CET(UG)-2016

Sr. No. : 120988

Booklet Series Code : A

Important: Please consult your Admit Card / Roll No. Slip before filling your Roll Number on the Test Booklet and Answer Sheet.

Roll No. *In Figures* | | | | | | | *In Words* _____

O.M.R. Answer Sheet Serial No. | | | | | | |

Signature of the Candidate : _____

Subject : PHYSICS

Time : 70 minutes **Number of Questions : 60** **Maximum Marks : 120**

DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO

INSTRUCTIONS

1. Write your Roll No. on the Question Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Subject and Series Code of Question Booklet on the OMR Answer Sheet. Darken corresponding bubbles with **Black Ball Point / Black Gel pen.**
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. To open the Question Booklet remove the Paper Seal gently when asked to do so.
5. Please check that this Question Booklet contains **60** questions. In case of any discrepancy, inform Assistant Superintendent within 10 minutes of the start of test.
6. Each question has four alternative answers (A, B, C, D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point / Black Gel pen.**
7. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Sheet. No marks will be deducted in such cases.
8. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the questions given in the Question Booklet.
9. Negative marking will be adopted for evaluation i.e., 1/4th of the marks of the question will be deducted for each wrong answer. A wrong answer means incorrect answer or wrong filling of bubble.
10. For calculations, use of simple log tables is permitted. Borrowing of log tables and any other material is not allowed.
11. For rough work only the sheets marked "Rough Work" at the end of the Question Booklet be used.
12. The Answer Sheet is designed for **computer evaluation**. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e., not following the instructions completely, shall be of the candidate only.**
13. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
14. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so, would be expelled from the examination.
15. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistance or found giving or receiving assistance or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
16. **Telecommunication equipment such as pager, cellular phone, wireless, scanner, etc., is not permitted inside the examination hall. Use of calculators is not allowed.**

SEAL

1. **Two point charges of 25 μC and 100 μC are placed 30 cm apart. The electric field intensity will be zero at a point on the line joining the two charges :**

(A) 10 cm from the 100 μC charge

(B) 12 cm from the 25 μC charge

(C) 18 cm from the 25 μC charge

(D) 10 cm from the 25 μC charge

2. **The longest wavelength in Lyman series is 1216 Å. The shortest wavelength of this series is :**

(A) 1621 Å

(B) 412 Å

(C) 912 Å

(D) 632Å

3. **A dipole is consisting of two charges +q and –q separated by distance d. The dipole is placed at angle θ_1 in the uniform electric field $\vec{E}$. The work done in rotating the electric dipole from angle θ_1 to θ_2 in the electric field is :**

(A) $qdE[\text{Cos}\,\theta_1 - \text{Cos}\,\theta_2]$

(B) $q(d/2)E[\text{Cos}\,\theta_1 - \text{Cos}\,\theta_2]$

(C) $qdE[\text{Cos}\,\theta_1 + \text{Cos}\,\theta_2]$

(D) $qdE[\text{Sin}\,\theta_1 - \text{Sin}\,\theta_2]$

4. **The electric flux through a surface of area 20 units lying in the y–z plane due to the electric field $\vec{E} = 6\hat{i} + 3\hat{j} + 4\hat{k}$ is :**

(A) 120 units

(B) 100 units

(C) 60 units

(D) 80 units

5. **During a negative beta decay :**

(A) an atomic electron is ejected

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

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

(D) a proton in the nucleus decays emitting a positron

6. A charged particle of mass 'm' and charge 'q' is released from rest in a uniform electric field of intensity 'E'. The kinetic energy acquired by the particle in time 't' will be given by :

(A) $\frac{q^2E^2t^2}{2m}$

(B) $\frac{mq^3E^2t^2}{2m}$

(C) $\frac{mq^2E^2t^2}{2}$

(D) $\frac{qE^2t^2}{2m}$

7. A potential difference of 30 V is applied across a colour coded carbon resistor with rings of blue, black and yellow colours. The number of electrons (electron charge = 1.6×10^{-19} C) flowing through the resistor per second will be :

(A) 8.0×10^{12}

(B) 3.1×10^{14}

(C) 8.0×10^{15}

(D) 3.1×10^{13}

8. The kinetic energy of a particle varies with time according to the relation $E_k = (3t + 4)$. The force acting on the particle :

(A) is constant

(B) varies inversely with velocity

(C) varies directly with velocity

(D) none of the above

9. In the Lachlanche cell :

(A) MnO_3 acts as depolarizer and NH_4Cl solution as electrolyte. Zinc and carbon rods act as anode and cathode, respectively

