A-88

ENTRANCE EXAMINATIONS 2021
Ph.D. (Nano Science and Technology)

Marks: 70
Time: 2 h

Hall Ticket No: [ ]

I. Write your Hall Ticket Number on the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the Space provided above.
II. Read the following instructions carefully before answering the questions.
III. This Question paper has TWO parts: PART 'A' AND PART 'B'

1. Part 'A': It consists of 20 objective type questions of **1.75** marks each.
2. Part 'B: It consists of 35 objective questions of one mark each.
3. All questions are to be answered. Answers for these questions are to be entered on the OMR sheet, filling the appropriate circle against each question. For example, if the answer to a question is D, it should be marked as below:

No additional sheets will be provided. Rough work can be done in the question paper itself.

4. Hand over the OMR answer sheet at the end of the examination to the invigilator.

5. Mobile phones, log tables and calculators of any type are NOT permitted inside the Examination Hall.

6. This book contains 13 pages including this cover sheet.

PART A

1. The moon's radius is $1/4^{th}$ that of the earth and its mass $1/80^{th}$ times that of the earth. If "g" represents the acceleration due to gravity on the surface of the earth, then on the surface of the moon its value is
   A. g/4
   B. g/5
   C. g/6
   D. g/8

2. A block metal weights 5 N in air and 2 N when immersed in a liquid. The buoyant force is
   A. 3 N
   B. 5 N
   C. 7 N
   D. Zero

3. An ice cube containing a lead piece in it is floating in a vessel of water. As ice melts, the water level will
   A. fall
   B. rise
   C. remains stationary
   D. cannot be predicted from the given information

4. When a metal sphere is heated, maximum percentage increase occurs in its
   A. density
   B. surface area
   C. radius
   D. volume

5. A bomb explodes on the moon. How long will it take for the sound to reach the earth?
   A. 10 s
   B. 1000 s
   C. 1 day
   D. Cannot reach the earth

6. Velocity of sound is maximum in
   A. He
   B. N_2
   C. H_2
   D. O_2

7. A bar magnet of magnetic moment 80 units is cut into two halves of equal length, the magnetic moment of each half will be
   A. 80 units
   B. 40 units
   C. 60 units
   D. 20 units

8. If "r" be the distance of a point on the axis of a bar magnet from its centre, the magnetic field at this point is proportional to
   A. $1/r$
   B. $1/r^2$
   C. $1/r^3$
   D. $1/r^4$

9. A shopkeeper intends to sell his goods at cost price but uses a weight of 800 g instead of kilogram weight. Thus he makes a profit of
   A. 20%
   B. 16.66%
   C. 25%
   D. 10%

10. A cricket team won 3 matches more than they lost. If a win gives 2 points and loss -1 point, how many matches, in all, have they played if their score is 23?
   A. 17
   B. 20
   C. 37
   D. 40

11. A cone of height 9 cm with diameter of its base 18 cm is carved out from a wooden solid sphere of radius 9 cm. The percentage of the wood wasted is
   A. 25%
   B. 25π %
   C. 50%
   D. 75%

12. The vector $\vec{a}$ has magnitude of 5 units, $\vec{b}$ has magnitude of 6 units and the cross product of $\vec{a}$ and $\vec{b}$ has a magnitude of 30 units. The angle between $\vec{a}$ and $\vec{b}$ is
   A. 30^0
   B. 45^0
   C. 90^0
   D. 60^0

13. A force of 20 N acts on a particle along a direction making an angle of 60 degree with the vertical. The component of the force in the vertical direction is
   A. 8.4 N
   B. 10 N
   C. 20 N
   D. 0 N

14. The distance travelled by a particle in time 't' is given by $S = (2.5\ m/s^2)t^2$. The instantaneous speed, in m/s, at t = 5.0s is
    A. 12.5
    B. 125
    C. 2.5
    D. 25

15. Which of the following is true about nuclear reactions?
    A. Nuclear reactions change one element into another
    B. Nuclear reactions involve only electron exchanges
    C. Nuclear fusion can occur at ambient conditions on earth's crust
    D. Nuclear fission cannot occur in stars

16. A moving object in empty space keeps moving at
    A. zero acceleration
    B. finite constant acceleration
    C. sinusoidal acceleration
    D. exponential acceleration

17. Which of the following is not a combination of chemical substances?
    A. Earth
    B. Water
    C. Fire
    D. Air

18. The solution of the equation give below, C being a constant, is

$$\frac{dy}{dx} + y\,tanx = \sec x$$

    A. $y.secx = tan\,x + C$
    B. $y = sinx + C$
    C. $y\,cosx = tanx + C$
    D. $y\,sinx = cos\,x + C$

19. If 'n' couples are invited to a party with the condition that every husband must be accompanied by his wife, but the wife need not be accompanied by her husband, then the number of different gatherings possible in the party is
    A. 3
    B. 3^n
    C. 3n
    D. 0

