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M. Sc. Entrance Examination, June - 2022**PHYSICS****Sub. Code : 58718****Day and Date : Friday, 10 - 06 - 2022****Total Marks : 100****Time : 3.30 p.m. to 5.00 p.m.**

- Instructions :**
- 1) All questions are compulsory.
 - 2) Each question carries one mark.
 - 3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
 - 4) Follow the instructions given on OMR sheet.
 - 5) Rough work shall be done on the sheet provided at the end of question paper.

- 1) Angular acceleration is the rate of change of _____
(A) Angular momentum (B) Linear momentum
(C) Linear velocity (D) Angular velocity
- 2) The principle virtual work deals only the cases of _____
(A) Statics (B) Dynamics
(C) Mechanics (D) Kinematics
- 3) All accessible microstates corresponding to possible macrostates are equally probable is known as _____
(A) Priori probability (B) Thermodynamic probability
(C) Most probable distribution (D) Probability distribution

P.T.O.

- 4) For a system of N Particles moving independent of each other the number degrees of freedom is _____
- (A) N (B) 2N
(C) 3N (D) 6N
- 5) A charged particle in an electromagnetic field experience a force called _____
- (A) Gravitational force (B) Lorentz force
(C) Frictional force (D) Restoring force
- 6) The _____ force is an interaction.
- (A) Frictional (B) Electromagnetic
(C) Centrifugal (D) Viscous
- 7) 1 Fermi is equal to _____
- (A) 10^{-9} m (B) 10^{-10} m
(C) 10^{-11} m (D) 10^{-15} m
- 8) _____ is the minimum energy required to break the nucleus into its constituent particles.
- (A) Potential energy (B) Kinetic energy
(C) Binding energy (D) None of these
- 9) In hall effect, if current is flowing due to motion of holes, the hall coefficient is.
- (A) Positive (B) Negative
(C) Zero (D) Either positive or negative

- 10)** The conduction band of-insulator is
- (A) Completely empty (B) Completely filled
(C) Partially filled (D) Partially empty
- 11)** The SI unit of Flux density B is _____
- (A) A/m (B) A.m
(C) wb/m (D) wb/(m²)
- 12)** In powder X-ray diffraction _____
- (A) λ is fixed while both θ and dhkl varies
(B) λ is fixed and θ varies
(C) θ is fixed and λ and varies
(D) Both λ and θ varies
- 13)** The amount of work done in moving a unit positive charge from infinity to that point against the electrostatic forces is called _____
- (A) Electric charge (B) Electric current
(C) Electric potential (D) All
- 14)** The volume of unit cell of reciprocal lattice is
- (A) $a^*.(b^*xc^*)$ (B) $a^*.(b^*.c^*)$
(C) $a^*.b^*.c^*$ (D) $a^*xb^*xc^*$

- 15) The parallelogram law of vector addition is also used to find the _____ of two vectors
- (A) Multiplication (B) Division
(C) Substraction (D) Resultant
- 16) The magnitude of the resultant of two unit vectors is _____
- (A) Zero (B) Square root of three
(C) Square root of two (D) Two
- 17) The cross product of the vectors $3\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$ and $-\mathbf{i} + \mathbf{j} - 2\mathbf{k}$ is, _____
- (A) $3\mathbf{i} - 11\mathbf{j} + 7\mathbf{k}$ (B) $-3\mathbf{i} + 11\mathbf{j} + 7\mathbf{k}$
(C) $-3\mathbf{i} - 11\mathbf{j} - 7\mathbf{k}$ (D) $-3\mathbf{i} + 11\mathbf{j} - 7\mathbf{k}$
- 18) For dielectric medium dielectric constant _____
- (A) $K = 1$ (B) $K > 1$
(C) $K < 1$ (D) $K = 0$
- 19) The induced charge per unit area of a given dielectric substance is called as _____
- (A) Electric polarization vector (B) Electric displacement vector
(C) Electric intensity vector (D) None of these
- 20) If $\mathbf{v} = ix + jy + zk$, then $\nabla \bullet \mathbf{V} =$ _____
- (A) 0 (B) 1
(C) 2 (D) 3

