CCE(P) - 2015
PHYSICS

KTM–24–XV

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Subject Code : 2 4

Test Booklet No. : 00795

TEST BOOKLET

PHYSICS

Time Allowed : 2 (Two) Hours **Full Marks : 200**

INSTRUCTIONS

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Subject Code shall be written legibly and correctly in the space provided on the Answer Sheet with black ball pen.
2. **Space provided for Series in the Answer Sheet is not applicable for Optional Subject. So the space shall be left blank.**
3. All questions carry equal marks. Your total marks will depend only on the number of correct responses marked by you in the Answer Sheet.
4. No candidate shall be admitted to the Examination Hall/Room 20 minutes after commencement of distribution of the paper. The Supervisor of the Examination Hall/Room will be the time-keeper and his/her decision in this regard is final.
5. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/ Invigilator. No candidate shall be permitted to hand over his/her Answer Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.
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7. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected paper permitted by the Commission.
8. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.
9. After you have completed filling in all your responses on the Answer Sheet and the Examination has concluded, you should hand over to the Invigilator *only the Answer Sheet.* You are permitted to take away with you the Test Booklet.
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12. **This Test Booklet contains one sheet (two pages) for Rough Work at the end.**

SEAL

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[No. of Questions : 100]

CCE(P)-2015

PHYSICS

1. The rotational kinetic energy of a body of moment of inertia I rotating about an axis with an angular velocity ω is

(A) $I\omega$

(B) $I\omega^2$

(C) $\frac{1}{2}I\omega^2$

(D) $\frac{1}{2}I^2\omega$

2. The relation between moment of inertia I of a body of mass M and radius of gyration K is

(A) $I = MK^2$

(B) $I = \frac{M}{K}$

(C) $I = M^2K$

(D) $I = \frac{K}{M}$

3. For a circular disc of mass M and radius R, the moment of inertia about an axis passing through its centre and perpendicular to its plane is

(A) $I = MR^2$

(B) $I = \frac{1}{4}MR^2$

(C) $I = \frac{1}{2}MR^2$

(D) $I = \frac{3}{4}MR^2$

4. In case of simple harmonic motion, the restoring force is proportional to

(A) velocity

(B) acceleration

(C) displacement

(D) time

5. The time period T of a simple pendulum of length l is

(A) $T = 2\pi\sqrt{\frac{l}{g}}$

(B) $T = 2\pi\frac{\sqrt{l}}{g}$

(C) $T = 2\pi\sqrt{\frac{g}{l}}$

(D) $T = 2\pi lg$

6. Hooke's law states that within the elastic limit, stress is proportional to

(A) pressure

(B) force

(C) length

(D) strain

7. The unit of surface tension is

(A) newton/meter

(B) joule/meter

(C) newton

(D) joule

8. According to Stokes' law, the force of viscosity F along on a spherical body of radius r moving with a velocity v through a fluid of viscosity η is

(A) $F = 2\pi\eta rv$

(B) $F = 6\pi\eta rv$

(C) $F = 4\pi\eta rv$

(D) $F = 9\pi\eta rv$

9. The dimension of coefficient of viscosity is

(A) $ML^{-1}T^{-1}$

(B) MLT^{-1}

(C) $ML^{-1}T$

(D) $ML^{-1}T^{-2}$

10. Change of momentum is also known as

(A) torque

(B) inertia

(C) impulse

(D) moment of inertia

11. The ratio of the velocity of escape v_e and velocity of projection v_0 of a body to become a satellite of the earth is

