प्रश्न पुस्तिका / QUESTION BOOKLET

विषय / Subject :

# Physics

ACf

कोड / Code : **OP10**

पुस्तिका में पृष्ठों की संख्या /
Number of Pages in Booklet : **48**

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पुस्तिका में प्रश्नों की संख्या /
Number of Questions in Booklet : **200**

OP 10 विषय कोड — Physics — A बुकलेट सीरीज

समय / Time : **3** घंटे / Hours

पूर्णांक / Maximum Marks : **100**

**INSTRUCTIONS**

1. **Answer all questions.**
2. **All questions carry equal marks.**
3. Only one answer is to be given for each question.
4. If more than one answers are marked, it would be treated as wrong answer.
5. Each question has four alternative responses marked serially as **1, 2, 3, 4**. You have to darken only one circle **or** bubble indicating the correct answer on the Answer Sheet using **BLUE BALL POINT PEN.**
6. **1/3 part of the mark(s) of each question will be deducted for each wrong answer.** (A wrong answer means an incorrect answer **or** more than one answers for any question. Leaving all the relevant circles **or** bubbles of any question blank will not be considered as wrong answer.)
7. The candidate should ensure that Series Code of the Question Paper Booklet and Answer Sheet must be same after opening the envelopes. In case they are different, a candidate must obtain another Question Paper of the same series. Candidate himself shall be responsible for ensuring this.
8. Mobile Phone or any other electronic gadget in the examination hall is strictly prohibited. A candidate found with any of such objectionable material with him/her will be strictly dealt as per rules.
9. Please correctly fill your Roll Number in O.M.R. Sheet. 5 marks will be deducted for filling wrong or incomplete Roll Number.

***Warning :*** If a candidate is found copying or if any unauthorised material is found in his/her possession, F.I.R. would be lodged against him/her in the Police Station and he/she would liable to be prosecuted under Section 3 of the R.P.E. (Prevention of Unfairmeans) Act, 1992. Commission may also debar him/her permanently from all future examinations of the Commission.

**निर्देश**

1. **सभी प्रश्नों के उत्तर दीजिए ।**
2. **सभी प्रश्नों के अंक समान हैं ।**
3. प्रत्येक प्रश्न का केवल एक ही उत्तर दीजिए।
4. एक से अधिक उत्तर देने की दशा में प्रश्न के उत्तर को गलत माना जाएगा ।
5. प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं, जिन्हें क्रमशः 1, 2, 3, 4 अंकित किया गया है। अभ्यर्थी को सही उत्तर निर्दिष्ट करते हुए उनमें से केवल एक गोले अथवा बबल को उत्तर-पत्रक पर नीले बॉल प्वाइंट पेन से गहरा करना है ।
6. प्रत्येक गलत उत्तर के लिए प्रश्न अंक का **1/3** भाग काटा जायेगा। गलत उत्तर से तात्पर्य अशुद्ध उत्तर अथवा किसी भी प्रश्न के एक से अधिक उत्तर से है । किसी भी प्रश्न से संबंधित गोले या बबल को खाली छोड़ना गलत उत्तर नहीं माना जायेगा।
7. प्रश्न-पत्र पुस्तिका एवं उत्तर पत्रक के लिफाफे की सील खोलने पर परीक्षार्थी यह सुनिश्चित कर लें कि उसके प्रश्न-पत्र पुस्तिका पर वही सीरीज अंकित है जो उत्तर पत्रक पर अंकित है। इसमें कोई भिन्नता हो तो वीक्षक से प्रश्न-पत्र की ही सीरीज वाला दूसरा प्रश्न-पत्र का लिफाफा प्राप्त कर लें। ऐसा न करने पर जिम्मेदारी अभ्यर्थी की होगी।
8. मोबाईल फोन अथवा इलेक्ट्रोनिक यंत्र का परीक्षा हॉल में प्रयोग पूर्णतया वर्जित हैं। यदि किसी अभ्यर्थी के पास ऐसी कोई वर्जित सामग्री मिलती है तो उसके विरुद्ध आयोग द्वारा नियमानुसार कार्यवाही की जायेगी।
9. कृपया अपना रोल नम्बर ओ.एम.आर. पत्रक पर सावधानी पूर्वक सही भरें। गलत अथवा अपूर्ण रोल नम्बर भरने पर 5 अंक कुल प्राप्तांकों में से अनिवार्य रूप से काटे जाएंगे।

चेतावनी : अगर कोई अभ्यर्थी नकल करते पकड़ा जाता है या उसके पास से कोई अनधिकृत सामग्री पाई जाती है, तो उस अभ्यर्थी के विरुद्ध पुलिस में प्राथमिकी दर्ज कराई जायेगी और आर. पी. ई. (अनुचित साधनों की रोकथाम) अधिनियम, 1992 के नियम 3 के तहत कार्यवाही की जायेगी। साथ ही आयोग ऐसे अभ्यर्थी को भविष्य में होने वाली आयोग की समस्त परीक्षाओं से विवर्जित कर सकता है।

1 Which of the following is conserved when light waves interfere ?

(1) Mass (2) Energy

(3) Intensity (4) Frequency

2 Two light beams with intensities $I_1$ and $I_2$ superimpose to produce interference pattern. The contrast between the fringes is the best when

(1) $I_1 = I_2$ (2) $I_1 = \frac{I_2}{4}$

(3) $I_1 = \frac{I_2}{3}$ (4) $I_1 = 2I_2$

3 Colours are produced in a soap bubble by

(1) Interference (2) Dispersion

(3) Diffraction (4) Polarisation

4 Two waves having the intensities in the ratio 9:1 produce interference. The ratio of maximum to minimum intensity is

(1) 4:1 (2) 4:3

(3) 3:1 (4) 2:1

5 The thickness of an oil film on the water surface so that colours can be seen on it should be

(1) 1 mm (2) 1 cm

(3) 1 nm (4) 1 μm

6 What is the nature of the source of light in the biprism interference experiment ?

(1) Point source (2) Extended source

(3) Narrow slit (4) Multiple source

7 Two sources of light are said to be coherent when both give out light waves of same

(1) speed and phase

(2) amplitude and phase

(3) wavelength and constant phase difference

(4) wavelength and intensity

8 In a young's double slit experiment, maxima is obtained for path difference between interfering wave -

($n$ is an integer)

(1) $2n\lambda$ (2) $n\lambda$

(3) $(2n+1)\lambda/2$ (4) $n\lambda/2$

9 The ratio of phase difference to the path difference between two light waves is

(1) $2\pi/\lambda$ (2) $2\pi\lambda$

(3) $\lambda/2\pi$ (4) $\frac{1}{2\pi\lambda}$

10 Monochromatic light from a narrow slit illuminates two parallel narrow slits producing an interference pattern on a screen far away. What is the effect on the fringe width if the slit separation is made twice and distance between the screen and slit is reduced to half.

