TB242419Z

Reg. No :.....

Name :.....

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2024

2023 ADMISSIONS REGULAR

SEMESTER II -Chemistry COMPLEMENTARY COURSE 2

PH2B02B23 - Mechanics and Crystallography

Time : 3 Hours **Maximum Marks : 60**

Part A

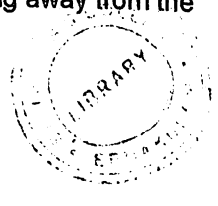
I. Answer any Ten questions. Each question carries 1 marks **(10x1=10)**

1. Rotational analogue of force in linear motion is ——.
2. Describe in brief the structure of a flywheel.
3. **The moment of inertia of a planar disc about a diameter is 8kgm^2. What is the moment of inertia about an axis passing through its centre and perpendicular to the plane of disc?**
   a) 8kgm^2
   b) 16kgm^2
   c) 4kgm^2
   d) 2√2kgm^2
4. Explain the reason why ultrasonic waves are not audible to humans.
5. Write down the equation connecting energy flux and density of the medium. Explain the symbols.
6. A source moves towards a stationary observer with a speed of 10m/s. If the frequency of the source is 10Hz what will be the wavelength of sound heard by the observer? Speed of sound = 330m/s. a) 32m b) 34m c) 33m d) 31m
7. Explain the characteristics of oscillatory motions.
8. List out two effects produced by damping.
9. **Draw a graph representing the resonance condition in forced oscillaitons.**
10. Crystalline solids are anisotropic in nature. Substantiate this statement.
11. Define rotation inversion axis.
12. Name the crystal structure with 68% packing efficiency.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. A solid spherical ball is set rolling on a horizontal table. Find the ratio of its translational K.E. to its rotational K.E.
14. A square thin lamina has a moment of inertia of $100\,kgm^2$ about its diagonal. Compute its moment of inertia about an axis through its centre and perpendicular to the plane of the lamina.
15. List any four properties of ultrasonic waves. Calculate the length of iron rod needed to produce ultrasonic wave of frequency 30 KHz, density = 7.3 gm/cm^3. Y = 12 x 10^{10}N/m^2.
16. An ambulance moves at 72 km/hour while sounding a siren with a frequency of 1500 Hz. Motorcyclists move at speeds of 20 m/s in opposite directions with ambulances. If the speed of sound in air is 340 m/s, then obtain the ratio of frequencies heard by motorcyclists when approaching and moving away from the ambulance.



17. A particle makes simple harmonic motion in a straight line $4\ cm$ long. Its velocity while passing through the centre of the line is $16\ cms^{-1}$. Find the period.

18. A 0.56kg mass is placed at the end of a spring. The spring is compressed 0.2m. What is the maximum velocity of the mass if the spring has a spring constant of 200Nm?

19. A magic trick involves a performer singing a note toward a crystal glass until the glass shatters. Explain why the trick works in terms of resonance and natural frequency.

20. Explain spacing of planes in crystal lattice. Obtain an expression for the interplanar distance for a simple cubic structure of crystal.

21. A beam of X-rays of wavelength 0.071 nm is diffracted by (110) plane of rock salt with lattice constant of 0.28 nm. Find the glancing angle for the second-order diffraction.

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. Calculate the moment of inertia of a thin annular ring about (i) an axis passing through its centre and perpendicular to its plane (ii)a diameter.

23. Describe the concept of plane progressive waves. Discuss the relevant theory.

24. Set up the differential equation for a simple harmonic motion and obtain the solutions.

25. Explain symmetry operations in solid state physics with suitable examples.