(B) MnO_2 acts as depolarizer and NH_4Cl solution as electrolyte. Zinc and carbon rods act as anode and cathode, respectively

(C) MnO_3 acts as depolarizer and NH_4Cl solution as electrolyte. Carbon and zinc rods act as anode and cathode, respectively

(D) MnO_2 acts as depolarizer and NH_4Cl solution as electrolyte. Carbon and zinc rods act as anode and cathode, respectively

10. An electric power station transmits 100 MW power to a distant load through long and thin cables. The ratio of power loss in the transmission of power at 200 V and 20 kV will be :

(A) 2×10^4

(B) 10^4

(C) 10^2

(D) 10^8

11. **Four point masses, each of mass M, are placed at the corners of a square ABCD of side L. The moment of inertia of this system about an axis passing through A and parallel to BD is :**

(A) $3\,ML^2$ (B) $2\,ML^2$

(C) ML^2 (D) $5\,ML^2$

12. **The magnetic field at a point is 0.4 Gauss and angle of dip is 30°. The horizontal and vertical components of the field are :**

(A) 0.2 and $0.2\sqrt{3}$ Gauss, respectively (B) $0.5\sqrt{2}$ and 0.5 Gauss, respectively

(C) $0.2/\sqrt{3}$ and 0.2 Gauss, respectively (D) $0.2\sqrt{3}$ and 0.2 Gauss, respectively

13. **An A.C. generator consists of a coil of 50 turns and area 2.5 m^2 rotating at angular speed of $(1800/\pi)$ rotations/minute in a uniform field B = 0.2 T between two fixed pole pieces. The resistance of circuit including that of coil is 500 ohm. The maximum current will be :**

(A) 3 Amperes (B) 3π Amperes

(C) 18 Amperes (D) $40/\pi$ Amperes

14. **A hydrogen ($_1^1H$) nucleus and tritium ($_1^3H$) nucleus enter a uniform magnetic field at 90° with same velocity. The period of rotation of tritium nucleus inside the magnetic field is :**

(A) same as that of hydrogen nucleus (B) 9 times that of hydrogen nucleus

(C) 3 times that of hydrogen nucleus (D) 4 times that of hydrogen nucleus

15. **One mole of oxygen at 0 °C temperature and 1 atmosphere pressure is compressed adiabatically, till its pressure is 8 atmosphere. The ratio of specific heat at constant pressure to that at constant volume is given to be 1.5. The final temperature of the gas will be :**

(A) 273 K (B) 546°C

(C) 273 °C (D) 200 °C

16. **Given coefficient for linear expansion for brass = $1.9 \times 10^{-5}\,°C^{-1}$. At the room temperature of 25 °C, the volume of a thin brass vessel and volume of a solid brass cube are equal to one litre each. The change in the volume of the vessel and that of the cube upon being heated to 50 °C will be :**

(A) 1.425 cm^3 in both cases (B) 1.425 cm^3 and 2.850 cm^3, respectively

(C) 1.425 cm^3 and 4.275 cm^3, respectively (D) 4.275 cm^3 in both cases

17. **Diameter of a plano-convex lens is 6 cm and its thickness at the centre is 3 mm. The radius of curvature for the convex surface is :**

(A) 3 cm (B) 12 cm

(C) 15 cm (D) 5.7 cm

18. **A reversible engine converts one-sixth of heat input into work. When the temperature of the sink is reduced by 62 °C, its efficiency is doubled. The temperature of the source will be :**

(A) 99 °C (B) 370°C

(C) 172 °C (D) 199 °C

19. **A potential difference of 20 kV is applied across a Cu-anode X-ray tube. Given value of Planck's constant = 6.62×10^{-34} J-s. The minimum wavelength of continuous spectrum of photons generated will be :**

(A) 10^{0} m (B) 6.2×10^{-11} m

(C) 1.32 nm (D) 6.2 Å

20. **The number of air molecules in a room of capacity 30 m^3 at a temperature of 27 °C and one atmosphere pressure. Given Boltzmann constant $k = 1.38 \times 10^{-23}$ J K^{-1} :**

(A) 6.1×10^{26} (B) 7.3×10^{26}

(C) 6.1×10^{23} (D) 7.3×10^{25}

21. **The degree of freedom of a monoatomic gas molecule, a diatomic gas molecule and a triatomic gas molecule are :**

(A) 1, 2 and 3, respectively (B) 3, 6 and 9, respectively

(C) 2, 4 and 6, respectively (D) 3, 5 and 6, respectively

22. **At a given temperature, the ratio of r.m.s. speed of oxygen molecules to that of ozone molecules will be :**

