Seat No.

PD-02

Total No. of Pages : 10

Shivaji University, Kolhapur
Ph.D. Entrance Examination, February- 2024
PHYSICS
Sub. Code : 58795

Day and Date : Tuesday, 06-02-2024 **Total Marks : 100**

Time : 10:00 am to 12:00 noon

Instructions:

1) All questions are compulsory.
2) Each question carries 2 marks.
3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
4) Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR Answer Sheet.
5) Follow the instructions given on OMR Sheet.
6) Rough work shall be done on the sheet provided at the end of question paper.
7) Only non programmable calculators are allowed.

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1) XRD intensity depends upon

   A) Crystal Structure
   B) Atomic positions
   C) Occupancies
   D) All of the above

2) X-ray diffraction patterns are used for studying the crystal structure of solids because

   A) They have very high energy, hence they can penetrate through solids
   B) They are electromagnetic radiation and hence do not interact with matter
   C) Their wavelengths are comparable to inter-atomic distances
   D) Their high frequency enables rapid analysis

3) The wavelength of Cu K∝ radiation is _____ nm

A) 0.1542 B) 0.1791

C) 0.1937 D) 0.2291

4) In XRD analysis the unit cell parameters are calculated from

A) Background B) Peak positions

C) Peak intensity D) FWHM

5) The Miller indices h, k and 1 of parallel planes in a BCC lattice should satisfy which of the following X-ray diffraction reflection rules?

A) h+k+1 should be even

B) h, k and 1 should all be either even or odd

C) h, k and 1 should form Pythagoras triplet

D) all planes allow reflections

6) In thermo gravimetric analysis (TGA), the change in weight of the sample may occur due to

A) Gas desorption B) Decomposition

C) Chemisorption D) All of above

7) IR spectroscopy provides valuable information about

A) molecular weight B) melting point

C) conjunction D) functional groups

8) According to the Beer-Lambert Law, which of the following does absorbance not depend?

A) Color of the solution

B) Extinction coefficient of the sample

C) Solution concentration

D) The distance that the light has traveled through the sample

9) In DTA, an endothermic peak occurs due to

A) Oxidation B) Chemisorption

C) Melting D) Crystallization

10) Which of the following statements regarding IR spectroscopy is not correct?

A) Infrared radiation is higher in energy than UV radiation.

B) Infrared spectra record the transmission of IR radiation.

C) Molecular vibrations are due to periodic motions of atoms in molecules and include bond stretching, torsional changes, and bond angle changes.

D) Infrared spectra give information about bonding features and functional groups in molecules.

11) Both the current and potential are varied in _____ mode of electrodeposition.

A) Potentiodynamic B) Galvonostatic

C) Potentiostatic D) None of these

12) For _____ ionic product must be greater than solubility product.

A) Aggregation B) Precipitation

C) Dissociation D) Decomposition

13) In the spray pyrolysis technique solution is converted into fine droplets according to which principle?

A) Bernoulli's B) Archimedes

C) Siphon D) Stokes

14) The sol-gel method of thin film deposition is_____ approach.

A) Bottom-up B) Up-bottom

C) Top-down D) Down-top

15) What is the nature of the radiation pattern of an isotropic antenna?

A) Hyperbolic B) Spherical

C) Elliptical D) Dough-nut

16) In_____numerical method, we approximate the curve of a solution by the tangent in each interval.

A) Picard B) Euler

C) Newton D) Runge Kutta

17) Which antennas are renowned as patch antennas especially adopted for space-craft applications?

A) Aperture B) Array

C) Lens D) Microstrip

18) RF amplifiers are used in radio receivers for

A) improved image frequency rejection

B) improved rejection of adjacent unwanted signals

C) prevention of re-radiation of the local oscillator through the antenna of the receiver

D) all of the above

19) The frequency of a transition is 3.0 x 1015 Hz. What is the energy of this transition?

A) 0.124 eV B) 1.240 eV

C) 12.40 eV D) 124.0 eV

20) Newton-Raphson method of solution of numerical equation is not preferred when

A) Graph of A (B) is vertical

B) The graph of x (y) is not parallel

C) The graph of $f(x)$ is nearly horizontal-where it crosses the x-axis.

D) None of these

21) The abstract should include:

A) An explanation of the statistical analysis employed

B) Only the most relevant tables and diagrams

C) A list of references

D) None of these

22) What is deemed a good measure of the quality of a journal?

A) The impact factor B) Citations

C) h-index D) i-10 index

23) The testing hypothesis is a

A) inferential statistics. B) descriptive statistics

C) Data preparation D) Data analysis

24) A reasoning where we start with certain particular statements and conclude with a universal statement is called

A) Inductive reasoning

B) Abnormal reasoning

C) Transcendental reasoning

D) Deductive reasoning

25) What is a Patent?

A) An agreement between the inventor and the Government

B) An agreement with the Government

C) Document of the library

D) An agreement between the library and the publisher

26) If a generalized co-ordinate has dimensions of velocity, then generalized velocity has dimensions of

A) Velocity

B) Acceleration.

