INDIAN SCHOOL SOHAR
FIRST TERM EXAM- 2014
PHYSICS – THEORY

CLASS: XI **MARKS:70**
DATE: 22 /9/2014 **TIME:3hrs**

General Instructions:

1. All questions are compulsory.

2. There are 26 questions in all .Questions 1 to 5 carry one mark each, questions 6 to 10 carry two marks each, questions 11 to 22 carry three marks each. Question 23 is a value based question carrying four marks and questions 24 to 26 carry five marks each.

3. There is no overall choice. However, internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each.

4. You have to attempt only one of the given choices in such questions.

5. Use of calculator is not permitted.

6. You may use the following physical constants wherever necessary.

1. Express 4 light years distance in SI unit. (1)
2. Define atomic mass unit. (1)
3. Draw the position-time graphs for two objects initially occupying different positions but having zero relative velocity. (1)
4. A particle moves along a straight line such that its displacement at any time t is given by x= (t^3-$6t^2$+3t+4) m. Find the velocity when the acceleration is zero. (1)
5. A Diwali rocket is ejecting 0.05kg of gases per second at a speed of 400 m/s. What is the accelerating force on the rocket? (1)
6. The frequency of vibration (n) of a string mass depends upon length (l) of the string, tension (T) in the string and mass per unit length (m) of the string. Use method of dimensions for establishing the formula for the frequency. (2)
7. State Newton's second law of motion and hence derive a formula for force. (2)
8. Obtain an expression for work done by variable force with the help of graph between force and distance.

OR

8. Prove the work – energy theorem for a variable force. (2)
9. Prove the Newton's second law of motion for a system of particles. (2)
10. A bullet fired at an angle of 15^0 with the horizontal hits the ground 3 km away. Can we hit a target at a distance of 7km by adjusting the angle of projection. (2)
11. A man starts from his home at 8.00 am to his office. He stays in the office upto 4.00 pm and returns to his home by bus which moves non-stop with a speed of 10m/s. Calculate (i) the time taken by man to reach his office and (ii) time taken by man to reach his home. Also plot x-t graph of his motion. (3)
12. In the gas equation $(P + \frac{a}{V^2})(V-b)=RT$, where T is the absolute temperature, P is the pressure and V is the volume. What are dimensions of constants **a** and **b**? (3)
13. Obtain an expression for instantaneous acceleration in vector form. Explain the graphical method to determine its direction. (3)
14. Describe the motion of a projectile with the help of diagram. Hence obtain an expression for path of projectile. (3)
15. A boy runs on a straight road from his home to a market 2.0 km away with a speed of 4km/h. Finding the market closed, he at once runs back to his home with a speed of 6km/h. Calculate his (i) average speed (ii) magnitude of average velocity and (iii) average speed of the boy in the time interval (a) 0 to 30 minutes,(b) to 40 minutes. (3)
16. Obtain an expression for the maximum speed that can be achieved on a banked road. (3)

17.Define work as a scalar product with the help of diagram.

A particle of mass 0.5kg travels in a straight line with a velocity v = ($5x^{5/2}$)m/s. How much work is done by the net force during the displacement from x=0 to x=2m? (3)

18. State the rule for error of sum or a difference with the mathematical expression.
The percentage errors in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimate of the kinetic energy obtained by measuring mass and speed. (3)

19. Define vector product of two vectors .Mention its properties.

OR

19. Define torque as a vector product. Find the torque of a force 7**i**+3**j**-5**k** about the origin. The force acts on a particle whose position vector is **i-j**+**k.** (3)

20.State the law of static friction. A body is rolling on the ground with a velocity of 1m/s. After travelling a distance of 5m, it comes to rest. Find the coefficient of friction .Take g=10m/s^2. (3)

21. Describe with the help of diagram the conversion of potential energy into kinetic energy for a ball of mass 'm' dropped from a height 'H'. (3)

22. Obtain the condition for the equilibrium of a particle for two, three, n forces with the help of diagram. (3)

23. Two boys A and B jumped from a certain height. Boy 'A' fell on a cemented floor and got injured. Boy 'B' fell on a heap of sand and was not injured. Boy B started laughing at boy A. Satish was watching both the boys. He immediately took boy A to nearby hospital. The doctor treated the boy A.(i) Why was boy A injured and not boy B? (ii)What values are shown by Satish. (4)

24. Find an expression for final velocities of two bodies after one dimensional elastic collision(the second body at rest).Discuss the possible cases.

OR

24. Obtain an expression for (a) the work done by the spring force for a block attached to a spring in positive and negative direction with the help of diagram.
(b)potential energy of the spring (c)maximum speed that can be achieved by the block. (5)

25. (a)Obtain an expression for the maximum speed that can be obtained by a car on the leveled road with the help of diagram.(b)A circular racetrack of radius 300 m is banked at an angle of 15^0. If the coefficient of friction between the wheels of a race-car and the road is 0.2, what is the optimum speed of the race-car to avoid wear and tear on its tyres, and maximum possible speed to avoid slipping.

OR

25. Formulate an expression for angular momentum and hence prove the Newton's second law of motion for the rotation of a body.
A cart and a man move towards each other. The masses of the cart and the man are 25kg and 50kg respectively. The velocity of the cart is 0.2m/s. When the jumps into the cart it acquires a velocity of 0.6m/s in the direction in which the man was walking. What is the velocity with which the man was walking? (5)

26. Derive an expression for centripetal acceleration with the help of diagram. Hence define centripetal force.
A stone tied to the end of a string 80 cm long is whirled in a horizontal circle with a constant speed. If the stone makes 14 revolutions in 25 s, what is the magnitude and direction of acceleration of the stone.

(OR)

26. Derive an expression for time of flight and horizontal range of a projectile.
The ceiling of a long hall is 25m high. What is the maximum horizontal distance that a ball thrown with speed of 40m/s can go without hitting the ceiling. (5)