

COMMON P.G. ENTRANCE TEST-2022 (CPET-2022)

Subject Code : **68**

Test Booklet No.:

Entrance Subject : **Material Science**

Hall Ticket No.:

TEST BOOKLET

Time Allowed : **90 Minutes**

Full Marks : **70**

INSTRUCTIONS TO CANDIDATES

1. **Please do not open this Question Booklet until asked to do so.**
2. Check the completeness of the Question Booklet immediately after opening.
3. Enter your **Hall Ticket No.** on the Test Booklet in the box provided alongside. **Do not** write anything else on the Test Booklet.
4. Fill up & darken Hall Ticket No. & Test Booklet No. in the OMR Answer Sheet as well as fill up Test Booklet Serial No. & OMR Answer Sheet Serial No. in the Attendance Sheet carefully. Wrongly filled up OMR Answer Sheets are liable for rejection.
5. Each question has four answer options marked (A), (B), (C) & (D).
6. Answers are to be marked on the Answer Sheet, which is provided separately.
7. Choose the most appropriate answer option and darken the oval completely, corresponding to (A), (B), (C) or (D) against the relevant question number.
8. Use only **Blue/Black Ball Point Pen** to darken the oval for answering.
9. Please do not darken more than one oval against any question, as scanner will read such markings as wrong answer.
10. **Each question carries equal marks. There will be no negative marking for wrong answer.**
11. **Electronic items such as calculator, mobile, etc., are not permitted inside the examination hall.**
12. Don't leave the examination hall until the test is over and permitted by the invigilator.
13. **The candidate is required to handover the original OMR sheet to the invigilator and take the question booklet along with the candidate's copy of OMR sheet after completion of the test.**
14. Sheet for rough work is appended in the Test Booklet at the end.

1. If resistance of a material increases with temperature, the material is a.....
 - (A) Metal
 - (B) Semi-conductor
 - (C) Non-metal
 - (D) All of these

2. The net electric charge inside an isolated system remains constant. This is known as
 - (A) Law of conservation of energy
 - (B) Coulomb's first law
 - (C) Coulomb's second law
 - (D) Law of conservation of charge

3. Why sky appear blue
 - (A) Much more red light than blue light is absorbed by air atoms.
 - (B) Red light is reflected by the atmosphere.
 - (C) Higher energy light waves have more penetration through the atmosphere.
 - (D) Blue light is scattered to a greater extent than red light.

4. The Fresnel Equations: (I) are a consequence of Maxwell's equations; (II) imply a phase shift of 180° when light in vacuum with electric field perpendicular to the plane of incidence reflects from a surface; (III) imply that polarization can be achieved by reflection.
 - (A) (I), (II), and (III) all the false
 - (B) (I),(II), and (III) all are true
 - (C) Only (I) is true
 - (D) Only (I) is false

5. What is the distance between two convex lenses L_A and L_B with focal length F_A and F_B ?
 - (A) $F_A - F_B$
 - (B) $F_A + F_B$
 - (C) F_A
 - (D) F_B

6. If a parallel beam of light is incident on a convex lens, all the rays after refraction through the lens.....
 - (A) Approach one another and converge at a point
 - (B) Move away from one another
 - (C) Move parallel to the principal axis
 - (D) None of these
7. The point of intersection of the principal plane with the axis of the lens is called....
 - (A) The optical center of the lens
 - (B) Pole of the lens
 - (C) Focus
 - (D) Radius of curvature
8. To prevent a DC return between source and load, it is necessary to use
 - (A) Resistor between source and load,
 - (B) Inductor between source and load
 - (C) Capacitor between source and load,
 - (D) Either (A) or (B)
9. The action of JFET in its equivalent circuit can best be represented as a
 - (A) Current controlled current source
 - (B) Current controlled voltage source
 - (C) Voltage controlled voltage source
 - (D) Voltage controlled current source
10. In a pn junction diode under reverse bias, the magnitude of electric field is maximum at
 - (A) The edge of the depletion region on the p side
 - (B) The edge of the depletion region on the n side
 - (C) The pn junction
 - (D) The center of the depletion region on the n side