(A) 1.5 (B) 1.22

(C) 0.66 (D) 0.81

23. **A point bulb is placed at the bottom of tank containing liquid (refractive index = 1.5) to a depth of 100 cm. The approximate area of the surface of water through which light from the bulb can emerge out is approximately equal to :**

(A) 22,500 cm^2 (B) 1,500 cm^2

(C) 25,100 cm^2 (D) 27,500 cm^2

24. **For the Glass-Air system, the value of critical angle is in increasing order for the :**

(A) Blue, Yellow, Green, Red colours of light (B) Green, Yellow, Red, Blue colours of light

(C) Red, Yellow, Green, Blue colours of light (D) Blue, Green, Yellow, Red colours of light

25. **If the two slits in Young's double slit experiment have width ratio 4:1, the ratio of intensity at maxima and minima in the interference pattern will be :**

(A) 1:4 (B) 4:1

(C) 9:1 (D) 16:1

26. **A body of mass 100 kg falls on the earth from infinity. Given radius of earth = 6400 km and $g = 9.8\ m/s^2$. Air friction may be neglected. Its velocity and energy on reaching the earth are :**

(A) 8 km/s and 3.2×10^9 J, respectively (B) Both infinity

(C) 11.2 km/s and 6.27×10^9 J, respectively (D) 11.2 km/s and 6272 J, respectively

27. **A sample of milk diluted with pure water has density of 1032 kg/m^3. If pure milk has density of 1080 kg/m^3. The percentage of water by volume added in the milk is :**

(A) 50 % (B) 60 %

(C) 40 % (D) 30%

28. **A water drop of radius 'R' falling on the earth achieves terminal velocity due to viscous force on the drop due to air. The terminal velocity will be proportional to :**

(A) R (B) $1/R^2$

(C) R^2 (D) $1/R^3$

29. **If 10% of a radioactive material decays in 5 days, then the amount of the original material left after 20 days is approximately :**

(A) 60 %
(B) 65 %
(C) 70 %
(D) 75 %

30. **A geostationary satellite is orbiting the earth at a height 6 R above the surface of earth; where R is the radius of the earth. The time period of another satellite orbiting at the height 2.5 R from the surface of the earth will be approximately :**

(A) 6.5 hours
(B) 8.5 hours
(C) 7.5 hours
(D) 6 hours

31. **The ratio of the respective resolving powers of an optical microscope corresponding to the wavelengths of light $\lambda_1 = 400$ nm and $\lambda_2 = 500$ nm used is :**

(A) 5 : 4
(B) 4 : 5
(C) 16 : 25
(D) 25 : 16

32. **Rainbow is formed due to combination of :**

(A) Dispersion and total internal reflection
(B) Refraction and polarization
(C) Dispersion and focusing
(D) Reflection and polarization

33. **Light of wavelength 500 nm is made to pass from air to glass, its wavelength and frequency in the glass (refractive index = 1.5) will be :**

(A) 500 nm and 6×10^{14} Hz
(B) 333 nm and 6×10^{14} Hz
(C) 500 nm and 4×10^{14} Hz
(D) 333 nm and 4×10^{14} Hz

34. **The electromagnetic waves spectrum in the correct increasing order of wavelengths is :**

(A) Microwaves, X-rays, Ultraviolet, Visible, Infrared
(B) Ultraviolet, Visible, Infrared, Microwaves, X-rays
(C) X-rays, Ultraviolet, Visible, Infrared, Microwaves
(D) X-rays, Microwaves, Ultraviolet, Visible, Infrared

35. Two air columns (closed at one end) 100 cm and 101 cm long give 17 beats in 20 s, when each is sounding its fundamental note. The velocity of sound is :

(A) 34340 cm/s
(B) 30340 cm/s
(C) 33240 cm/s
(D) 32000 cm/s

36. The moment of force $F = \hat{i} + \hat{j} + \hat{k}$ acting at point (-2, 3, 4) about the point (1, 2, 3) is equal to :

(A) $4(\hat{i} + 2\hat{j} - 3\hat{k})$
(B) $4(2\hat{i} + 3\hat{j} - 4\hat{k})$
(C) $3(\hat{j} - \hat{k})$
(D) $4(\hat{j} - \hat{k})$

37. If the linear density of a rod varies as $\lambda = Bx$ along its length L kept along the x-axis, its centre of mass will be at :

