnifying power (M) and magnifying powers of objective (m_1) and eye piece (m_2) bear the following relationship

(A) $M = m_1 m_2$ (B) $M = \frac{m_1}{m_2}$

(C) $M = \frac{m_2}{m_1}$ (D) $M = (m_1 m_2)^2$

23. D and f are least distances of distinct vision and focal length of a convex lens respectively. Magnifying power of a convex lens can be expressed as

(A) $1 - \frac{D}{f}$ (B) $1 + \frac{D}{f}$

(C) $1 + \frac{f}{D}$ (D) $1 - \frac{f}{D}$

24. The minimum distance between the real object and real image of a convex lens is

(A) 4 times the focal length
(B) twice the focal length
(C) equal to the focal length
(D) one-fourth of the focal length

25. At what speed a source must move towards a stationary observer so that the apparent frequency may be double the true frequency of the source

(A) $2V$ (B) V

(C) $V/2$ (D) $V/4$

26. The Earth's magnetic field always has a vertical component except at the

(A) magnetic equator (B) geographical north pole
(C) magnetic poles (D) latitude 45°

27. A steel wire of length l has a magnetic moment M. It is then bent into a semi circular arc. The new magnetic moment will be

(A) M/π (B) $2M/\pi$

(C) M/l (D) M

28. When a specimen of magnetic material is taken through a cycle of magnetisation and when magnetising field is made zero then the residual magnetism left behind is called

(A) hysteresis loss (B) coersivity

(C) retentivity (D) hysteresis

29. A bar magnet of magnetic moment M is cut into two parts of equal length. The magnetic moment of either part is

(A) $2M$ (B) $M/2$

(C) $M/4$ (D) $M/8$

30. A cylinder of radius R and length L is placed in a uniform electrical field E parallel to the axis of the cylinder. The total flux for the surface of the cylinder is given by

(A) $2\pi R^2 E$ (B) $\pi R^2/E$

(C) $\frac{\pi r^2 + \pi R^2}{4}$ (D) zero

31. A pendulum bob of mass $80mg$ and carrying a charge of $2\times10^{-8}C$ is at rest in a horizontal uniform electric field of $20KV/m$. The tension in the thread of the pendulum is

(A) $2.2\times10^{-4}N$ (B) $4.4\times10^{-4}N$

(C) $8.8\times10^{-4}N$ (D) $17.6\times10^{-4}N$

32. A conducting sphere of radius r carries a charge q. The total energy stored in the surrounding space is

(A) $q^2/8\pi\varepsilon_0 r$ (B) $q^2/2\pi\varepsilon_0 r$

(C) $q^2/4\pi\varepsilon_0 r$ (D) $q/\varepsilon_0 r$

33. Energies of electrons can be increased by allowing them

(A) to fall from a great height
(B) to fall through electric potential
(C) to pass through lead blocks
(D) to move in high magnetic fields

34. A soap bubble of radius R is in equilibrium with outside and inside pressure equal. If T be the surface tension of soap solution, then the soap bubble must have a potential in volts equal to

(A) $\left(\frac{8TR}{\varepsilon_o}\right)^{1/2}$ (B) $\left(\frac{8T_0}{\varepsilon_o R}\right)^{1/2}$

(C) $\left(\frac{R}{\varepsilon_o T}\right)^{1/2}$ (D) $(8TR\varepsilon_0)^{1/2}$

35. The empty space between the plates of a capacitor is filled by a liquid of dielectric constant K. The capacitance of the capacitor

(A) increases by a factor K (B) decreases by a factor K
(C) increased by a factor K^2 (D) decreased by a factor K^2

36. A coil of inductance 50 henries is joined to the terminals of a battery of *e.m.f.* 2 volts through a resistance of 10Ω. The time constant of the circuit is

(A) 50 secs. (B) 20 secs.

(C) $1/5$ secs. (D) 5 secs.