(A) $v_e / v_0 = \sqrt{2}$

(B) $v_e / v_0 = 1/\sqrt{2}$

(C) $v_e / v_0 = 2$

(D) $v_e / v_0 = 1$

12. The working of a sprayer or atomizer is based on

(A) fluid continuity equation

(B) Bernoulli's theorem

(C) Stokes' law

(D) Poiseuille's formula

13. The relations between the coefficient of linear expansion α, superficial expansion β and cubical expansion γ are

(A) $\alpha = 2\beta$ and $\beta = 3\gamma$

(B) $\beta = 2\alpha$ and $\gamma = 3\alpha$

(C) $\alpha = 2\beta$ and $\gamma = 3\alpha$

(D) $\beta = 2\alpha$ and $\alpha = 3\gamma$

14. Which one of the following is not a thermodynamic variable?

(A) Pressure

(B) Temperature

(C) Volume

(D) Work

15. Rusting of iron is an example of

(A) irreversible process

(B) reversible process

(C) adiabatic process

(D) isothermal process

16. If an ideal gas is compressed at constant temperature, its change of internal energy will

(A) increase

(B) decrease

(C) remain same

(D) become zero

17. The coefficient of performance of a heat engine working between source temperature T_1 and sink temperature T_2 is

(A) $T_2 / (T_1 - T_2)$

(B) $T_1 / (T_1 - T_2)$

(C) $1 - T_2 / T_1$

(D) $(T_1 - T_2) / T_2$

18. In a Carnot engine, the temperature of source is 1000 K and the efficiency of engine is 80%. The temperature of the sink is

(A) 700 K

(B) 400 K

(C) 600 K

(D) 200 K

19. In an adiabatic process, the quantity which remains constant is

(A) volume

(B) pressure

(C) temperature

(D) total heat of the system

20. "Heat cannot itself flow from a body at lower temperature to a body at higher temperature" is a statement of

(A) second law of thermodynamics

(B) zeroth law of thermodynamics

(C) conservation of mass

(D) first law of thermodynamics

21. The quantity of heat required to change the state of unit mass of a substance at constant temperature is known as

(A) latent heat

(B) water equivalent

(C) specific heat

(D) thermal capacity

22. At which temperature, the Celsius and Fahrenheit scales are equal?

(A) 40°

(B) 36°

(C) – 40°

(D) – 80°

23. Two gases are at absolute temperature 300 K and 350 K respectively. The ratio of average kinetic energy of their molecules is

(A) 7 : 6

(B) 6 : 7

(C) 36 : 49

(D) 49 : 36

24. If γ_a is the coefficient of apparent expansion of a liquid and γ_c is the coefficient of cubical expansion of the container, then both are related with the coefficient of real expansion γ_r as

(A) $\gamma_r = \gamma_a - \gamma_c$

(B) $\gamma_r = \gamma_a + \gamma_c$

(C) $\gamma_a = \gamma_c - \gamma_r$

(D) $\gamma_a = -\gamma_r - \gamma_c$

25. Two thin lenses of focal lengths + 10 cm and – 5 cm are put in contact. The power of the combination is

(A) 5 D

(B) 10 D

(C) – 10 D

(D) – 5 D

26. Nicol prism is an optical device based on the phenomenon of

(A) diffraction

(B) interference

(C) dispersion

(D) double refraction

27. Transverse nature of light is shown by

(A) interference

(B) refraction

(C) polarization

(D) dispersion

28. In Fraunhofer's diffraction, the incident wavefront is

(A) spherical

(B) cylindrical

(C) elliptical

(D) planar

29. Polarized light can be obtained with the help of

(A) Nicol prism

(B) biprism

(C) polarimeter

(D) convex lens

30. X-rays cannot be diffracted by means of ordinary grating because

(A) it has high intensity

(B) it is unidirectional

(C) its wavelength is very short

(D) it has high velocity

31. The zone plate can behave

(A) only as a convergent lens

(B) only as a divergent lens

(C) simultaneously as convergent and divergent lens

(D) only as a plano-concave lens

32. If a is the width of each slit of a grating and b is the width of opaque space between two consecutive slits, then grating elements is

