

Question Booklet Series: **A**

Question Booklet Serial No.: **311359**

CET (UG) – 2023

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

Roll No.

(In Figure)

(In Words)

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O.M.R. Answer Sheet Serial No.

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Signature of Candidate: _____

Signature of Invigilator: _____

SUBJECT: PHYSICS

Time: 70 Minutes

Number of Questions: 60

Total Marks: 120

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

INSTRUCTIONS:

1. Write your Roll No. on the Questions Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Question Booklet Serial No. on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball /Black Gel Pen**.
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. The medium of examination shall be **English** only.
5. Please check that this Question Booklet contains **60** Questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of Test.
6. Each question has four alternative answer (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 /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 Booklet. No marks will be deducted in such cases.
8. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the question given in the Question Booklet.
9. **Negative marking will be adopted for evaluation i.e. 25% 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. The University will provide logarithmic table. Borrowing of log tables and any other material is not allowed.
11. For rough work only the blank sheet 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.**
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. **20 minutes** extra will be given to the visually handicapped/Person with Disability (PwD) for each paper.
16. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistant or found giving or receiving assistant 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.
17. Tele-communication equipment such as Cellular/cordless phones, pager, wireless, scanner, camera or any electronic/digital gadget etc., is not permitted inside the examination hall. **Use of calculator is not allowed.**
18. The candidates will not be allowed to leave the Examination Hall/Room before the expiry of the allotted time.

(PHY- A)

1. A ship steams 8 Km east and then 6 Km northeast. What is the distance of the ship from the starting point?
(A) 10 Km (B) 14 Km (C) 13 Km (D) 12 Km
2. A diver dives off from the edge of a cliff, 200 m from the sea, in a horizontal direction at a speed of 3 m/sec. The horizontal range covered by the diver from the foot of the cliff is 19.2 m. The diver hits the water almost vertically. By how much factor the vertical velocity will be higher than the horizontal velocity at the time of hitting the water?
(A) 5 times (B) 10 times (C) 15 times (D) 20 times
3. A vehicle with a mass of 1000 Kg accelerates from rest to a speed of 30 m/sec over a distance of 120 m. Assuming a constant force was applied to accelerate the car, the magnitude of the force was
(A) 2.75×10^3 N (B) 3.75×10^3 N (C) 4.75×10^3 N (D) 5.75×10^3 N
4. An asteroid moves around the sun having a period of revolution of 5 years (in earth year units), what is its average distance from the sun (in A.U.)?
(A) 5.4 A.U. (B) 3.2 A.U. (C) 2.9 A.U. (D) 1.8 A.U.
5. What is acceleration due to gravity (in terms of that on the earth, say g_e) on Jupiter which has the mass 318 times the earth mass and the radius 11 times the earth's radius?
(A) $2.63 g_e$ (B) $28.90 g_e$ (C) $1.62 g_e$ (D) $14.45 g_e$
6. The true weight of an object (say a stationary person of 80 Kg) on the earth can be obtained at:
(A) The equator (B) The North & the South Poles
(C) The Tropics of Cancer and Capricorn (D) Anywhere on Earth
7. Two persons A and B of weight 50 Kg and 100 Kg respectively, turn by turn sit on a swing, which while swinging rises upto 2 m (above its lowest point). The speed of the swing at its lowest point will be, for the two persons A and B, in the ratio (ignore air drag, gravitational potential energy of the swing):
(A) 1:1 (B) 1:2 (C) 1:4 (D) 1:8
8. An 8 Kg ball moving at a speed of 16 m/sec strikes head-on a 4 Kg ball at rest. After the collision the 8 Kg ball is still moving in the same direction but with a speed of 8 m/sec. How much percent of the Kinetic Energy is lost in this inelastic collision?
(A) 15 % (B) 25 % (C) 35 % (D) 50 %
9. A hoop (ring), a disk and a spherical ball, all with the same radius and same mass roll down on an inclined plane. Which reaches the bottom first, i.e., which has the highest speed at the bottom?
(A) Disk (B) Ring (C) Ball (D) All