37. The magnitude of induced electro magnetic field in a conductor depends upon

(A) resistance of the conductor only
(B) strength of the magnetic field only
(C) rate of change of flux linkage with the conductor
(D) orientation of the conductor only

38. The Peltier coefficient of a couple of metals A and B at junction temperature T is given by

(A) $\pi_{AB} = \frac{1}{T}\frac{dE}{dT}$ (B) $\pi_{AB} = T\frac{d^2E}{dT^2}$

(C) $\pi_{AB} = T\frac{dE}{dT}$ (D) $\pi_{AB} = \frac{1}{T}\frac{d^2E}{dT^2}$

39. The particle accelerator that uses the phenomenon of electro magnetic induction is the

(A) betatron (B) cyclotron
(C) Cockroft-Walton generator (D) Van de Graaf generator

40. A copper rod of length l is rotated about the end perpendicular to the uniform magnetic field B with constant angular velocity ω The induced *e.m.f.* between the two ends is

(A) $\frac{1}{2}B\omega l^2$ (B) $B\omega l^2$

(C) $2B\omega l^2$ (D) $4B\omega l^2$

41. In a step down transformer the input voltage is $22KV$ and the output voltage is $550V$. The rate of number of turns in the secondary to primary is

(A) 1 : 20 (B) 20 : 1
(C) 1 : 40 (D) 40 : 1

42. The natural frequency of L-C circuit is equal to

(A) $\frac{(LC)^{1/2}}{2\pi}$ (B) $\frac{1}{2\pi(LC)^{1/2}}$

(C) $\frac{1}{2\pi}\left(\frac{L}{C}\right)^{1/2}$ (D) $\frac{1}{2\pi}\left(\frac{C}{L}\right)^{1/2}$

43. The Maxwell's equation $\vec{\nabla} \times \vec{E}$ could be directly derived from

(A) Biot-Savart's law
(B) Ampere's law
(C) Gauss law
(D) Faraday's law

44. A charged particle of charge q and mass m moves with a velocity V in a circular path due to transverse magnetic field B. Its gyro frequency is

(A) $\frac{qB}{2\pi m}$
(B) $\frac{qmVB}{2\pi}$
(C) $\frac{VB}{2\pi qm}$
(D) $\frac{qVB}{2\pi m}$

45. The velocity of an electron in the n^{th} orbit of hydrogen atom is given by

(A) $V_n = \frac{2\pi ke^2}{n^2h^2}$
(B) $V_n = \frac{2\pi ke^2}{nh}$
(C) $V_n = \frac{nh}{2\pi ke^2}$
(D) $V_n = \frac{\gamma^2 h^2}{2\pi ke^2}$

46. If V be the accelerating voltage, then the maximum frequency of continuous X-rays is given by

(A) $\frac{eh}{V}$
(B) $\frac{hV}{e}$
(C) $\frac{eV}{h}$
(D) $\frac{h}{eV}$

47. Bragg's equation will have no solution, if

(A) $\lambda > 2d$
(B) $\lambda < 2d$
(C) $\lambda < d$
(D) $\lambda = d$

48. A particle of mass $10^{-31} kg$ is moving with a velocity equal to $10^5 m/\text{sec}$. The wavelength of the particle is equal to

(A) zero
(B) $6.6 \times 10^{-8} m$
(C) $0.66m$
(D) $1.5 \times 10^7 m$

49. According to Yukawa theory of nuclear forces, the origin of nuclear force between nucleons is due to exchange of

(A) mesons
(B) photons
(C) positrons
(D) electrons

50. The size of the atomic nucleus is of the order of

(A) $10^{-15}m$
(B) $10^{-8}m$
(C) $10^{-6}m$
(D) $0.01m$

51. The half life of radium is 1600 years. The fraction of the sample of radium that would remain after 6400 years is

(A) $1/2$
(B) $1/4$
(C) $1/8$
(D) $1/16$

52. The structure of CO_2 is

(A) linear and symmetrical
(B) non-linear and symmetrical
(C) unsymmetrical
(D) bent

