CET-2011 P

Sr. No. :

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 the 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(s) gently when asked to do so.
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 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.**

1. The units of M (mass) and L (length) are doubled. The unit of kinetic energy will increase by a factor of

(A) 16 (B) 8

(C) 4 (D) 2

2. The dimensions of the quantities in one of the following pairs are the same, identify the pair.

(A) Torque and force (B) Angular momentum and work

(C) Light year and wavelength (D) Energy and Young's modulus

3. The distances travelled by a body freely falling from rest in first, second and third seconds are in the ratio

(A) 1 : 4 : 9 (B) 1 : 3 : 5

(C) 1 : 2 : 3 (D) 3 : 2 : 1

4. At what angle should the two forces 2P and $\sqrt{2}$P act so that the resultant force is P $\sqrt{10}$.

(A) 45º (B) 60º

(C) 90º (D) 120º

5. At the top of the trajectory of a projectile, the directions of its velocity and acceleration are

(A) parallel to each other (B) anti-parallel to each other

(C) inclined to each other at an angle of 45º (D) prependicular to each other

6. A particle is acted upon by a force of constant magnitude which is always perpendicular to the velocity of the particle. The motion of the particle takes place in a plane. It follows that

(A) its velocity is constant (B) its acceleration is constant

(C) its kinetic energy is constant (D) it moves in a straight line

7. A 15 g bullet is fired horizontally into a 3 kg block of wood suspended by a long cord. The bullet sticks the block. If the impact causes the block to swing 10 cm above its initial level, the velocity of the bullet was

(A) 251 m s^{-1} (B) 261 m s^{-1}

(C) 271 m s^{-1} (D) 281 m s^{-1}

8. The two cars C_1 and C_2 are going around concentric circles of radii r_1 and r_2. They complete the circular paths in same time. The ratio of the speeds of C_1 and C_2 is

(A) r_2/r_1 (B) r_1/r_2

(C) 1 (D) can not be found

9. If the kinetic energy of a body becomes four times of its initial value, then the new momentum will be

(A) double (B) three times

(C) four times (D) unchanged

10. In the elastic collision of heavy vehicle moving with a velocity of 10 m/s and a small stone at rest, the stone will fly away with a velocity of

(A) 5 m/s (B) 10 m/s

(C) 20 m/s (D) 40 m/s

11. The power supplied by a force acting on a particle moving in a straight line is constant. The velocity of the particle varies with the displacement x as

(A) $\sqrt{x}$ (B) x

(C) x^2 (D) $x^{1/3}$

12. Two rotating bodies have same angular momentum but their moments of inertia at I_1 and I_2 ($I_1 > I_2$), respectively. Which body will have higher kinetic energy of rotation ?

(A) first (B) second

(C) both will have same kinetic energy (D) not possible to predict

13. A cylindrical rod of mass m is of 1 m length. The radius of gyration of the rod about an axis of rotation perpendicular to its length and passing through the centre is

(A) 1/3 m (B) $2/\sqrt{3}$ m

(C) $1/2\sqrt{3}$ m (D) 1/2 m

14. A body rolls down an inclined plane. If its kinetic energy of rotational motion is 40% of its kinetic energy of translational motion, then the body is a

(A) ring (B) cylinder

(C) spherical shell (D) solid sphere

15. A satellite is moving around the earth with speed v in a circular orbit of radius r. If the orbit radius is reduced by 1%, its speed will

(A) increase by 1% (B) increase by 0·5%

(C) decrease by 1% (D) decrease by 1·5%

16. If the change in the value of g at a height h above the surface of the earth is the same as that at a depth x below it (assuming h << R and x << R), then

(A) x = h (B) x = 2h

(C) x = h/2 (D) x = h/3

17. The two satellites are at a distance R and 7R above the surface of earth. The ratio of their

(A) potential energies is 7 : 1 (B) kinetic energies is 7 : 1

(C) potential energies is 4 : 1 (D) kinetic energies is 5 : 1

18. A spherical liquid drop of radius R is divided into eight equal droplets. If its surface tension is T, then the work done in the process will be

(A) $2\pi R^2T$ (B) $3\pi R^2T$

(C) $4\pi R^2T$ (D) $2\pi RT^2$

19. Two glass balls of radii r and 2r are dropped in air. The terminal velocity of the ball of radius r is 1 cm/s, then the terminal velocity of the other ball will be

(A) 4 cm/s (B) 2 cm/s

(C) 1 cm/s (D) 0·5 cm/s

20. Two circular metal plates of radius 1 m and 2 m are placed horizontally in a liquid at rest at the same depth. The radio of thrusts on them is

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

(C) 1 : 2 (D) 2 : 1

21. The length and the radius of a wire are halved. The modulus of elasticity of the wire material will be

(A) one fourth (B) halved

(C) doubled (D) unchanged

22. A gram mole of a gas at 127ºC expands isothermally until its volume is doubled. The work done in this expansion is

(A) 238 J (B) 548 cal

(C) 238 cal (D) 548 J

23. A reversible heat engine works between two temperatures whose difference is 100ºC. If it absorbs 746 J of heat from the source and gives 546 J to sink, the temperature of the source is

