Total No. of Printed Pages : 13

	IS QUESTION BOOKLET BEFO ARE ASKED TO DO SO) PG-EE-June, 2023	RE TIME OR UNTIL YOU
	SUBJECT : Physics	10457
		Sr. No
Time : 11/4 Hours	Max. Marks : 100	Total Questions : 100
Roll No. (in figures)	(in words)	
Name	Date of Birth	
Father's Name	Mother's Name	
		(Signature of the Invigilator)
(Signature of the Candid	late)	NUNSTRUCTIONS BEFORE
CANDIDATES MUST	DEAD THE FOLLOWING INFORMANC	

STARTING THE QUESTION PAPER.

1. All questions are compulsory.

- 2. The candidates must return the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfairmeans / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer sheet of such a candidate will not be evaluated.
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- 1. The volume element in spherical polar co-ordinates is :
 - (1) $r dr \sin \theta d\theta d\phi$ (3) $r^2 dr \sin \theta d\theta$ (4) $r^3 dr \sin \theta d\theta d\phi$
- 2. Total kinetic energy of circular disc rolling on a table is :
 - (1) $\frac{3}{4} Mr^2 w^2$ (2) $\frac{1}{2} Mr^2 w^2$ (3) $\frac{3}{4} M^2 r^2 w^2$ (4) $\frac{1}{2} M^2 r^2 w^2$
- **3.** An inclined plane makes an angle of 30° with the horizontal. A solid sphere rolling down the inclined plane from rest without slipping has a linear acceleration given by :
 - (1) g/3 (2) 2g/3 (3) 5g/3 (4) 5g/14
- 4. The number of degrees of freedom of the particle moving on the circumference of a circle is :
 - (1) 1 (2) 2 (3) 3 (4) 6

5. The constraint on a particle moving on an ellipsoid under the influence of gravity is :

- (1) Holonomic (2) Nonholonomic
- (3) rheonomic (4) both holonomic and rheonomic
- 6. The homogeneity of time leads to the law of conservation of :
 - (1) Linear momentum
 (2) Angular momentum
 (3) Energy
 (4) Parity
- 7. Three identical metal balls, each of radius R, are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of the three balls are joined. The centre of mass of the system is located at :
 - (1) Horizontal surface
 - (2) Centre of one of the balls
 - (3) Line joining centres of any two balls
 - (4) Point of intersection of their medians

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8.	Increase in length of a wire on stretching is 0.025%. If it's Poisson's ratio is 0.4, then the percentage increase in diameter is :			
	(1) 0.01	(2) 0.02	(3) 0.03	(4) 0.04
9.	A beam of metal s the centre is propor	upported at the two tional to :	ends is loaded at the	e centre. The depression at
	(1) Y^2	(2) <i>Y</i>	(3) 1/Y	(4) $1/Y^2$
10.	The stress required	to double the length	of a wire of Young's	modulus Y is :
	(1) $Y/2$	(2) $2Y$	(3) <i>Y</i>	(4) 4Y
11.	The bulk modulus rubber ball be taker	of a rubber is 9.1 > n in a lake so that it's	$< 10^8 N / m^2$. To what volume is decreased	t depth (approximately) a by 0.1%?
	(1) 25 m	(2) 100 m	(3) 200 m	(4) 500 m
12.	If the masses of al ratio of initial and f	l molecules of a gas final pressures would	are halved and their be :	r speeds doubled, then the
	(1) 2:1	(2) 1:2	(3) 4:1	(4) 1:4
13.	The root mean sq probable speed of t	uare velocity of the he molecules is :	e molecules of a ga	s is 1260 m/s. The most
	(1) 1029 m/s	(2) 1161 m/s	(3) 1671 m/s	(4) 917 m/s
14.	Two photons appro	ach each other. Their	r relative velocity wil	l be :
	(1) Zero	(2) Less than C	(3) More than C	(4) C
15.	The <i>apparent</i> lengwill be :	th of a meter rod me	oving parallel to it's	length with velocity 0,8C
	(1) 0.5 m	(2) 0.6 m	(3) 1 m	(4) 1.5 m
16.	The equation $\overrightarrow{\nabla} \times \overrightarrow{D}$	$\vec{E} = -\frac{\partial \vec{B}}{\partial \vec{B}}$ represent	s :	
	(1) Gauss's law	∂t	(2) Coulomb's law	
	(3) Ampere's law	•	(4) Faraday's law	
17.	An electromagnetic Which of the follow	wave going through	h vacuum is describe of wavelength ?	ed by $E = E_0 \sin(kx - wt)$.
	(1) k	(2) w	(3) w/k	(4) kw

The electric field intensity on the surface of a solid charged sphere of radius r and 18. volume charge density ρ is given by :

(1)
$$\rho r/3 \in_0$$
 (2) $\frac{1}{4\pi \in_0} \frac{\rho}{r}$ (3) zero (4) $\frac{5\rho r}{6 \in_0}$

- **19.** Liquids and gases never exhibit :
 - (1) Diamagnetic properties
 - (3) Ferromagnetic properties
- (2) Paramagnetic properties
- (4) Ferromagnetic properties
- 20. Electromagnets are made of soft iron because soft iron has :
 - (1) Low retentivity and low coercivity
 - (2) High retentivity and high coercivity
 - (3) Low retentivity and high coercivity
 - (4) High retentivity and low coercivity
- **21.** Curie temperature is the temperature above which :
 - (1) A paramagnetic material becomes diamagnetic
 - (2) A ferromagnetic material becomes diamagnetic
 - (3) A paramagnetic material becomes ferromagnetic
 - (4) A ferromagnetic material becomes paramagnetic
- 22. The Poisson's equation in CGS Gaussian system is :

(1) $\nabla^2 V = -\frac{\rho}{\epsilon_0}$ (2) $\nabla^2 V = -4\pi\rho$ (3) $\nabla^2 V = -4\pi\epsilon_0$ (4) $\nabla^2 V = 0$

- **23.** An inductance of 2H and resistance of 10Ω are connected in series to a battery of 5V. The initial rate of change of current is :
 - (3) 0.5 A/s (2) 2.0 A/s(4) 0.25 A/s (1) 2.5 A/s
- **24.** A solenoid of resistance 50 Ω and inductance 5mH is connected to 200V battery. The maximum energy stored is :
 - (3) 40 mJ (4) 400 mJ (1) 4 mJ(2) 0.4 mJ
- 25. In LCR circuit if resistance increases, the quality factor :
 - (1) Increases (2) Decreases
 - (3) Remains constant (4) None of these

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26. The phase difference between the voltage and current of LCR circuit in series at resonance is : (4) $\pi/4$ (1) π (3) Zero (2) $\pi/2$ **27.** A P-N junction diode can not be used : (1) as a rectifier (2) for increasing the amplitude of an AC signal (3) for getting light radiation (4) for converting light energy into electrical energy 28. The bandwidth and voltage gain of an amplifier using negative feedback : (2) Decreases, decreases respectively (1) Decreases, increases respectively (4) Increases, increases respectively (3) Increases, decreases respectively **29.** Emitter follower is an amplifier employing : (1) Voltage series feedback (2) Current series feedback (4) Current shunt feedback (3) Voltage shunt feedback **30.** The time base of a CRO is developed by : (1) Sawtooth waveform (2) Square waveform (4) Sinusoidal waveform (3) Triangular waveform **31.** If the temperatures of source and sink of a Carnot engine having efficiency η are each decreased by 100 K, then the efficiency : (1) Remains constant (2) Decreases (4) Becomes Zero (3) Increases In a reversible process, the entropy of the universe : 32. (1) Decreases (2) Increases (3) Remains unchanged (4) Fluctuates **33.** Method which uses a list of well defined instruction to complete a task starting from a given initial state to end state is : (4) Both (1) and (2) (3) Algorithm (2) Flow chart (1) Program

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- **34.** On a T-S diagram, the isothermals are :
 - (1) Straight lines parallel to the T-axis (2) Straight lines parallel to the S-axis
 - (3) Straight lines inclined at any angle (4) Rectangular parabola

35. For an isolated thermodynamical system P, V, T, U and S represent the pressure, volume, temperature, internal energy and entropy respectively then the Gibb's potential (G) is defined as :

- (1) G = U PV + TS(2) G = U + PV + TS
- (4) G = U + PV TS(3) G = U - PV - TS

36. A fluid at high pressure in throttled through a narrow porous opening in a region of lower pressure without any transfer of heat. In such a process :

- (2) The Gibb's free energy remains constant (1) The entropy does not change
- (4) The enthalpy of the fluid is constant (3) The entropy is decreased
- **37.** Which of th
 - (1) $\left(\frac{\partial S}{\partial V}\right)$ (3) $\left(\frac{\partial V}{\partial P}\right)_{S} = \left(\frac{\partial T}{\partial S}\right)_{V}$

The combined form of first and second law of thermodynamics is given by : 38.

- (2) dQ = TdS + PdV(1) TDS = dU + PdV
- (4) TdS = dU + PdV(3) dU = TdS + dQ

To a fish under water, viewing obliquely a fisherman standing on the bank of a lake. 39. the man looks :

- (2) Shorter than what he actually is (1) Taller than what he actually is
- (3) The same height as he actually is (4) depends on obliquity

Critical angle of light passing from glass to air is minimum for : 40.

(4) violet (2) green (3) yellow (1) red

41. Lenses of power + 3D and -5D are combined to form a compound lens. An object is placed at a distance of 50 cm from the lens. It's image will be formed at a distance from the lens :

(1) 25 cm	(2) 20 cm	(3) 30 cm	(4) 40 cm	
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- (1) of non-paraxial rays
- (2) radii of curvature of two sides are not same
- (3) of the defects in grinding
- (4) The focal length varies with wavelength
- **43.** One cannot see through fog because :
 - (1) fog absorbs light
 - (2) the refractive index of fog is infinity
 - (3) light suffers total reflection at the droplets in fog
 - (4) light is scattered by droplets in fog
- 44. A person is suffering from the defect of astigmatism. It's main reason is :
 - (1) distance of the eye lens from retina is increased
 - (2) power of accommodation of the eye is decreased
 - (3) the cornea is not spherical
 - (4) the distance of the eye lens from the retina is decreased
- **45.** In a Fresnel biprism experiment, the two positions of lens give separation between the slits as 16 cm and 9 cm respectively. The actual distance of separation of slits is :
 - (1) 12.5 cm (2) 12.0 cm (3) 13 cm (4) 14 cm

46. A thin mica sheet of thickness 2×10^{-6} m and refractive index $\mu = 1.5$ is introduced in the path of one of the waves. The wavelength of the wave used is 5000 Å. The central bright maximum will shift :

- (1) 2 fringes upward (2) 2 fringes downward
- (3) 10 fringes upward (4) 10 fringes downward
- **47.** A bag contains 5 red balls, 8 white balls and 10 black balls. If a ball is drawn from the bag, the probability that it is either white or black is :
 - (1) 5/18 (2) 8/18 (3) 10/23 (4) 18/23
- **48.** Sterling's formula states that for every large value of N, ln N ! is equal to :
 - (1) N! (2) $N(\ln N 1)$ (3) N ln N (4) $\frac{\ln N}{N}$