53. In absorption region, the refractive index increases with increase in wavelength and the phenomenon is called

(A) normal dispersion
(B) anomalous dispersion
(C) scattering
(D) polarisation

54. Which one represents Rayleigh scattering law?

(A) $\upsilon \alpha 1/\lambda^4$
(B) $\upsilon \alpha \lambda^4$
(C) $\upsilon = \lambda^2$
(D) $\upsilon \alpha 1/\lambda^2$

55. The density or the packing fraction in the case of simple cubic structure is about

(A) $\pi/2$
(B) $\pi/4$
(C) $\pi/6$
(D) $\pi/8$

56. The magnetic induction $\vec{B}$ inside a superconductor is always

(A) infinite
(B) positive
(C) zero
(D) negative

57. The Fermi energy $E_f(0)$ is a function of

(A) pressure
(B) volume
(C) temperature
(D) susceptibility

58. In order to obtain the Zener effect, the Zener diode has to be

(A) reverse biased
(B) forward biased
(C) connected to resistance
(D) exposed to solar power

59. The colour of light emitted by LED depends on

(A) its forward bias
(B) its reverse bias
(C) amount of forward current
(D) the type of semiconductor material used

60. The three axes of a crystal lattice are mutually perpendicular and two of the lattice parameters are equal. The crystal system is

(A) tetragonal
(B) rhombocubic
(C) rhombohedral
(D) cubic

61. An air bubble in water behaves as a

(A) bifocal lens
(B) convergent lens
(C) divergent lens
(D) cylindrical lens

62. The existence of fixed energy levels within the nucleus is shown by the emission of

(A) positrons
(B) neutrons
(C) alpha particles
(D) gamma rays

63. A tunnel diode is

(A) a high resistivity junction diode
(B) a very heavily-doped junction diode
(C) a slow switching device
(D) used with reverse bias

64. 20 million electrons pass through a point in millionth of a second. The current passing through the point is

(A) $1.6\mu A$ (B) $3.2\mu A$
(C) $0.8\mu A$ (D) $4.8\mu A$

65. In a bubble chamber, the path of a particle is marked by

(A) an electric spark (B) water droplets
(C) a trace of vapour (D) None of the above

66. Three amplifier stages each with a voltage gain of 10 are cascaded. The net gain will be

(A) 30 (B) 130
(C) 200 (D) 1000

67. In the given reaction ${}_{Z}X^{A} \rightarrow {}_{Z+1}Y^{A} \rightarrow {}_{Z-1}K^{A-4} \rightarrow {}_{Z-1}K^{A-4}$ radioactive radiations are emitted in the sequence

(A) α, β, γ (B) β, α, γ
(C) γ, α, β (D) β, γ, α

68. The duration of a laser pulse is 10^{-8} sec. The uncertainty in its energy will be $(\Delta E.\Delta t \geq \hbar)$

(A) $6.6\times10^{26} J$ (B) $1.05\times10^{-26} J$
(C) $1.05\times10^{-28} J$ (D) $6.6\times10^{-28} J$

69. The expectation value of an operator is

(A) $\langle A \rangle = \int \psi^{*} A \psi dr$ (B) $\langle A \rangle = \int \psi^{*} \psi dr$

(C) $\langle A \rangle = A\psi$ (D) $\langle A \rangle = \dfrac{1}{\int \psi^{*} \psi dr}$

70. A liquid drop at temperature 't' isolated from its surroundings, breaks into a number of droplets. The temperature of the droplets will be

(A) equal to 't' (B) greater than 't'
(C) less than 't' (D) None of the above

71. If the radius of the Earth becomes half of its present value, with its mass remaining the same, the duration of one day will become

(A) 6 h (B) 12 h
(C) 48 h (D) 96 h

72. Zeroth law states that two bodies A and B, kept at a temperature T

(A) are in non-equilibrium (B) are in thermal equilibrium
(C) are thermally stable (D) are thermally different

73. What mass of steam at 100°C must be mixed with 150g of ice at its melting point, in a thermally insulated container, to produce liquid water at 50°C?