(1) It is doubled (2) It is halved

(3) It remains the same (4) It becomes one fourth

11 A thin film having thickness $t \ll \lambda$ is seen in white light. It will appear

(1) white (2) red

(3) black (4) violet

12 The diameter of dark rings in Newtons rings is

(1) inversely proportional to the square root of odd numbers

(2) directly proportional to the square root of natural numbers

(3) directly proportional to the square root of odd numbers

(4) inversely proportional to the square root of natural numbers

13 In the Fresnel's Biprism experiment, the two Coherent sources are obtained by

(1) refraction

(2) reflection

(3) internal reflection

(4) reflection and refraction both

14 When a light wave suffers reflection at the interface between air and glass medium, the change of phase of the reflected wave in air medium is given as -

(1) 0 (2) $\pi$

(3) $\pi/2$ (4) $2\pi$

15 Two slits illuminated with red light of wavelength 650 nm have a separation of 1mm. The interference fringes are observed on a screen at 1m from the slits. The distance between the third dark fringe and the fifth bright fringe will be :

(1) 0.65 mm (2) 4.88 mm

(3) 3.25 mm (4) 1.63 mm

16 A thin film is observed in white light. The colour of the film seen at a particular point depends on

(1) thickness of the film

(2) distance of the source

(3) location of the observer

(4) width of source

17 In an interference pattern produced by two identical slits, the intensity at the maxima is $I$. If eigher slit is closed, the intensety at the maxima is $I_0$. Which of the following is true ?

(1) $I = 2I_0$ (2) $I = 4I_0$

(3) $I = 16I_0$ (4) $I = I_0$

18 Which of the following is essential for observing diffraction ?

(1) A narrow slit (2) White light

(3) Screen (4) Two coherent sources

19 The condition for observing Fraunhofer diffraction from a single slit is that the light wave front incident on the slit should be

(1) elliptical (2) plane

(3) cylindrical (4) spherical

20 For Fraunhofer diffraction, the first diffraction minima due to a single slit diffraction is at $\theta = 30^{\circ}$ for a light of $5000\mathring{A}^{\circ}$ wavelength. The width of the slit is

(1) $1.5\times10^{-5} cm$ (2) $1.0\times10^{-5} cm$

(3) $10\times10^{-5} cm$ (4) $15\times10^{-5} cm$

21 When white light is incident on a diffraction grating, the light that is deviated most from the central image

(1) blue (2) yellow

(3) red (4) violet

22 Maximum number of orders available with a grating is

(1) directly proportional to the grating element.

(2) inversely proportional to the grating element.

(3) independent of the grating element.

(4) directly proportional to the square of grating element.

23 Which property of light is confirmed by diffraction ?

(1) Particle nature

(2) Transverse wave nature

(3) Longitudinal wave nature

(4) Wave nature

24 Which of the following undergoes largest diffraction

(1) Gamma Rays (2) Ultraviolet light

(3) Radio waves (4) Infrared light

25 In the diffraction pattern due to a single slit, the width of the central maximum will be

(1) less for narrow slit

(2) greater for narrow slit

(3) greater for wide slit

(4) less for wide slit

26 Interference differs from diffraction in that

(1) interference minima are perfectly dark and that of diffraction may not be dark.

(2) the fringe width is same for diffraction fringes but not for interference fringes.

(3) interference cannot be observed with white light.

(4) the intensities for interference fringes is constant but not for diffraction fringes.

27 The width of the diffraction fringe varies.

(1) inversely as the wavelength.

(2) directly as the width of slit.

(3) directly as the distance between the slit and screen.

(4) inversely as the width of slit.

28 What is the angular spread between the first maximum and the central maximum when Fraunhofer diffraction is observed with 540 nm light through a slit of 1 mm ?

(1) $924\times10^{-6}\,rad$ (2) $108\times10^{-6}\,rad$

(3) $270\times10^{-6}\,rad$ (4) $540\times10^{-6}\,rad$

29 To observe diffraction, the size of the obstacle

(1) should be of same order as the wavelength.

(2) should be much larger than the wavelength.

(3) is independent of wavelength.

(4) should be half of the wavelength.

30 Dispersine power of a grating can be defined as

(1) change in angle of reflection with change in wavelength.

(2) change in angle of diffraction with respect to change in wavelength.

(3) change in angle of refraction with change in wavelength.

(4) change in angle of incidence with change in wavelength.

31 The resolving power of a microscope is

(1) limited by the wavelength of light.

(2) limited by the refractive index of the glass of the lens.

(3) limited by the diameter of the objective lens.

(4) independent of all three.

32 The resolving power of a telescope with lens of diameter 1.22 m for a wavelength of 500 nm is

(1) 200 (2) 2

(3) 2000 (4) 2000000

33 The wavelengths of light used in an optical instrument are $\lambda_1 = 400\,nm$ and $\lambda_2 = 500\,nm$. The ratio of their respective resolving powers corresponding to $\lambda_1$ and $\lambda_2$ will be

(1) 16:25 (2) 9:1

(3) 5:4 (4) 4:5

34 The resolution limit of the eye is 1 minute. At a distance of $x$ km from the eye, two persons stand with a lateral separation of 3 m. For the two persons to be just resolved by the naked eye, $x$ should be

(1) 10 km (2) 20 km

(3) 15 km (4) 30 km

35 The criterion of resolution of optical instruments was given by

(1) Chadwick (2) Newton

(3) Rayleigh (4) Huygens

36 The resolving power of a telescope depends on

(1) the focal length of the objective lens

(2) diameter of the objective lens

(3) the magnification of the eye-piece

(4) refractive index of the objective lens

37 The resolving power of a grating having $N$ slits in $n^{th}$ order will be

(1) $n^2N$ (2) $n/N$

(3) $n+N$ (4) $nN$

38 A limit on the performance of a resolving instrument is set by

(1) interference of light

(2) quantum nature of light

(3) diffraction of light

(4) polarization of light

39 The resolving power of a prism is

(1) directly proportional to the rate of change of refractive index with wavelength.

(2) inversely proportional to the rate of change of refractive index with wavelength.

(3) directly proportional to the thickness of the prism.

(4) independent of the thickness of prism.