(A) $a+b$

(B) $a-b$

(C) $2(a+b)$

(D) $(a+b)/2$

33. If light from denser medium is reflected into rarer medium

(A) no phase change occurs

(B) phase changes by π radian

(C) phase changes by $\pi/2$ radian

(D) phase changes by 2π radian

34. When a compact disc (CD/DVD) is illuminated by white light, coloured lines are observed due to

(A) dispersion

(B) diffraction

(C) refraction

(D) interference

35. A transformer works on the principle of

(A) self-induction

(B) converter

(C) inverter

(D) mutual induction

36. The substance whose conductivity increases on heating is

(A) metal

(B) insulator

(C) semiconductor

(D) ferromagnetic

37. In an open coil, inductance L and resistance R are

(A) $L=\infty,\ R=0$

(B) $L=0,\ R=0$

(C) $L=\infty,\ R=\infty$

(D) $L=0,\ R=\infty$

38. A moving-coil galvanometer can be converted to an ammeter by connecting

(A) a low resistance in series

(B) a low resistance in parallel

(C) a high resistance in series

(D) a high resistance in parallel

39. A capacitor blocks direct current (d.c.) because for d.c.

(A) frequency is zero

(B) frequency remains unchanged

(C) amplitude is very high

(D) frequency is very high

40. In case of wattless current

(A) power factor is unity

(B) reactance of the circuit is zero

(C) no power is consumed in a.c. circuit

(D) no power is consumed in d.c. circuit

41. When a current flows in a thermocouple, the Peltier phenomenon occurs

(A) only at the junctions

(B) all along the conductor

(C) only at the hot junction

(D) only at the cold junction

42. The relation between root-mean-square value I_{rms} and peak value I_0 of a.c. is

(A) $I_{rms} = I_0 / \sqrt{2}$

(B) $I_{rms} = \left(\frac{1}{2}\right) I_0$

(C) $I_0 = \left(\frac{1}{2}\right)^{1/2} I_{rms}$

(D) $I_{rms} = \sqrt{2} I_0$

43. In a thermocouple, the neutral temperature is 270 °C and the temperature of inversion is 525 °C. The temperature of the cold junction is

(A) 30 °C

(B) 25 °C

(C) 15 °C

(D) 255 °C

44. Kirchhoff's first and second laws of electrical circuits are consequences of

(A) conservation of charge and energy respectively

(B) conservation of energy and charge respectively

(C) conservation of energy

(D) conservation of charge

45. The internal resistance acts in a cell

(A) in an open circuit

(B) in a closed circuit

(C) in both open and closed circuits

(D) depending on the types of cell

46. If L is the self-inductance of coil and I is the maximum current passing through it, then the energy stored in the coil is