(A) 330 g (B) 0.33 g
(C) 33 g (D) 3.3 g

74. Consider a spherical shell of inner radius R. A point charge of $-0.5\mu C$ is located at a distance R/2 from the centre of the shell. If the shell is electrically neutral, then what is the charge on the outer shell?

(A) $-5.0\mu C$ (B) $+5.0\mu C$
(C) $10.0\mu C$ (D) $-10.0\mu C$

75. Capacitor 1 with $C_1 = 3.55\mu F$ is charged to a potential difference Vo=6.30 V using a 6.30V battery. The battery is then removed and the capacitor is connected to an uncharged capacitor $C_2 = 8.95\mu F$. After some time, both capacitors will have the same potential equal to

(A) 2.79 V (B) 1.79 V
(C) 3.79 V (D) 4.79 V

76. What is the magnitude of repulsive electrostatic force between two of the protons that are separated by 4.0×10^{-15} m?

(A) 10 N (B) 14 N
(C) 12 N (D) 13 N

77. A 15.0 kΩ resistor and a capacitor are connected in series and then a 12.0 V potential difference is suddenly applied across them. The potential difference across the capacitor rises to 5.0V in 1.3μs. Calculate the time constant?

(A) 2.41μs (B) 3.41μs
(C) 3.51μs (D) 3.71μs

78. A circular coil with 250 turns, an area A of $2.52\times10^{-4}m^2$ and a current of 100μA is at rest in a uniform magnetic field of 0.85T, with its magnetic dipole moment initially aligned with B. What is the direction of the current?

(A) The current is from bottom to top
(B) The current is from top to bottom
(C) The current is from bottom to side
(D) None of the above

79. A positron with kinetic energy 2.0 keV is projected into a uniform magnetic field B of magnitude 0.10 T. With its velocity vector making an angle of 89° with B, find the period?

(A) 0.26 ns (B) 0.46 ns
(C) 0.16 ns (D) 0.36 ns

80. A solenoid has length L=1.23 m and inner diameter d=3.55cm, and it carries a current i=5.57A. It consists of 5 close packed layers, each with 850 turns along length L. What is B at its centre?

(A) 22.2 mT (B) 23.2 mT
(C) 24.2 mT (D) 25.2 mT

81. If the Earth's surface is treated as conducting surface with some charge, what should be the order of magnitude of the charge per unit area, in C/m^2, so that a proton remains suspended in space near the Earth's surface?

(A) 10^{-18} (B) 10^{-12}
(C) 10^{-6} (D) 1

82. When the white light is passed through hydrogen gas at room temperature, absorption lines will be observed in the

(A) Lyman Series (B) Balmer Series
(C) Both (A) and (B) (D) Neither (A) or (B)

83. The distances of two satellites from the surface of the Earth are R and 7R. Their time periods of rotation are in the ratio

(A) 1:7
(B) 1:8
(C) 1:49
(D) 1:10

84. The minimum wavelength of X-ray that can be produced in a Coolidge tube depends on

(A) the metal used as the target
(B) the intensity of the electron beam striking the target
(C) the current flowing through the filament
(D) the potential difference between cathode and the anode

85. A wave travelling in a stretched string is described by the equation $y = A\sin(kx - \omega t)$. The maximum particle velocity is

(A) $A\omega$
(B) ω / k
(C) $d\omega / dk$
(D) x / t

86. The ratio of the gravitational and electrostatic forces respectively between two electrons at some distance apart is

(A) 10^{43}
(B) 10^{39}
(C) 10^{-39}
(D) 10^{-43}

87. The unit of permittivity of free space ε_0 is

(A) Coulomb/Newton-meter
(B) Newton-meter^2/coulomb^2
(C) Coulomb^2(Newton-meter)^2
(D) Coulomb^2/Newton-meter^2

88. For constructive interference to take place between two monochromatic light waves of wavelength λ, the path difference should be

(A) $(2n-1)\lambda/4$
(B) $(2n-1)\lambda/2$
(C) $n\lambda$
(D) $(2n+1)\lambda/2$

89. An electron is accelerated through a potential difference of 1000 Volt. Its velocity is nearly

(A) $1.9\times10^{7} m/s$ (B) $3.4\times10^{6} m/s$
(C) $1.7\times10^{5} m/s$ (D) $2.6\times10^{6} m/s$