(A) 173 K (B) 100 K

(C) 373 K (D) 273ºC

24. Which one of the following the parameters is same for molecules of all gases at a given temperature ?

(A) Mass (B) Speed

(C) Kinetic energy (D) Momentum

25. According to first law of thermodynamics

(A) heat neither enters nor leaves the system

(B) heat is constant in isothermal system

(C) energy is conserved

(D) extra energy is created

26. If a gas has f degrees of freedom, the value of C_p/C_v for such a gas would be

(A) f (B) $1 + 2/f$

(C) $f/2$ (D) $2f$

27. At identical temperatures, the root mean square speed of all molecules in a mixture containing hydrogen and oxygen in the mass ratio 1 : 8 is found to be n times the root mean square speed of O_2 molecules. The value of n is

(A) $3/2$ (B) $2/3$

(C) $\sqrt{3}/8$ (D) $\sqrt{8}/3$

28. A cylindrical tube, open at both ends, has a fundamental frequency ν. If one of the ends is closed, the fundamental frequency will become

(A) $\nu/2$ (B) 2ν

(C) 4ν (D) $\nu/4$

29. For a particle executing simple harmonic motion, the kinetic energy is equal to the potential energy of the particle when its displacement from the mean position is 2 cm. The amplitude of motion of the particle is

(A) 2·0 cm (B) $4\sqrt{2}$ cm

(C) 4·0 cm (D) $2\sqrt{2}$ cm

30. A certain mass (m) of mercury (density ρ) is poured into a glass U tube (inner radius, r) and it oscillates freely up and down about its position of equilibrium. The force constant of the oscillation is

(A) $2\pi r^2/\rho\, g$ (B) $m/2\pi r^2\, \rho g$

(C) $2\pi m/r^2\, \rho g$ (D) $2m/g$

31. How many electrons would approximately contribute to a net charge of one Coulomb ?

(A) 6×10^{23} (B) One

(C) 6×10^{18} (D) $1{\cdot}6\times10^{19}$

32. Determine the field (in SI units) inside a parallel plate capacitor with two infinite planes that carry an equal and opposite uniform charge densities of $\pm \sigma$ The gap between the plates is d.

(A) Zero

(B) $\sigma/2\in_o$

(C) $\sigma/\in_o$

(D) $\sigma/\in_o d$

33. A charged capacitor C_1 is connected with an uncharged capacitor C_2. What happens to the total energy of the capacitor system ?

(A) Remains same

(B) Increase by $\left(\frac{C_1 + C_2}{C_1}\right)$

(C) Decrease by $\left(\frac{C_1}{C_1 + C_2}\right)$

(D) Increase by $\frac{C_1}{C_2}$

34. An uncharged hollow cubic conductor of total surface area A has a charge q kept inside its cavity. What is the magnitude of electric field outside the conductor ?

(A) $\frac{1}{4\pi\in_o}\frac{q}{r^2}$

(B) Zero

(C) $\frac{1}{4\pi\in_o}\frac{q_A}{r^2}$

(D) $\frac{1}{4\pi\in_o}\frac{q}{Ar^2}$

35. What is the power output of a 12 volt battery operating at 4 Amperes of current with an internal resistance of 3 ohms ?

(A) 48 W

(B) 36 W

(C) Zero

(D) 12 W

36. A 10 Ampere current flows through a wire of cross-sectional area 4 millimeter square. How much approximate time does it take for an electron to travel 4 meters of the length of wire ? The free electron density is 8×10^{28} m^{-3}.

(A) 2×10^4 seconds

(B) Instant

(C) 2·5 seconds

(D) 2×10^5 seconds

37. Find the correct statement regarding two infinitely long parallel current carrying wires.

(A) The total force of interaction is infinite.

(B) The two wires repel each other.

(C) The interaction is inversely proportional to the square of their separation.

(D) The mutual magnetic fields vanish around the two wires.

38. What is the magnetic field (in SI units) outside an infinitely long solenoid that consists of n closely wound turns per unit length ? A current I flows through the solenoid.

(A) $\mu_o nI$ (B) Infinite

(C) Zero (D) $\frac{\mu_o n}{I}$

39. Which of the following statement is not appropriate ?

(A) Magnetic domains are responsible for Ferromagnetism.

(B) Paramagnetism involves a weak interaction of magnetic field with unpaired electrons.

(C) Diamagnetism is due to pairing of electrons and Lenz's law.

(D) All ferromagnets have permanent magnetism at bulk scale.

40. A 5 Ampere of current flows through a single circular coil of wire of radius 5 cm. What is the torque experienced by this coil when kept parallel to a magnetic field of 1·2 Tesla ?

(A) Zero (B) 0·047 N m

(C) 6 N m (D) 0·015 N m

41. Select a correct statement for an LCR circuit.

(A) The impedance of circuit decrease with increase in capacitance.

(B) At resonance frequency, the impedance of the circuit is equal to the resistance R.