- 21) In phase space, each cell has _____ volume.
- (A) Minimum (B) Maximum
(C) Negligible (D) Finite
- 22) Thermal conductivity in gases is due to _____
- (A) Difference in molecular concentrations
(B) The difference in velocity of molecules
(C) Difference in temperatures
(D) None of these
- 23) Normal coordinates in coupled oscillatory system involve _____ frequency
- (A) One (B) Two
(C) Three (D) Two or Three
- 24) The del operator was first introduced by _____
- (A) Newton (B) Kepler
(C) Ferguson (D) Hamilton
- 25) The dimension of electric field is _____
- (A) $[M L T^{-3} A^{-1}]$ (B) $[M L T^{-2} A^{-1}]$
(C) $[M L T^{-3} A^{-2}]$ (D) $[M L T^3 A^{-1}]$

26) Intensity of Sound waves is proportional to _____

- (A) Square of the amplitude (B) Square of the frequency
(C) Density of the medium (D) All of the above

27) $\int_0^1 x^2(1-x)^{-1/2} dx =$ _____

- (A) $8\pi^{1/2}/15$ (B) $8/15$
(C) $16\pi^{1/2}/15$ (D) $16/15$

28) Legendre's differential equation has general solution.in the form _____

- (A) $y = AP_n(x)$ (B) $y = BQ_n(x)$
(C) $y = AP_n(x) - BQ_n(x)$ (D) $y = AP_n(x) + BQ_n(x)$

29) It is thought that the main origin of cosmic rays is _____

- (A) Supernova and pulsar (B) Sun
(C) Moon (D) None of these

30) In a cubic crystal structure system if atomic radii $r = 2\text{\AA}$, then value of lattice constant, $a =$ _____

- (A) $0.5\text{\AA}$ (B) $1\text{\AA}$
(C) $2\text{\AA}$ (D) $4\text{\AA}$

- 31) For a HCP crystal structure if $c = 1.63 \text{ \AA}$, then interplanar spacing for (100) plane is
- (A) $1.63 \text{ \AA}$ (B) $(1/1.63) \text{ \AA}$
(C) $1 \text{ \AA}$ (D) $3.26 \text{ \AA}$
- 32) Nicol prism is made up of _____
- (A) Natural calcite crystal (B) Properly cut natural calcite crystal
(C) Natural quartz crystal (D) Properly cut quartz crystal
- 33) For just resolution of two nearby wavelengths, the central maximum of one should fall at _____
- (A) Central maximum of the other (B) First minimum of the other
(C) First secondary maximum of other (D) All the above
- 34) The most probable distribution depends upon _____
- (A) Total area of phase space (B) Area of cell
(C) Average density (D) average density and area of cell
- 35) The gradient of a vector field is _____ quantity.
- (A) A vector (B) A scalar
(C) Physical (D) Chemical

- 36) In Joule Thomson effect, cooling effect is observed at _____
- (A) $T_i = 193 \text{ K}$ (B) $T_i > T$
 (C) $T_i < T$ (D) $T_i = T$
- 37) Slow frequency of normal mode of oscillation of two identical pendula is given by _____
- (A) $\sqrt{g/l}$ (B) $\sqrt{g/l + 2k/m}$
 (C) $\sqrt{l/g}$ (D) $\sqrt{l/g + 2k/m}$
- 38) Reflection coefficient (R) and transmission coefficient (T) are related by _____
- (A) $R + T = 0$ (B) $R + T = 1$
 (C) $R = l/T$ (D) $R - T = 0$
- 39) The total probability of the system _____
- (A) Increasing (B) Decreasing
 (C) Remains constant (D) None of the above
- 40) The magnetic lines of force cannot penetrate through the body of superconductor this phenomenon is known as _____
- (A) Isotopic effect (B) London effect
 (C) Meissener effect (D) BCS theory
- 41) The susceptibility of superconductor is _____
- (A) 0 (B) 1
 (C) -1 (D) 2

- 42) Which of the following method is physical method of synthesizing nanomaterials?
- (A) Colloidal (B) Sputtering
(C) Spray pyrolysis (D) Electrodeposition
- 43) Quantum dots are _____ dimensional nanostructures.
- (A) One (B) Zero
(C) Two (D) Three
- 44) Which of the following is an example of top-down approach for the preparation of nanomaterials ?
- (A) Ball milling (B) Nucleation and growth
(C) Molecular beam *epitaxy* (D) Gas phase agglomeration
- 45) Nanomaterials are the materials with at least one dimension measuring less than _____
- (A) 1 nm (B) 10 nm
(C) 100 nm (D) 1000 nm
- 46) For the equation $\frac{d^2y}{dx^2} + H(x)\frac{dy}{dx} + B(x)y = 0$ the functions $P(x)$ and $Q(x)$ are analytical at point $x = x_0$, then the point x_0 is _____ point.
- (A) Singular (B) Ordinary
(C) Differential (D) None