90. Light of wavelength 4000 Å is incident on a sodium surface for which the threshold wavelength of photoelectrons is 5420 Å. The work function of sodium is

(A) 4.58 eV (B) 2.29 eV
(C) 1.14 eV (D) 0.57 eV

91. The ratio of speed of electron in the ground state of hydrogen to the speed of light in vacuum is

(A) $\frac{1}{2}$ (B) $\frac{1}{137}$
(C) $\frac{2}{137}$ (D) $\frac{1}{237}$

92. A metal wire of length L, area of cross section A and Young's modulus Y behaves as a spring of spring constant k. Then

(A) k=YA/L (B) k=2YA/L
(C) k=YA/2L (D) k=YL/A

93. Two identical sounds A and B reach a point in the same phase. The resultant sound is C. The loudness of C is ndB higher than the loudness of A. The value of n is

(A) 2 (B) 3
(C) 4 (D) 6

94. The ray of light travels from an optically denser to rarer medium. The critical angle for the two media is c. The maximum possible deviation of the ray will be

(A) $\pi - c$ (B) $\pi - 2c$
(C) 2c (D) $\pi/2 + c$

95. If c is the velocity of light, which of the following is correct?

(A) $\mu_0 \varepsilon_0 = c$ (B) $\mu_0 \varepsilon_0 = c^2$

(C) $\mu_0 \varepsilon_0 = 1/c$ (D) $\mu_0 \varepsilon_0 = 1/c^2$

96. A particle undergoes SHM with a time period of 2 sec. In how much time will it travel from its mean position to a displacement equal to half of its amplitude?

(A) $\frac{1}{2}s$ (B) $\frac{1}{3}s$

(C) $\frac{1}{4}s$ (D) $\frac{1}{6}s$

97. The penetrating power of α, β and γ radiations, in decreasing order are

(A) γ, α, β (B) γ, β, α

(C) α, β, γ (D) β, γ, α

98. 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 and of germanium decreases
(D) copper decreases and of germanium increases

99. Bernoulli's principle (or equation) is a consequence of

(A) conservation of energy only
(B) conservation of momentum only
(C) conservation of angular momentum only
(D) more than one of the above

100. In common base connection of a transistor $I_E = 1mA; I_C = 0.95mA$. Calculate the value of I_B

(A) 0.03 mA (B) 0.05 mA

(C) 0.04 mA (D) 0.07 mA

101. What is the binding energy per nucleon for ^{120}Su?

(A) 7.51 MeV/nucleon
(B) 9.51 MeV/nucleon
(C) 6.51 MeV/nucleon
(D) 8.51 MeV/nucleon

102. What is the de Broglie wavelength of an electron with a kinetic energy of 120 eV?

(A) 122 pm
(B) 92 pm
(C) 112 pm
(D) 102 pm

103. A ray of light is incident normally on one face of an equilateral prism of refractive index 1.5. The angle of deviation is

(A) 30°
(B) 45°
(C) 60°
(D) 75°

104. A capacitor of capacitance C discharging through a resistor of resistance R. In terms of time constant $\tau = RC$, when will the charge on the capacitor be of its initial value?

(A) 0.69τ
(B) 6.9τ
(C) 69τ
(D) 0.069τ

105. The mean diameters of Mars and Earth are 6.9×10^{3} km and 1.3×10^{4} km respectively. The mass of Mars is 0.11 times Earth's mass. What is the ratio of the mean density of Mars to that of Earth?