40 What is the angle between the plane of oxillation and plane of polarisation of the polarised light ?

(1) $\pi/4$ (2) $\pi/2$

(3) 0 (4) $\pi$

41 Which of the following show transverse nature of light ?

(1) interference (2) dispersion

(3) polarisation (4) refraction

42 If a polaroid is rotated, it is found that intensity of light varies but never reduces to zero. It shows that incident light is

(1) partially plane polarised

(2) unpolarised

(3) complete plane polarised

(4) circularly polarised

43 Which of the following cannot be polarised ?

(1) X-rays (2) Radio waves

(3) Transverse waves (4) Sound waves

44 The amplitude of the unpolarised light incident on the polariser is '$a$'. What will be the amplitude of the polarised light transmitted through it ?

(1) $a/2$ (2) $\frac{a}{\sqrt{2}}$

(3) $\frac{\sqrt{3}}{2}a$ (4) $a/4$

45 "The refractive index is equal to the tangent of the angle of polarisation". This statement is called

(1) Huygen's law (2) Bragg's law

(3) Malus law (4) Brewster's law

46 For a doubly refracting crystal, the refractive indices for the ordinary and extraordinary rays are given as $\mu_0$ and $\mu_e$. Along the optic axis, which of the following is true ?

(1) $\mu_0 = \mu_e$ (2) $\mu_0 \leq \mu_e$

(3) $\mu_0 > \mu_e$ (4) $\mu_0 < \mu_e$

47 Nicol prism is based on the action of

(1) scattering (2) double refraction

(3) reflection (4) refraction

48 Which of the following material may be used for manufacturing polaroids?

(1) Calcite (2) Tourmaline

(3) Quartz (4) Quinine iodosulphate

49 In elliptically polarised light

(1) amplitude of vibrations changes in magnitude and direction both

(2) amplitude of vibrations changes only in magnitude

(3) amplitude of vibrations changes only in direction

(4) no change in amplitude

50 Plane polarised light can be produced by

(1) simple reflection (2) nicol's prism

(3) pile of plates (4) all of the above

51 Optically active substances are those which

(1) cause double refraction

(2) rotate the plane of polarisation

(3) polarise light

(4) scatter light

52 Polaroid sunglasses decrease glare on a sunny day because

(1) block a portion of light

(2) refract the light

(3) have a special colour

(4) completely absorb the light

53 Doubly refracting calcite crystal is placed over an ink dot. On seeing through the crystal, one observes.

(1) both dots rotating about a common axis.

(2) two stationary dots.

(3) one dot rotating about the other.

(4) a single dot.

54 When the light is polarised by reflection, what is the angle between the reflected and refracted rays ?

(1) $\pi/4$ (2) $\pi/2$

(3) 0 (4) $\pi$

55 When the light is incident at the polarising angle, which of the following is completely polarised ?

(1) reflected light

(2) refracted light

(3) both reflected and refracted light

(4) neigher reflected nor refracted light

56 The intensity of light incident on a polariser is I and that of the light emerging from it is also I. The nature of light incedent on the polariser is

(1) circularly polarised (2) unpolarised

(3) polarised (4) elliptically polarised

57 When the analyser in rotated through 360°, one observes

(1) one brightness only

(2) one extinction only

(3) one brightness and one extination

(4) two extinctions and two brightness

58 In double refraction, two refracted rays are produced, called as O-ray and E-ray. Which of the following statements is true ?

(1) only O-ray is polarised

(2) only E-ray is polarised

(3) both O-ray and E-ray are polarised

(4) neither E-ray nor O-ray are polarised

59 Which of the following is Malus law ?

(1) $I = I_0^2 \cos^2 \theta$ (2) $I = I_0 \cos^2 \theta$

(3) $I = I_0 \sin^2 \theta$ (4) $I = I_0^2 \sin^2 \theta$

60 Polarimeter is a device used for -

(1) measurement of optical roration

(2) measurement of angle of polarisation

(3) measurement of angle of reflection

(4) measurement of angle of refraction

61 Sound waves are -

(1) magnetic waves

(2) electrical waves

(3) mechanical waves

(4) electromagnetic waves

62 The total energy of a particle executing simple harmonic motion is directly proportional to

(1) square root of amplitude

(2) square of amplitude

(3) amplitude

(4) reciprocal of amplitude

63 Which of the following characteristics must remain constant for undamped oscillations of the particle ?

(1) Acceleration (2) Phase

(3) Velocity (4) Amplitude

64 Energy is not carried by -

(1) transverse progressive waves

(2) electromagnetic waves

(3) stationary waves

(4) longitudinal waves

65 Which of the following is an essential condition for the motion to be simple harmonic ?

(1) Constant force

(2) Force proportional to displacement

(3) Force opposite to displacement

(4) Force proportional and opposite to displacement

66 An electron of charge $q = e$ moving around the nucleus of a hydrogen atom in a circular orbit of radius '$r$' experiences a force given by -

(1) $K\frac{e^2}{r^3}\vec{r}$ (2) $-K\frac{e^2}{r^3}\vec{r}$

(3) $K\frac{e^2}{r^3}\hat{r}$ (4) $-K\frac{e^2}{r^3}\hat{r}$

67 Gauss's law is used for -

(1) determining the nature of charge

(2) determining electric potential due to symmetric charge distributions

(3) determining electric field due to symmetric charge distributions

(4) determining electric force between point charges

68 An electric charge in uniform motion produces -

(1) only electric field

(2) both electric and magnetic field

(3) only magnetic field

(4) neither electric nor magnetic field

69 Which of the following is true -

(1) Magnetic effects are a consequence of quantum mechanics

(2) Superconductors are not perfectly diamagnetic

(3) Diamagnetism results from permanent magnetic dipoles

(4) Paramagnetism results from induced magnetic dipoles

70 Rubber based materials are example of -

(1) Conductors (2) Superconductors

(3) Dielectrics (4) Semiconductor

71 In high voltage applications, which one of the following may be used -

(1) Silicon (2) Metal

(3) Resin (4) Porcelain

72 The total electric flux leaving a cubical box of side 2 cm, surrounding an electric dipole will be

(1) zero (2) $q/\varepsilon_0$

(3) $2q/\varepsilon_0$ (4) $3q/\varepsilon_0$

73 The torque acting on a dipole of moment $\vec{p}$ placed in a uniform electric field $\vec{E}$ is given by -

(1) $\vec{p}+\vec{E}$ (2) $\vec{p}\times\vec{E}$

(3) $\vec{p}-\vec{E}$ (4) $\vec{p}\cdot\vec{E}$

74 A material when placed in a magnetic field does not allow the field to pass through it. The nature of material is -

(1) paramagnetic (2) non magnetic

(3) ferromagnetic (4) diamagnetic

75 Which of the following represents a mathematical statement of local charge conservation for steady current -

(1) $\vec{\nabla}\cdot\vec{J}=\frac{\partial\rho}{\partial t}$ (2) $\vec{\nabla}\cdot\vec{J}=1$