11. The force between two charges is 120 N. If the distance between the charges is doubled, the force will be
- (A) 60 N
 - (B) 30 N
 - (C) 40 N
 - (D) 15 N
12. The lines of force due to charged particles are
- (A) Always straight
 - (B) Always curved
 - (C) Sometimes curved
 - (D) None of the above
13. If three 15 μF capacitors are connected in series, the net capacitance is
- (A) 5 μF
 - (B) 30 μF
 - (C) 45 μF
 - (D) 50 μF
14. Electric field intensity is a quantity
- (A) Scalar
 - (B) Vector
 - (C) Both (A) and (B)
 - (D) None of the above
15. The dimensional formula for moment of inertia of a body is_____
- (A) $L^0M^1T^{-2}$
 - (B) $L^2M^1T^0$
 - (C) $L^1M^1T^{-1}$
 - (D) $L^0M^2T^{-1}$

16. The moment of inertia of a body does not depend upon the_____
- (A) Mass of the body
 - (B) Position of the axis of rotation
 - (C) Distribution of the mass
 - (D) The angular acceleration of the body
17. The SI unit of torque is_____
- (A) $\text{N}\cdot\text{m}^{-1}$
 - (B) $\text{N}\cdot\text{m}^2$
 - (C) $\text{N}\cdot\text{m}$
 - (D) $\text{N}^2\cdot\text{m}$
18. The physical quantity in translational motion, which is analogous to moment of inertia in rotational motion is_____
- (A) Velocity
 - (B) Force
 - (C) Energy
 - (D) Mass
19. The mass of an electron in motion depends upon
- (A) Direction of motion
 - (B) its velocity
 - (C) its shell number
 - (D) All of these
20. It is given for the azimuthal quantum number $l = 3$, the total number of different possible values of the magnetic azimuthal quantum number, m_l is
- (A) 3
 - (B) 5
 - (C) 7
 - (D) 2

21. The acceleration of electron in the first orbit of hydrogen atom is

- (A) $4\pi^2m/h^3$
- (B) $h^2/4\pi^2mr$
- (C) $h^2/4\pi^2m^2r^3$
- (D) $m^2h^2/4\pi^2r^3$

22. The temperature T at a three dimensional surface S is given by

$$T(X Y Z) = X^2+Y^2-Z$$

The direction along which a mosquito at the point $P (4,4,2)$ on the surface S , will fly such that the mosquito cools at the fastest rate, will be

- (A) $i + j - k$
- (B) $2i + j - k$
- (C) $i + 2j - k$
- (D) $-8i - 8j + k$

23. De-Broglie wavelength of a material particle having a kinetic energy, E is proportional to

- (A) \sqrt{E}
- (B) $\frac{1}{\sqrt{E}}$
- (C) E
- (D) $\frac{1}{E}$

24. The equation of motion of matter wave was derived by:

- (A) Heisenberg
- (B) Bohr
- (C) de-Broglie
- (D) Schrodinger

25. If the momentum of a particle is increased to four times, then the de-Broglie wavelength will become:
- (A) two times
 - (B) four times
 - (C) half times
 - (D) one-fourth times
26. The Phenomenon of ejection of electron from metal surface when light of suitable frequency falls on it is known as
- (A) Compton effect
 - (B) Photoelectric effect
 - (C) Raman effect
 - (D) None of these
27. The orbital with $n = 3$ and $l = 2$ is.....
- (A) 3s
 - (B) 3p
 - (C) 3d
 - (D) 3f
28. The concept of matter wave was suggested by_____
- (A) Heisenberg
 - (B) de Broglie
 - (C) Schrodinger
 - (D) Laplace
29. The total probability of finding the particle in space must be _____
- (A) zero
 - (B) unity
 - (C) infinity
 - (D) double