- 47) If natural frequency of vibration of a body is u and is subjected to periodic force of frequency v , then the body vibrates with frequency _____
- (A) u (B) v
(C) Greater than u (D) less than u
- 48) Damped oscillatory motion occurs when the restoring force is _____
- (A) Greater than damping force (B) Less than damping force
(C) Equal to damping force (D) Equal to external periodic force
- 49) A small amount of liquid, set free in the air, takes spherical shape because of its _____
- (A) High density (B) Viscosity
(C) Elasticity (D) Surface tension
- 50) A beam supported at both the ends and loaded at the centre is equivalent to _____
- (A) a cantilever (B) Three cantilevers
(C) Two cantilevers (D) Four cantilevers
- 51) The oscillatory motion of a body about its mean position only under the action of restoring force developed is called _____ oscillatory motion.
- (A) Damped (B) Free
(C) Over damped (D) Forced

- 52) If a diatomic gas molecule has translational, rotational and vibrational degrees of freedom, then the ratio of C_p/C_v , is _____
- (A) 1.29 (B) 1.40
(C) 1.33 (D) 2
- 53) A Carnot's engine is operating between 100°C and 50°C . Its efficiency will be.
- (A) 13.4 % (B) 15.29%
(C) 50 % (D) 100%
- 54) During an adiabatic change of thermodynamic system, ... remains constant.
- (A) Pressure (B) Temperature
(C) Volume (D) entropy
- 55) Entropy is a measure of _____
- (A) Perfect order (B) Available energy
(C) Disorder (D) Chemical composition of matter
- 56) Which of thermodynamic function have P and T independent variables?.
- (A) Internal energy (B) Helmholtz free energy
(C) Gibb's function (D) Enthalpy

- 57) The method of separation of variables is useful for conversion of given differential equation into _____ equation.
- (A) Ordinary differential (B) Partial differential
(C) Cubic (D) Quadratic
- 58) As absolute temperature of a perfectly black body is reduced to half its Value, then rate of emission of energy per unit area becomes _____ times.
- (A) 0.045 (B) 0.056
(C) 0.063 (D) 0.073
- 59) To obtain two coherent sources _____
- (A) They must have same wavelength
(B) They must have same path difference
(C) They must have same phase difference
(D) They must be derived from the same original source
- 60) For just resolution of two nearly equal wavelengths the angular separation, their principal maxima should be equal to _____
- (A) Angular width (B) Half the angular width
(C) Double the angular width (D) Quarter the angular width
- 61) In IC 555, trigger is applied at terminal number _____
- (A) 3 (B) 1
(C) 4 (D) 2

- 62) When $J = K = 1$ and clock is high then the J-K Flip-Flop is in the _____ state.
- (A) Reset (B) Set
(C) toggle (D) Last
- 63) The arrangement of electrodes which produce a focused beam of electrons is called _____
- (A) Electron tube (B) Electron gun
(C) Electric tube (D) Electric gun
- 64) The working principle of cloud chamber states that the super saturated vapor remains _____ against the formation of droplets.
- (A) Stable (B) Unstable
(C) First stable and then unstable (D) None of these
- 65) In cyclotron, the energy of the particles accelerated is _____ P.D. between the Dees.
- (A) Directly proportional to (B) Inversely proportional to
(C) Independent of (D) None of these
- 66) _____ are elementary particles which are not constituted of quarks.
- (A) Baryons (B) Mesons
(C) Leptons (D) Nucleons
- 67) _____ colour of stars are hottest
- (A) Red (B) Blue
(C) Yellow (D) None of these

- 68) The equation $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = 1$ is called _____ equation.
- (A) Linear (B) Non-linear
(C) quadratic (D) Non-homogeneous
- 69) Stokes and anti-stokes lines are observed in _____ spectra
- (A) Hydrogen (B) Optical
(C) Scattering (D) Raman
- 70) Normal Zeeman effect is observed when the atom is placed in _____ external field.
- (A) Strong magnetic (B) Weak magnetic
(C) Strong electric (D) Weak electric
- 71) Raman effect is due to _____ of light
- (A) Interference (B) Polarization
(C) Diffraction (D) Scattering
- 72) Zeeman effect is not used in _____
- (A) MRI scan (B) NMR
(C) Optical amplifiers (D) Laser cooling
- 73) _____ is the cause of origin of biomass energy.
- (A) Photosynthesis (B) Fermentation
(C) Oxidation (D) Deoxidation