20. If a fair coin is tossed 10 times, then the probability that only the first two tosses will yield heads is

A. $(1/2)^{10}$
B. $(1/2)^{8}$
C. $(1/2)^{6}$
D. ${}^{10}C_2(1/2)^{10}$

PART B

21. If C(T) is the heat capacity of a solid at temperature T, and when an amount of heat is absorbed by the body, the entropy of the body at temperature T is given by
    A. $\int_0^T \frac{C(T)}{T^3} dT$
    B. $\int_0^T \frac{C(T)}{T} dT$
    C. $\int_0^{\frac{T}{2}} \frac{C(T)}{T} dT$
    D. $\int_0^T \frac{C(T)}{T^2} dT$

22. In the case of nanostructures, the ratio of the number of atoms on the surface to the number of atoms in the interior
    A. may be of the order of unity
    B. is exactly zero because the total energy tends to infinity
    C. tends to infinity because the surface energy tends to infinity
    D. is always 0.5

23. In everyday life quantum effects
    A. take place and are perceptible to the naked eye
    B. take place but they are not perceptible to the naked eye
    C. do not take place and therefore they are not perceptible to the naked eye
    D. do not take place but we seem to perceive them

24. What is the magnitude of de Broglie wavelength (in m) of a 1 kg mass moving with a velocity of 1 m/sec?
    A. Newtonian gravitation constant
    B. Josephson constant
    C. Planck's constant
    D. Boltzmann constant

25. Radiography is not used to detect
    A. volume defects
    B. cracks and unfused defects
    C. surface defects
    D. crystal structure

26. In solid state sintering of oxide powders densification
    A. increases with higher coarsening of the powder particles
    B. decreases with lower coarsening of the powder particles
    C. increases with lower coarsening of the powder particles
    D. is not affected by the coarsening of the powder particles

27. The gauge factor of a strain gauge is expressed as (ε *is strain and R is resistance*)
    A. $GF = \frac{\varepsilon}{\Delta R/R}$
    B. $GF = \frac{\Delta R/R}{\varepsilon}$
    C. $GF = \varepsilon\,(\Delta R/R)$
    D. $GF = (\frac{\Delta R/R}{\varepsilon})^2$

28. Which of the following semiconductor materials is used for light-emitting diode (LED)?
    A. Si
    B. Bi_2Te_3
    C. Ge
    D. ZnO

29. Which of the following is an essential factor to cause stress corrosion cracking in metals?
    A. Cyclic load
    B. High temperature
    C. Tensile stress
    D. Pitting

30. Etching of a passive metal/alloy involves which of the following forms of corrosion?
    A. Galvanic corrosion
    B. Fretting corrosion
    C. Corrosion fatigue
    D. Erosion corrosion

31. Which of the following is wrong with regard to a reversible process?
    A. Maximum enthalpy
    B. Maximum entropy
    C. Maximum exergy?
    D. Maximum efficiency

32. Clausius Clapeyron equation is useful to calculate the
    A. temperature change for a process due to pressure change
    B. entropy change for a process due to enthalpy change
    C. Gibbs energy change for a process due to enthalpy change
    D. Gibbs energy change for a process due to pressure change

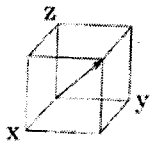
33. Long period of a semi-crystalline polymer can be evaluated from _____
    A. Scanning confocal microscopy
    B. Small angle X-ray scattering technique
    C. Polarizing optical microscopy
    D. Wide angle X-ray diffraction analysis

34. What is the crystal structure of Copper?
    A. FCC
    B. BCC
    C. HCP
    D. SC

35. Which of the following alloys are generally known as electrical steels?
    A. Fe-Si Alloys
    B. Fe-Al alloys
    C. Fe-Cr Alloys
    D. Fe-Ni Alloys

36. The size of a unit cell is described by
    A. a lattice constant
    B. a unit cell diagonal
    C. a crystallographic direction
    D. Miller indices

37. The direction indices for the crystallographic direction indicated by the vector in the following diagram is



    A. <111>
    B. (111)
    C. <112>
    D. <110>

38. The bandgap of pristine graphene is
    A. 1 eV
    B. 0.5 eV
    C. 0.25 eV
    D. 0 Ev

39. For a LCR circuit (Inductance (L),capacitance (C) and resistance (R) are connected in series), the Q-factor is
    A. $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$
    B. $Q = \frac{1}{R}\sqrt{\frac{C}{L}}$
    C. $Q = \frac{1}{L}\sqrt{\frac{R}{C}}$
    D. $Q = \frac{1}{C}\sqrt{\frac{L}{R}}$

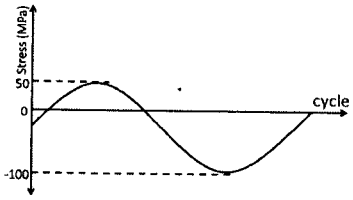
40. A catalyst
    A. increases the average kinetic energy of reacting molecules
    B. decreases the average kinetic energy of reacting molecules
    C. increases the activation energy
    D. decreases the activation energy

41. The colour of $KMnO_4$ is due to
    A. $\sigma \rightarrow \sigma^*$ transition
    B. d → d transition
    C. M → L charge transfer transition
    D. L → M charge transfer transition