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49. Boltzmann relation between entropy (s) and thermodynamic probability (W) is : (2) $S = \frac{\ln W}{k}$ (3) $S = k \ln W$ (4) $S = \frac{k}{\ln W}$ (1) $S = \ln W$ 50. Maxwell-Boltzmann statistics is applicable for : (1) Photon (4) Proton (2) Ideal gas (3) Electron 51. Particles obeying Bose-Einstein statistics have : (1) any spin (2) integral spin (3) half integral spin (4) zero spin Planck's law of radiation can be derived by applying : 52. (1) Maxwell-Boltzmann Statistics (2) Bose-Einstein Statistics (3) Fermi-Dirac Statistics (4) None of these The number of co-ordinates in the phase space of a single particle is : 53. (1) 2(4) 6(2) 3 (3) 5 54. If a shift of 200 fringes is observed when the movable mirror is shifted through 0.0589 mm, the wavelength of light used in Michelson's Interferometer is : (3) 2006 Å (4) 1475 Å (2) 2945 Å (1) 5890 Å A wedge shaped film is viewed with light of $\lambda = 6 \times 10^{-5}$ cm. There are 10 fringes per 55. cm. The angle of wedge is : (1) 1×10^{-4} radian (2) 2×10^{-4} radian (3) 3×10^{-4} radian (4) 4×10^{-4} radian Which optical instrument is employed to obtain interference fringes of various shapes ? 56. (1) Michelson interferometer (2) Fabrey-Perot interferometer (4) Fresnel's biprism (3) Newton rings If white light is used in the Newton's rings experiment, the colour observed in the 57. reflected light is complementary to that observed in the transmitted light through the same point. This is due to : (1) 90° change of phase in one of the reflected waves (2) 180° change of phase in one of the reflected waves (3) 135° change of phase in one of the reflected waves

(4) 45° change of phase in one of the reflected waves

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58. Which of the following is a dichoric crystal?				
	(1) Quartz	(2) Tourmaline	(3) Mica	(4) Selenite
59 .	A calcite crystal is the calcite, one will	placed over a dot on l see :	a piece of paper and	rotated. On seeing through
	(1) one dot		(2) two stationary	dots
	(3) two rotating do	ts	(4) one dot rotating	g about the other
60 .	Which of the follow	wing in <i>correct</i> stater	nent?	
	(1) The dispersive spectrum.	e power of a grating	g decreases with the	e increase in the order of
	(2) The dispersive spectrum.	e power of a gratin	g increases with the	e increase in the order of
	(3) The dispersive	power of a grating d	ecrease with decrease	e of grating element.
	(4) The dispersive	power of a grating of	loes not depend on g	rating element.
61.	What does not char	nge on polarization o	f light ?	
	(1) Intensity	(2) Phase	(3) Frequency	(4) Wavelength
62.	The Miller indices	of the plane parallel	to the X and Y-axes a	are :
	(1) (100)	(2) (010)	(3) (001)	(4) (111)
63.	A plane intercepts plane are :	at <i>a</i> , $b/2$, $3c$ in a since $a = b/2$, $b/2$,	imple cubic unit cell	. The Miller indices of the
	(1) (132)	(2) (261)	(3) (361)	(4) (123)
64.	The number of latt	ice points in a primit	ive cell are :	
	(1) 1	(2) 1/2	(3) 2	(4) 3/2
65.	The nearest neight	our distance in the c	ase of bcc structure is	5:
	(1) $(a\sqrt{3})/2$	(2) $(a\sqrt{2})/2$	(3) $2a/\sqrt{3}$	(4) $2a/\sqrt{2}$
66.	When the potentia take place an incre	l difference between ase in :	the electrodes of X-	ray tube is increased, there
	(1) Intensity	(2) Frequency	(3) Wavelength	(4) Speed of X-rays

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67.	The packing factor of diamond cubic crystal structure is :			
	(1) 60%	(2) 56%	(3) 90%	(4) 34%
68.	If 0.28 nm is the in	terionic distance in	NaCl crystal, the latti	ce parameter is :
	(1) 0.14 nm	(2) 0.56 nm	(3) 0.08 nm	(4) 0.41 nm
69.	If the angle betwee the angle of incider	en the direction of t nce will be :	he incident X-ray an	nd the diffracted ray is 16°,
	(1) 32°	(2) 24°	(3) 90°	(4) 82°
70.	Which of the follo heat of solids :	wing statements is	in accordance with I	Einstein's theory of specific
	(1) Specific heat d	rops linearly with in	crease of temperature	2
	(2) Specific heat d	rops linearly with de	ecrease of temperatur	e
	(3) Specific heat d	rops exponentially v	with decrease of temp	erature
	(4) Specific heat re	emains constant		
71.	The number of sulp	bhide atoms in the un	nit cell of zinc sulphie	de crystal is :
	(1) 2	(2) 4	(3) 3	(4) 6
72.	In Compton effect scattering of the ph	the transfer of ene oton is :	ergy becomes the ma	aximum when the angle of
	(1) 90°	(2) 180°	(3) 60°	(4) 30°
73.	Davisson-Germer e	xperiment is related	to the phenomenon	of:
	(1) Interference		(2) Diffraction	
	(3) Reflection		(4) Polarization	
74.	The correct relation	between group velo	ocity (v_g) and phase v	velocity (v_p) is :
	(1) $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$	2	(2) $v_g = v_p + \lambda \frac{dv}{dt}$	γ <u>ρ</u> λ
	(3) $v_g = v_p - \lambda \frac{dv_g}{d\lambda}$	<u>_</u>	(4) $v_p = v_g - \frac{1}{\lambda} \frac{dv}{dt}$	$\frac{\nu_g}{\lambda}$

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- (1) A particle can have only position but no momentum.
- (2) A particle can have only momentum but no position.
- (3) One can determine simultaneously the position and momentum of a particle.
- (4) One cannot determine simultaneously the position and momentum of a particle.
- **76.** In three dimensions the momentum operator \hat{p} is :

(1)
$$\hat{p} = -\frac{\hbar}{i}\nabla$$
 (2) $\hat{p} = -\frac{i\hbar}{\nabla}$ (3) $\hat{p} = \frac{\hbar}{i}\nabla$ (4) $\hat{p} = \frac{\hbar}{i}\nabla$
77. The value of $\left[\hat{x}, \frac{\hat{d}}{dx}\right]$ is :
(1) 0 (2) 1 (3) -1 (4) ∞

- **78.** The energy of a particle in the nth quantum state in a one-dimensional closed box is proportional to :
 - (1) n (2) n^2 (3) $\frac{1}{n}$ (4) $\frac{1}{n^2}$

79. The ground state energy of the one-dimensional oscillator is :

- (1) $\hbar w$ (2) $\frac{1}{2}\hbar w$ (3) $\frac{3}{2}\hbar w$ (4) ∞
- 80. In case of a potential step of height V₀, for a particle of energy E < V₀, the transmittance is:
 (1) Zero
 (2) Finite non-zero (3) Infinite
 (4) 1
- 81. The eigen value associated with an Hermitian operator is :
 (1) Imaginary
 (2) Complex
 (3) Real
 (4) None of these

82. The doublets observed in alkali spectra are due to :

- (1) Screening of the K electron (2) Spin–orbit interaction of the electron
- (3) Pressure of isotopes (4) Pressure of isotones
- **83.** The value of Lande g factor for the doublet term ${}^{2}D_{3/2}$ is : (1) 2/5 (2) 3/5 (3) 4/5 (4) 6/5
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84. The splitting of single line singlet into three component lines in the presence of magnetic field is known as :

- (1) Paschen-Back effect (2) normal Zeeman effect
- (3) Anomalous Zeeman effect (4) Stark effect

85. For a diatomic molecule, Raman lines are observed due to appreciable change in :

(1) Pressure (2) Shape (3) Polarizability (4) Solubility

86. Rotational constant (B) is related to moment of inertia (I) through the relation :

(1) $B = h/8\pi^2 IC$ (2) $B = 2h/8\pi^2 I^2 C^2$ (3) $B = 3h/\pi^2 IC$ (4) $B = hIC/8\pi^2$

87. The exciting line in an experiment is 5460 Å and the Stoke's line is at 5520 Å. The wavelength of anti-Stoke's line is :

(1) 5200 Å (2) 4200 Å (3) 5401 Å (4) 5308 Å

88. In the first order Stark effect in hydrogen atom, the ground state :

- (1) Splits in two levels (2) Splits in three levels
- (3) Splits in four levels (4) Does not split

89. In He-Ne laser the population inversion is achieved by :

- (1) Chemical excitation (2) Photon excitation
- (3) Inelastic atomic collisions (4) Thermal excitation

90. Ratio of probabilities of spontaneous emission and stimulated emission is :

- (1) Proportional to frequency (υ) (2) Independent of frequency (υ)
- (3) Proportional to v^2 (4) Proportional to v^3

91. In a Ruby laser, the rod is surrounded by a helical photographic flash lamp filled with :
(1) Chromium (2) Aluminium (3) Xenon (4) Neon

- **92.** Half-life of a radioactive substance A is two times the half-life of another radioactive substance B. Initially the number of nuclei of A and B are N_A and N_B respectively. After three half-lives of A, number of nuclei of both are equal. Then the ratio N_A / N_B is :
 - (1) 1/4 (2) 1/8 (3) 1/3 (4) 1/6

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93.	Radio carbon dating is done by estimating in specimen the:				
	(1) Amount of ordinary carbon still present				
	(2) Amount of radio carbon still present				
	(3) Ratio of amo	ant of C^{14} to C^{12} s	till present		
	(4) Ratio of amo	$C^{12} = C^{13}$	all present		
		$10^{\circ} \text{ for } 6^{\circ} \text{ for } 6^{$	still present		
94.	The electron emit	ted in beta radiation of	originates from :		
	(1) Inner orbit of	atoms	(2) Free electron	s exciting in nuclei	
	(3) Decay of a ne	utron in a nucleus	(4) Photon escap	ing from the nucleus	
95.	Which of the follo	owing is <i>true</i> for a Ne	eutrino ?		
	(1) It is charged a	ind has spin	(2) It is charged a	and has no spin	
	(3) It is chargeles	s and has spin	(4) It is chargeles	ss and has no spin	
96.	The operation of a nuclear reactor is said to be critical, if the multiplication factor (K) has a value :			the multiplication factor (K)	
	(1) 1	(2) 1.5	(3) 2.1	(4) 2.5	
97.	The instrument will source is :	nich is suitable for al	osolute measurement	t of the activity of a β -active	
	(1) G. M. Counter	• • •	(2) Scintillation (Counter	
	(3) Proportional (Counter	(4) Ionization Co	unter	
98.	Primary cosmic ra	ys are composed of y	erv energetic :		
	(1) Electrons	(2) Mesons	(3) Protons	(4) Neutrons	
99.	Nuclear fusion reaction occurs at temperatures of the order of				
	(1) $10^3 K$	(2) $10^7 K$	(3) $10^2 K$	(4) $10^4 K$	
100.	The radius of a nu with atomic mass r	cleus with atomic m number 189 is :	ass number 7 is 2 F	Fermi. The radius of nucleus	
	(1) 3 Fermi.	(2) 4 Fermi	(3) 5 Fermi	(4) 6 Fermi	