- 74) First wind turbine was constructed and installed in 1985 in _____
(A) Denmark (B) Canada
(C) Netherland (D) Sweden
- 75) Clarity index on clear day at noon is _____
(A) 0.1 (B) 0
(C) 0.7 (D) Infinity
- 76) In satellite station solar energy plant the solar energy from satellite is send to the ground station in the form of _____
(A) IR waves (B) Heat waves
(C) Micro waves (D) Light waves
- 77) Which of the following is not renewable source of energy?
(A) Wind (B) Solar
(C) Nuclear (D) Ocean
- 78) Body having larger value of _____ rolls down slowly and takes larger time to reach bottom.
(A) Mass (B) Acceleration
(C) Radius of gyration (D) Angular velocity
- 79) Hamilton's principle is _____ principle.
(A) Differential (B) Integral
(C) Algebraic (D) Virtual

- 80)** If an object reaches the speed of light, its length changes to _____
(A) Infinite (B) Double of the value
(C) Half of the value (D) Zero
- 81)** The inertial frame of reference is _____ frame of reference
(A) An accelerated (B) An unaccelerated
(C) A rotating (D) An oscillating
- 82)** In Brachistochrone Problem, the path of the particle is _____
(A) Parabolic (B) Circular
(C) Straight line (D) Cycloid
- 83)** If the particle moves in a central force field, its _____ remains constant.
(A) Linear velocity (B) Areal velocity
(C) Angular velocity (D) Linear momentum
- 84)** If energy of the particle is less than the step potential then classically _____
(A) $R = 1, T = 0$ (B) $R = 0, T = 1$
(C) $R = T = 1/2$ (D) None of these
- 85)** The wavelength of matter wave is independent of _____
(A) Mass (B) Momentum
(C) Velocity (D) Charge
- 86)** In a transistor circuit, $I_c =$ _____
(A) I_B (B) I_E
(C) $I_B - I_C$ (D) Both (A) & (B)

- 87) _____ flip-flop is a refinement of R-S flip-flop.
 (A) J-K (B) D
 (C) T (D) All
- 88) Differential amplifiers uses _____ stages of amplifiers.
 (A) Four balanced (B) Two balanced
 (C) Three balanced (D) Two unbalanced
- 89) The astronomer who first observed the red shift in the spectra of distant galaxies was _____.
 (A) Hubble (B) Slipher
 (C) Sandage (D) Kepler
- 90) A diatomic molecule in a space can be completely specified _____ number of co-ordinates
 (A) Three (B) five
 (C) Six (D) $3N$
- 91) According to Biot Savart's law magnetic field at a point due to small element of current carrying conductor is _____.
 (A) Directly proportional to current flowing through it
 (B) Inversely proportional to current flowing through it
 (C) Inversely proportional to the length of conductor
 (D) Directly proportional to r
- 92) A moving coil microphone works on the principle of _____.
 (A) Electromagnetic induction (B) Motor action
 (C) Amplifier (D) Transformer
- 93) $(-15 - 81)^{1/2} =$ _____.
 (A) $\pm (1 - 4i)$ (B) $\pm (1 + 4i)$
 (C) $\pm (1 - 2i)$ (D) $\pm (1 + 2i)$

- 94) The argument of $-1 - \sqrt{3}$ is _____
 (A) $4\pi/3$ (B) $\pi/3$
 (C) $2\pi/3$ (D) $5\pi/3$
- 95) $\operatorname{erf}(x) + \operatorname{erfc}(x) =$ _____
 (A) 0 (B) 1
 (C) 2 (D) ∞
- 96) Frank-Condon principle helps in estimating the _____
 (A) Moment of inertia of the molecule (B) Bond length
 (C) Reduced mass of molecule (D) Intensity of bands
- 97) Big-bang theory was strongly supported by _____
 (A) Hubble (B) Fred Hoyle
 (C) George Gamow (D) Einstein
- 98) The transitions from nS levels to the lowest P-level give rise to a spectral series called _____
 (A) Sharp (B) Principal
 (C) Diffuse (D) Fundamental
- 99) In adiabatic expansion, real gas show _____ effect.
 (A) Cooling (B) Heating
 (C) heating and cooling (D) Temperature dependent
- 100) Using Maxwell's thermodynamics relations, E_s/E_T is _____
 (A) 1 (B) 2
 (C) γ (D) $1/\gamma$



Rough Work

Rough Work