(3) $\vec{\nabla}\cdot\vec{J}=0$ (4) $\vec{\nabla}\times\vec{J}=0$

76 Which of the following is not a vector field ?

(1) Magnetic field (2) Electric field

(3) Electric potential (4) Gravitational field

77 The poynting vector is given as -

(1) $\vec{E}\times\vec{H}$ (2) $\vec{E}\cdot\vec{H}$

(3) $\vec{H}\times\vec{E}$ (4) $\varepsilon\left(\vec{H}\times\vec{E}\right)$

78 The velocity of light in free space is given as -

(1) $\sqrt{\mu_0 \varepsilon_0}$ (2) $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$

(3) $\sqrt{\mu_0/\varepsilon_0}$ (4) $\sqrt{\varepsilon_0/\mu_0}$

79 The ratio of the phase velocity and velocity of light is -

(1) less then unity

(2) unity

(3) more than unity

(4) depends on the medium in which light travels

80 The phase difference between $\vec{E} \& \vec{B}$ in a dielectric medium is -

(1) $\pi$ (2) $\pi/2$

(3) 0 (4) $\pi/3$

81 If $\vec{r} = x\hat{i} + y\hat{j} + 3\hat{k}$, the value of curl $\vec{r}$ is given as :

(1) 2 (2) 4

(3) 3 (4) 0

82 Which of the following is not one of the maxwells equations ?

(1) $Curl\,\vec{E} = \frac{-\partial \vec{B}}{\partial t}$ (2) $div\,\vec{E} = 0$

(3) $Curl\,\vec{H} = \vec{j} + \frac{\partial \vec{D}}{\partial t}$ (4) $div\,\vec{B} = 0$

83 One kg of a diatomic gas is at a pressure of $4\times10^4\ N/m^2$. The density of gas is $2kg\ m^{-3}$. What is the energy of the gas due to its thermal motion ?

(1) $3\times10^4 J$ (2) $2.5\times10^4 J$

(3) $5\times10^4 J$ (4) $6\times10^4 J$

84 Three sound waves of equal amplitudes have frequencies $v-1, v, v+1$. What is the number of beats produced per sec. when these waves superpose.

(1) 2 (2) 3

(3) 4 (4) 1

85 Which one of the following are the dimensions of megnetic field -

(1) $MT^{-2}C^{-2}$ (2) $MC^{-1}T^{-1}$

(3) $MLC^{-1}T^{-1}$ (4) $MC^{-1}T^{-2}$

86 A carnot engine with an efficiency of $\eta=\frac{1}{10}$ as heat engine, is used as a refrigerator. If the work done on the system is 10J, the amount of energy absorbed from the reservoir at lower temperature is -

(1) 100 J (2) 40 J

(3) 50 J (4) 90 J

87 The resistance of wire at $50^oC$ and $100^oC$ is $5\Omega$ and $6\Omega$ repectively the resistance of the wire at $0^oC$ will be

(1) $3\Omega$ (2) $5\Omega$

(3) $4\Omega$ (4) $2\Omega$

88 A sound absorber attenuates the sound level by 20 dB. This results in the decrease of intensity by a factor of

(1) 10 (2) 100

(3) 1 (4) 1000

89 In a region, steady and uniform electric and magnetic fields parallel to each other are present. A charged particle released from rest in this region will move on a path which is a -

(1) straight line (2) circle

(3) helix (4) ellipse

90 Three thin rods 1, 2 and 3 made of diamagnetic, paramagnetic and ferromagnetic substances respectively are brought close to a magnet, which one is true -

(1) The magnet attracts rod 1 and rod 2 and repels rod 3

(2) The magnet attracts rod 1 and rod 3 and repels rod 2

(3) The magnet attracts rod 2 and rod 3 and repels rod 1

(4) The magnet attracts all three

91 Which one of the following units denotes the dimensions $\left[ML^2\theta^{-2}\right]$, where $\theta$ denotes the electric charge.

(1) Weber (Wb) (2) Henry (H)

(3) $H/m^2$ (4) $Wb/m^2$

92 A solid which is not transparent to visible light and whose conductivity increases with temperature is formed by -

(1) metallic binding

(2) ionic binding

(3) covalent binding

(4) vander waal's binding

93 The refractine index of glass is 1.520 for red light and 1.525 for blue light. If $D_1$ and $D_2$ are the angles of minimum deviation for red and blue light respectively, then

(1) $D_2 \leq D_1$ (2) $D_2 < D_1$

(3) $D_2 = D_1$ (4) $D_2 > D_1$

94 In an AC generator, a coil with N turns, all of the same area A and total resistance R, rotates with frequency W in a magnetic field. The maximum value of emf generated in the coil is -

(1) BAN (2) BANW

(3) BANR (4) BANRW

95 The maximum velocity of a particle, executing simple harmonic motion with an amplitude 7m, is 4.4 m/s. What is the period of oscillation ?

(1) 0.01 sec (2) 0.001 sec

(3) 1.0 sec (4) 0.1 sec

96 If the ratio of the concentration of electrons to that of holes in a semiconductor is $\frac{7}{5}$ and the ratio of currents is $\frac{7}{4}$, then what is the ratio of their drift velocities ?

(1) 5/3 (2) 4/5

(3) 5/4 (4) 5/8

97 The rms value of the electric field of the light coming from the sun is 720 N/C. The average total energy density of the electromagnetic wave is :

(1) $2.68\times10^{-4}\,J/m^3$ (2) $4.58\times10^{-6}\,J/m^3$

(3) $3.64\times10^{-6}\,J/m^3$ (4) $2.58\times10^{-3}\,J/m^3$

98 Average density of the earth -

(1) is independent of g

(2) is inversely proportional to g

(3) is directly proportional to g

(4) is directly proportional to $g^2$

99 The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 2480nm is incident on it. The band gap in ev for the semiconductor is -

(1) 2.3 ev (2) 2.5 ev

(3) 0.1 ev (4) 0.5 ev

100 What is the shape of interference fringes formed on a screen by a young's double slit experiment apparatus with a monochromatic source ?

(1) Hyperbola (2) Parabola

(3) Circle (4) Straight line

101 A heater coil is cut into two equal parts and only one part is used now in the heater. The heat generated now will be -

(1) One fourth (2) halved

(3) doubled (4) One third

102 Two soap bubbles of radii $r_1$ and $r_2$ are connected by a tube, where $r_1 > r_2$; which one of the following is true ?