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- 1. The number of sulphide atoms in the unit cell of zinc sulphide crystal is :
 - (1) 2 (2) 4 (3) 3 (4) 6
- 2. In Compton effect the transfer of energy becomes the maximum when the angle of scattering of the photon is :
 - (1) 90° (2) 180° (3) 60° (4) 30°

3. Davisson-Germer experiment is related to the phenomenon of :

- (1) Interference (2) Diffraction (3) Reflection (4) Polarization
- 4. The correct relation between group velocity (v_g) and phase velocity (v_p) is :
 - (1) $v_g = v_p \lambda \frac{dv_p}{d\lambda}$ (2) $v_g = v_p + \lambda \frac{dv_p}{d\lambda}$ (3) $v_g = v_p - \lambda \frac{dv_g}{d\lambda}$ (4) $v_p = v_g - \frac{1}{\lambda} \frac{dv_g}{d\lambda}$
- 5. The uncertainty principle tells us that :
 - (1) A particle can have only position but no momentum.
 - (2) A particle can have only momentum but no position.
 - (3) One can determine simultaneously the position and momentum of a particle.
 - (4) One cannot determine simultaneously the position and momentum of a particle.
- 6. In three dimensions the momentum operator \hat{p} is :
- (1) $\hat{p} = -\frac{\hbar}{i}\nabla$ (2) $\hat{p} = -\frac{i\hbar}{\nabla}$ (3) $\hat{p} = \frac{\hbar}{i}\nabla$ (4) $\hat{p} = \frac{\hbar}{i}\nabla$ 7. The value of $\left[\hat{x}, \frac{\hat{d}}{dx}\right]$ is : (1) 0 (2) 1 (3) -1 (4) ∞
- 8. The energy of a particle in the nth quantum state in a one-dimensional closed box is proportional to :
 - (1) n (2) n^2 (3) $\frac{1}{n}$ (4) $\frac{1}{n^2}$

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- 9. The ground state energy of the one-dimensional oscillator is :
 - (1) $\hbar w$ (2) $\frac{1}{2} \hbar w$ (3) $\frac{3}{2} \hbar w$ (4) ∞

10. In case of a potential step of height V_0 , for a particle of energy $E < V_0$, the transmittance is :

- (1) Zero (2) Finite non-zero (3) Infinite (4) 1
- 11. Particles obeying Bose-Einstein statistics have :
 (1) any spin
 (2) integral spin
 (3) half integral spin
 (4) zero spin

12. Planck's law of radiation can be derived by applying :

- (1) Maxwell-Boltzmann Statistics (2) Bose-Einstein Statistics
- (3) Fermi-Dirac Statistics (4) None of these
- **13.** The number of co-ordinates in the phase space of a single particle is :
 - (1) 2 (2) 3 (3) 5 (4) 6
- 14. If a shift of 200 fringes is observed when the movable mirror is shifted through 0.0589 mm, the wavelength of light used in Michelson's Interferometer is :
 - (1) 5890 Å (2) 2945 Å (3) 2006 Å (4) 1475 Å
- **15.** A wedge shaped film is viewed with light of $\lambda = 6 \times 10^{-5}$ cm. There are 10 fringes per cm. The angle of wedge is :
 - (1) 1×10^{-4} radian (2) 2×10^{-4} radian (3) 3×10^{-4} radian (4) 4×10^{-4} radian

16. Which optical instrument is employed to obtain interference fringes of various shapes ?

- (1) Michelson interferometer (2) Fabrey-Perot interferometer
- (3) Newton rings (4) Fresnel's biprism
- **17.** If white light is used in the Newton's rings experiment, the colour observed in the reflected light is complementary to that observed in the transmitted light through the same point. This is due to :
 - (1) 90° change of phase in one of the reflected waves
 - (2) 180° change of phase in one of the reflected waves
 - (3) 135° change of phase in one of the reflected waves
 - (4) 45° change of phase in one of the reflected waves

18. Which of the following is a dichoric crystal ?

- (1) Quartz (2) Tourmaline (3) Mica (4) Selenite
- **19.** A calcite crystal is placed over a dot on a piece of paper and rotated. On seeing through the calcite, one will see :
 - (1) one dot (2) two stationary dots
 - (3) two rotating dots (4) one dot rotating about the other
- 20. Which of the following in *correct* statement ?
 - (1) The dispersive power of a grating decreases with the increase in the order of spectrum.
 - (2) The dispersive power of a grating increases with the increase in the order of spectrum.
 - (3) The dispersive power of a grating decrease with decrease of grating element.
 - (4) The dispersive power of a grating does not depend on grating element.
- 21. If the temperatures of source and sink of a Carnot engine having efficiency η are each decreased by 100 K, then the efficiency :
 - (1) Remains constant (2) Decreases
 - (3) Increases (4) Becomes Zero
- 22. In a reversible process, the entropy of the universe :
 - (1) Decreases (2) Increases
 - (3) Remains unchanged (4) Fluctuates
- **23.** Method which uses a list of well defined instruction to complete a task starting from a given initial state to end state is :
 - (1) Program (2) Flow chart (3) Algorithm (4) Both (1) and (2)
- 24. On a T-S diagram, the isothermals are :
 - (1) Straight lines parallel to the T-axis
 - (2) Straight lines parallel to the S-axis
 - (3) Straight lines inclined at any angle
 - (4) Rectangular parabola

- 25. For an isolated thermodynamical system P, V, T, U and S represent the pressure, volume, temperature, internal energy and entropy respectively then the Gibb's potential (G) is defined as :
 - (1) G = U PV + TS (2) G = U + PV + TS
 - (3) G = U PV TS (4) G = U + PV TS

26. A fluid at high pressure in throttled through a narrow porous opening in a region of lower pressure without any transfer of heat. In such a process :

- (1) The entropy does not change (2) The Gibb's free energy remains constant
 - (3) The entropy is decreased (4) The enthalpy of the fluid is constant
- 27. Which of the following is *not* Maxwell's equation ?

(1) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$	(2) $\left(\frac{\partial T}{\partial V}\right)_{S} = -\left(\frac{\partial P}{\partial S}\right)_{V}$
(3) $\left(\frac{\partial V}{\partial P}\right)_{S} = \left(\frac{\partial T}{\partial S}\right)_{V}$	(4) $\left(\frac{\partial T}{\partial P}\right)_{S} = \left(\frac{\partial V}{\partial S}\right)_{P}$

28. The combined form of first and second law of thermodynamics is given by :

- (1) TDS = dU + PdV (2) dQ = TdS + PdV
- (3) dU = TdS + dQ (4) TdS = dU + PdV

29. To a fish under water, viewing obliquely a fisherman standing on the bank of a lake, the man looks :

- (1) Taller than what he actually is (2) Shorter than what he actually is
- (3) The same height as he actually is (4) depends on obliquity

30. Critical angle of light passing from glass to air is minimum for :
(1) red
(2) green
(3) yellow
(4) violet

- **31.** The bulk modulus of a rubber is $9.1 \times 10^8 N/m^2$. To what depth (approximately) a rubber ball be taken in a lake so that it's volume is decreased by 0.1%?
 - (1) 25 m (2) 100 m (3) 200 m (4) 500 m
- **32.** If the masses of all molecules of a gas are halved and their speeds doubled, then the ratio of initial and final pressures would be :
 - (1) 2:1 (2) 1:2 (3) 4:1 (4) 1:4

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33.	The root mean square velocity of the probable speed of the molecules is :	e molecules of a ga	s is 1260 m/s. The most
	(1) 1029 m/s (2) 1161 m/s	(3) 1671 m/s	(4) 917 m/s
34.	Two photons approach each other. Their	r relative velocity wil	l be :
	(1) Zero (2) Less than C	(3) More than C	(4) C
35.	The <i>apparent</i> length of a meter rod meter will be :	oving parallel to it's	length with velocity 0.8C
	(1) 0.5 m (2) 0.6 m	(3) 1 m	(4) 1.5 m
36.	The equation $\overrightarrow{\nabla} \times \overrightarrow{E} = -\frac{\partial \overrightarrow{B}}{\partial t}$ represent	s :	
	(1) Gauss's law	(2) Coulomb's law	
	(3) Ampere's law	(4) Faraday's law	· · ·
37.	An electromagnetic wave going through Which of the following is independent of	n vacuum is describe f wavelength ?	ed by $E = E_0 \sin(kx - wt)$.
	(1) k (2) w	(3) w/k	(4) kw
38.	The electric field intensity on the surf volume charge density ρ is given by :	ace of a solid charg	ed sphere of radius r and
	(1) $\rho r/3 \in_0$ (2) $\frac{1}{4\pi \in_0} \frac{\rho}{r}$	(3) zero	$(4) \frac{5\rho r}{6\epsilon_0}$
20	Liquids and gages never exhibit :		
39.	(1) Diamagnetic properties	(2) Paramagnetic p	roperties
	(3) Ferromagnetic properties	(4) Ferromagnetic	properties
			-
40.	(1) Low retentivity and low coercivity	cause son fron has :	
	(2) High retentivity and high coercivity		
	(3) Low retentivity and high coercivity		
	(4) High retentivity and low coercivity		
41.	In a Ruby laser, the rod is surrounded by	a helical photograph	nic flash lamp filled with
	(1) Chromium (2) Aluminium	(3) Xenon	(4) Neon

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- **42.** Half-life of a radioactive substance A is two times the half-life of another radioactive substance B. Initially the number of nuclei of A and B are N_A and N_B respectively. After three half-lives of A, number of nuclei of both are equal. Then the ratio N_A / N_B is :
 - (1) 1/4 (2) 1/8 (3) 1/3 (4) 1/6
- 43. Radio carbon dating is done by estimating in specimen the :
 - (1) Amount of ordinary carbon still present
 - (2) Amount of radio carbon still present
 - (3) Ratio of amount of ${}_{6}C^{14}$ to ${}_{6}C^{12}$ still present
 - (4) Ratio of amount of ${}_{6}C^{12}$ to ${}_{6}C^{13}$ still present
- 44. The electron emitted in beta radiation originates from :
 - (1) Inner orbit of atoms (2) Free electrons exciting in nuclei
 - (3) Decay of a neutron in a nucleus (4) Photon escaping from the nucleus
- **45.** Which of the following is *true* for a Neutrino ?
 - (1) It is charged and has spin (2) It is charged and has no spin
 - (3) It is chargeless and has spin (4) It is chargeless and has no spin

46. The operation of a nuclear reactor is said to be critical, if the multiplication factor (K) has a value :

(1) 1 (2) 1.5 (3) 2.1 (4) 2.5

47. The instrument which is suitable for absolute measurement of the activity of a β -active source is :

- (1) G. M. Counter (2) Scintillation Counter
- (3) Proportional Counter (4) Ionization Counter

