Roll Number		

Code Number: 42/2/2

INDIAN SCHOOL MUSCAT
SECOND TERM EXAMINATION
SUBJECT : PHYSICS

CLASS: XI | Sub. Code: 042 | Time Allotted: 3 Hrs

06.12.2017 | Max. Marks: 70

General instructions

1. *All questions are compulsory. There are 26 questions in all.*
2. *This question paper has five sections: section A, section B, section C, section D and section E.*
3. *Section A contains five questions of one mark each, Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each.*
4. *There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and in all the three questions of five marks weightage. You have to attempt only one of the choices in such questions.*
5. *You may use the following values of physical constant wherever necessary: $g = 9.8\ m/s^2$, radius of the earth 6400 km, mass of the earth 6×10^{24} kg.*

SECTION A

1. Draw the velocity-time graph of an object dropped downwards and rebounding to the same height. 1

2. Can a body have energy without momentum? If so, give an example. 1

3. What happens to the potential energy when two dissimilar charges are brought near each other? 1

4. Why thick steel ropes are made by braiding a number of thin steel wires together? 1

5. Write two factors on which moment of inertia of an object depends. 1

SECTION B

6. What is the advantage of choosing wavelength of light radiation as standard of length? 2

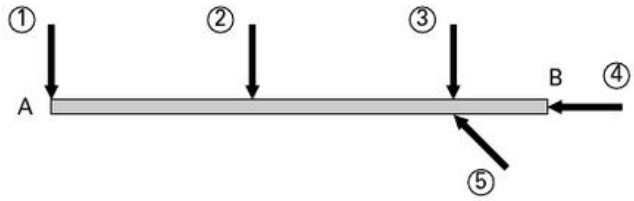
OR

List out any four limitations of dimensional analysis.

7. Show that $\frac{H_{max}}{R} = \frac{\tan\theta}{4}$ where R is the horizontal range and H_{max} is the maximum height reached by a body projected with a velocity u at an angle θ with respect to the horizontal. 2

8. Why are porcelain objects wrapped in paper or straw before packing for transportation? 2

9. Look at the diagram below, all forces (numbered from1 to 5) are of equal magnitude. 2



a) Which force has the greatest moment about point A? (1)

b) Which force has no moment about point B? (1)

10. a) Show graphically how acceleration due to gravity varies as we move from the centre of the earth to great heights above the surface of the earth. (1) 2

b) What is a parking orbit?

SECTION C

11. A gas bubble from an explosion under water, oscillates with time period T which depends on pressure P, density of water d and the total energy of explosion E. Using dimensional analysis, obtain an expression for the time period. 3

OR

Find the dimensions of a and b in the relation $P = \frac{b - x^2}{at}$, where P is power, x is distance and t is the time.

12. a) An object travels with a velocity $(3\hat{\imath} + 4\hat{\jmath})$ m/s. Calculate its speed.(1) 3

b) An aircraft takes off at an angle of 30º to the horizontal. If the component of its velocity along the horizontal is 250 kmph, what is the actual velocity? Also find the vertical component of velocity.(2)

13. Show that the trajectory of a projectile is a parabola. 3

14. Using a velocity-time graph, derive the equation: $S = ut + \frac{1}{2} at^2$, where u is initialis initial vel an object, a is acceleration and t is time. 3

15. a) What is the angle between frictional force and instantaneous velocity of a body moving on a rough surface? (1) 3

b) State laws of static friction. (2)

16. a) Is the linear momentum of a ball falling freely conserved? Why? (1) 3

b) Define impulse. Derive the relation between impulse and linear momentum. (2)

17. a) State any two differences between conservative and non-conservative forces. (1) 3

b) Derive an expression for the potential energy stored in a system of a block attached to a massless spring when the block is pulled from its equilibrium position. (2)

18. a) Mountain roads rarely go straight up but wind up gradually. Give reason. 3

b) A light body and heavy body have same momentum. Which one has more kinetic energy?

c) A body is moving along a circular path. How much work is done by the centripetal force?

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

20. a) In a hand driven grinding machine, handle is put near the circumference of the stone. Why? (1) 3

b) Derive the relation between torque and angular momentum. (2)

21. a) Define escape velocity of an object. (1) 3

b) Derive the expression for the escape velocity of an object from the earth. (2)

2 a) State Hooke's law. (1) 3
2. b) Represent graphically the variation of stress with strain in an elastic body. On this graph mark (i) elastic limit (ii) yield strength and (iii) breaking point. (2)

SECTION D

2 Ramu was explaining about conservation of angular momentum to his friends in the class. 4
3. After the completion of his explanation he wanted to check how far how far they understood the topic. In the process he asked Babita and Ram to give more examples.

a) What qualities did you find in Ramu?

b) A man sits on a stool that is free to rotate nearly without friction about a vertical axis. He outstretched hands, each holding a large mass so that the moment of inertia is 12 kg m^2. By pulling his arms close to his body he is able to reduce his rotational inertia to 6 kg m^2. If he starts spinning at 0.5 rad/s, what is his angular speed after he draws his arms in?

SECTION E

2 a) State and prove law of conservation of linear momentum. (3) 5
4. b) A bullet of mass 0.04 kg moving with a speed of 90 m/s enters a heavy wooden block and is stopped after a distance of 60 cm. What is the average resistive force exerted by the block on the bullet? (2)

OR

a) With the help of a neat free body diagram, derive the expression for optimum and maximum speed of a car on a banked circular track. (3)

b) A car moves at a speed of 36 km/h on a level road. The coefficient of friction of friction between the tyres and the road is 0.8. The car negotiates a curve s a curve of radius 10 m at this speed. Will the car skid while negotiating the curve. (Take g= 10 m/s^2) (2)

2 A small body tied to one end of the string is whirled in a vertical circle. 5
5. a) Represent the forces on a diagram when the string makes an angle θ with vertical position. Find the difference in tension between the lowest and highest points. (3)

b) One end of a string of length 1.5 m is tied to a stone of mass 0.4 kg and the other end to a small pivot on a smooth vertical board. What is the minimum speed of the stone required at its lower most point so that the string does not slacken at any point in its motion along the vertical circle? (2)

OR

a) Show that in case of one-dimensional elastic collision of two bodies, the relative velocity of separation after collision is equal to relative velocity of approach after the collision. (3)

b) A body of mass m moving with a speed v collide elastically head on with another body of mass m initially at rest. Show that the moving body will come to stop as a result of this collision. (2)

26. a) Derive an expression for acceleration due to gravity at a depth d below the surface of the earth of radius R in terms of acceleration due to gravity g on the surface of the earth. Assume the earth to be a perfect sphere of uniform density ρ. (3) 5

b) At what height above the surface of the earth the acceleration due to gravity will become 64% its value on the surface of the earth? Take R = 6400 km. (2)

OR

a) Derive an expression for the orbital velocity and the time period of an artificial satellite orbiting at a height h above the earth surface. (3)

b) If a body is launched at three times the escape velocity from earth, ignoring air resistance, what will be its velocity at infinity? (2)

End of the Question Paper