(1) air flows from the smaller to bigger bubble

(2) air flows from the bigger to smaller till the sizes are equal

(3) air flows from the bigger to smaller till they interchange their size

(4) no flow of air takes place

**103** Which one of the following is true for any thermodynamic system ?

(1) Internal energy and entropy are state functions

(2) Work done in an adiabatic process is always zero

(3) Internal energy changes in all processes

(4) Change in entropy can never be zero

**104** A light ray is incident perpendicular to one face of a 90° prism and is totally internally reflected at the glass - air interface. If the angle of reflection is 45°, the refractive index n is given as -

(1) $n < \frac{1}{\sqrt{2}}$ (2) $n > \sqrt{2}$

(3) $n < \sqrt{2}$ (4) $n < \frac{1}{\sqrt{2}}$

**105** The maximum number of possible interference maxima for slit separation equal to twice the wavelength in youngs double slit experiment is

(1) 4 (2) 3

(3) 2 (4) 5

**106** The thermistors are usually made of

(1) Metals with low temperature coefficient of resistivity

(2) metals with high temperature coefficient of resistivity

(3) metal oxides with high temperature coefficient of resistivity

(4) semiconducting meterials with low temperature coefficient of resistivity

**107** Alternating current cannot be measured by DC ammeter because -

(1) DC ammeter may be damaged

(2) average value of current for complete cycle is zero

(3) DC ammeter does not allow AC to pass through it

(4) DC ammeter reads only direct current

**108** An electric current is passed through a circuit containing two wires of same material, connected in parallel, if the lengths and radii of the wires are in the ratio of $\frac{4}{3}$ and $\frac{2}{3}$, then the ratio of the currents passing through the wire will be -

(1) 1/5 (2) 3/4

(3) 1/3 (4) 2

**109** What are the characteristics required for the material suitable for making electromagnets ?

(1) high retentivity and low coercivity

(2) low retentivity and low coercivity

(3) high retentivity and high coercivity

(4) low retentivity and high coercivity

**110** If a piece of copper and another of Germanium are cooled from room temperature to 77k, which one of the following is true ?

(1) Resistance of copper increases and that of germanium decreases

(2) Resistance of both increases

(3) Resistance of both decreases

(4) Resistance of copper decreases and that of germanium increases

**111** The manifestation of band structure in solids is due to -

(1) Boltzmann's law

(2) Pauli's exclusion principle

(3) Heisenberg's uncertainly principle

(4) Bohr's correspondence principle

112 Curie temperature is the temperature above which -

(1) a ferromagnetic material becomes diamagnetic

(2) a paramagnetic material becomes diamagnetic

(3) a ferromagnetic material becomes paramagnetic

(4) a paramagnetic material becomes ferromagnetic

113 Which of the following radiations has the least wavelength ?

(1) $\gamma$ - rays (Gamma rays)

(2) X - rays

(3) $\beta$ - rays (Beta rays)

(4) $\alpha$ - rays (Alpha rays)

114 If the electric flux entering and leaving an enclosed surface respectively is $\phi_1$ and $\phi_2$ then the electric charge inside the surface will be :

(1) $2(\phi_1+\phi_2)/\varepsilon_0$ (2) $(\phi_1+\phi_2)/\varepsilon_0$

(3) $(\phi_1-\phi_2)/\varepsilon_0$ (4) $(\phi_2-\phi_1)/\varepsilon_0$

115 The core of any transformer is laminated so as to -

(1) to increase its strength

(2) reduce the energy loss due to eddy currents

(3) to make it non magnetic

(4) to increase the voltage

116 "Heat cannot on its own flow from a body at lower temperature to a body at higher temperature". This statement comes from -

(1) first law of thermodynamics

(2) conservation of energy

(3) second law of thermodynamics

(4) conservation of momentum

117 Which of the following parameters does not characterise the thermodynamic state of matter ?

(1) Pressure (2) Work

(3) Temperature (4) Volume

118 A carnot engine takes $3\times10^6$ calories of heat from a reservoir at 627°C and gives it to a sink at 27°C. What is the work done by the engine ?

(1) $8.4 \times 10^6$ J (2) $3.2 \times 10^6$ J

(3) $4.2 \times 10^6$ J (4) $1.2 \times 10^6$ J

119 If an ammeter is to be used in place of a voltmeter, then the ammeter should be connected with a -

(1) high resistance in series

(2) high resistance in parallel

(3) low resistance in series

(4) low resistance in parallel

120 On moving a charge of 10 C by 2 Cm, 1J of work is done, so the potential difference between the points is -

(1) 0.5 V (2) 0.1 V

(3) 1 V (4) 2 V

121 Heat given to a body which raises its temperature by 1°C is -

(1) thermal capacity (2) specific heat

(3) thermal gradient (4) heat equivalent

122 Which of the following is not correct ?

(1) Carnot cycle is a reversible cycle

(2) Carnot cycle has the maximum efficiency in all cycles

(3) All reversible cycles have same efficiency

(4) Efficiency of a reversible cycle is more than that of irreversible

123 At what temperature is the rms velocity of a hydrogen molecule equal to that of an oxygen molecule at 47°C ?

(1) 90 k (2) 100 k

(3) 200 k (4) 20 k

124 The time period of a charged particle traversing on a circular path in a uniform magnetic field is independent of its -

(1) mass (2) speed

(3) charge (4) magnetic field

125 What is the capacitance of a spherical conductor with a radius *1m*?

(1) $1.1\times10^{-10}f$ (2) $2.1\times10^{-10}f$

(3) $1.5\times10^{-10}f$ (4) $10^{-3}f$

126 In a transformer, number of turns in the primary are 200 and that in the secondary are 400 if the current in the primary is 4A, then what is the current in the secondary

(1) 6A (2) 4A

(3) 2A (4) 8A

127 Molar heat capacity of a gas depends on -

(1) the nature of gas

(2) the state of gas

(3) the process

(4) the nature of gas and the process both

128 An alternating current with peak value 14A is used to heat a metal wire what is the magnitude of constant current $i$ required to produce the same heating effect ?