(C) The phase angle maximizes at resonance.

(D) The current through the circuit minimizes at resonance.

42. Identify the correct statement.

(A) An alternate current cannot flow through a parallel plate capacitor.

(B) A capacitor provides zero impedance for direct current.

(C) The displacement current deals with rate of change of electric field with time.

(D) Faraday's law is substantially modified by incorporation of displacement current.

43. The stopping potential in the case of photoelectric effect does not depend upon,

(A) Frequency of incoming photons

(B) Intensity of incoming photons.

(C) Work function of cathode material

(D) Particle nature of photons

44. The de Broglie duality relation is generally not discussed in content to the

(A) Elementary particles like electrons and protons

(B) Energy quantization of electronic orbits around nucleus.

(C) X-ray beam striking a crystal

(D) Classical theory of electromagnetic waves

45. What is the mass defect of carbon-12 ? Masses of proton, neutron and electron are 1·007276 amu, 1·008665 amu and 0·000549 amu, respectively.

(A) 0·0989 amu (B) 0

(C) 0·0956 amu (D) 0·09945 amu

46. How much percentage of radioactive isotopes decay in their three half lives ?

(A) 12·5 (B) 87·5

(C) 56·7 (D) 97·5

47. The wavelength of the lowest energy photon emitted in the Balmer series of hydrogen spectra, in the units of Rydberg constant R, is

(A) 1·33/R (B) 7·2/R

(C) 5·33/R (D) 20·6/R

48. Identify the incorrect statement.

(A) The binding energy per nucleon is maximum for iron-peaked nuclides.

(B) The fussion processes dominate bellow iron nuclides.

(C) Fission process occurs for very heavy nuclides apart from alpha decay.

(D) Alpha decay is generally followed by beta decay.

49. The FM radio operates approximately in the wavelength range of

(A) Meters (B) Kilometers

(C) Centimeters (D) Micrometers.

50. Identify the incorrect statement in content to the electromagnetic wave (EM).

(A) The electric and magnetic field vectors are perpendicular to the propagation of EM wave.

(B) EM waves travel through a medium at a velocity lower than that in vacuum.

(C) Velocity of EM waves in vacuum depends upon the permittivity and permeability of free space.

(D) Strength of the electric and magnetic fields decrease with distance as the EM waves pass through vacuum.

51. An incident ray is reflected at the boundary surface between glass immersed in water of refractive index 1·33. If the angle of incidence is 43º determine the criteria for internal reflection.

(A) Internal reflection occurs in glass of refractive index 1·95

(B) Internal reflection criteria cannot be satisfied.

(C) Internal reflection occurs in water in case the refractive index of glass is 1·95

(D) Internal reflection occurs in any glass of refractive index greater than 1·33.

52. A thin convex lens of focal length 40 cm has to be designed from a glass of refractive index 1·55. Estimate the radius of curvature in case the curvature of the other surface is 50 cm.

(A) 15·3 cm (B) 27·3 cm

(C) 24·0 cm (D) 39·3 cm

53. A 60 years old person suffers from presbyopia with the near point at 200 cm. Recommend a lens to read a book kept at a distance of 25 cm in front of him.

(A) 28·6 cm concave lens (B) 22·2 cm convex lens

(C) 22·2 cm concave lens (D) 28·6 cm convex lens

54. In the Young's double slit experiment with slit separation of 0·3 mm, the screen distance of 150 cm. The fifth bright fringe is found at a gap of 1·25 cm from the central fringe. Estimate the wavelength of light.

(A) 700 nm (B) 500 nm

(C) 475 nm (D) 650 nm

55. As a voltage regulator, a Zener diode is connected through a resistance of 1000 ohms to a voltage source that can provide voltage as high as 50 volts. Find the maximum current that can flow through the regulator if the breakdown voltage and the diode is 10 volts.

(A) 50 mA (B) 10 mA

(C) 40 mA (D) 60 mA

56. In an npn transistor most of the electrons that flow through the base will

(A) Flow out to the base lead. (B) Flow into the collector.

(C) Recombine with base holes. (D) Recombine with collector holes.

57. In a common emitter configuration with a current gain of 100, a base voltage supply of 15 volts is applied through a base resistance of 500 kilo ohms. Estimate the collector current assuming a base emitter voltage drop of 0·7 volts.

(A) 3·00 mA (B) 2·86 μA

(C) 3·14 mA (D) 2·86 mA

58. Estimate the number of NAND gates that can be connected with each other to finally produce an OR gate.

(A) 1 (B) 2

(C) 3 (D) 4

59. A light beam is incident on a glass of refractive index 1·5. The reflected beam is totally polarized. What is the angle of refraction ?

(A) 56·31º (B) 33·69º

(C) 45·00º (D) 19·89º

60. What was the major accomplishment of Oersted's Experiment ?

(A) A change in magnetic flux induce emf.

(B) The demonstration of magnetic domains.

(C) The presence of displacement current.

(D) The interaction of the electric current through a wire with the magnetic compass.

ROUGH WORK