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INDIAN SCHOOL SOHAR

FINAL EXAMINATION (2017-18)

Date: 22-2-2018 Time allowed: 3 hours

CLASS: XI Physics (Theory) Maximum Marks: 70

General Instructions:

(i) All questions are compulsory.

(ii) There are 26 questions in total. Questions 1 to 5 are very short answer type questions and carry **one** mark each.

(iii) Questions 6 to 10 carry **two** marks each, questions 11 to 22 carry **three** marks each and questions 24 to 26 carry **five** marks each.

(iv) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the choices in such questions.

(v) Question 23 is a **value based question** carrying **four** marks.

Use of calculator is not permitted.

Section A

1. What is a conservative force? Give one example.
2. What are the characteristics of S.H.M.?
3. Two sound sources produce 12 beats in 4 seconds. By how much do their frequencies differ?
4. What are the essential conditions for a satellite to be stationary (geostationary) satellite?
5. A body oscillates with SHM along the x- axis. Its displacement varies with the time according to the equation $x = 4.0\cos(\pi t + \frac{\pi}{4})$ where x in meter and t in second. Determine the amplitude and the frequency.

Section B

6. How does Bernoulli's principle explain airplane lift?
7. The force acting on a body of mas 10 kg is (2i + j – k) N. if the body is initially at rest, what will be the velocity at the end of 20 s ?
8. A physical constant P is given by $P = ab^2c^3d^4$. The percentage error in measurement of a, b, c and d are 0.5% each. What is the percentage error in P?
9. A ball is thrown vertically upwards. Draw its height – time and velocity – time graphs.
10. The SHM of a particle is given by $y = 3\sin\omega t + 4\cos\omega t$. What is the amplitude and initial phase of the motion?

OR

What is the length of a simple pendulum, which ticks seconds?

Section C

11. (a) Moment of inertia of a rigid body is independent of the magnitude of the angular velocity (ω). It is a characteristic of a rigid body and the axis about which it rotates. Establish this fact by deriving the expression for the moment of inertia of a rigid body. (b) Why do we use flywheel in automobile engines.
12. Assuming that the escape velocity for a planet depends on gravitational constant G, radius R of the planet and also its density ρ, derive formula for escape velocity from dimensional considerations.

13. (i) What is Stopping distance ? Derive an expression for stopping distance of a vehicle in terms of initial velocity v_0 and deceleration a. (ii) the reaction time for an automobile driver is 0.7s. If the automobile can be decelerated at $5m/s^2$ calculate the total distance travelled in coming to stop from an initial velocity of 30 km/h after signal is observed.
14. Discuss the variation of 'g' with depth. Show it graphically. What happens to 'g' at the centre of earth.
15. Define the term orbital speed. Establish a relation for orbital speed of a satellite orbiting very close to the Earth surface.
16. Define the terms: (a) Young's modulus
    (b) Bulk modulus
    (c) Modulus of rigidity. Also give their units.
17. (a) Plot temperature versus time graph showing the changes in the state of ice on heating.
    (b) Explain why temperature remains constant during a phase change.
    (c) What is regelation?
18. (a) State and explain the law of equi-partition of energy. (b) Apply this law to estimate the specific heats of monoatomic and diatomic gases.
19. Why the motion of a projectile is considered as plane motion? Show that the trajectory of a projectile is a parabola.
20. (a) Define power. Derive the expression for the instantaneous power. (b) A pump on the ground floor of a building can pump up water to fill a tank of volume 30 m^3 in 15 min. if the tank is 40 m above the ground, and the efficiency of the pump is 30%, how much electric power is consumed by the pump?
21. (a) State theorems of perpendicular and parallel axes.
    (b) Find the moment of inertia of a sphere about a tangent to the sphere, given the moment of inertia of the sphere about any of its diameters to be $2MR^2/5$, where M is the mass of the sphere and R is the radius of the sphere.
    (c) Given the moment of inertia of a disc of mass M and radius R about any of its diameters to be $MR^2/4$, find its moment of inertia about an axis normal to the disc and passing through as point on its edge.
22. A particle starts from origin t = 0 with a velocity 5.0 i m/s and moves in x-y plane under action of a force which produces a constant acceleration of (3.0 i + 2.0 j) m/s^2. a) What is the y- coordinate of the particle at the instant its x-coordinate is 84 m? What is the speed of the particle at this time ?

OR

A motor boat is racing towards North at 25 km/h and the water current in that region is 10 km/h in the direction of 60^0 East of South. Find the resultant velocity of the boat.

Section D

23. Rehan went to purchase a refrigerator in a shop. He was given two options – one was of Rs 20,000 which was of five star rating and CFC free. The other was of Rs 12,000 with the same capacity and design but did not have the other two features. Rehan ultimately bought the first refrigerator Answer the following questions:
    (i) What is the meaning of (a) 5 star rating? (b) CFC free.
    (ii) Draw a schematic diagram of refrigerator or heat pump and what is the coefficient of performance?
    (iii) What are the moral values shown by Rehan?

Section E

24. (a) Derive Newton's formula for the velocity of longitudinal waves in air. What correction was applied by Laplace and why?

(b) Use Laplace formula to explain the speed of sound in air-

(i) Independent of Pressure

(ii) Increases with temperature

(iii) Increases with humidity.

OR

a) Explain how stationary waves are formed in open and closed pipes. Compare the first three harmonics produced in them.

b) A bat if flitting about in a cave, navigating via ultrasound beeps. Assume that the sound emission frequency of the bat is 40 kHz. During one fast swoop directly toward flat wall surface, the bat is moving at 0.03 times the speed of sound in air. What frequency does the bat hear reflected sound off the wall?

25. a) Define the coefficient viscosity and give its SI unit. Is viscosity a vector ?

b) State Stoke's law and express in mathematical form.

c) The terminal velocity of a copper ball of radius 2.0 mm falling through a tank of oil at 20^0 C is 6.5 cm s^{-1}. Compute the viscosity of the oil at 20^0 C. density of oil is 1500 kg m^3, relative density of copper is 8.9.

OR

(a) Define surface tension. Derive the relation between surface tension and surface energy.

(b) How surface tension of a liquid is explained on the basis of intermolecular forces.

(c) How do we measure the surface tension of a liquid? Briefly explain the experimental set up.

(d) A tiny liquid drop is spherical but a larger drop has oval shape. Why?

26. What is meant by banking of roads? What is the need of banking of roads? Obtain an expression for the maximum speed, which a vehicle can safely negotiate a curved road banked at an angle θ. B) an aircraft executes a horizontal loop at a speed of 720 km/h with its wings banked at 15^0 . what is the radius of the loop ?

OR

A. Derive an expression for centripetal acceleration of an object in uniform circular motion in a plane. What will be the directions of the velocity and acceleration at any instant?

B. A monkey of mass 40 kg climbs on a rope which can stand a maximum Tension of 600 N. in which of the following cases will the rope break: the monkey

a. Climbs up with an acceleration of 6 m/s^2

b. Climbs down with an acceleration of 4 m/s^2

c. Climbs up with a uniform speed of 5 m/s

d. Falls down the rope nearly freely under gravity? (Ignore the mass of the rope).