(1) 12A (2) 7A

(3) $\sim 15$A (4) $\sim 10$A

129 Two bodies at different temperatures are mixed in a calorimeter. Which of the following quantities are conserved ?

(1) Internal energy of each body

(2) Total internal energy of the system

(3) Total heat of the system

(4) Heat energy of each body

130 What is the SI unit of torque ?

(1) $N-m^2$ (2) $N-m$ or $J$

(3) $J\ m$ (4) $N/m^2$

131 Which of the following is correct ?

(1) Rate of cooling is proportional to temperature difference - Newton's law

(2) Newton's law of cooling is valid for all temperature ranges

(3) Rate of cooling is proportional to $T^4-T_0^4$, where $T$ and $T_0$ are temperatures of body and surrounding respectively

(4) Both (1) and (2)

**132** Which of the following is true in regards to an adiabatic process -

(1) Free expansion of gas is an adiabatic process

(2) Molar heat capacity for adiabatic process is zero

(3) $dU = nCvdT$ for an adiabatic process

(4) All of the above is true

**133** A magnetized steel wire has a magnetic moment $M$. If the wire is bent to form a semicircular arc, then new magnetic moment will be -

(1) $M/\pi$ (2) $2M/\pi$

(3) $2M$ (4) $4M/\pi$

**134** 0.3 kg of hot coffee at $70^{o}C$ is poured into a cup of mass 0.12 kg. What is the final equilibrium temperature ? Let the room temperature be $20^{o}C$.

Given - $S_{coffee} = 4080 J/kg-k$ and $S_{cup} = 1020 J/kg-k$

(1) $35.5^{o}C$ (2) $45.5^{o}C$

(3) $65.5^{o}C$ (4) $50.5^{o}C$

**135** The resistance of a galvonometer coil is $25\Omega$ and the current required for full scale deflection is $500\mu A$. Find the values of resistance to be connected in parallel and series to convert it into an ammeter (20.5 $mA$ full scale) and voltmeter (512.5 $mv$ full scale) respectively -

(1) $0.625\Omega, 1000\Omega$ (2) $0.625\Omega, 500\Omega$

(3) $0.5\Omega, 100\Omega$ (4) $0.5\Omega, 1000\Omega$

136 To identify whether the transistor is working or not, with a multimeter, which of the following serves the purpose ?

(1) The common lead of multimeter is connected to base and other lead to first emitter and then to collector, both the connections show the continuity

(2) In the above, only first connection shows the continuity

(3) The common lead of multimeter is connected to base and other lead to first emitter and then to collector, none of the connection shows the continuity

(4) All of the above

137 Long distance short - wave radio broadcasting uses -

(1) sky wave (2) direct wave

(3) ground wave (4) ionospheric wave

138 Electric conduction in discharge tube takes place due to -

(1) positive ions and electrons

(2) positive ions and negative ions

(3) positive ions, negative ions and electons

(4) electrons only

139 The deflection in moving coil galvanometer falls from 80 division to 40 division when a shunt of 20Ω is connected acron it. What in the resistance of the galvanometer ?

(1) 20Ω (2) 30Ω

(3) 15Ω (4) 40Ω

**140** If the charge of $10\mu C$ and $-2\mu C$ are given to two plates of a capacitor which are connected across a battery of $12V$, what is the coapcitance of a capacitor ?

(1) $0.3\mu F$ (2) $2.5\mu F$

(3) $5\mu F$ (4) $0.5\mu F$

**141** A dip circle is taken to geomagnetic equator. The needle is allowed to move in a vertical plane perpendicular to the magnetic meridian. The needle will stay -

(1) in horizontal direction

(2) in vertical direction

(3) in any direction it is released

(4) in any direction except horizontal and vertical

**142** Internal resistance of a battery depends on -

(1) material of the plate

(2) distance between plates of battery and area of plates

(3) medium between the plates

(4) All of the above

**143** The force required to separate two glass plates of area $10^{-2}m^2$ with a film of water $0.05mm$ thick between them. Surface tension of water is $70\times10^{-3}N/m$

(1) $14N$ (2) $28N$

(3) $35N$ (4) $40N$

144 Hysteresis is a characteristic property shown by -

(1) ferromagnetic materials

(2) diamagnetic materials

(3) paramagnetic materials

(4) both paramagnetic and ferromagnetic materials

145 Electric flux crossing the surface S ,which is enclosing a charge $q$ will be maximum if surface S is -

(1) cube (2) sphere

(3) cylindrical (4) same in all three

146 Electromagnetic waves are produced by -

(1) a moving charge

(2) a static charge

(3) an accelerating charge

(4) an uncharged particle

147 During charging and discharging of a capacitor which one of the following is true ?

(1) during charging current is constant but varying during discharging

(2) during charging current is varying but constant during discharging

(3) varying current flows in the circuit in both cases

(4) no current flows in the circuit

148 If an isolated charge particle is moving in a magnetic field, then

(1) Work done by magnetic field is zero

(2) its kinetic energy remains constant

(3) velocity of particle changes with time

(4) All of the above

149 Earthing a conductor means -

(1) its potential becomes zero

(2) no current flows through it

(3) its resistance becomes infinite

(4) both (1) and (2)

150 A source of sound mones towards an observer, which of the following takes place ?

(1) The wavelength of sound in the medium behind the source is decreased

(2) The wavelength of sound in the medium towards the observer is decresed

(3) The velocity of sound in the medium increases

(4) The frequency of the source increases

151 On a carnot referigerator, 230I of work is done as it extracts 346J from cold reservoir at 300 K compute the coefficient of performance and temperature of hot reservoir, to which energy is being supplied.

(1) 1.0, 800K (2) 1.0, 700K

(3) 2.5, 500K (4) 1.5, 500K

152 Which of the following is correct ?

(1) If the final rays are meeting at point, the image is real

(2) If the incident rays are meeting at a point the image is real

(3) A virtual object gives a virtual image

(4) Formation of image is independent of object

153 1kg of water at $0^oC$ is heated to $100^oC$, calculate its change in entropy given $S_{water}$ = 4190 *J/kg-K*, *ln* 1.36 = 0.3118

(1) $11.31\times10^3\,J/K$ (2) $1.31\times10^3\,J/K$

(3) $9.7\times10^3\,J/K$ (4) $1.74\times10^3\,J/K$

154 An AC source producing emf. $e=e_0\left[\cos\left(100\pi5^{-1}\right)t+\cos\left(500\pi5^{-1}\right)t\right]$ is connected in series with a capacitor and resistor. The steady state current in the circuit is given as :

$i=i_1\cos\left[\left(100\pi5^{-1}\right)t+\phi_1\right]+i_2\cos\left[\left(500\pi5^{-1}\right)t+\phi_2\right]$ state which one of the following is true -

(1) $i_1>i_2$ (2) $i_1=i_2$

(3) $i_1<i_2$ (4) Insufficient information

155 If electric potential due to some charge distribution is given as $v=\frac{3}{r^2}$, where $r$ is the radial distance, then find electric field at (1, 1, 1) :

(1) $\frac{3}{2}\left(\hat{i}+\hat{j}+\hat{k}\right)$ (2) $\frac{2}{3}\left(\hat{i}+\hat{j}+\hat{k}\right)$

(3) $\frac{5}{2}\left(\hat{i}+\hat{j}+\hat{k}\right)$ (4) $\frac{3}{8}\left(\hat{i}+\hat{j}+\hat{k}\right)$

156 What is the ratio of surface energy of drop A and drop B, if drop A is made up of 1000 small drops of B type ?

(1) 100 : 1 (2) 1000 : 1

(3) 10 : 1 (4) 1 : 10

157 A container having 1 mole of gas at 27°*C* has a movable piston which is at constant presure at 1 atm. The gas is compressed to temperature 127°*C*. Find out the work done if $c_p$ for gas = 7.03 *cal/mol–k*.