10. To decrease the volume of two similar metal blocks of Copper and Aluminum, by 1 percent, which metal, if at all, requires more increase in pressure?
 (A) Copper (B) Aluminum
 (C) Same for both metals (D) Cannot be compressed
11. A mosquito of mass 2 gm is sitting on the surface of the water supported by eight legs. What is the order of radius of the depression made by each leg if the surface tension makes an angle of 45° with the vertical? (Given: Surface Tension = 7.28×10^{-2} N/m)
 (A) 0.55 cm (B) 0.65 cm (C) 0.75 cm (D) 0.85 cm
12. A solid object with specific gravity of 0.8 in water will
 (A) Sink 100% in water (B) Float 100% in water
 (C) Float with 20% of it out of water (D) Float with 80% of it out of water
13. What is the amount of heat required to raise the temperature of a 2Kg aluminum pan from 20°C room temperature to 100°C ? (Given: Specific heat of Aluminum = $0.22 \text{ Cal/g}^\circ\text{C}$)
 (A) 35.2 Kcal (B) 52.8 Kcal (C) 8.8 Kcal (D) 44.0 Kcal
14. In a steam engine, steam is heated to 200°C so as to make superheated steam. This steam expands a piston in doing work and then condenses into water in thermal equilibrium with an icy river water at 4°C . What will be the maximum efficiency of this engine?
 (A) 25% (B) 36% (C) 41% (D) 49%
15. A 500 cm^3 volume of hydrogen gas is at a temperature of 20°C and a pressure of 74 cm of mercury. If this quantity of hydrogen is heated to 40°C , keeping the pressure same, the resulting volume will be:
 (A) 534 cm^3 (B) 250 cm^3 (C) 1000 cm^3 (D) 500 cm^3
16. What is the frequency of the first overtone in a closed organ pipe that is 2 m long? (Given: speed of sound = 320 m/sec)
 (A) 40 Hz (B) 80 Hz (C) 120 Hz (D) 160 Hz
17. A comparison between the electrical force and the gravitational force between a proton and an electron, in the hydrogen atom, having the same fundamental charge of $1.6 \times 10^{-19} \text{ C}$ and mass $1.67 \times 10^{-27} \text{ Kg}$ and $9.11 \times 10^{-31} \text{ Kg}$ respectively shows the difference of the order of: (Given: proton and electron separation = $0.53 \times 10^{-10} \text{ m}$)
 (A) 10^{39} (B) 10^{14} (C) 10^{28} (D) 10^{20}
18. What is the force on a charge of $-5 \mu\text{C}$ placed at the midway point between two charges of $+20 \mu\text{C}$ and $+40 \mu\text{C}$ sitting 4 m apart?
 (A) -0.45 N (B) $+0.675 \text{ N}$ (C) -0.225 N (D) 0 N
19. A rectangular coil consisting of 100 turns of wire and having a width of 20 cm and a length of 30 cm is mounted in a uniform magnetic field of $8 \times 10^{-3} \text{ Tesla}$. A current of 20 Amperes passes through 100-turn loop. What is the torque on the loop when the loop makes an angle of 30° with the magnetic field?
 (A) 0.42 N-m (B) 0.83 N-m (C) 0.64 N-m (D) 0.94 N-m

20. An oil film 0.40μ thick is illuminated with white light normal to the film. The refractive index of the oil is 1.50. The wavelength, within the visible spectrum, which will be strongly reflected is:
 (A) 4.0×10^{-7} m (Violet) (B) 4.8×10^{-7} m (Blue)
 (C) 5.3×10^{-7} m (Green) (D) 7.0×10^{-7} m (Red)
21. How far from a converging lens, with focal length of +20 cm, a specimen be placed so that its image is a real one and three times as large as the specimen object?
 (A) +13.4 cm (B) +20.0 cm (C) +26.7 cm (D) +52.4 cm
22. A lens-maker wants to construct a planoconvex lens from glass of index of refraction 1.5. If the radius of curvature of the convex surface is 30 cm, what will be the power of this lens in diopters?
 (A) 1.22 diopters (B) 1.44 diopters (C) 1.66 diopters (D) 1.88 diopters
23. What is the minimum height of a plane mirror, which enables one to see one's entire reflection?
 (A) Same as the viewer's height (B) 1/2 of viewer's height
 (C) 1/4 of viewer's height (D) 1/3 of viewer's height
24. A typical helium-neon gas laser, with the beam radiation wavelength of 6328 \AA is of 1 milliwatt power. How many visible photons does the laser emit per second? (Given: Planck's constant $h = 6.627 \times 10^{-34}$ joule-sec)
 (A) 2.0×10^{16} (B) 3.2×10^{15} (C) 4.4×10^{17} (D) 5.0×10^{18}
25. All the emission spectral lines from excited states in hydrogen to the $n = 3$ level appear in the wavelength region of:
 (A) Infrared (B) Ultraviolet (C) Visible (D) Radio waves
26. The work function for potassium is 2.25 eV. If a light of 4000 \AA falls on potassium, what is the stopping potential required to stop the fastest electrons?
 (Given $1 \text{ eV} = 1.6 \times 10^{-19}$ joule)
 (A) 1.1 V (B) 0.75 V (C) 0.86 V (D) 0.55 V
27. The spacing between atoms in crystals generally varies between 1 \AA and 5 \AA . Which particle's beam can undergo diffraction when encountering this crystal?
 (A) 100 eV electron (B) 1 MeV neutrons
 (C) 10 MeV protons (D) 10 eV photon
28. The nuclear force variation between two nucleons, as a function of the separation from one another, gives the idea of the diameter of a nucleon. This idea comes from when the force changes from attractive to repulsive around:
 (A) 1.0×10^{-15} m (B) 2.0×10^{-15} m (C) 2.5×10^{-15} m (D) 3.0×10^{-15} m
29. The binding energy for the deuteron is 0.002388 amu. What is the threshold frequency of gamma-ray (photons) for the photodisintegration of the deuteron?
 (A) 2.5×10^{20} Hz (B) 5.4×10^{21} Hz (C) 6.5×10^{21} Hz (D) 7.3×10^{22} Hz