30. The normalized wave function must have _____ norm
- (A) infinite
 - (B) zero
 - (C) finite
 - (D) complex
31. Plank's constant has unit
- (A) J
 - (B) S
 - (C) JS⁻¹
 - (D) JS
32. To solve Schrodinger wave equation we need potential,
- (A) Physical requirement of system
 - (B) Boundary condition
 - (C) Both (A) and (B)
 - (D) All of these
33. The energy spectra of bound state is
- (A) Continuous
 - (B) Discrete
 - (C) Degenerate
 - (D) Non-degenerate
34. The plot between intensity vs. 2θ is observed in
- (A) XRD
 - (B) Raman Spectrum
 - (C) UV-VIS spectroscopy
 - (D) FTIR
35. For a non-relativistic free particle, the phase velocity (v_p) and group velocity (v_g) is related as:
- (A) $V_p = V_g$
 - (B) $V_p = V_g/2$
 - (C) $V_p = 2V_g$
 - (D) None of these

36. According to wave mechanics, a material particle is associated with :
- (A) a single wave
 - (B) a wave packet
 - (C) progressive wave
 - (D) light wave
37. Find the value of $[L_x L_y]$
- (A) $i\hbar L_x$
 - (B) $i\hbar L_y$
 - (C) $-\hbar L_z$
 - (D) $i\hbar L_z$
38. Which of the following is the Eigen function of momentum operator?
- (A) e^{ikx}
 - (B) $3x^2$
 - (C) $\sin x$
 - (D) None of these
39. What is the rate of formation of X_2 in the following reaction?




- (A) $2r$
- (B) r
- (C) $3r$
- (D) None of these

Where, r stands for rate of the reaction.

40. Which of the following is not true for rate of a reaction?
- (A) Rate increases with temperature
 - (B) Rate of a reaction is always the slowest step
 - (C) Rate is independent of temperature
 - (D) Rate is an experimental quantity.

41. Find the value of Isobaric thermal expansion coefficient for ideal gas?
- (A) $\frac{1}{T}$
 - (B) $\frac{1}{P}$
 - (C) $\frac{1}{v}$
 - (D) None of these
42. Heat absorbed at constant volume is what?
- (A) Internal energy
 - (B) Enthalpy
 - (C) Entropy
 - (D) None of these.
43. Heat absorbed at constant pressure is what?
- (A) Internal energy
 - (B) Enthalpy
 - (C) Entropy
 - (D) None of these.
44. $\Delta S_{\text{universe}}$ for a reversible process is?
- (A) Zero
 - (B) Greater than zero
 - (C) Less than Zero
 - (D) None of these.
45. Which of the following complex has maximum number of unpaired electron?
- (A) $[\text{Mn}(\text{CN})_6]^{4-}$
 - (B) $[\text{Cr}(\text{CN})_6]^{4-}$
 - (C) $[\text{RhF}_6]^{3-}$
 - (D) $[\text{Fe}(\text{CN})_6]^{4-}$

46. Which of the following complex have minimum value of magnetic moment?
- (A) $[\text{RuF}_6]^{3-}$
 (B) $[\text{Cr}(\text{CN})_6]^{4-}$
 (C) $[\text{Ti}(\text{H}_2\text{O})_6]^{+2}$
 (D) $[\text{NiF}_6]^{2-}$
47. Which one of the following is the correct ground state term symbol of high spin d^5s^1 configuration?
- (A) ${}^3\text{H}_4$
 (B) ${}^2\text{S}_4$
 (C) ${}^2\text{H}_1$
 (D) ${}^6\text{S}_{5/2}$
48. Which one of the following is the correct order of energy of splitting for tetragonal compression?
- (A) $d_{xy} > d_{yz} = d_{zx} > d_{x^2-y^2} > d_{z^2}$
 (B) $d_{xy} < d_{yz} = d_{zx} < d_{x^2-y^2} < d_{z^2}$
 (C) $d_{xy} > d_{yz} = d_{zx} = d_{x^2-y^2} > d_{z^2}$
 (D) $d_{xy} = d_{yz} = d_{zx} > d_{x^2-y^2} = d_{z^2}$
49. To satisfy the 18 electron rule in the complex cycloheptatriene $\text{Mo}(\text{CO})_3$ the hapticity of cycloheptatriene must be ?
- (A) 2
 (B) 4
 (C) 6
 (D) 5
50. How many types of allowed electronic transitions are possible in UV-VIS spectroscopy?
- (A) 2
 (B) 4
 (C) 6
 (D) 5