(A) $\frac{1}{2} L I^2$

(B) $L I^2$

(C) $\frac{1}{2} L^2 I$

(D) $2 L I^2$

47. The thermoelectric e.m.f. is produced by

(A) heating junctions of similar metals

(B) applying voltage at metal junctions

(C) heating junctions of dissimilar metals

(D) passing current at metal junctions

48. At neutral temperature, the thermo-electric power is

(A) zero

(B) negative

(C) maximum

(D) constant

49. During electrolysis

(A) the mass of the cathode increases

(B) the mass of the cathode decreases

(C) the masses of the cathode and anode remain same

(D) the mass of the anode increases

50. If the kinetic energy of a free electron doubles, its de Broglie wavelength changes by a factor of

(A) 2

(B) $\frac{1}{2}$

(C) $\sqrt{2}$

(D) $1/\sqrt{2}$

51. Cathode rays consist of

(A) photons

(B) electrons

(C) α-particles

(D) γ-particles

52. The energy of a photon wavelength λ is

(A) hc/λ

(B) λch

(C) $h\lambda/c$

(D) $\lambda c/h$

53. Bohr's theory of hydrogen atom cannot fully explain the

(A) energy of electron in an atom

(B) ionization energy

(C) fine structure of spectrum

(D) emission spectra

54. The number of waves contained in unit length of a medium is called

(A) wave velocity

(B) wavelength

(C) wave number

(D) wave pulse

55. The frequency f of the characteristic X-rays depends on atomic number Z as

(A) $f \propto Z$

(B) $f \propto Z^2$

(C) $f \propto \sqrt{Z}$

(D) $f \propto Z^3$

56. The function of heavy water in a reactor is to

(A) stop the neutrons

(B) slow down the neutrons

(C) absorb the neutrons

(D) speed up the neutrons

57. Nuclear fusion is possible

(A) only between light nuclei

(B) only between heavy nuclei

(C) between both light and heavy nuclei

(D) between only nuclei those are stable against decay

58. Isotopes have same number of

(A) protons

(B) neutrons

(C) positrons

(D) electrons

59. To avoid harm of radioactive radiations, radioactive samples are stored in lead boxes because it is

(A) good conductor

(B) heavy

(C) good absorber

(D) bad conductor

60. Penetrating power is minimum for

(A) α-rays

(B) β-rays

(C) γ-rays

(D) X-rays

61. Suitable impurities are added to intrinsic semiconductor in order to

(A) increase its life

(B) increase its electrical resistivity

(C) increase its electrical conductivity

(D) withstand high voltage

62. In a *P-N* diode, the depletion region expands

(A) under forward-biased condition

(B) when zero voltage is applied

(C) under unbiased condition

(D) under reverse-biased condition

63. In order to rectify an alternating current, one uses a

(A) transistor

(B) capacitor

(C) transformer

(D) diode

64. In a Raman spectra, spectral lines have frequencies

(A) equal to the incident frequency

(B) greater than the incident frequency

(C) lesser than the incident frequency

(D) greater and lesser than the incident frequency

65. The east-west effect of cosmic ray predicts that

(A) majority of particles are positively charged

(B) majority of particles are negatively charged

(C) majority of particles are neutrals

(D) majority of particles are photons

66. The spectra that arises due to scattering of light by the vibrating molecules is

(A) fluorescence spectra

(B) Raman spectra

(C) infrared spectra

(D) X-ray spectra

67. When a triode is used as an amplifier, the phase difference between input and output is

(A) zero

(B) $\pi/4$

(C) $\pi/2$

(D) π

68. Electromagnetic waves are radiated by

(A) a stationary charge

(B) a charge in uniform motion

(C) an accelerated or an oscillating charge

(D) both an accelerated charge and a charge in uniform motion

69. A man is sitting with folded hands on a revolving table. Suddenly he stretches his arms. The angular speed of the table could

(A) increase

(B) decrease

(C) remain the same

(D) first increase then decrease

70. The relation between Kelvin scale T_K and Celsius scale T_C is

(A) $T_C = T_K + 273$

(B) $T_C = T_K + 212$

(C) $T_C = T_K - 273$

(D) $T_C = T_K - 80$

71. On which factor does the average kinetic energy of gas molecules depend?

(A) Nature of the gas

(B) Volume

(C) Temperature

(D) Pressure

72. Which one of the following statements is true?

(A) Both light and sound waves can travel in vacuum

(B) Both light and sound waves are transverse

(C) Sound wave is longitudinal and light wave is transverse

(D) Both sound and light waves are longitudinal

73. The moment of inertia of a solid sphere and a spherical shell of equal masses about their diameters are equal. The ratio of their radii is

(A) 5 : 3

(B) 3 : 5

(C) $\sqrt{5} : \sqrt{3}$

(D) $\sqrt{3} : \sqrt{5}$

74. The orbital speed of an artificial satellite in a circular orbit just above the earth's surface is v. For a satellite orbiting at an altitude of half the earth's radius, the orbital speed is

(A) $\frac{3}{2}v$

(B) $\frac{\sqrt{3}}{2}v$

(C) $\frac{\sqrt{2}}{3}v$

(D) $\frac{2}{3}v$

75. The speed of sound in oxygen at a certain temperature is 460 ms^{-1}. The speed of sound in hydrogen at the same temperature will be

(A) 460 ms^{-1}

(B) 920 ms^{-1}

(C) 1380 ms^{-1}

(D) 1840 ms^{-1}

76. Specific heat of water is

(A) 4·2 J kg^{-1} K^{-1}

(B) 420 J kg^{-1} K^{-1}

(C) 1 cal kg^{-1} K^{-1}

(D) 4200 J kg^{-1} K^{-1}

77. Two sources of light are said to be coherent if the waves produced by them have

(A) same amplitude

(B) same wavelength

(C) same wavelength and a constant phase difference

(D) same amplitude and same wavelength

78. The dual nature of light is exhibited by

(A) diffraction and reflection

(B) diffraction and polarization

(C) diffraction and photoelectric effect

(D) refraction and interference

79. Which of the following phenomena is not common to sound and light waves?

(A) Interference

(B) Diffraction

(C) Coherence

(D) Polarization

80. Which of the following characteristics of electrons determines the current in a conductor?

(A) Drift velocity alone

(B) Thermal velocity alone

(C) Both drift velocity and thermal velocity

(D) Neither drift velocity nor thermal velocity

81. A wire of resistance R is cut into n equal parts. These parts are then connected in parallel. The equivalent resistance of the combination will be