30. What happens to the capacity – C , of a parallel-plate capacitor, whose each plate area is doubled and the separation between the plates is reduced to half?
 (A) C becomes $2C$ (B) C becomes $C/2$ (C) C becomes $4C$ (D) C remains C
31. With a 600 pf capacitor in an LC circuit which has a resonant frequency of 92 KHz, what is amount of inductance required assuming the circuit with no resistance?
 (A) 3.99 mH (B) 4.99 mH (C) 5.99 mH (D) 6.99 mH
32. In terms of the energy level structure, a semiconductor and an insulator differ only in the size of: (for low temperature and ideal case)
 (A) Conduction band (B) Valence band
 (C) Forbidden Energy gap (D) Partially filled conduction band
33. What is the magnitude of the charges (positive or negative) in a 250 g of water?
 (A) $6.02 \times 10^{23} C$ (B) $1.6 \times 10^{-19} C$ (C) $9.63 \times 10^5 C$ (D) $1.34 \times 10^7 C$
34. A bulb-lamp is connected to a capacitor of capacity C in series. What happens if the capacitance of the capacitor is reduced with an AC supply in the circuit?
 (A) Bulb will not glow (B) Bulb keeps glowing
 (C) Bulb Brightens up (D) Bulb dims down
35. What is the order of inter-atomic crystal spacing required to form a p-n junction with a p-type semiconductor slab and an n-type semiconductor slab?
 (A) $5 \text{ \AA} - 10 \text{ \AA}$ (B) $2 \text{ \AA} - 3 \text{ \AA}$
 (C) $0.01 \text{ \AA} - 0.1 \text{ \AA}$ (D) $50 \text{ \AA} - 100 \text{ \AA}$
36. What is the main difference in a forward biased p-n junction and a reversed biased p-n junction?
 (A) Diffusion current increase in reversed bias
 (B) Diffusion current decreases in reversed bias
 (C) Barrier height decreases in reversed bias
 (D) Depletion region narrows down in reversed bias
37. Which is the correct combination of the statements?
 (A) Density of nuclear matter is independent of the size of the nucleus but the mass density of the atom is not
 (B) Density of nuclear matter is dependent on the size of the nucleus and so is the mass density of the atom
 (C) Density of nuclear matter is independent of the size of the nucleus and so is the mass density of the atom
 (D) Density of nuclear matter is dependent on the size of the nucleus but the mass density of the atom is not

38. Generally in a quantum system, a given energy level may not refer to just one quantum state but usually is characterised by four quantum numbers: n , l , m and s . How come the hydrogen atom energy depends only on n ?
- (A) Due to proton's Strong force participation
 (B) Due to a pure Coulomb potential
 (C) Due to cancellation of +ve and -ve charge
 (D) Due to hydrogen being the lightest element
39. India uses PSLV rocket to launch Polar Satellites in the orbit. This orbit is usually at a height of: (from Earth surface)
- (A) 500 km – 800 km (B) 100 km – 300 km
 (C) 32000 km – 36000 km (D) 100000 km – 200000 km
40. An airplane with mass 3.3×10^5 kg with a wing span of 500 m^2 is flying with a speed of 960 km/h. The pressure difference required to stay afloat between the lower and the upper surfaces of the wings is $6.5 \times 10^3 \text{ N/m}^2$. Ignoring the small height differences, what is the fractional speed increase in the air on the upper surface of the wing relative to the lower surface? (Density of air = 1.2 kg m^{-3})
- (A) 18 % (B) 11% (C) 8% (D) 2%
41. If the nuclear radius ^{64}X nucleus is 5 fermi then the nuclear radius of ^{216}Y nucleus is:
- (A) 7.5 fermi (B) 6 fermi (C) 3.8 fermi (D) 4 fermi
42. Let in the energy level of a certain atom, frequency ν is emitted when the electron makes a transition from energy level of energy $5E$ to $3E$. The frequency emitted during transition from energy level of energy $3E$ to $5E/2$ is
- (A) 2ν (B) $\nu/2$ (C) $\nu/4$ (D) 4ν
43. A positively charged object is brought near an uncharged conducting sphere. What happens to the charge distribution in the sphere?
- (A) Positive charges are attracted to the object, causing a net negative charge on the sphere
 (B) Negative charges are attracted to the object, causing a net positive charge on the sphere
 (C) Positive charges are repelled from the object, causing a net positive charge on the sphere
 (D) Negative charges are repelled from the object, causing a net negative charge on the sphere
44. A wire of length L and resistance R is connected to a battery of voltage V . If the length of the wire is increased by 50% and its radius is reduced by 40% , what is the new resistance of the wire?
- (A) $25R/6$ (B) $5R$ (C) $4R$ (D) $6R$