48. Primary cosmic rays are composed of very energetic :

- (1) Electrons (2) Mesons (3) Protons (4) Neutrons
- 49. Nuclear fusion reaction occurs at temperatures of the order of :
 - (1) $10^3 K$ (2) $10^7 K$ (3) $10^2 K$ (4) $10^4 K$
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50.	The radius of a nucleus with atomic mass number 7 is 2 Fermi. The radius of nucleus with atomic mass number 189 is :			
	(1) 3 Fermi	(2) 4 Fermi	(3) 5 Fermi	(4) 6 Fermi
51.	What does not cha	ange on polarization of	of light ?	
	(1) Intensity	(2) Phase	(3) Frequency	(4) Wavelength
52.	The Miller indices	s of the plane parallel	to the X and Y-axes	are :
	(1) (100)	(2) (010)	(3) (001)	(4) (111)
53.	A plane intercepts plane are :	s at $a, b/2, 3c$ in a s	imple cubic unit cell	. The Miller indices of the
	(1) (132)	(2) (261)	(3) (361)	(4) (123)
54.	The number of late	tice points in a primit	ive cell are :	а. ⁶ . а
	(1) 1	(2) 1/2	(3) 2	(4) 3/2
55.	The nearest neight	oour distance in the ca	ase of bcc structure is	5:
	(1) $(a\sqrt{3})/2$	(2) $(a\sqrt{2})/2$	(3) $2a/\sqrt{3}$	(4) $2a/\sqrt{2}$
56.	When the potentia take place an incre	l difference between ase in :	the electrodes of X-	ray tube is increased, there
	(1) Intensity		(2) Frequency	
	(3) Wavelength		(4) Speed of X-ray	vs
57.	The packing factor	of diamond cubic cr	ystal structure is :	
	(1) 60%	(2) 5.6%	(3) 90%	(4) 34%
5 8.	If 0.28 nm is the in	terionic distance in N	aCl crystal, the lattic	ce parameter is :
	(1) 0.14 nm		(2) 0.56 nm	
	(3) 0.08 nm		(4) 0.41 nm	
5 9 .	If the angle betwee the angle of incider	en the direction of the new will be :	e incident X-ray and	d the diffracted ray is 16°,
	(1) 32°	(2) 24°	(3) 90°	(4) 82°

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60.	 Which of the following statements is in accordance with Einstein's theory of specific heat of solids : (1) Specific heat drops linearly with increase of temperature (2) Specific heat drops linearly with decrease of temperature (3) Specific heat drops exponentially with decrease of temperature (4) Specific heat remains constant 			
61.	The eigen value associated with an Herm(1) Imaginary(2) Complex	nitian operator is : (3) Real (4) None of these		
62.	The doublets observed in alkali spectra are due to :(1) Screening of the K electron(2) Spin-orbit interaction of the electron(3) Pressure of isotopes(4) Pressure of isotones			
63.	The value of Lande g factor for the doub (1) $2/5$ (2) $3/5$	blet term ${}^{2}D_{3/2}$ is : (3) 4/5 (4) 6/5		
64.	The splitting of single line singlet in magnetic field is known as : (1) Paschen-Back effect (3) Anomalous Zeeman effect	to three component lines in the presence(2) normal Zeeman effect(4) Stark effect	of	
65.	For a diatomic molecule, Raman lines a	re observed due to appreciable change in .		
	(1) Pressure (2) Shape	(3) Polarizability (4) Solubility		
66.	Rotational constant (B) is related to mo (1) $B = h/8\pi^2 IC$	ment of inertia (I) through the relation : (2) $P_{1} = 2L/R_{1}^{2}r^{2}r^{2}$		
	(3) $B = 3h/\pi^2 IC$	(2) $B = 2h/8\pi^{-1}C^{-2}$ (4) $B = hIC/8\pi^{2}$		
67.	The exciting line in an experiment is wavelength of anti-Stoke's line is : (1) 5200 Å (2) 4200 Å	5460 Å and the Stoke's line is at 5520 Å. (3) 5401 Å (4) 5200 Å	The	
68.	In the first order Stark effect in hydrog	en atom, the ground state :		
	 (1) Splits in two levels (3) Splits in four levels 	(2) Splits in three levels(4) Does not split		

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 - 69. In He-Ne laser the population inversion is achieved by :
 - (2) Photon excitation (1) Chemical excitation
 - (4) Thermal excitation (3) Inelastic atomic collisions
 - 70. Ratio of probabilities of spontaneous emission and stimulated emission is :
 - (1) Proportional to frequency (v)
 - (3) Proportional to v^2
 - 71. Lenses of power + 3D and -5D are combined to form a compound lens. An object is placed at a distance of 50 cm from the lens. It's image will be formed at a distance from the lens :
 - (4) 40 cm (3) 30 cm (1) 25 cm(2) 20 cm
 - 72. Chromatic aberration in the formation of images by a lens arises because :
 - (1) of non-paraxial rays
 - (2) radii of curvature of two sides are not same
 - (3) of the defects in grinding
 - (4) The focal length varies with wavelength
 - 73. One cannot see through fog because :
 - (1) fog absorbs light
 - (2) the refractive index of fog is infinity
 - (3) light suffers total reflection at the droplets in fog
 - (4) light is scattered by droplets in fog
 - 74. A person is suffering from the defect of astigmatism. It's main reason is :
 - (1) distance of the eye lens from retina is increased
 - (2) power of accommodation of the eye is decreased
 - (3) the cornea is not spherical
 - (4) the distance of the eye lens from the retina is decreased
 - 75. In a Fresnel biprism experiment, the two positions of lens give separation between the slits as 16 cm and 9 cm respectively. The actual distance of separation of slits is :
 - (1) 12.5 cm(2) 12.0 cm (3) 13 cm (4) 14 cm

- (2) Independent of frequency (v)

- (4) Proportional to v^3

76. A thin mica sheet of thickness 2×10^{-6} m and refractive index $\mu = 1.5$ is introduced in the path of one of the waves. The wavelength of the wave used is 5000 Å. The central bright maximum will shift :

- (1) 2 fringes upward (2) 2 fringes downward
- (3) 10 fringes upward (4) 10 fringes downward

77. A bag contains 5 red balls, 8 white balls and 10 black balls. If a ball is drawn from the bag, the probability that it is either white or black is :

(1) 5/18 (2) 8/18 (3) 10/23 (4) 18/23

78. Sterling's formula states that for every large value of N, ln N'! is equal to :

(1) N! (2) $N(\ln N - 1)$ (3) N ln N (4) $\frac{\ln N}{N}$

79. Boltzmann relation between entropy (s) and thermodynamic probability (W) is :

(1)
$$S = \ln W$$
 (2) $S = \frac{\ln W}{k}$ (3) $S = k \ln W$ (4) $S = \frac{k}{\ln W}$

80. Maxwell-Boltzmann statistics is applicable for :

(1) Photon (2) Ideal gas (3) Electron (4) Proton

81. Curie temperature is the temperature above which :

- (1) A paramagnetic material becomes diamagnetic
- (2) A ferromagnetic material becomes diamagnetic
- (3) A paramagnetic material becomes ferromagnetic
- (4) A ferromagnetic material becomes paramagnetic
- 82. The Poisson's equation in CGS Gaussian system is :

(1)
$$\nabla^2 V = -\frac{\rho}{\epsilon_0}$$
 (2) $\nabla^2 V = -4\pi\rho$ (3) $\nabla^2 V = -4\pi\epsilon_0$ (4) $\nabla^2 V = 0$

- 83. An inductance of 2H and resistance of 10Ω are connected in series to a battery of 5V. The initial rate of change of current is :
 (1) 2.5 A/s
 (2) 2.0 A/s
 (3) 0.5 A/s
 (4) 0.25 A/s
- 84. A solenoid of resistance 50Ω and inductance 5mH is connected to 200V battery. The maximum energy stored is :
 - (1) 4 mJ (2) 0.4 mJ (3) 40 mJ (4) 400 mJ

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- 85. In LCR circuit if resistance increases, the quality factor :
 - (1) Increases (2) Decreases
 - (3) Remains constant (4) None of these
- **86.** The phase difference between the voltage and current of LCR circuit in series at resonance is :
 - (1) π (2) $\pi/2$ (3) Zero (4) $\pi/4$
- 87. A P-N junction diode can not be used :
 - (1) as a rectifier
 - (2) for increasing the amplitude of an AC signal
 - (3) for getting light radiation
 - (4) for converting light energy into electrical energy
- 88. The bandwidth and voltage gain of an amplifier using negative feedback :
 - (1) Decreases, increases respectively (2) Decreases, decreases respectively
 - (3) Increases, decreases respectively (4) Increases, increases respectively
- 89. Emitter follower is an amplifier employing :
 - (1) Voltage series feedback
 (2) Current series feedback
 (3) Voltage shunt feedback
 (4) Current shunt feedback
- **90.** The time base of a CRO is developed by :
 - Sawtooth waveform
 Triangular waveform
 Sinusoidal waveform

91. The volume element in spherical polar co-ordinates is :

- (1) $r dr \sin \theta d\theta d\phi$ (3) $r^2 dr \sin \theta d\theta$ (2) $r^2 dr \sin \theta d\theta d\phi$ (4) $r^3 dr \sin \theta d\theta d\phi$
- 92. Total kinetic energy of circular disc rolling on a table is :
 - (1) $\frac{3}{4}Mr^2w^2$ (2) $\frac{1}{2}Mr^2w^2$ (3) $\frac{3}{4}M^2r^2w^2$ (4) $\frac{1}{2}M^2r^2w^2$

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- **93.** An inclined plane makes an angle of 30° with the horizontal. A solid sphere rolling down the inclined plane from rest without slipping has a linear acceleration given by :
 - (1) g/3 (2) 2g/3 (3) 5g/3 (4) 5g/14
 - **94.** The number of degrees of freedom of the particle moving on the circumference of a circle is :
 - (1) 1 (2) 2 (3) 3 (4) 6
 - **95.** The constraint on a particle moving on an ellipsoid under the influence of gravity is :
 - (1) Holonomic (2) Nonholonomic
 - (3) rheonomic (4) both holonomic and rheonomic

96. The homogeneity of time leads to the law of conservation of :

- (1) Linear momentum
 (2) Angular momentum
 (3) Energy
 (4) Parity
- (3) Energy

97. Three identical metal balls, each of radius R, are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of the three balls are joined. The centre of mass of the system is located at :

- (1) Horizontal surface (2) Centre of one of the balls
- (3) Line joining centres of any two balls (4) Point of intersection of their medians
- **98.** Increase in length of a wire on stretching is 0.025%. If it's Poisson's ratio is 0.4, then the percentage increase in diameter is :
 - (1) 0.01 (2) 0.02 (3) 0.03 (4) 0.04
- **99.** A beam of metal supported at the two ends is loaded at the centre. The depression at the centre is proportional to :
 - (1) Y^2 (2) Y (3) 1/Y (4) $1/Y^2$
- **100.** The stress required to double the length of a wire of Young's modulus Y is : (1) Y/2 (2) 2Y (3) Y (4) 4Y