(A) nR

(B) R/n

(C) n/R

(D) R/n^2

82. A 100 mH coil carries a current of 1 A. The energy stored in the magnetic field is

(A) 0·5 J

(B) 1 J

(C) 0·1 J

(D) 0·05 J

83. A coil of resistance R and inductance L is connected to a battery of e.m.f. E volts. The final current in the coil is

(A) E/R

(B) E/L

(C) $E/\sqrt{R^2+L^2}$

(D) $\sqrt{R^2+L^2}/E$

84. What will be the phase difference between RMS voltage and RMS current when current in the circuit is wattless?

(A) 60°

(B) 45°

(C) 90°

(D) 180°

85. Which of the following colours of light has the minimum stopping potential?

(A) Blue

(B) Yellow

(C) Violet

(D) Red

86. A sodium lamp emits $3{\cdot}14 \times 10^{20}$ photons per second. The distance from sodium lamp, where flux of photon is one photon per second per cm^2, is

(A) 10^{10} cm

(B) 5×10^{9} cm

(C) 5×10^{8} cm

(D) 10^{9} cm

87. The ground state energy of H-atom is – 13·6 eV. The energy needed to ionize H-atom from its second excited state is

(A) 3·4 eV

(B) 1·51 eV

(C) 13·6 eV

(D) 12·1 eV

88. When hydrogen atom is in its first excited state, its radius is how many times of its ground state radius?

(A) Half

(B) Four times

(C) Twice

(D) Same

89. The energy equivalent of one atomic mass unit (amu) is

(A) $1{\cdot}6 \times 10^{-19}$ J

(B) $6{\cdot}02 \times 10^{23}$ J

(C) 931 MeV

(D) 9·31 MeV

90. Atoms whose nuclei contain different numbers of protons but same number of neutrons are called

(A) isotones

(B) isotopes

(C) isobars

(D) photons

91. The binding energy of a nucleus is a measure of its

(A) mass

(B) stability

(C) charge

(D) momentum

92. According to Maxwell, the velocity of light in any medium is expressed as

(A) $1/\sqrt{\mu\varepsilon}$

(B) $1/\sqrt{\mu_0\varepsilon_0}$

(C) $\sqrt{\frac{\mu}{\varepsilon}}$

(D) $\sqrt{\frac{\mu_0}{\varepsilon_0}}$

93. Triode valve is used as

(A) amplifier only

(B) oscillator only

(C) both amplifier and oscillator

(D) rectifier

94. The amplification factor (μ), plate resistance (r_p) and mutual conductance (g_m) of a triode valve are related by the relation

(A) $\mu = r_p \times g_m$

(B) $\mu = r_p / g_m$

(C) $\mu = g_m / r_p$

(D) $\mu = 1 / r_p \times g_m$

95. Which of the following Newton's laws of motion gives a measure of the force?

(A) First law

(B) Second law

(C) Third law

(D) All of the above

96. Heat travels through vacuum by

(A) conduction

(B) convection

(C) radiation

(D) Both (A) and (B)

97. In photoelectric effect, electrons are ejected from metals if the incident light has a certain minimum

(A) amplitude

(B) angle of incidence

(C) intensity

(D) frequency

98. In anomalous Zeeman effect, a single line is split up into

(A) two components

(B) three components

(C) a number of components

(D) either two or three components

99. Which of the following pairs has no dimension and unit?

(A) Stress and Young's modulus

(B) Stress and strain

(C) Stress and Poisson's ratio

(D) Strain and Poisson's ratio

100. The electromagnetic waves do not transport

(A) charge

(B) energy

(C) momentum

(D) information