(A) $X_{CM} = 4L/5$
(B) $X_{CM} = L/2$
(C) $X_{CM} = 2L/3$
(D) $X_{CM} = 5L/3$

38. The dimensions of $\varepsilon_0 E^2$ (ε_0 is permittivity of free space and E is electric field) is :

(A) $M L T^{-1}$
(B) $M L^2 T^{-2}$
(C) $M L^{-1} T^{-2}$
(D) $M L^2 T^{-1}$

39. A neutron travelling with a velocity v and kinetic energy E collides elastically head on with the nucleus of an atom of mass number A at rest. The fraction of total energy retained by the neutron is approximately equal to :

(A) $\left[\frac{A+1}{A-1}\right]^2$
(B) $\left[\frac{A-1}{A+1}\right]^2$
(C) $\left[\frac{A}{A-1}\right]^2$
(D) $\left[\frac{A+1}{A}\right]^2$

40. Energy levels A, B and C of a certain atom correspond to increasing values of energy, i.e., $E_A < E_B < E_C$. If λ_1, λ_2 and λ_3 are the wavelengths of radiations for the transitions $C \rightarrow B$, $B \rightarrow A$ and $C \rightarrow A$, respectively, which of the following is correct ?

(A) $1/\lambda_3 = 1/\lambda_1 + 1/\lambda_2$
(B) $(\lambda_3)^2 = (\lambda_1)^2 + (\lambda_2)^2$
(C) $\lambda_1 + \lambda_2 + \lambda_3 = 0$
(D) $\lambda_3 = \lambda_1 + \lambda_2$

41. **The minimum distance between an object and its real image formed by a convex lens of foc length 'f' is :**

(A) 2f

(B) 4f

(C) f

(D) zero

42. **The height y (in metres) and distance x (in metres) along a horizontal plane of a projectile earth are given by $x = 6t$ and $y = (8t - 5t^2)$, where t represents time in seconds. The veloci with which the projectile is projected is :**

(A) 8m/s making angle $\tan^{-1}(3/4)$ with x-axis

(B) 6 m/s making angle $\tan^{-1}(4/3)$ with x-axi

(C) 10 m/s making angle $\tan^{-1}(4/3)$ with x-axis

(D) 12 m/s making angle $\tan^{-1}(4/3)$ with x-ax

43. **If the relation between distance x and time t is of the form $t = ax^2 + bx$, then acceleration of t particle is :**

(A) $-2av^3$, where $v = dx/dt$

(B) $2bv^3$, where $v = dx/dt$

(C) $-2av^{3/2}$, where $v = dx/dt$

(D) $-2bv^3 + 2av$, where $v = dx/dt$

44. **A particle of mass m is projected with velocity v making an angle of 45° with the horizonta The magnitude of the angular momentum of the projectile about the point of projection whe the particle is at maximum height is :**

(A) Zero

(B) $\frac{mv^3}{2\sqrt{2}\,g}$

(C) $\frac{mv^2}{4\sqrt{2}\,g}$

(D) $\frac{mv^3}{4\sqrt{2}\,g}$

45. **Two linear harmonic motions of equal amplitude and frequencies ω and 2ω are impressed o a particle along x and y-axes, respectively. If the initial phase difference between them is 90 the resultant path followed by the particle will be :**

(A) Parabola

(B) Ellipse

(C) Circle

(D) Hyperbola

46. Limbs of a manometer consist of uniform capillary tubes of radii 'r_1' and 'r_2', respectively, are connected to pressures p_1 and p_2, respectively. Given $r_2 < r_1$. The level of the liquid (density = d, surface tension = T) in the narrower tube stands at height 'h' above the broader tube. Then the correct pressure difference $(p_1 - p_2)$ between the limbs of manometer is given by :

(A) $hdg - 2T\left[\frac{1}{r_2} - \frac{1}{r_1}\right]$

(B) hdg

(C) $hdg - T\left[\frac{1}{r_2} - \frac{1}{r_1}\right]$

(D) $hdg - 2T\left[\frac{1}{r_1} - \frac{1}{r_2}\right]$

47. A barking dog delivers about 1 mW of power, which is uniformly distributed over a hemispherical area. The intensity of sound at a distance of 5 m is :

(A) $0.04\ mW/m^2$

(B) $3.19\ \mu W/m^2$

(C) $12.74\ \mu W/m^2$

(D) $6.37\ \mu W/m^2$

48. A progressive wave of frequency 500 Hz is travelling with a velocity of 360 m/s. The distance between the two points 60° out of phase is :