(A) 0.074
(B) 0.74
(C) 7.4
(D) 74

106. A cyclotron can be used to produce high energy

(A) α – particles
(B) β – particles
(C) neutrons
(D) deuterons

107. The direction of the induced emf is always to oppose the change causing it. It is known as

(A) Ampere's law
(B) Lenz's law
(C) Fleming's rule
(D) Henry law

108. As a result of radioactive decay a $_{92}U^{238}$ nucleus is changed to a $_{91}Pa^{234}$ nucleus. During the decay the particles emitted are

(A) one proton and two neutrons
(B) one alpha-particle and one beta-particle
(C) two beta-particles and one neutron
(D) two beta particles and one proton

109. The wavelength of maximum radiation from the moon is 14×10^{-6} m. If the value of the constant in Wein's displacement law is 0.00293 mK, the surface temperature of the moon is

(A) 207K
(B) 146K
(C) 277K
(D) 103.5K

110. The solar constant at Earth's surface is

(A) 1.4 w/m^2
(B) 14 w/m^2
(C) 14 Kw/m^2
(D) 1.4 Kw/m^2

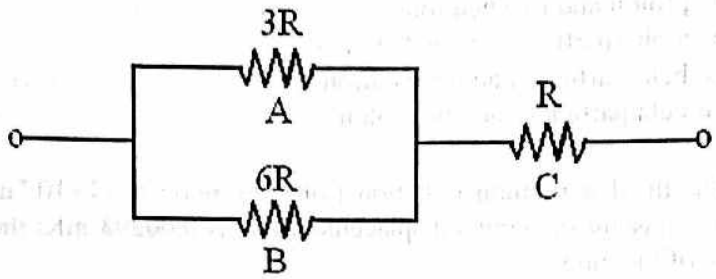
111. When a ceiling fan is switched on, it makes 10 rotations in the first 3 seconds. How many rotations will it make in the next 3 seconds? (Assume uniform angular acceleration)

(A) 10
(B) 20
(C) 30
(D) 40

112. A fraction f_1 of a radioactive sample decays in one mean life, and a fraction f_2 decays in one half life. Then

(A) $f_1>f_2$
(B) $f_1<f_2$
(C) $f_1=f_2$
(D) May be (A), (B) or (C) depending on the values of the mean life and half life

113. The three resistances A, B and C have values 3R, 6R and R respectively. When some potential difference is applied across the network, the thermal powers dissipated by A, B and C are in the ratio



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

114. A long straight conductor carrying a current lies along the axis of a ring. The conductor will exert a force on the ring if the ring

(A) carries a current
(B) has uniformly distributed charge
(C) has non-uniformly distributed charge
(D) None of the above

115. The rotation of the Earth about its axis speeds up such that a man on the equator becomes weightless. In such a situation, what would be the duration of one day?

(A) $2\pi\sqrt{\frac{R}{g}}$
(B) $\left(\frac{1}{2\pi}\right)\sqrt{\frac{R}{g}}$
(C) $2\pi\sqrt{Rg}$
(D) $\left(\frac{1}{2\pi}\right)\sqrt{Rg}$

116. The time period of a simple pendulum of infinite length is

(A) Infinite
(B) $2\pi\frac{R}{g}$
(C) $2\pi\sqrt{\frac{g}{R}}$
(D) $\left(\frac{1}{2\pi}\right)\sqrt{\frac{R}{g}}$

117. The name Black hole is given because

(A) it is completely made up of carbon
(B) it is part of space which has no matter
(C) its gravity is so high that it prevents even light to radiate into space
(D) it is a star which does not emit visible light

118. To obtain p-type silicon semiconductor, we dope pure silicon with

(A) Aluminium
(B) Phosphorus
(C) Oxygen
(D) Germanium

119. N-P-N transistors are preferred over P-N-P transistors because they have

(A) low cost
(B) low dissipation of energy
(C) capability of handling large power
(D) high mobility of energy

120. Which of the following statements is correct?

(A) ${}_{78}Pt^{192}$ has 78 neutrons
(B) ${}_{84}Po^{214} \rightarrow {}_{82}Pb^{210} + \beta^-$
(C) ${}_{90}Th^{234} \rightarrow {}_{91}Pa^{234} + {}_{2}He^{4}$
(D) ${}_{92}U^{238} \rightarrow {}_{2}He^{4} + {}_{90}Th^{234}$

121. The ionisation energy of hydrogen atoms is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 12.75 eV. The spectral lines emitted by hydrogen atoms according to Bohr's theory will be

(A) One
(B) Two
(C) Six
(D) Four

122. A cathode ray tube is operated at 2 kV and the velocity of the electron beam is $6\times10^{6}\ m/s$. What is the velocity when voltage is 8 kV?

