

Reg. No. :

Name :

First Semester B.Sc. Degree Examination, November 2019

First Degree Programme under CBCSS

Complementary Course for Chemistry

PY 1131.2 – ROTATIONAL DYNAMICS AND PROPERTIES OF MATTER

(2018 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **1** mark.

1. Define moment of inertia in terms of torque.
2. The moment of inertia of a thin uniform rod about an axis passing through the centre of mass and perpendicular to its length is $MI^2/12$. What is its moment of inertia about an axis passing through one end of the rod and perpendicular to its length? Identify the theorem involved.
3. Can we consider quartz as a perfectly plastic body? Explain.
4. What are the two types of normal stress? What is its main feature?
5. What are the functions of Ostwald's viscometer?
6. Write the unit of surface tension based on dimensional analysis.
7. What is the principle of Jaeger's method?
8. Why does a periodic motion be called harmonic motion?

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9. What is zero point energy?
10. What is meant by energy flux of a progressive wave?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions, **not** exceed one paragraph.

Each question carries **2** marks.

11. Compare the moment of inertia of solid circular disc with that of a wheel, having the same mass and the same external radius.
12. How do you calculate the kinetic energy of a rolling body with circular symmetry when it rolls over a plane surface?
13. Explain the significance of I section girders.
14. You have given two cylinders of same length, mass and material. One is hollow and the other is solid. Which one out of these would you prefer to make a shaft? Explain.
15. List the limitations of Poiseuille's formula.
16. How do you compare friction and viscosity?
17. Explain the essential requirements necessary for measuring the surface tension of a liquid.
18. Distinguish between streamline flow and turbulent flow.
19. What are the properties of progressive waves?
20. Does a diatomic molecule represent a two body harmonic oscillator? Explain.
21. Draw the potential energy curve and energy level diagram of a diatomic molecule.
22. Define a wave motion. Give its one dimensional differential equation.

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. A circular disc of diameter 20cm and mass 100g is rotating at the rate of 10 revolutions per second about an axis at right angles to its plane and passing through its centre. Find the work that must be done to increase the rate of revolution to twice the present rate.
24. Find the moment of inertia of a solid iron sphere of diameter 20cm and relative density 7.8 about its diameter and tangent.
25. A wire of 2mm diameter and 1 m length is twisted through 90° . Where does the shearing stress be maximum? Find the maximum angle of shear. If the modulus of rigidity is 8GPa, what is the torsional couple?
26. A cantilever of length 1 m and uniform cross section shows a depression of 1cm at the loaded end. Calculate the depression at a distance 50cm from the fixed end.
27. A liquid is flowing through a 20cm long tube of 0.5mm internal diameter due to a pressure of 10cm of mercury. Calculate the volume of the liquid flowing in one minute and the velocity of the liquid on the axis of the capillary. Coefficient of viscosity of liquid $0.85 \text{ m N s m}^{-2}$.
28. Find the force required to separate two thin circular glass plates of diameter 2cm, which have a thin layer of water of thickness $1 \mu\text{m}$ in between them. Given the surface tension of water 72 m N/m .
29. A particle of 1 g mass moves along the y-axis and is attracted towards origin by a force $4y$. If the particle is initially at rest at $y = 8 \text{ cm}$, find the differential equation of motion, amplitude, period and frequency of vibration.

30. If the transition from one energy level to an adjacent one involves an energy change of 0.5eV in the case of hydrogen, calculate the energy involved in a similar transition in the case of HCl.
31. If in air a plane wave of frequency 512Hz and amplitude $1 \mu\text{m}$ is produced, calculate the radiated energy per unit volume and the energy current. Velocity of sound = 340m/s and the density of air = 1.3kgm^{-3} .

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. With necessary theory give the details of the experiment to determine moment of inertia of a flywheel.
33. Describe the theory of the bending of beams and derive the expression for bending moment and flexural rigidity.
34. How do conclude the resultant force of surface tension on liquid surface from its shape? Obtain the expression for the difference of pressure across a curved liquid surface.
35. Discuss the theory of a compound pendulum and derive the equation of the period of oscillations. Hence explain the method of finding the acceleration due to gravity at a place using asymmetric compound bar pendulum.

(2 × 15 = 30 Marks)