(1) 570*J* (2) 1018*J*

(3) 970*J* (4) 814*J*

158 In a Newtons Ring apparatus, the center of fringes formed by reflected rays will be -

(1) having medium intensity

(2) bright

(3) dark

(4) given by the type of source

159 If body cools from 100°*C* to 90°*C* in 20 min, then the time taken by it to cool down from 110°*C* to 100°*C* in same surroundings will be -

(1) Same

(2) less than 20 min

(3) slightly more than 20 min

(4) 50 min

160 Why does a glass sometimes break, if boiling water is poured quickly on it ?

(1) Because glass is brittle

(2) Because it has small mechanical strength

(3) Because of its non crystalline nature

(4) Because of uneven expansion of glass

**161** N moles of an ideal diatomic gas are in a cylinder at temperature $T$. If we supply some heat to it, then $\frac{N}{3}$ moles of gas dissociate into atoms at constant temperature. Heat supplied to the gas is -

(1) $\frac{5}{2}NRT$ (2) $NRT/2$

(3) $NRT/6$ (4) $\frac{3}{4}NRT$

**162** Following is necessary to determine the internal resistance of a given primary cell using potentiometer -

(1) The e.m.f. of the battery should be greater than that of the cell

(2) Positive pole of battery and negative pole of cell should be connected at the same end of wire

(3) A low resistance in series should be connected to the cell

(4) High current should be passed through the galvanometer.

**163** Michelson interferometer can be used for -

(1) finding out the focal length of an eyepiece

(2) finding out wavelength difference between two close wavelengths

(3) finding out thickness of a thin glass plate

(4) finding the coherence nature of the source

**164** If $\vec{\nabla} \cdot \vec{A} = 0$, then $\vec{A}$ is -

(1) axial (2) irrotational

(3) rotational (4) solenoidal

**165** If $\vec{A}$ and $\vec{B}$ are irrotational, then $\vec{A} \times \vec{B}$ is -

(1) irrotanional (2) rotational

(3) solenoidal (4) not known

**166** Electric lines of force are -

(1) straight lines (2) open curves

(3) closed curves (4) neither of these

**167** Kinetic energy of an electron of rest mass $m_0$ moving in a potential $V$ is -

(1) $eV$ (2) $eV/2$

(3) $\frac{1}{2}m_0V^2$ (4) $m_0V^2$

**168** At a point just outside a current carrying conducting wire -

(1) magnetic field is zero but electric field is not zero

(2) electric field is zero while the magnetic field is not

(3) both the fields are zero

(4) neither of the fields are zero

**169** The differential form of Gauss's law in electrostatics is -

(1) $\vec{\nabla} \times \vec{E} = \rho/\varepsilon_0$ (2) $\vec{\nabla} \cdot \vec{E} = 0$

(3) $\vec{\nabla} \times \vec{E} = 0$ (4) $\vec{\nabla} \cdot \vec{E} = \rho/\varepsilon_0$

170 The unit of the absolute permittivity of a medium is -

(1) $Nm^{-2}C^2$ (2) $N/m$

(3) $N^{-1}m^{-2}C^2$ (4) $NmC^2$

171 If electric intensity at a point is zero, then potential at that point is -

(1) zero (2) constant

(3) infinite (4) not known

172 The volume element in spherical polar coordinates is -

(1) $r\sin\theta\, dr\, d\theta\, d\phi$ (2) $r^2\sin^2\theta\, dr\, d\theta\, d\phi$

(3) $r^2\sin\theta\, dr\, d\theta\, d\phi$ (4) $\sin\theta\, dr\, d\theta\, d\phi$

173 The work done by the Lorentz force $\vec{f}$ on a charged particle is -

(1) zero (2) $\vec{f}\cdot\vec{q}$

(3) $\vec{f}\cdot\vec{r}$ (4) $\vec{q}\times\vec{f}$

174 The drift velocity of electron in a metal is of the order of -

(1) $km/s$ (2) $cm/s$

(3) $m/s$ (4) $mm/s$

175 The magnetic field at a point outside an infinite solenoid is -

(1) $\mu_0 nI/2$ (2) $\mu_0 nI$

(3) zero (4) infinite

176 "Isolated magnetic monopoles do not exist". This statement is given by the following expression -

(1) $\vec{\nabla}\cdot\vec{B}=\rho/\varepsilon_0$ (2) $\vec{\nabla}\cdot\vec{B}=0$

(3) $\vec{\nabla}\times\vec{B}=0$ (4) $\vec{\nabla}\cdot\vec{B}=\frac{\partial\vec{E}}{\partial t}$

177 Two long parallel conductors carrying current in the same direction -

(1) repel each other

(2) attract each other

(3) do not interact

(4) behaviour cannot be predicted

178 Ampere's circuital law is valid for -

(1) alternating current

(2) varying current

(3) steady current

(4) conservative field

179 A current is passed through a hanging coiled spring of copper. The coiled spring will

(1) extend in length (2) contract in length

(3) remain same (4) change its shape

180 Lenz's law is consistent with the conservation principle of -

(1) kinetic energy

(2) potential energy

(3) total energy

(4) total mechanical energy

**181** The concept of displacement current was introduced by -

(1) faraday (2) Maxwell

(3) ampere (4) lenz

**182** Magnetic field in vacuum can be produced by -

(1) displacement current

(2) conduction current

(3) steady current

(4) non steady current

**183** In a charge free space, $\vec{\nabla} \cdot \vec{D} = 0$ because

(1) $\vec{\nabla}$ and $\vec{D}$ are perpendicular to each other

(2) $\vec{D} = 0$

(3) charge density, $\rho = 0$

(4) $\vec{\nabla} = 0$

**184** Which of the following quantity is independent of wavelength in the electromagnetic wave : $\vec{E} = \vec{E}_0 \sin(kx - cut)$?