(A) $3.6\times10^{7}\ m/s$
(B) $1.2\times10^{7}\ m/s$
(C) $4.8\times10^{7}\ m/s$
(D) $10\times10^{7}\ m/s$

123. An astronomical telescope has an angular magnification of magnitude 5 for distant objects. The separation between the objective and the eye-piece is 36 cm and the final image is formed at infinity. The focal length f_o of the objective and f_e of the eye-piece are

(A) $f_o = 45$ cm and $f_e = -9$ cm
(B) $f_o = 50$ cm and $f_e = 10$ cm
(C) $f_o = 7.2$ cm and $f_e = 5$ cm
(D) $f_o = 30$ cm and $f_e = 6$ cm

124. The resolving power of a telescope depends upon

(A) the focal length of eye-piece
(B) the focal length of objective lens
(C) the length of the telescope
(D) the aperture diameter of the objective lens

125. Approximate height of ozone layer above the ground is

(A) 60 km to 70 km
(B) 50 km to 80 km
(C) 70 km to 100 km
(D) 100 km to 200 km

126. A circular coil of radius 30 cm and resistance $\pi^2\Omega$ is rotated at a rate of 200 rpm about an axis normal to a magnetic field of 10^{-2} Tesla. The amplitude of the a.c. induced in the coil will be

(A) 6 mA
(B) 30 mA
(C) 200 mA
(D) $4\pi^2$mA

127. In a series a.c. circuit $R = 100\,\Omega, X_L = 300\Omega$ and $X_C = 200\Omega$. The phase difference between the applied emf and the current will be

(A) 0^o
(B) 37^o
(C) 45^o
(D) 90^o

128. A straight line conductor of length 0.4 m is moved with a speed of 7 m/s perpendicular to a magnetic field of 0.9 Wb/m^2. The induced emf across the conductor is

(A) 5.04 V
(B) 1.26 V
(C) 2.52 V
(D) 15.2 V

129. Metals getting magnetised by orientation of atomic magnetic moments in external magnetic field are called

(A) diamagnetics
(B) paramagnetics
(C) ferromagnetics
(D) antimagnetics

130. A magnetic dipole is placed in two perpendicular magnetic fields B and H and is in equilibrium making an angle θ with B. Then

(A) $B = H$
(B) $B\cos\theta = H\sin\theta$
(C) $B\sin\theta = H\cos\theta$
(D) $B = H\tan\theta$

131. Atoms of an element differing in mass though possessing the same chemical properties are called

(A) isotones
(B) isotopes
(C) isobars
(D) isomers

132. In Bohr's model of hydrogen atom, radiation is emitted when the electron

(A) revolves in its orbit
(B) jumps from its orbit into the nucleus
(C) jumps from higher orbit into a lower orbit
(D) rises from a lower orbit into a higher orbit

133. The velocity of light is maximum in

(A) Diamond
(B) Water
(C) Vacuum
(D) Glass

134. Which of the following phenomenon is not common to sound and light waves?

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

135. A coil of wire of a certain radius has 600 turns and a self inductance of 108 mH. The self inductance of a second similar coil of 500 turns will be

(A) 74 mH
(B) 75 mH
(C) 76 mH
(D) 77 mH

136. If the electron in a hydrogen atom jumps from an orbit with level $n_i = 3$ to an orbit with level $n_f = 2$, the emitted radiation has a radiation given by

(A) $\lambda = \frac{36}{5R}$
(B) $\lambda = \frac{5R}{36}$
(C) $\lambda = \frac{6}{R}$
(D) $\lambda = \frac{R}{6}$