(A) 0.05 m

(B) 0.06 m

(C) 0.12 m

(D) 0.24 m

49. A message signal of 12 kHz and peak voltage 20 V is used to amplitude modulate a carrier wave of frequency 12 MHz and peak voltage 30 V. The value of modulation index (m_a) and the side band frequencies produced will be :

(A) $m_a = 1.5$ and LSB = 11988 kHz, HSB = 12012 kHz

(B) $m_a = 0.67$ and LSB = 11.88 kHz, HSB = 12.12 kHz

(C) $m_a = 0.67$ and LSB = 11988 kHz, HSB = 12012 kHz

(D) $m_a = 1.5$ and LSB = 11.88 kHz, HSB = 12.12 kHz

50. A TV transmitting antenna in the plane area is 81 m tall. For the receiving antenna height to be at near ground level, the service area covered by the transmitting antenna will be about :

(A) $81\ km^2$

(B) $6400\ km^2$

(C) $5100\ km^2$

(D) $3200\ km^2$

51. A full wave rectifier consists of two identical junction diodes having negligible forward resistance. When a sinusoidal voltage supply of peak value 100 V is fed to the rectifier, the RMS value of the voltage at its output will be :

(A) 100 V
(B) $100\sqrt{2}$
(C) 70.7 V
(D) $100/(2\sqrt{2})$

52. An n-type semiconductor is having electron concentration of 8×10^{19} m^{-3} and hole concentration of 5×10^{16} m^{-3}. Given electron mobility = 2.3 $m^2 V^{-1}s^{-1}$ and hole mobility = 0.01 $m^2 V^{-1}s^{-1}$. Electron charge = 1.6×10^{-19} C. The resistivity of the sample is :

(A) 3.4×10^{-2} Ω-m
(B) 29.4 Ω-m
(C) 2.94 Ω-m
(D) 3.3 Ω-m

53. A train moves towards a stationary observer with speed 34m/s. The train sounds a whistle and its frequency registered by an observer is f_1. If the train's speed is reduced to 17m/s, the frequency registered is f_2. If the speed of the sound is 340 m/s then the ratio f_1/f_2 is :

(A) 19/17
(B) 1/2
(C) 2
(D) 19/18

54. An electron is released at rest in an electric field of intensity 2×10^4 N/C. Given mass of electron = 9×10^{-31} kg. The time taken for the electron to travel 1.6 cm in the electric field is :

(A) 28.8 ns
(B) 9 ns
(C) 3 ns
(D) 3×10^{-8} s

55. There are two 500 pF capacitors A and B. The capacitor A is charged by connecting it to a 200 V battery. Then it is disconnected from the battery and connected in parallel to capacitor B. The electrostatic energy stored in the final system will be :

(A) 10 μJ
(B) 20 μJ
(C) 5 μJ
(D) 2.5 μJ

56. N identical cells each of emf 'E' and internal resistance 'r' are put in parallel across an external resistance 'R'. The current drawn from each of the cell will be :

(A) $\frac{(n-1)E}{nR+r}$

(B) $\frac{nE}{nr+R}$

(C) $\frac{nE+r}{nR}$

(D) $\frac{E}{nR+r}$

57. A ray of light passes through an equilateral prism such that the angle of incidence is equal to the angle of emergence and the latter is equal to 3/4 times the angle of prism. The angle of deviation is :

(A) 20°

(B) 60°

(C) 30°

(D) 45°

58. Given Density of silver = 10.0 g/c.c and E.C.E of silver = 0.00112 g/Coulomb. A current of one ampere is passed through a silver voltameter in order to deposit a layer of 0.14 mm thick on a metal plate of 140 cm^2 area. The time taken for the deposit is :

(A) 17500 sec

(B) 175 sec

(C) 20000 sec

(D) 1750 sec

59. A ball is dropped from a height h on to a floor and undergoes multiple bounces. If in each collision its speed becomes 'e' times of its striking value, the time taken by the ball between first bounce and second bounce is :

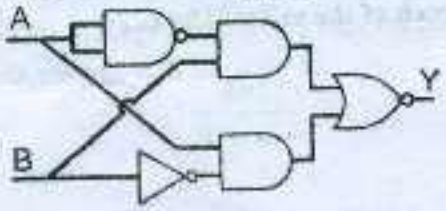
(A) $\frac{c}{g}\sqrt{2gh}$

(B) $2e\sqrt{\frac{2h}{g}}$

(C) $\frac{2e\sqrt{h}}{g}$

(D) $\frac{2e\sqrt{g}}{h}$

60. **The truth table for the following logic circuit is :**



(A)

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

(B)

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

(C)

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

(D)

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