(1) $k$ (2) $k/w$

(3) $w$ (4) $kx/w$

185 Electromagnetic wave is propagated through a region of vacuum not having any charge or current. If the electric vector in given as

$\vec{E} = \vec{E}_0 \; exp \; i \; (kx - cut) \vec{j}$, then the magnetic vector is -

(1) in Z - direction

(2) in Y - direction

(3) in X - direction

(4) in XY plane

186 The energy of a system is equally divided among all degrees of freedom" This statement is called as -

(1) law of transport process

(2) theorem of equipartition of energy

(3) law of conservation of energy

(4) law of diffusion

187 Coefficient of self diffusion of gas in independent of -

(1) Temperature

(2) Pressure

(3) Molecular diameter

(4) Viscosity

188 The blueness of the sky or redness of the sunset are due to -

(1) scattering of light by atmospheric particles

(2) interference of light

(3) diffraction of light

(4) polarization of light

189 Which one of the following is false ?

(1) Transmission losses are minimum in case of ac.

(2) Choke is used as a filter to prevent ripple in power supply

(3) An ideal transformer should have zero power dissipation in primary and secondary coils

(4) Diode cannot be used as a rectifier

190 Energy stored (per unit volume) in a charged capacitor in given by (where E is the electric field. $k$ is the dielectric constant of the medium between the plates)

(1) $\frac{1}{2}k\,\varepsilon_0 E$ (2) $\frac{1}{2}k\,\varepsilon_0 E^2$

(3) $\frac{1}{2}\varepsilon_0 E^2$ (4) $\varepsilon_0 E^2$

191 Working of Nicol's prism is based on -

(1) the phenomenon of bire fringence

(2) phenomenon of total internal reflection

(3) phenomenon of scattering

(4) phenomenon of refraction

192 What is $I_{rms}$ for an inductor of 2 H connected to a source of 220 V (rms) and frequency 50 Hz

(1) 0.375 A (2) 1.150 A

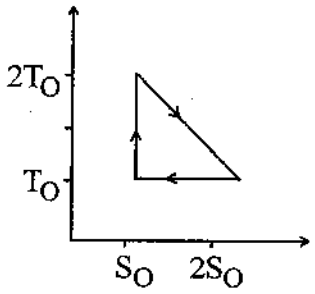
(3) 0.350 A (4) 0.425 A

193 The force experienced by a closed current carrying loop of area A in a uniform magnetic field is -

(1) $i\vec{l}\cdot\vec{B}$ (2) $i\left(\vec{l}\times\vec{B}\right)$

(3) zero (4) $i\left(\vec{A}\times\vec{B}\right)$

194 The temperature - entropy diagram of a reversible engine is given below in the figure. What is its efficiency ?




(1) $\frac{1}{2}$ (2) $\frac{1}{3}$

(3) $\frac{4}{5}$ (4) $\frac{2}{3}$

195 (I) The Faraday's law of electromagnetic induction is induced e.m.f. $e=-\frac{d\phi}{dt}$

(II) Due to changing magnetic field, if $E$ is the induced electric field, then $e=\int\vec{E}\cdot\vec{dl}$

(III) From above two statements, $\int\vec{E}\cdot\vec{dl}=-\frac{d\phi}{dt}$

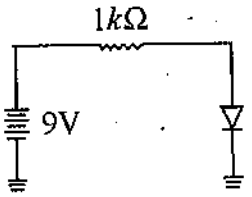
(1) All the above three statements are always true

(2) Only (I) and (II) are correct

(3) (I) and (II) are true, (III) is true only for stationary path

(4) All three are incorrect

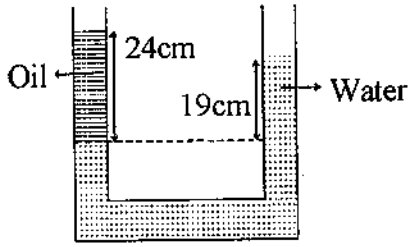
**196** Find the current through the diode as given in the figure -




(1) $\sim 9mA$ (2) $\sim 12mA$

(3) $\sim 10mA$ (4) $\sim 15mA$

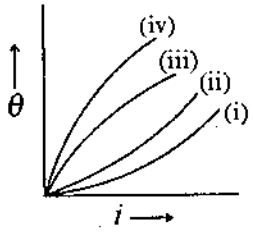
**197** Compute the density of oil in the given figure -




(1) $655\ kg/m^3$ (2) $792\ kg/m^3$

(3) $680\ kg/m^3$ (4) $780\ kg/m^3$

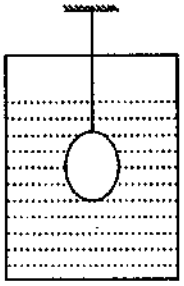
**198** Which of the following graphs best represent the $i-\theta$ relation in a tangent galvanometer ?




(1) (i) (2) (ii)

(3) (iii) (4) (iv)

**199** A Solid sphere of steel is dipped in a liquid. What will happen to the force of buoyancy if the temperature is increased ?



(1) It increases

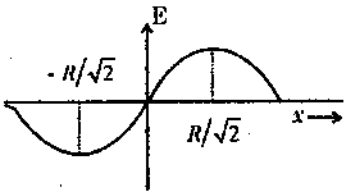
(2) It decreases

(3) remains constant

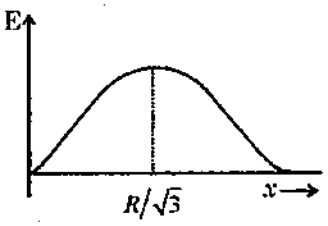
(4) is independent of temperature

**200** Which of the following plot represents the variation of electric field due to uniformly distributed charged ring along its own axis with distance from the centre. (R is the radium of ring)

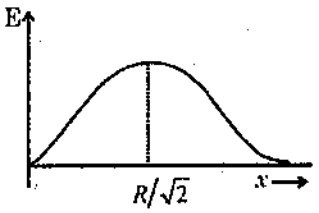
(1)



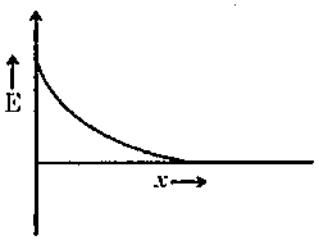

(2)




(3)




(4)



SPACE FOR ROUGH WORK

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SPACE FOR ROUGH WORK