137. Which of the following represents an inert gas?

(A) $1s^2\ 2s$ (B) $1s^2\ 2s^2\ 2p^2$

(C) $1s^2\ 2s^2\ 2p^6\ 3s^2$ (D) $1s^2\ 2s^2\ 2p^6$

138. For a transistor, in a common emitter arrangement, the alternating current gain β is given by

(A) $\beta = \left(\frac{\Delta I_C}{\Delta I_B}\right)$ at Vc = constant (B) $\beta = \left(\frac{\Delta I_B}{\Delta I_C}\right)$ at Vc = constant

(C) $\beta = \left(\frac{\Delta I_C}{\Delta I_E}\right)$ at Vc = constant (D) $\beta = \left(\frac{\Delta I_E}{\Delta I_C}\right)$ at Vc = constant

139. Two stars, circling around each other constitute

(A) White dwarfs (B) Neutron stars
(C) Binary (D) None of the above

140. The temperature co-efficient of resistance of a wire is 0.00125°C. Its resistance at 300K is 1 ohm. Its resistance will be 2 ohm at

(A) 1154K (B) 1100K
(C) 1400K (D) 1127K

141. Two voltmeters V_1 and V_2 are connected in series across a d.c line. V_1 reads 80 volt and has a per volt resistance of 200 ohm. V_2 has a total resistance of 32 Kilo-ohm. The line voltage is

(A) 120 (B) 160
(C) 220 (D) 240

142. The masses of different substances liberated in electrolysis by the same quantity of electricity are proportional to their relative

(A) atomic masses
(B) valencies
(C) ratios of atomic mass and valency
(D) products of atomic mass and valency

143. The SI unit of magnetic field is T (Tesla). It may also be written as

(A) $JA^{-2}m^{-2}$
(B) $JA^{-1}m^{-2}$
(C) $JA^{-1}m^{-1}$
(D) $JA^{-2}m^{-3}$

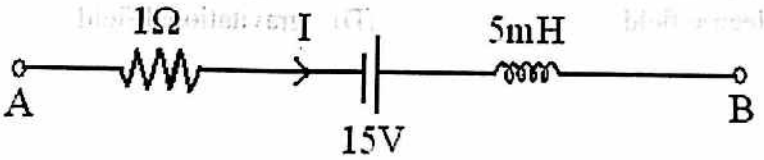
144. Hysteresis cycle for the material of permanent magnet should be

(A) long and wide
(B) long and thin
(C) short and wide
(D) short and thin

145. Two soap bubbles with radii r_1 and r_2 $(r_1 > r_2)$ come in contact. Their common surface has a radius of curvature r. Then

(A) $r = \frac{(r_1 + r_2)}{2}$
(B) $r = \frac{r_1 r_2}{(r_1 - r_2)}$
(C) $r = \frac{r_1 r_2}{(r_1 + r_2)}$
(D) $r = r_1 r_2$

146. The network shown in the figure is part of a complete circuit. If at a certain instant, the current I is 5A, and is decreasing at a rate 10^3 A/s then $V_B - V_A$ is



(A) 20V
(B) 15V
(C) 10V
(D) 5V

147. An electron of mass m_e initially at rest, moves through a certain distance in a uniform electric field in time t_1. A proton of mass m_p, also initially at rest, takes time t_2 to move through an equal distance in this uniform electric field. Neglecting the effect of gravity, the ratio t_2/t_1 is nearly equal to

(A) 1

(B) $\left(\frac{m_p}{m_e}\right)^{\frac{1}{2}}$

(C) $\left(\frac{m_e}{m_p}\right)^{\frac{1}{2}}$

(D) 1836

148. In an insulator, the forbidden energy gap between the valence band and conduction band is of the order of

(A) 1 MeV
(B) 0.1 MeV
(C) 1 eV
(D) 5 eV

149. If 10% of main current is to be passed through the moving coil galvanometer of resistance 99 ohm, then the required shunt resistance will be

(A) 9.9 ohms
(B) 10 ohms
(C) 11 ohms
(D) 9 ohms

150. Induction furnace is based on the heating effect of

(A) eddy current
(B) magnetic field
(C) electric field
(D) gravitational field

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