SHARJAH INDIAN SCHOOL
MODEL EXAMINATION – February 2012

Class : XI (Boys Wing)   **Time Allotted: 3hrs.**
Subject: PHYSICS   **Max. Marks :   70**
Day & Date: Tuesday, 31/01/2012

General Instructions:
1. *All questions are compulsory.*
2. *There are 30 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.*
3. *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 given choices in such questions.*
4. *Use of calculators is not permitted. However, logarithms can be used for calculations.*
5. *You may use the value of acceleration due to gravity g = 10 m/s².*

Name of student:………………………………………………   Exam. No:………………….

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1. An object is covering distance in direct proportion to t^3, where t is the time elapsed. What conclusions might you draw about the acceleration? Is it constant? Increasing? Decreasing? Zero?   1

2. State Kepler's law of periods.   1

3. Spring A & B are identical except that A is stiffer than B. In which spring is more work expended if, they are stretched by the same force.   1

4. The stress- strain graphs of two wires A and B are given below.
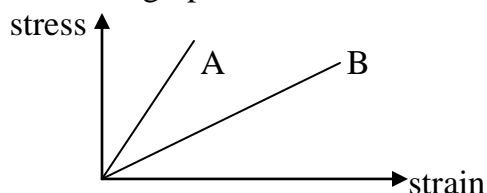
   Which one of the two has greater Young's modulus and why?   1

5. A planet moves around the sun under the effect of gravitational force exerted by the sun. Why is the torque on the planet due to the gravitational force zero?   1

6. A bullet is dropped from a height h and at exactly the same moment another bullet is fired horizontally from the same height. Compare the time taken by the two bullets.   1

7. How does the time period of a loaded spring change when taken to moon?   1

8. What are beats?   1

9. The motion of a particle of mass M is given by $y = ut + \frac{1}{2} gt^2$. Show that the force acting on the particle is Mg.   2

10. State the laws of friction. 2
11. Show that in an elastic one dimensional collision, the relative velocity of approach before collision is equal to the relative velocity of separation after collision. 2
12. State parallel axes theorem.(a) 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 $\frac{2}{5}MR^2$, where M is the mass of the sphere and R is the radius of the sphere. 2
13. The radii of two planets are respectively R_1 and R_2 and their densities are respectively ρ_1 and ρ_1. What is the ratio of the accelerations due to gravity at their surfaces? 2

(OR)

Calculate the percentage decrease in the weight of a body, when it is taken from the surface of the earth to an altitude equal to half the radius of the earth. 2
14. Derive an expression for escape velocity of a body of mass 'm' from the surface of a planet. 2
15. (a) A capillary tube is dipped first in cold water and then in hot water. Compare the capillary rise in both the cases with reason.
    (b) Explain why heating systems based on circulation of steam are more efficient in warming a building than those based on circulation of hot water. 2
16. A steel wire of length 4.7 m and cross-sectional area 3.0×10^{-5} m^{2}stretches by the same amount as a copper wire of length 3.5 m and cross-sectional area of 4.0×10^{-5} m^2 under a given load. What is the ratio of the Young's modulus of steel to that of copper? 2
17. A refrigerator is to maintain eatables kept inside at 9^0C.If room temperature is 36^0C calculate the coefficient of performance. 2
18. Give the expression for pressure exerted by gas molecules on the walls of the container. Hence arrive at the expression for translational kinetic energy of a molecule. 2

19. What are systematic and random errors? The error in the measurement of edge length of a cube is 3%.What is the percentage error in its volume? 3
20. How do the vertical and horizontal components of velocity of an oblique projectile vary during its flight? Show that the projection angle θ for a projectile launched from the origin is given by
$$\theta = \tan^{-1}\left\{\frac{4H}{R}\right\},$$ where the symbols have their usual meaning. 3
21. A car travels from town A to town B with a speed of 40 km/h. If it returns to A with a speed of 60 km/h, calculate the average speed and average velocity of the car for the whole journey. 3

22. A body attached to a string of length L describes a vertical circle. Show that the difference in tension between the top and the bottom of the circular path is 6 times the weight of the body. Hence write down the expression for the minimum velocity at the top of the circle. 3

23. Find the centre of mass of three particles at the vertices of an equilateral triangle. The masses of the particles are 100g, 150g, and 200g respectively. Each side of the equilateral triangle is 0.5m long.

(OR)

Three bodies, a ring, a solid cylinder and a solid sphere roll down the same inclined plane without slipping. They start from rest. The radii of the bodies are identical. Which of the bodies reaches the ground with maximum velocity? 3

24. Distinguish between isothermal and adiabatic processes? Which of the two will increase the pressure more – adiabatic or isothermal – in reducing the volume to 50 %? 3

25. A body of mass 40kg is moving up an inclined plane with a uniform velocity when a force of 460N is applied along the plane. If the plane is inclined to the horizontal as shown, calculate the coefficient of kinetic friction between the surfaces.
(Given AB = 5m and BC = 3m)
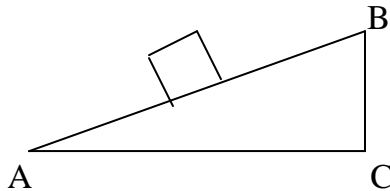
3

26. State the law of equi- partition of energy. Using this find the ratio of two specific heat capacities of a diatomic gas at room temperature. 3

27. Define simple harmonic motion. Displacement of a particle executing simple harmonic motion is given by x = 0.24 sin(200t - 1.5) where x is in metre and t is in second. Find

      (a) Amplitude   (b) angular frequency

      (c) period   (d) initial phase of the simple harmonic motion   3

28. (a) Assuming that the velocity of sound depends on the density(ρ) and modulus of elasticity of the medium(E), deduce by the method of dimensions the formula for the velocity of sound.

   (b) Prove that in case of a closed end organ pipe of length L the frequencies of vibrating air column are given by $\nu = \frac{(2n-1)}{4L}$ v, where n is an integer. 5

(OR)

(a) Explain Doppler effect in sound. Derive an expression for the apparent frequency of the sound when the listener moves towards a stationary source of sound.

(b)The sirens of two fire engines have a frequency of 600 Hz each. A man hears the sirens from the two engines , one approaching him with a speed of 10m/s and the other going away from him at a speed of 15m/s .What is the difference in frequency of two sirens heard by the man?

(Velocity of sound in air = 350 m/s)   5

29. State and prove Bernoulli's theorem. Mention any two applications of it.   5

(OR)

(a) Derive an expression for excess pressure inside a spherical drop of radius R in terms of the surface tension of the liquid. Hence deduce an expression for excess pressure inside a spherical bubble of same radius.

(b) What is the pressure inside a drop of mercury of radius 3mm at room temperature? Surface tension of mercury at the temperature is 0.465N/m. The atmospheric pressure is 1.01×10^5Pa.   5

30. (a) Explain the need of banking of curves of a circular road. Obtain an expression for the max velocity of a car that moves on a rough banked road with angle of banking θ and coefficient of friction μ.

(b) An aircraft executes a horizontal loop at a speed of 200m/s with its wings banked at 15^0 .What is the radius of the loop?   5

(OR)

(a) Two objects of masses m_1 and m_2 ($m_1 > m_2$) are connected vertically by a light cord passing over a frictionless pulley .Derive expressions for acceleration and tension of the system.

(b) A 0.01 kg bullet is fired from a rifle horizontally into a 5 kg block of wood suspended by a string and the bullet gets embedded in the block. The impact causes the block to swing to a height of 0.05 m above its initial level. Calculate the velocity of the bullet.   5

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