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	Tota	I No. of Printed Pages : 13
	QUESTION BOOKLET BEFOR ARE ASKED TO DO SO) PG-EE-June, 2023	RE TIME OR UNTIL YOU
	SUBJECT : Physics	10459 Sr. No.
Time : 1¼ Hours Roll No. (in figures)	Max. Marks : 100	Total Questions : 100
Name	Date of Birth	
Father's Name	Mother's Name	
Date of Examination (Signature of the Candidate)		(Signature of the Invigilator)
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- 2. The candidates *must return* the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hatt, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
- 4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
- 5. The candidate *must not* do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers *must not* be ticked in the question booklet.
- 6. There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
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- 8. Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

- С
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- 14. A solenoid of resistance 50Ω and inductance 5mH is connected to 200V battery. The maximum energy stored is :
 - (1) 4 mJ (2) 0.4 mJ (3) 40 mJ (4) 400 mJ
- **15.** In LCR circuit if resistance increases, the quality factor :
 - (1) Increases (2) Decreases
 - (3) Remains constant (4) None of these
- 16. The phase difference between the voltage and current of LCR circuit in series at resonance is :
 - (1) π (2) $\pi/2$ (3) Zero (4) $\pi/4$

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(4) Proton

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- 17. A P-N junction diode can not be used :
 - (1) as a rectifier
 - (2) for increasing the amplitude of an AC signal
 - (3) for getting light radiation
 - (4) for converting light energy into electrical energy
- **18.** The bandwidth and voltage gain of an amplifier using negative feedback :
 - (1) Decreases, increases respectively (2) Decreases, decreases respectively
 - (3) Increases, decreases respectively (4) Increases, increases respectively
- **19.** Emitter follower is an amplifier employing :
 - (1) Voltage series feedback (2) Current series feedback
 - (3) Voltage shunt feedback (4) Current shunt feedback
- **20.** The time base of a CRO is developed by :
 - (1) Sawtooth waveform (2) Square waveform
 - (3) Triangular waveform (4) Sinusoidal waveform

21. The volume element in spherical polar co-ordinates is :

- (1) $r dr \sin \theta d\theta d\phi$ (2) $r^2 dr \sin \theta d\theta d\phi$ (3) $r^2 dr \sin \theta d\theta$ (4) $r^3 dr \sin \theta d\theta d\phi$
- **22.** Total kinetic energy of circular disc rolling on a table is :
 - (1) $\frac{3}{4} Mr^2 w^2$ (2) $\frac{1}{2} Mr^2 w^2$ (3) $\frac{3}{4} M^2 r^2 w^2$ (4) $\frac{1}{2} M^2 r^2 w^2$
- **23.** An inclined plane makes an angle of 30° with the horizontal. A solid sphere rolling down the inclined plane from rest without slipping has a linear acceleration given by :
 - (1) g/3 (2) 2g/3 (3) 5g/3 (4) 5g/14
- **24.** The number of degrees of freedom of the particle moving on the circumference of a circle is :
- (1) 1 (2) 2 (3) 3 (4) 6 PG-EE-June, 2023/(Physics)(SET-X)/(C)

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- (1) Holonomic (2) Nonholonomic
- (3) rheonomic

26. The homogeneity of time leads to the law of conservation of :

- (1) Linear momentum (2) Angular momentum
- (3) Energy (4) Parity
- 27. Three identical metal balls, each of radius R, are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of the three balls are joined. The centre of mass of the system is located at :
 - (1) Horizontal surface
 - (2) Centre of one of the balls
 - (3) Line joining centres of any two balls
 - (4) Point of intersection of their medians
- 28. Increase in length of a wire on stretching is 0.025%. If it's Poisson's ratio is 0.4, then the percentage increase in diameter is :
 - (1) 0.01 (2) 0.02 (4) 0.04(3) 0.03
- 29. A beam of metal supported at the two ends is loaded at the centre. The depression at the centre is proportional to :
 - (3) 1/Y (4) $1/Y^2$ (1) Y^2 (2) Y
- 30. The stress required to double the length of a wire of Young's modulus Y is : (3) Y (4) 4Y(2) 2Y(1) Y/2
- 31. In a Ruby laser, the rod is surrounded by a helical photographic flash lamp filled with : (2) Aluminium (3) Xenon (4) Neon (1) Chromium
- 32. Half-life of a radioactive substance A is two times the half-life of another radioactive substance B. Initially the number of nuclei of A and B are N_A and N_B respectively. After three half-lives of A, number of nuclei of both are equal. Then the ratio N_A / N_B is :
 - (2) 1/8(3) 1/3 (4) 1/6(1) 1/4

- (4) both holonomic and rheonomic

33.	 (1) Amount of ordinary carbon still present (2) Amount of radio carbon still present 					
	(3) Ratio of amo	Solution of ${}_{6}C^{14}$ to ${}_{6}C^{12}$	still present			
	(4) Ratio of amo	bunt of ${}_6C^{12}$ to ${}_6C^{13}$;	still present			
34.	The electron emi (1) Inner orbit o (3) Decay of a n	itted in beta radiation f atoms neutron in a nucleus	originates from : (2) Free electror (4) Photon escar	ns exciting in nuclei bing from the nucleus		
35.	5. Which of the following is <i>true</i> for a Neutrino ?					
	(3) It is chargele	ess and has spin	(2) It is charged(4) It is chargele	and has no spin ss and has no spin		
36.	The operation of has a value :	a nuclear reactor is	said to be critical, if	the multiplication factor (K)		
	(1) 1	(2) 1.5	(3) 2.1	(4) 2.5		
37.	The instrument v source is :	which is suitable for a	ibsolute measuremen	at of the activity of a β -active		
	(1) G. M. Count	er	(2) Scintillation	Counter		
	(3) Proportional	Counter	(4) Ionization Co	ounter		
38.	Primary cosmic r	ays are composed of	very energetic :			
	(1) Electrons	(2) Mesons	(3) Protons	(4) Neutrons		
39.	Nuclear fusion re	action occurs at temp	peratures of the order	of:		
	(1) $10^3 K$	(2) $10^7 K$	(3) $10^2 K$	(4) $10^4 K$		
40.	The radius of a n with atomic mass	nucleus with atomic 1 number 189 is :	mass number 7 is 2	Fermi. The radius of nucleus		
	(1) 3 Fermi	(2) 4 Fermi	(3) 5 Fermi	(4) 6 Fermi		
41.	What does not ch (1) Intensity	ange on polarization (2) Phase	of light ? (3) Frequency	(4) Wavelenoth		
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(1) (100) (2) (010) (3) (001) (4) (111)

43. A plane intercepts at a, b/2, 3c in a simple cubic unit cell. The Miller indices of the plane are :

(1) (132) (2) (261) (3) (361) (4) (123)

44. The number of lattice points in a primitive cell are :

- (1) 1 (2) 1/2 (3) 2 (4) 3/2
- 45. The nearest neighbour distance in the case of bcc structure is :
 - (1) $(a\sqrt{3})/2$ (2) $(a\sqrt{2})/2$ (3) $2a/\sqrt{3}$ (4) $2a/\sqrt{2}$
- **46.** When the potential difference between the electrodes of X-ray tube is increased, there take place an increase in :
 - (1) Intensity (2) Frequency (3) Wavelength (4) Speed of X-rays
- 47. The packing factor of diamond cubic crystal structure is :
 - (1) 60% (2) 56% (3) 90% (4) 34%

48. If 0.28 nm is the interionic distance in NaCl crystal, the lattice parameter is :

- (1) 0.14 nm (2) 0.56 nm (3) 0.08 nm (4) 0.41 nm
- **49.** If the angle between the direction of the incident X-ray and the diffracted ray is 16°, the angle of incidence will be :
 - (1) 32° (2) 24° (3) 90° (4) 82°
- **50.** Which of the following statements is in accordance with Einstein's theory of specific heat of solids :
 - (1) Specific heat drops linearly with increase of temperature
 - (2) Specific heat drops linearly with decrease of temperature
 - (3) Specific heat drops exponentially with decrease of temperature
 - (4) Specific heat remains constant

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51. If the temperatures of source and sink of a Carnot engine having efficiency η are each decreased by 100 K, then the efficiency :

(1) Remains constant
(2) Decreases
(3) Increases
(4) Becomes Zero

52. In a reversible process, the entropy of the universe :

- (1) Decreases(2) Increases(3) Remains unchanged(4) Fluctuates
- **53.** Method which uses a list of well defined instruction to complete a task starting from a given initial state to end state is :
 - (1) Program (2) Flow chart (3) Algorithm (4) Both (1) and (2)
- 54. On a T-S diagram, the isothermals are :
 - (1) Straight lines parallel to the T-axis (2) Straight lines parallel to the S-axis
 - (3) Straight lines inclined at any angle (4) Rectangular parabola
- **55.** For an isolated thermodynamical system P, V, T, U and S represent the pressure, volume, temperature, internal energy and entropy respectively then the Gibb's potential (G) is defined as :
 - (1) G = U PV + TS(3) G = U - PV - TS(4) G = U + PV - TS
- **56.** A fluid at high pressure in throttled through a narrow porous opening in a region of lower pressure without any transfer of heat. In such a process :
 - (1) The entropy does not change
- (2) The Gibb's free energy remains constant
- (3) The entropy is decreased
- (4) The enthalpy of the fluid is constant
- 57. Which of the following is not Maxwell's equation ?
 - (1) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$ (2) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$ (3) $\left(\frac{\partial V}{\partial P}\right)_S = \left(\frac{\partial T}{\partial S}\right)_V$ (4) $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$

58. The combined form of first and second law of thermodynamics is given by :

(1) TDS = dU + PdV(2) dQ = TdS + PdV(3) dU = TdS + dQ(4) TdS = dU + PdV

59.	To a fish under wat the man looks : (1) Taller than wha (3) The same heigh	ter, viewing oblique t he actually is t as he actually is	ly a fisherman stand (2) Shorter than wl (4) depends on obl	ling on the bank of a lake, hat he actually is iquity
60.	Critical angle of light	ht passing from glass	to air is minimum f	or :
	(1) red	(2) green	(3) yellow	(4) violet
61.	The number of sulp	hide atoms in the uni	it cell of zinc sulphic	le crystal is :
	(1) 2	(2) 4	(3) 3	(4) 6
62.	In Compton effect scattering of the pho-	the transfer of ener oton is :	gy becomes the ma	ximum when the angle of
	(1) 90°	(2) 180°	(3) 60°	(4) 30°
63.	Davisson-Germer e	xperiment is related	to the phenomenon o	of:
	(1) Interference		(2) Diffraction	
	(3) Reflection		(4) Polarization	
64.	The correct relation	between group velo	city (v_g) and phase v	velocity (v_p) is :
	(1) $v_g = v_p - \lambda \frac{dv_p}{d\lambda}$	<u>,</u>	(2) $v_g = v_p + \lambda \frac{dv}{dt}$	$\frac{p}{\lambda}$
	(3) $v_g = v_p - \lambda \frac{dv_g}{d\lambda}$	<u>z</u>	(4) $v_p = v_g - \frac{1}{\lambda} \frac{dv}{d}$	$\frac{\partial g}{\partial \lambda}$

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65. The uncertainty principle tells us that :

(1) A particle can have only position but no momentum.