42. Zener breakdown of PN junction diode occurs
    A. in heavily doped junction when forward biased
    B. in lightly doped junction when forward biased
    C. in heavily doped junction when reverse biased
    D. in lightly doped junction when reverse biased

43. The effective number of atoms in an FCC unit cell are
    A. 2
    B. 4
    C. 6
    D. 8

44. What is the mean stress and the stress amplitude for the given stress cycle?



A. 75 MPa, -25 MPa
B. -25 MPa, 75 MPa
C. -25 MPa, 150 MPa
D. 150 MPa, -25 MPa

45. In a cubic crystal of lattice parameter 4 Å, the Miller indices of a plane that makes intercepts on a, b, and c axes equal to 4 Å, ∞, and 2 Å, respectively, is
A. (402)
B. (204)
C. (102)
D. (201)

46. If an electron of mass m_1 and proton of mass m_2 are confined to move in regions of dimensions a_1 and a_2 respectively, then the ratio of the ground state energy of the proton to the electron is approximately (Assume both particles are free to move, in the region defined)
A. $(m_1a_1^2)/(m_2a_2^2)$
B. $(m_2a_2^2)/(m_1a_1^2)$
C. $(m_1a_1)/(m_2a_2)$
D. $(m_2a_2)/(m_1a_1)$

47. Which of the following is not a surface hardening technique?
A. Carburizing
B. Nitriding
C. Shot peening
D. Galvanizing

48. A charged particle is moving in an electromagnetic field. The force acting on the particle is
A. parallel to electric field and parallel to magnetic field
B. perpendicular to electric field and parallel to magnetic field
C. perpendicular to electric field and perpendicular to magnetic field
D. parallel to electric field and perpendicular to magnetic field

49. According to Arrhenius kinetics, if the temperature is increased, the growth rate
    A. increases linearly with temperature
    B. decreases linearly with temperature
    C. increases exponentially with temperature
    D. increases logarithmically with temperature

50. Bubbles forming on a plastic straw inserted into a carbonated drink (e.g. Coke/Pepsi) bottle is a result of
    A. reaction of acidic drink with the plastic surface of the straw
    B. heterogeneous nucleation of bubbles from the supersaturated solution
    C. transfer of bubbles from the bulk to the lower surface energy straw surface
    D. entrained air from the atmosphere appearing on the straw surface

51. Two narrow straight slits separated by a distance of 0.4 mm are illuminated by a light source of unknown wavelength. If the sixth bright fringe in the interference pattern is formed 12 mm away from the central fringe when the distance between the screen and slits is 1m, then the wavelength of the unknown source is
    A. 800 nm
    B. 480 nm
    C. 600 nm
    D. 8 μm

52. Which of the following is the case of heat transfer primarily by radiation?
    A. Heating of a building interiors in day time
    B. Inside of a blast furnace
    C. Heat received by a person from a fireplace
    D. Cooling of parts in a furnace

53. The process of magnetization of iron crystal is
    A. aligning the electron spins of different atoms
    B. changing the crystal structure of iron
    C. alignment of the domains
    D. introducing overlap of *d*-orbitals

54. Which one of these following materials exhibits a very good creep resistance?
    A. Nanocrystalline
    B. Microcrystalline
    C. Directionally solidified
    D. Single crystalline

55. An n-type doped semiconductor slab of thickness 0.5 mm is placed in a magnetic field of 4000 Gauss. When a current of 5mA is passed through this slab in a direction perpendicular to the applied magnetic field, the Hall voltage developed across the sample is 60 mV. The Hall coefficient of the semiconductor and the density of charge carriers are, respectively,
    A. -15×10^{-3} ohm m/Tesla and 4×10^{20} m^3
    B. 1.5×10^{-3} ohm m/Tesla and 4×10^{20} m^3
    C. -6×10^{-3} ohm m/Tesla and 4×10^{20} cm^3
    D. 1.5×10^{-3} ohm cm/Tesla and 4×10^{20} cm^3

University of Hyderabad
Entrance Examinations - 2021

School/Department/Centre : SEST
Course/Subject : PhD Nanoscience and Technology

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	B	26	C	51	A	76	
2	A	27	B	52	C	77	
3	A	28	D	53	C	78	
4	D	29	C	54	D	79	
5	D	30	A	55	A	80	
6	C	31	B	56		81	
7	B	32	A	57		82	
8	C	33	B	58		83	
9	C	34	A	59		84	
10	A	35	A	60		85	
11	D	36	A	61		86	
12	C	37	A	62		87	
13	B	38	D	63		88	
14	D	39	A	64		89	
15	A	40	D	65		90	
16	A	41	D	66		91	
17	C	42	C	67		92	
18	A	43	B	68		93	
19	B	44	B	69		94	
20	A	45	C	70		95	
21	B	46	A	71		96	
22	A	47	D	72		97	
23	B	48	D	73		98	
24	C	49	C	74		99	
25	D	50	B	75		100	

Note/Remarks :

10/9/21

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