C) Force

D) Torque

27) The product of energy and time is known as

A) Work done

B) Power

C) Momentum

D) Action

28) The Lagrangian for positively charged particle in an electromagnetic field is

A) $\text{K.E.} + \text{P.E.} + q\frac{v.A}{c}$

B) $\text{K.E.} - \text{P.E.} + q\frac{v.A}{c}$

C) $\text{K.E.} - \text{P.E.} - q\frac{v.A}{c}$

D) $\text{K.E.} + \text{P.E.} - q\frac{v.A}{c}$

29) If external force action on a particle is zero then its

A) K.E. is conserved

B) P.E. is conserved

C) Angular momentum is conserved

D) Linear momentum is conserved.

30) In Newton's third law of action-reaction, the two forces acts on

A) The same body at same time

B) Two different bodies at two different times.

C) Two different bodies at the same time

D) The same body at different time

31) If physical system is invariant under rotation about the fixed axis, then

A) Its angular momentum is conserved

B) Its linear momentum is conserved.

C) Its angular acceleration is conserved

D) Its linear acceleration is conserved

32) If the forces acting on a body are conservative,

A) Its angular momentum is conserved

B) Its linear momentum is conserved

C) Its energy is conserved

D) None of the above is conserved

33) In case of elliptic orbits, energy is proportional to

A) A B) $1/a$

C) $1/a^3$ D) a^3

34) A particle moving in a central force field located at r = 0 describes the spiral $r = e^{-\theta}$, the magnitude of the force is inversely proportional to

A) r B) r^2

C) r^3 D)r^4

35) For attractive inverse square force, the shape of the orbit can be

A) Elliptical
B) Parabolic
C) Hyperbolic
D) All of these

36) A graph of velocity against time for freely falling body with finite initial velocity is

A) A straight line passing through origin but with positive slope
B) A straight line parallel to velocity axis
C) A straight line having positive intercept on velocity axis and but with negative slope
D) A straight line having positive intercept on velocity axis and also with positive slope

37) Ice (H_2O) is an example of

A) Triclinic System
B) Hexagonal System
C) Orthorhombic System
D) Monoclinic System

38) Germanium and silicon have diamond structure for which the molecules per unit cell are equal to

A) 1
B) 2
C) 4
D) 8

39) The translation vectors of a space lattice are given as follows

$\bar{a} = \frac{\hat{x}}{2} + \frac{\sqrt{3}}{2}\hat{y}\,;\ \bar{a} = -\frac{\hat{x}}{2} + \frac{\sqrt{3}}{2}\hat{y}\,;\ c = \hat{z}$ the volume of cell is

A) $\frac{2}{\sqrt{3}}$
B) $\frac{\sqrt{3}}{2}$
C) $2\sqrt{3}$
D) $3\sqrt{2}$

40) For a SC lattice KCl, density = 1.98g/cc, interplaner spacing =3014 A^0, molecular weight = 74.60, Using given data, we can know

A) Boltzmann's constant
B) Planck's constant
C) Avogadro's constant
D) Rydberg's constant

41) In a closed packed crystal structure, the percentage of available volume occupied by hard spheres is nearly

A) 60%
B) 90%
C) 74%
D) 82%

42) In simple cubic lattice $d_{100} : d_{110} : d_{111}$ is

A) 6:3:2
B) $6:3:\sqrt{2}$
C) $\sqrt{6} : \sqrt{3} : \sqrt{2}$
D) $\sqrt{6} : \sqrt{3} : \sqrt{4}$

43) A two dimensional lattice has basis vectors, $\hat{a} = 2\hat{x}$; $\hat{b} = \hat{x} + 2\hat{y}$. The basis vectors of the reciprocal lattice will be _____ if third vector is parallel to Z axis

A) $\frac{1}{2}\left(\hat{x} - \frac{\hat{y}}{2}\right) . \frac{\hat{y}}{2}$
B) $\frac{1}{4}(\hat{x} - 2\hat{y}) . \frac{\hat{y}}{4}$.
C) $2\left(\hat{x} - \frac{\hat{y}}{2}\right) . 2\hat{y}$
D) $4\left(\hat{x} - \frac{\hat{y}}{2}\right) . 4\hat{y}$

44) Calculate the interatomic distance for given Brugg's angle = 30°, and for a plane (1,1,1) the wavelength of x-ray incident is 1.75 A^0

A) 3.31 A^0
B) 3.031 A^0
C) 3.33 A^0
D) 4.51 A^0

45) Which of the following statement is not **TRUE**

A) All unit cells are primitive
B) FCC structure is a closed paek structure
C) A unit cell is primitive if it contains lattice points only at corners
D) A lattice does not contain any atom or molecule

46) A travelling harmonic waves which have a constant magnitude at great distances and for which the normalization integral diverges represent

A) Free particle
B) Restrained waves
C) Localized waves
D) All of these

47) For a nucleus having diameter 10^{-5} m leads to uncertainty in the momentum of proton to remain in the nucleus is of the order of

A) 6.62×10^{-19} Kg-m/s
B) 6.62×10^{-49} Kg-m/s
C) 10^{-23} Kg-m/s
D) 10^{-27} Kg-m/s

48) The uncertainty relation is not valid for which one of the following pairs?

A) Position and momentum
B) Energy and Time
C) Linear Momentum and angle
D) Angular momentum and angle

49) The Planck's constant is known as fundamental _____ in the nature

A) Energy packet
B) Momentum packet
C) Action packet
D) None of these

50) A hydrogen atom is in d-state, for which values of m are

A) 2,1,0
B) -1,0,1
C) -2,-1,0,1,2
D) -3,-1,0,1,3

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