(2) A particle can have only momentum but no position.

(3) One can determine simultaneously the position and momentum of a particle.

(4) One cannot determine simultaneously the position and momentum of a particle.

66. In three dimensions the momentum operator \hat{p} is :

(1)
$$\hat{p} = -\frac{\hbar}{i}\nabla$$
 (2) $\hat{p} = -\frac{i\hbar}{\nabla}$ (3) $\hat{p} = \frac{\hbar}{i}\nabla$ (4) $\hat{p} = \frac{\hbar}{i}\nabla$

67. The value of $\left[\hat{x}, \frac{\hat{d}}{dx}\right]$ is : (1) 0(2) 1 (3) -1 (4) ∞ The energy of a particle in the nth quantum state in a one-dimensional closed box is **68**. proportional to : (2) n^2 (1) *n* (3) $\frac{1}{n}$ (4) $\frac{1}{n^2}$ The ground state energy of the one-dimensional oscillator is : 69. (2) $\frac{1}{2}\hbar w$ (3) $\frac{3}{2}\hbar w$ (4) ∞ (1) ħw 70. In case of a potential step of height V_0 , for a particle of energy $E < V_0$, the transmittance is : (1) Zero (2) Finite non-zero (3) Infinite (4) 1 71. The eigen value associated with an Hermitian operator is : (1) Imaginary (2) Complex (3) Real (4) None of these The doublets observed in alkali spectra are due to : 72. (1) Screening of the K electron (2) Spin-orbit interaction of the electron (3) Pressure of isotopes (4) Pressure of isotones The value of Lande g factor for the doublet term ${}^{2}D_{3/2}$ is : 73. (1) 2/5(2) 3/5(3) 4/5 (4) 6/5The splitting of single line singlet into three component lines in the presence of 74. magnetic field is known as : (1) Paschen-Back effect . (2) normal Zeeman effect (3) Anomalous Zeeman effect (4) Stark effect

75. For a diatomic molecule, Raman lines are observed due to appreciable change in :
(1) Pressure
(2) Shape
(3) Polarizability
(4) Solubility

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 (1) B = h/8π²IC (2) B = 2h/8π²I²C²(3) B = 3h/π²IC (4) B = hIC/8π² 77. The exciting line in an experiment is 5460 Å and the Stoke's line is at 5520 Å wavelength of anti-Stoke's line is : (1) 5200 Å (2) 4200 Å (3) 5401 Å (4) 5308 Å 78. In the first order Stark effect in hydrogen atom, the ground state : (1) Splits in two levels (2) Splits in three levels (3) Splits in four levels (4) Does not split 79. In the Ne lever the population inversion is achieved by : 	
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 (1) 5200 Å (2) 4200 Å (3) 5401 Å (4) 5505 Å 78. In the first order Stark effect in hydrogen atom, the ground state : (1) Splits in two levels (2) Splits in three levels (3) Splits in four levels (4) Does not split 79. In the Ne lever the population inversion is achieved by :	. The
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 (1) Splits in two levels (2) Splits in three levels (3) Splits in four levels (4) Does not split 79 In He Ne leser the population inversion is achieved by :	
 (3) Splits in four levels (4) Does not split 70 In He Ne leser the population inversion is achieved by : 	
70 In the Ne laser the nonulation inversion is achieved by :	
	• 3
(1) Chemical excitation (2) Photon excitation	
(3) Inelastic atomic collisions (4) Thermal excitation	
D <i>i i i i i i i i i i</i>	•
80. Ratio of probabilities of spontaneous emission and simulated emission is r	
(1) Proportional to frequency (6) (2) machematic of frequency (6) (2) $P_{\text{respectively}}^2$ (4) Proportional to y^3	
(3) Proportional to 0 (4) Proportional to 0	
81. The bulk modulus of a rubber is $9.1 \times 10^8 N / m^2$. To what depth (approxima rubber ball be taken in a lake so that it's volume is decreased by 0.1%?	tely) a
(1) 25 m (2) 100 m (3) 200 m (4) 500 m	
92 If the masses of all molecules of a gas are halved and their speeds doubled, t	hen the
ratio of initial and final pressures would be :	
(1) $2:1$ (2) $1:2$ (3) $4:1$ (4) $1:4$	
The molecules of a gas is 1260 m/s. The	ne most
83. The root mean square velocity of the molecules of a gas is represented of the molecules is :	
(1) 1029 m/s (2) 1161 m/s .(3) 1671 m/s (4) 917 m/s	ie most
The stars environgly each other. Their relative velocity will be:	
84. Two photons approach each other. Then relative velocity (11) Z (2) Less than C (3) More than C (4) C	
85. The <i>apparent</i> length of a meter rod moving parallel to it's length with veloc	
will be: (1) 0.5 m (2) 0.6 m (3) 1 m (4) 1.5 m	ity 0.8C

The equation $\overrightarrow{\nabla} \times \overrightarrow{E} = -\frac{\partial \overrightarrow{B}}{\partial t}$ represents : 86. (1) Gauss's law (2) Coulomb's law (3) Ampere's law (4) Faraday's law

87. An electromagnetic wave going through vacuum is described by $E = E_0 \sin (kx - wt)$. Which of the following is independent of wavelength?

- (1) k(2) w (3) w/k (4) kw
- The electric field intensity on the surface of a solid charged sphere of radius r and 88. volume charge density ρ is given by :

(1)
$$\rho r/3 \in_0$$
 (2) $\frac{1}{4\pi \in_0} \frac{\rho}{r}$ (3) zero (4) $\frac{5\rho r}{6 \in_0}$

- 89. Liquids and gases never exhibit :
 - (1) Diamagnetic properties
 - (3) Ferromagnetic properties
- (2) Paramagnetic properties
- (4) Ferromagnetic properties
- 90. Electromagnets are made of soft iron because soft iron has :
 - (1) Low retentivity and low coercivity
 - (2) High retentivity and high coercivity
 - (3) Low retentivity and high coercivity
 - (4) High retentivity and low coercivity

91. Particles obeying Bose-Einstein statistics have :

(1) any spin (2) integral spin (3) half integral spin (4) zero spin

92. Planck's law of radiation can be derived by applying :

 $\langle \alpha \rangle = \alpha$

- (1) Maxwell-Boltzmann Statistics (2) Bose-Einstein Statistics
- (3) Fermi-Dirac Statistics (4) None of these

The number of co-ordinates in the phase space of a single particle is : 93.

$$(1) 2 (2) 3 (3) 5 (4) 6$$

If a shift of 200 fringes is observed when the movable mirror is shifted through 0.0589 94. mm, the wavelength of light used in Michelson's Interferometer is : (1) 5000 \$

(1) 5890 A	(2) 2945 A	(3) 2006 Å	(4) 1475 Å
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- **95.** A wedge shaped film is viewed with light of $\lambda = 6 \times 10^{-5}$ cm. There are 10 fringes per cm. The angle of wedge is :
 - (1) 1×10^{-4} radian (2) 2×10^{-4} radian (3) 3×10^{-4} radian (4) 4×10^{-4} radian
 - 96. Which optical instrument is employed to obtain interference fringes of various shapes ?
 - (2) Fabrey-Perot interferometer (1) Michelson interferometer
 - (3) Newton rings
 - 97. If white light is used in the Newton's rings experiment, the colour observed in the reflected light is complementary to that observed in the transmitted light through the same point. This is due to :
 - (1) 90° change of phase in one of the reflected waves
 - (2) 180° change of phase in one of the reflected waves
 - (3) 135° change of phase in one of the reflected waves
 - (4) 45° change of phase in one of the reflected waves
 - **98.** Which of the following is a dichoric crystal?
 - (4) Selenite (2) Tourmaline (3) Mica (1) Quartz
 - 99. A calcite crystal is placed over a dot on a piece of paper and rotated. On seeing through the calcite, one will see :
 - (2) two stationary dots (1) one dot
 - (4) one dot rotating about the other (3) two rotating dots
 - 100. Which of the following in *correct* statement?
 - (1) The dispersive power of a grating decreases with the increase in the order of spectrum.
 - (2) The dispersive power of a grating increases with the increase in the order of spectrum.
 - (3) The dispersive power of a grating decrease with decrease of grating element.
 - (4) The dispersive power of a grating does not depend on grating element.

(4) Fresnel's biprism

	Tota	al No. of Prir	nted Pages : 13
(DO NOT OPEN THIS	QUESTION BOOKLET BEFOR ARE ASKED TO DO SO) PG-EE-June, 2023 SUBJECT : Physics	RE TIME OF Sr. No.	SET-X
Time : 1¼ Hours Boll No. (in figures)	Max. Marks : 100	Тс	otal Questions : 100
Name	Date of Birth		1
Father's Name	Mother's Name		
Date of Examination			
(Signature of the Candidate	e)	(Signature o	f the Invigilator)
CANDIDATES MUST REA	AD THE FOLLOWING INFORMATIC STARTING THE QUESTION PAPE	N/INSTRUCT	IONS BEFORE

1. All questions are compulsory.

- 2. The candidates *must return* the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall failing which a case of use of unfair-means / mis-behaviour will be registered against him her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. Keeping in view the transparency of the examination system, oarbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
- 4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
- 5. The candidate *must not* do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers *must not* be ticked in the question booklet.
- 6. There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Use only Black or Blue Ball Point Pen of good quality in the OMR Answer-Sheet.
- 8. Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

- The bulk modulus of a rubber is 9.1 × 10⁸ N/m². To what depth (approximately) a rubber ball be taken in a lake so that it's volume is decreased by 0.1%?
 (1) 25 m
 (2) 100 m
 (3) 200 m
 (4) 500 m
- 2. If the masses of all molecules of a gas are halved and their speeds doubled, then the ratio of initial and final pressures would be :
 - (1) 2:1 (2) 1:2 (3) 4:1 (4) 1:4
- 3. The root mean square velocity of the molecules of a gas is 1260 m/s. The most probable speed of the molecules is :
 (1) 1029 m/s
 (2) 1161 m/s
 (3) 1671 m/s
 (4) 917 m/s
- 4. Two photons approach each other. Their relative velocity will be :
 - (1) Zero (2) Less than C (3) More than C (4) C
- 5. The *apparent* length of a meter rod moving parallel to it's length with velocity 0.8C will be :
 - (1) 0.5 m (2) 0.6 m (3) 1 m (4) 1.5 m
- 6. The equation $\overrightarrow{\nabla} \times \overrightarrow{E} = -\frac{\partial \overrightarrow{B}}{\partial t}$ represents : (1) Gauss's law (2) Coulomb's law (3) Ampere's law (4) Faraday's law
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- 8. The electric field intensity on the surface of a solid charged sphere of radius r and volume charge density ρ is given by :
 - (1) $\rho r/3 \epsilon_0$ (2) $\frac{1}{4\pi \epsilon_0} \frac{\rho}{r}$ (3) zero (4) $\frac{5\rho r}{6\epsilon_0}$
- 9. Liquids and gases never exhibit :
 - (1) Diamagnetic properties (2) Paramagnetic properties
 - (3) Ferromagnetic properties (4) Ferromagnetic properties

