# SHARJAH INDIAN SCHOOL

**MODEL EXAMINATION – FEBRUARY 2009**

**Class : XI (Boys Wing)** **Time Allotted : 3 hrs.**
**Subject : PHYSICS** **Max. Marks : 70**
**Day & Date: Sunday, 08.02.2009**

***General Instructions***

1. ***All questions are compulsory.***
2. ***There are 30 questions in total. Questions 1 to 8 carry 1 mark each, Questions 9 to 18 carry 2 marks each, questions 19 to 27 carry 3 marks each and questions 28 to 30 carry 5 marks each.***
3. ***There is no overall choice. However, an internal choice has been provided n one question of 2 marks, one question of 3 marks, and all the three questions of 5 marks each. You have to attempt only one of the given choices in such questions.***
4. ***Use of calculators is not permitted.***

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1. Two masses are in the ratio 1:5. What is the ratio of their inertia?
2. Ice at 0°C is a better coolant than water at 0°C. Explain.
3. What is the radius of gyration of a ring rotating about its diameter?
4. State Newton's law of cooling.
5. A spring is cut into two equal halves. How is the spring constant of each half affected?
6. A weighing machine inside a stationary lift reads W kg when a man stands on it. What would happen to the scale reading if the lift is moving upwards with
   (i) constant velocity V m/s (ii) constant acceleration of a $m/s^2$ ?
7. What does area of the following graphs represent?
   (i) acceleration–time graph (ii) speed–time graph.
8. State parallelogram law of vectors.
9. A car moves at a constant speed of 40 km/hr for 1 km and 120 km/hr for the next 1 km. What is the average speed?
10. Plot a graph between force and displacement when a variable force acts on a body. Explain how we can measure the work done by a variable force from the graph.

    **OR**

    Define 1 Joule of work. Explain the significance of positive and negative work with an example each.
11. (a) The angle between two vectors is 60° what is the ratio of $\vec{A}\cdot\vec{B}$ and $|\vec{A}\times\vec{B}|$ ?
    (b) A unit vector is represented by $a\hat{i}+b\hat{j}+c\hat{k}$. If the value of a and b are 0.6 and 0.8, find the value of c.
12. If earth contracts to half its present size without any change in its mass, what would be the duration of the day?
13. Two spheres of same radius R and made of same material are in contact with each other. Show that gravitational attraction F between them is directly proportional to $R^4$.
14. Using kinetic theory of gases deduce Boyle's law and Charles' law.
15. Distinguish between damped and undamped oscillations. Represent them graphically.
16. In a refrigerator heat from inside at –6°C is transferred to a room at 27°C. Calculate coefficient of performance of the refrigerator.
17. The velocity at the maximum height of a projectile is half of its initial velocity. Determine its horizontal range.
18. A car starting from rest accelerates uniformly with $\alpha$ $m/s^2$ for some time and then decelerates and comes to rest with $\beta$ $m/s^2$. Find the maximum velocity attained during the motion in $t$ seconds.
19. (a) If the diameter of earth is doubled without change in its mass, how would the weight of an object on its surface be affected?
    (b) To what height can a mass go when sent up with a velocity half of the escape velocity?

    **OR**

    State Kepler's second law of planetary motion. The mean distance of the sun from the planet is four times the distance from earth. In how many years will the planet complete one revolution?

20. Two bodies of masses $m_1$ and $m_2$ moving with velocities $u_1$ and $u_2$ in the same straight line undergoes an elastic collision in one dimension. Derive the expression for the velocity of the bodies after collision.

21. Obtain an expression for kinetic energy of rotation of a body.

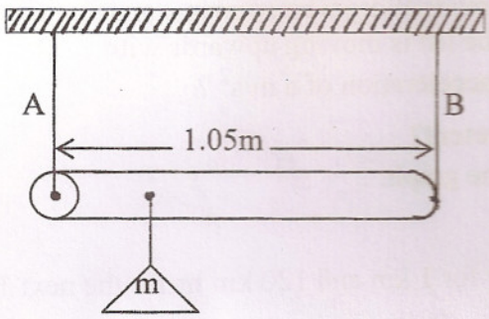
22. (a) Differentiate between isothermal and adiabatic process (any four points)
    (b) What happens to the internal energy of a gas compressed isothermally?

23. Explain how stationary waves are formed in the vibrations of a string. Compare the first three harmonics produced.

24. Using the law of equipartition of energy find the ratio of two specific heats of a monoatomic gas at room temperature.

25. Define centripetal acceleration. Obtain an expression for the same. What is the direction of centripetal acceleration?

26. A rod of length 1.05m having negligible mass is supported at its ends by two wires of steel (wire A) and aluminium (wire B) of equal lengths as shown The cross-sectional areas of A and B are 1 $mm^2$ and 2 $mm^2$ respectively. At what point along the rod should a mass m be suspended in order to produce (i) equal stress (ii) equal strain in both wires?
    [Young's modulus of steel = $2 \times 10^{11}$ $N/m^2$ and for Aluminium = $0.7 \times 10^{11}$ $N/m^2$]




27. Obtain by method of dimensional analysis, an expression for the surface tension $\sigma$ of a liquid rising in a capillary tube assuming that surface tension depends on mass m, pressure p of the liquid and radius r of the capillary tube. Given the constant k = ½.

28. (a) State the law of conservation of momentum.
    (b) Deduce Newton's first law of motion from second law of motion.
    (c) Two balls strike a rigid wall with the same speed, one normal to the wall and another at an angle of 30° with the surface of the wall and get reflected without any change in their speed.
        (i) What is the direction of force on the wall due to each ball?
        (ii) What is the ratio of magnitude of impulses imparted to the balls by the wall?

**OR**

    (a) Why is it necessary to bank the roads? Find the expression for maximum speed of a vehicle on a banked road.
    (b) A car of mass 1500 kg is moving with a speed of 12.5 m/s on a circular path of radius 20m on a level road. What should be the frictional force between the car and the road so that the car does not slip.

29. State and prove Bernoulli's theorem. Name any two applications of Bernoulli's principle.

**OR**

    State Stoke's law. Define terminal velocity and find an expression for terminal velocity in the case of a sphere falling through a viscous liquid.

30. What are beats? Show mathematically that beat frequency is the difference in frequencies of the waves super imposed. Also represent beats graphically.

**OR**

    (a) A harmonic oscillator is represented by $x = 0.34 \cos (2 \pi t + \pi/4)$ metres.
        Find the (i) amplitude (ii) frequency (iii) initial phase and (iv) period.
    (b) Show that motion of a simple pendulum is simple harmonic hence deduce an expression for the time period of pendulum.