51. How many types of bending vibrations are possible in IR spectroscopy?
- (A) 2
(B) 5
(C) 6
(D) None of these
52. Which one of the following is the correct order C=O stretching frequency of the following compounds; HCHO, CH₃CHO, CH₃COCH₃?
- (A) HCHO > CH₃CHO > CH₃COCH₃
(B) HCHO < CH₃CHO < CH₃COCH₃
(C) CH₃COCH₃ < CH₃CHO < HCHO
(D) None of these
53. How many fundamental vibrations are there in CO₂ molecule?
- (A) 2
(B) 4
(C) 6
(D) 8
54. How many signals appeared in the proton NMR spectrum of CH₃CH₂OH ?
- (A) 1
(B) 2
(C) 4
(D) 3
55. Which among the following molecule possess most acidic proton?
- (A) CH₃OH
(B) CH₃COOH
(C) 
(D) CH₃CH₂OH

56. What is the unit of 'b' in the equation $(P + \frac{an^2}{V^2})(V - nb) = nRT$?
- (A) lit mol^{-1}
 - (B) $\text{lit}^{-1} \text{ mol}^{-1}$
 - (C) lit atm mol
 - (D) None of these
57. The average distance travelled by a molecule between two successive collisions is called-
- (A) Average free path
 - (B) Partial free path
 - (C) Mean free path
 - (D) None of these
58. Real gases behave ideally at -----
- (A) Low temperature and high pressure
 - (B) Low temperature and low pressure
 - (C) High temperature and high pressure
 - (D) High temperature and low pressure
59. Association of molecules in water is due to
- (A) Surface tension
 - (B) Viscosity
 - (C) Hydrogen bonding
 - (D) Optical activity
60. NaCl type crystal (with coordination no. 6 : 6) can be converted into CsCl type crystal (with coordination no. 8 : 8) by applying
- (A) High temperature
 - (B) High pressure
 - (C) High temperature and high pressure
 - (D) Low temperature and low pressure

61. How many chloride ions are surrounding sodium ion in sodium chloride crystal?
- (A) 4
 - (B) 8
 - (C) 6
 - (D) 12
62. Alkali halides do not show Frenkel defect because
- (A) Cations and anions have almost equal size
 - (B) There is a large difference in size of cations and anions
 - (C) Cations and anions have low coordination number
 - (D) Anions cannot be accommodated in voids
63. The maximum wavelength that a X-ray source can have in X-ray diffraction is
- (A) $d/2$
 - (B) d
 - (C) $2d$
 - (D) None of these
64. The number of atoms per unit cell of a face centred cubic crystal is
- (A) 1
 - (B) 2
 - (C) 5
 - (D) 4
65. The coordination number of atoms in body centred cubic is
- (A) 4
 - (B) 6
 - (C) 8
 - (D) 12

66. Which of the following is the unit of magnetic flux density ?
- (A) Weber
 - (B) Lumens
 - (C) Tesla
 - (D) Ampere
67. The magnetic field left in a material after the exciting magnetic field has been removed is known as
- (A) Permeance
 - (B) Residual magnetism
 - (C) Reluctance
 - (D) Susceptance
68. Susceptibility is positive for.....
- (A) Non-magnetic substance,
 - (B) Diamagnetic substance,
 - (C) Paramagnetic substance,
 - (D) Ferromagnetic substance
69. The Biot-Savart's law is a modification of
- (A) Krichhoffs law
 - (B) Ampere's law
 - (C) Lenz's law
 - (D) None of these
70. Fuse wire should have
- (A) High resistance, high melting point,
 - (B) High resistance, low melting point
 - (C) Low resistance, low melting point,
 - (D) Low resistance, high melting point

ROUGH WORK