P. T. O.

- **10.** Electromagnets are made of soft iron because soft iron has :
 - (1) Low retentivity and low coercivity (2) High retentivity and high coercivity
 - (3) Low retentivity and high coercivity (4) High retentivity and low coercivity
- 11. In a Ruby laser, the rod is surrounded by a helical photographic flash lamp filled with : (1) Chromium (4) Neon (2) Aluminium (3) Xenon
- 12. Half-life of a radioactive substance A is two times the half-life of another radioactive substance B. Initially the number of nuclei of A and B are N_A and N_B respectively. After three half-lives of A, number of nuclei of both are equal. Then the ratio N_A / N_B is :
 - (4) 1/6(1) 1/4(2) 1/8(3) 1/3
- 13. Radio carbon dating is done by estimating in specimen the :
 - (1) Amount of ordinary carbon still present
 - (2) Amount of radio carbon still present
 - (3) Ratio of amount of ${}_{6}C^{14}$ to ${}_{6}C^{12}$ still present
 - (4) Ratio of amount of ${}_{6}C^{12}$ to ${}_{6}C^{13}$ still present
- 14. The electron emitted in beta radiation originates from :
 - (2) Free electrons exciting in nuclei (1) Inner orbit of atoms
 - (3) Decay of a neutron in a nucleus (4) Photon escaping from the nucleus
- **15.** Which of the following is *true* for a Neutrino?
 - (2) It is charged and has no spin (1) It is charged and has spin
 - (4) It is chargeless and has no spin (3) It is chargeless and has spin
- The operation of a nuclear reactor is said to be critical, if the multiplication factor (K) 16. has a value :
 - (4) 2.5 (3) 2.1(2) 1.5 (1) 1
- The instrument which is suitable for absolute measurement of the activity of a β -active 17. source is :
 - (2) Scintillation Counter (1) G. M. Counter
 - (3) Proportional Counter
- (4) Ionization Counter
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18.	Primary cosmic ra	ys are composed of v	very energetic :	
	(1) Electrons	(2) Mesons	(3) Protons	(4) Neutrons
19.	Nuclear fusion read	ction occurs at tempe	eratures of the order of	of:
	(1) $10^3 K$	(2) $10^7 K$	(3) $10^2 K$	(4) $10^4 K$
20.	The radius of a nu with atomic mass n	cleus with atomic m number 189 is :	ass number 7 is 2 Fo	ermi. The radius of nucleus
	(1) 3 Fermi	(2) 4 Fermi	(3) 5 Fermi	(4) 6 Fermi
21.	The number of sulp	bhide atoms in the un	it cell of zinc sulphid	le crystal is :
	(1) 2	(2) 4	(3) 3	(4) 6
22.	In Compton effect scattering of the ph	the transfer of ener oton is :	gy becomes the ma	ximum when the angle of
	(1) 90°	(2) 180°	(3) 60°	(4) 30°
23.	Davisson-Germer e	xperiment is related	to the phenomenon o	f :
	(1) Interference		(2) Diffraction	
	(3) Reflection		(4) Polarization	

24. The correct relation between group velocity (v_g) and phase velocity (v_p) is :

(1)
$$v_g = v_p - \lambda \frac{dv_p}{d\lambda}$$

(2) $v_g = v_p + \lambda \frac{dv_p}{d\lambda}$
(3) $v_g = v_p - \lambda \frac{dv_g}{d\lambda}$
(4) $v_p = v_g - \frac{1}{\lambda} \frac{dv_g}{d\lambda}$

- **25.** The uncertainty principle tells us that :
 - (1) A particle can have only position but no momentum.
 - (2) A particle can have only momentum but no position.
 - (3) One can determine simultaneously the position and momentum of a particle.
 - (4) One cannot determine simultaneously the position and momentum of a particle.

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26. In three dimensions the momentum operator \hat{p} is : (1) $\hat{p} = -\frac{\hbar}{i}\nabla$ (2) $\hat{p} = -\frac{i\hbar}{\nabla}$ (3) $\hat{p} = \frac{\hbar}{i}\nabla$ (4) $\hat{p} = \frac{\hbar}{i}\nabla$ **27.** The value of $\begin{bmatrix} \hat{x}, \frac{\hat{d}}{dx} \end{bmatrix}$ is : (1) 0(2) 1 (3) -1(4)00 28. The energy of a particle in the nth quantum state in a one-dimensional closed box is proportional to : (2) n^2 (3) $\frac{1}{n}$ (4) $\frac{1}{r^2}$ (1) nThe ground state energy of the one-dimensional oscillator is : 29. (2) $\frac{1}{2}\hbar w$ (3) $\frac{3}{2}\hbar w$ (4) ∞ (1) ħw In case of a potential step of height V_0 , for a particle of energy $E < V_0$, the 30. transmittance is : (1) Zero (2) Finite non-zero (3) Infinite (4) 1 31. Particles obeying Bose-Einstein statistics have : (1) any spin (2) integral spin (3) half integral spin (4) zero spin Planck's law of radiation can be derived by applying : 32. (1) Maxwell-Boltzmann Statistics (2) Bose-Einstein Statistics (3) Fermi-Dirac Statistics (4) None of these The number of co-ordinates in the phase space of a single particle is : 33. (3) 5(2) 3 (4) 6(1) 2If a shift of 200 fringes is observed when the movable mirror is shifted through 0.0589 34. mm, the wavelength of light used in Michelson's Interferometer is : (1) 5890 Å (2) 2945 Å (3) 2006 Å (4) 1475 Å

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- **35.** A wedge shaped film is viewed with light of $\lambda = 6 \times 10^{-5}$ cm. There are 10 fringes per cm. The angle of wedge is :
 - (1) 1×10^{-4} radian (2) 2×10^{-4} radian (3) 3×10^{-4} radian (4) 4×10^{-4} radian
- **36.** Which optical instrument is employed to obtain interference fringes of various shapes ?
 - Michelson interferometer
 Fabrey-Perot interferometer
 - (3) Newton rings (4) Fresnel's biprism
- **37.** If white light is used in the Newton's rings experiment, the colour observed in the reflected light is complementary to that observed in the transmitted light through the same point. This is due to :
 - (1) 90° change of phase in one of the reflected waves
 - (2) 180° change of phase in one of the reflected waves
 - (3) 135° change of phase in one of the reflected waves
 - (4) 45° change of phase in one of the reflected waves
- **38.** Which of the following is a dichoric crystal ?
 - (1) Quartz (2) Tourmaline (3) Mica (4) Selenite
- **39.** A calcite crystal is placed over a dot on a piece of paper and rotated. On seeing through the calcite, one will see :
 - (1) one dot (2) two stationary dots
 - (3) two rotating dots (4) one dot rotating about the other
- **40.** Which of the following in *correct* statement ?
 - (1) The dispersive power of a grating decreases with the increase in the order of spectrum.
 - (2) The dispersive power of a grating increases with the increase in the order of spectrum.
 - (3) The dispersive power of a grating decrease with decrease of grating element.
 - (4) The dispersive power of a grating does not depend on grating element.
- 41. If the temperatures of source and sink of a Carnot engine having efficiency η are each decreased by 100 K, then the efficiency :
 - (1) Remains constant (2) Decreases
 - (3) Increases (4) Becomes Zero

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- 42. In a reversible process, the entropy of the universe :
 - (1) Decreases (2) Increases
 - (3) Remains unchanged (4) Fluctuates

43. Method which uses a list of well defined instruction to complete a task starting from a given initial state to end state is :

- (1) Program (2) Flow chart (3) Algorithm (4) Both (1) and (2)
- 44. On a T-S diagram, the isothermals are :
 - (1) Straight lines parallel to the T-axis (2) Straight lines parallel to the S-axis
 - (3) Straight lines inclined at any angle (4) Rectangular parabola

45. For an isolated thermodynamical system P, V, T, U and S represent the pressure, volume, temperature, internal energy and entropy respectively then the Gibb's potential (G) is defined as :

(1) G = U - PV + TS(2) G = U + PV + TS(3) G = U - PV - TS(4) G = U + PV - TS

46. A fluid at high pressure in throttled through a narrow porous opening in a region of lower pressure without any transfer of heat. In such a process :

- (1) The entropy does not change
- (2) The Gibb's free energy remains constant

(4) The enthalpy of the fluid is constant

- (3) The entropy is decreased
- 47. Which of the following is *not* Maxwell's equation ?
 - (1) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$ (2) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$ (3) $\left(\frac{\partial V}{\partial P}\right)_S = \left(\frac{\partial T}{\partial S}\right)_V$ (4) $\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$

48. The combined form of first and second law of thermodynamics is given by :

- (1) TDS = dU + PdV (2) dQ = TdS + PdV
- (3) dU = TdS + dQ (4) TdS = dU + PdV

49. To a fish under water, viewing obliquely a fisherman standing on the bank of a lake, the man looks :

- (1) Taller than what he actually is
- (3) The same height as he actually is
- (2) Shorter than what he actually is
- (4) depends on obliquity

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50. Critical angle of light passing from glass to air is minimum for :

(1) red (2) green (3) yellow (4) violet

- 51. Curie temperature is the temperature above which :
 - (1) A paramagnetic material becomes diamagnetic
 - (2) A ferromagnetic material becomes diamagnetic
 - (3) A paramagnetic material becomes ferromagnetic
 - (4) A ferromagnetic material becomes paramagnetic
- 52. The Poisson's equation in CGS Gaussian system is :

(1) $\nabla^2 V = -\frac{\rho}{\epsilon_0}$ (2) $\nabla^2 V = -4\pi\rho$ (3) $\nabla^2 V = -4\pi\epsilon_0$ (4) $\nabla^2 V = 0$

53. An inductance of 2H and resistance of 10Ω are connected in series to a battery of 5V. The initial rate of change of current is :

(1) 2.5 A/s (2) 2.0 A/s (3) 0.5 A/s (4) 0.25 A/s

- 54. A solenoid of resistance 50Ω and inductance 5mH is connected to 200V battery. The maximum energy stored is :
 - (1) 4 mJ (2) 0.4 mJ (3) 40 mJ (4) 400 mJ

55. In LCR circuit if resistance increases, the quality factor :

- (1) Increases (2) Decreases
- (3) Remains constant (4) None of these
- **56.** The phase difference between the voltage and current of LCR circuit in series at resonance is :
 - (1) π (2) $\pi/2$ (3) Zero (4) $\pi/4$
- 57. A P-N junction diode can not be used :
 - (1) as a rectifier
 - (2) for increasing the amplitude of an AC signal
 - (3) for getting light radiation
 - (4) for converting light energy into electrical energy