45. The charge flowing through a resistance R varies with time t as $Q = xt - yt^2$, where x and y are positive constants. The total heat produced in R is

- (A) $\frac{x^3 R}{y}$ (B) $\frac{x^3 R}{2y}$ (C) $\frac{x^3 R}{3y}$ (D) $\frac{x^3 R}{6y}$

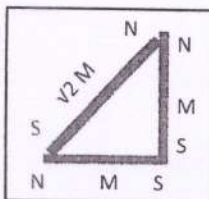
46. Which option is wrong in the context of a rainbow?

- (A) When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed
 (B) The order of colours remains same in the secondary rainbow
 (C) An observer cannot see a rainbow when facing towards the sun
 (D) Rainbow is a combined effect of dispersion, refraction and reflection of sunlight

47. A proton and an alpha particle are accelerated by potential difference of 1V and 2V respectively, the ratio of wavelength of proton to that of alpha particle is

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

48. The magnetic moment of the arrangements of magnet shown in the figure is:



- (A) Zero (B) $2\sqrt{2}M$ (C) M (D) $2M$

49. What is the ratio of the maximum velocity to the amplitude for a simple harmonic motion?

- (A) $\pi/2$ (B) π (C) 2π (D) $\sqrt{(\pi/2)}$

50. A particle moves along a straight line with constant acceleration a . What is the time taken for the particle to travel half the distance covered during the first 3 seconds?

- (A) $\sqrt{3/2} a$ (B) $\sqrt{2/3} a$ (C) $2\sqrt{2/3} a$ (D) $2\sqrt{3/3} a$

51. An object moves in a circle of radius 25 cm at a constant rate of 2 revolutions per second. The linear acceleration of the object is:

- (A) $4\pi \text{ cm/sec}^2$ towards the center (B) $40\pi \text{ cm/sec}^2$ towards the center
 (C) $400\pi \text{ cm/sec}^2$ towards the center (D) $40\pi \text{ m/sec}^2$ towards the center

52. The mean free path λ , for an ideal gas, is connected to the pressure p of the gas by:

- (A) λ proportional to p (B) λ proportional to p^2
 (C) λ proportional to p^{-1} (D) λ proportional to \sqrt{p}

53. In a diffraction grating the first-order bright fringes are seen at an angle given by $\theta = 36.1^\circ$ or $\sin\theta = 0.589$. The second-order bright fringes would be:

- (A) At $\sin\theta = 1.0$ (B) At $\sin\theta = 0.866$
 (C) At $\sin\theta = 0$ (D) No second-order bright fringes

54. An inventor claims to have constructed an engine with an efficiency of 54% when operated between the boiling and freezing points of water. By how much does this claim away from the reality?
(A) By factor of 4 (B) By factor of 3
(C) By factor of 2 (D) Matches with reality
55. A paratrooper's parachute fails to open and he lands in snow with some injuries. What does the presence of snow do to the paratrooper's impulse?
(A) Increases (B) Decreases
(C) Leaves it unchanged (D) Not enough information
56. If Planck's constant were 10^{-2} joule-sec, what would be the uncertainty of the speed of a 10 gm bouncing ball confined to a region of 0.1 m long?
(A) 10^{-2} m/sec (B) 1 m/sec (C) 10 m/sec (D) 100 m/sec
57. If 1 gram of matter were converted into energy, what would be its approximate value if energy costs Rs. 5 per kilowatt-hour (similar to electricity costs)?
(Given: 1 kw-hr = 3.6×10^6 joules)
(A) Rs. 10^8 (B) Rs. 10^6 (C) Rs. 10^9 (D) Rs. 10^{11}
58. The barrier voltage for a silicon diode, at 25°C , is:
(A) 0.3 V (B) 0.7 V (C) 0 V (D) Infinity
59. A reflecting astronomical telescope is always preferred for astronomical observations for many reasons. Which is not the correct reason?
(A) No Chromatic aberrations (B) No Spherical aberrations
(C) Large aperture of mirrors (D) Low resolving power
60. What is the ratio of the energy of a photon of wavelength λ to that of a photon of wavelength 2λ ?
(A) 1:1 (B) 1:2 (C) 2:1 (D) 4:1

x-x-x