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58.	The bandwidth and voltage gain of an a	mplifier using negativ	e feedback :
	(1) Decreases, increases respectively	(2) Decreases, decr	eases respectively
	(3) Increases, decreases respectively	(4) Increases, increases,	ases respectively
59.	Emitter follower is an amplifier employ	ing :	
	(1) Voltage series feedback	(2) Current series f	eedback
	(3) Voltage shunt feedback	(4) Current shunt f	eedback
60.	The time base of a CRO is developed b	y :	
	(1) Sawtooth waveform	(2) Square wavefo	rm
	(3) Triangular waveform	(4) Sinusoidal way	veform
61.	Lenses of power + 3D and -5D are c placed at a distance of 50 cm from the the lens :	ombined to form a co lens. It's image will b	ompound lens. An object is e formed at a distance from
	(1) 25 cm (2) 20 cm	(3) 30 cm	(4) 40 cm
62.	 Chromatic aberration in the formation (1) of non-paraxial rays (2) radii of curvature of two sides are (3) of the defects in grinding (4) The focal length varies with wave 	of images by a lens a not same elength	rises because :
63.	One cannot see through fog because :		
	(1) fog absorbs light		·
	(2) the refractive index of fog is infir	nity	
	(3) light suffers total reflection at the	droplets in fog	
	(4) light is scattered by droplets in fo	og	
64.	 A person is suffering from the defect (1) distance of the eye lens from reti (2) power of accommodation of the (3) the cornea is not spherical (4) the distance of the eye lens from 	of astigmatism. It's r na is increased cye is decreased the retina is decrease	nain reason is : ed

65	In a Fresnel bipr slits as 16 cm and	ism experiment, the d 9 cm respectively.	two positions of lea The actual distance	ns give separation between the of separation of slits is :
	(1) 12.5 cm	(2) 12.0 cm	(3) 13 cm	(4) 14 cm
66.	A thin mica shee the path of one o bright maximum	t of thickness $2 \times 10^{\circ}$ of the waves. The wa will shift :	⁻⁶ m and refractive i velength of the wav	index $\mu = 1.5$ is introduced in the used is 5000 Å. The central
	 (1) 2 fringes upv (3) 10 fringes up 	vard ward	(2) 2 fringes do(4) 10 fringes do	wnward ownward
67.	A bag contains 5 bag, the probabili	red balls, 8 white batter white the set of t	alls and 10 black bal ite or black is :	ls. If a ball is drawn from the
	(1) 5/18	(2) 8/18	(3) 10/23	(4) 18/23
68.	Sterling's formula	states that for every	large value of N, In	N ! is equal to :
	(1) N !	(2) $N(\ln N - 1)$	(3) N ln N	$(4) \ \frac{\ln N}{N}$
69.	Boltzmann relatio	on between entropy (s	and thermodynam	ic probability (W) is :
	(1) $S = \ln W$	$(2) S = \frac{\ln W}{k}$	$(3) S = k \ln W$	(4) $S = \frac{k}{\ln W}$
70.	Maxwell-Boltzma	nn statistics is applic	able for :	
	(1) Photon	(2) Ideal gas	(3) Electron	(4) Proton
71.	What does not cha	inge on polarization of	of light ?	
	(1) Intensity	(2) Phase	(3) Frequency	(4) Wavelength
72.	The Miller indices	of the plane parallel	to the X and Y-axes	are :
	(1) (100)	(2) (010)	(3) (001)	(4) (111)
73.	A plane intercepts plane are :	at $a, b/2, 3c$ in a since $a = b/2, 3c = b/2$	mple cubic unit cel	l. The Miller indices of the
	(1) (132)	(2) (261)	(3) (361)	(4) (123)
74.	The number of latt	ice points in a primiti	ve cell áre :	
	(1) 1	(2) 1/2	(3) 2	(4) 3/2

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	The second neighbo	our distance in the cas	se of bcc structure is	:
75.	The heatest heighton $(1) \cdot (a\sqrt{3})/2$	(2) $(a\sqrt{2})/2$	(3) $2a/\sqrt{3}$	(4) $2a/\sqrt{2}$
	(1) $(a\sqrt{3})/2$		the electrodes of X-1	ray tube is increased, there
76.	When the potential	difference between	the electrodes of T	
	take place an increa	(2) Frequency	(3) Wavelength	(4) Speed of X-rays
	(1) Intensity	(2) Frequency		х.
77.	The packing factor	of diamond cubic cry	ystal structure is :	(4) 34%
	(1) 60%	(2) 56%	(3) 90%	(4) 5.77
79	If 0.28 nm is the int	terionic distance in N	VaCl crystal, the latti	ce parameter is :
70.	(1) 0 14 nm	(2) 0.56 nm	(3) 0.08 nm	(4) 0.41 nm
	(1) 0.1 (1111		he incident X-ray ar	d the diffracted ray is 16°,
79 .	If the angle betwee	en the direction of u	ne meldent X tuy un	
	the angle of model	$(2) 24^{\circ}$	(3) 90°	(4) 82°
	$(1) 32^{-1}$	(2) 21	lence with	Einstein's theory of specific
80.	Which of the follo	owing statements is i	in accordance with	
	heat of solids :	1	crease of temperatur	e
	(1) Specific heat of	lrops linearly with h	ecrease of temperature	re
	(2) Specific heat of	trops intearly with u	with decrease of tem	perature
	(3) Specific heat (irops exponentially v		
	(4) Specific heat r	emains constant		
81.	The volume eleme	ent in spherical polar	co-ordinates is :	
	(1) $r dr \sin \theta d\theta d$	άφ	(2) $r^2 dr \sin \theta d\theta$	$d\phi$
	(3) $r^2 dr \sin \theta d\theta$		(4) $r^3 dr \sin \theta d\theta$	$\partial d\phi$
82	Total kinetic energy	gy of circular disc ro	olling on a table is :	
	(1) $\frac{3}{4}Mr^2w^2$		(2) $\frac{1}{2} Mr^2 w^2$	
	(3) $\frac{3}{4}M^2r^2w^2$		(4) $\frac{1}{2}M^2r^2w^2$	
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- 83. An inclined plane makes an angle of 30° with the horizontal. A solid sphere rolling down the inclined plane from rest without slipping has a linear acceleration given by : (1) g/3
 - (2) 2g/3(3) 5g/3(4) 5g/14
- 84. The number of degrees of freedom of the particle moving on the circumference of a circle is :
 - (1) 1 (2) 2(3) 3 (4) 6

The constraint on a particle moving on an ellipsoid under the influence of gravity is : 85.

- (1) Holonomic (2) Nonholonomic (3) rheonomic
- (4) both holonomic and rheonomic

86. The homogeneity of time leads to the law of conservation of :

- (1) Linear momentum (2) Angular momentum (3) Energy (4) Parity
- 87. Three identical metal balls, each of radius R, are placed touching each other on a horizontal surface such that an equilateral triangle is formed when the centres of the three balls are joined. The centre of mass of the system is located at :
 - (1) Horizontal surface
 - (2) Centre of one of the balls
 - (3) Line joining centres of any two balls
 - (4) Point of intersection of their medians
- 88. Increase in length of a wire on stretching is 0.025%. If it's Poisson's ratio is 0.4, then the percentage increase in diameter is : (1) 0.01
 - (2) 0.02 (3) 0.03(4) 0.04
- A beam of metal supported at the two ends is loaded at the centre. The depression at 89. the centre is proportional to :
 - (1) Y^2 (2) Y(3) 1/Y(4) $1/Y^2$

The stress required to double the length of a wire of Young's modulus Y is : 90. (1) Y/2(2) 2Y (3) Y(4) 4Y

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91.	The eigen value associated with an Herm(1) Imaginary(2) Complex	itian operator is : (3) Real (4) None of these
92.	The doublets observed in alkali spectra a(1) Screening of the K electron(3) Pressure of isotopes	re due to : (2) Spin–orbit interaction of the electron (4) Pressure of isotones
93.	The value of Lande g factor for the doub (1) $2/5$ (2) $3/5$	let term ${}^{2}D_{3/2}$ is : (3) 4/5 (4) 6/5
94.	The splitting of single line singlet in magnetic field is known as :(1) Paschen-Back effect(3) Anomalous Zeeman effect	o three component lines in the presence of(2) normal Zeeman effect(4) Stark effect
95.	For a diatomic molecule, Raman lines an (1) Pressure (2) Shape	e observed due to appreciable change in : (3) Polarizability (4) Solubility
96.	Rotational constant (B) is related to more (1) $B = h/8\pi^2 IC$ (3) $B = 3h/\pi^2 IC$	nent of inertia (I) through the relation : (2) $B = 2h/8\pi^2 I^2 C^2$ (4) $B = hIC/8\pi^2$
97.	The exciting line in an experiment is 5 wavelength of anti-Stoke's line is : (1) 5200 Å (2) 4200 Å	 460 Å and the Stoke's line is at 5520 Å. The (3) 5401 Å (4) 5308 Å
98.	In the first order Stark effect in hydroge(1) Splits in two levels(3) Splits in four levels	n atom, the ground state : (2) Splits in three levels (4) Does not split
99.	In He-Ne laser the population inversion(1) Chemical excitation(3) Inelastic atomic collisions	is achieved by :(2) Photon excitation(4) Thermal excitation
100.	 Ratio of probabilities of spontaneous er (1) Proportional to frequency (υ) (3) Proportional to υ² 	 (2) Independent of frequency (υ) (4) Proportional to υ³

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ANSWEI	ANSWER KEYS ENTRANCE EXAM OF M.SC. (PHYSICS) 2 YEAR SESSION 2023-24				
Q. NO.	Α	В	С	D	
1	2	2	1	2	
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3	4	2	4	1	
4	1	1	3	4	
5	2	4	2	2	
6	3	3	1	4	
7	4	3	4	3	
8	1	2	2	1	
9	3	2	3	3	
10	3	1	2	1	
11	2	2	4	3	
12	2	1	2	2	
13	1	4	1	3	
14	4	1	3	3	
15	2	3	2	3	
16	4	1	3	1	
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43	4	3	3	3	
44	3	3	1	2	
45	2	3	1	4	
46	1	1	2	4	
47	4	3	4	3	
48	2	3	2	1	
49	3	2	4	1	
50	2	4	3	4	

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ANSWE	R KEYS ENTRANCE EX	AM OF M.SC.(PHYSIC	S) 2 YEAR SESSION	2023-24
Q. NO.	A	В	С	D
51	2	3	3	4
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55	3	1	4	2
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74	1	2	3	1
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70	3	4	3	
78	2	2	4	<u> </u>
79	2	2	5	
80	1	2	4	2
81	3	4	2	2
82	2	2	2	1
83	3	1		4
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85	3	2	2	2
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88	4	3	1	
89	3	1	3	3
90	4	1	1	3
91	3	2	2	3
92	2	1	1	2
93	3	4	4	3
94	3	1	11	2
95	3	2	3	3
96	1	3	1	1
97	3	4	2	3
98	3	1	2	4
99	2	3	4	3
100	4	3	2	4

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