INDIAN SCHOOL SOHAR

TERM-1 EXAMINATION (2017-18)

Date: 19-11-2017   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.

(vi)   Use of calculator is not permitted. However, you may use log tables if necessary.

Section A (1 mark)

1. What is the kinetic energy of a body of mass 2 kg and momentum 2 Ns?

2. A person is lowering a bag weighing 20 kg. Is the work done positive or negative. Give reason.

3. The maximum horizontal range of a cannon is 4 km. what is the muzzle velocity of the shell, if $g=10m/s^2$.

4. Can action and reaction forces cancel each other?

5. What is streamline flow?

Section B (2 marks)

6. The recent discovery of gravitational waves confirms one of the most important theories of Einstein, name the theory. What is the order of the gravitational force?

7. Find the angle of projection for a projectile whose range R is **n** times the maximum height H

8. Four balls are thrown with the same initial velocity at angles 25^0, 35^0, 45^0 and 69.7^0 with the horizontal. Which ball would come back to the ground at the earliest and why?

9. If the length and time period of an oscillating simple pendulum have errors of 1% and 2 % respectively, what is the error in the estimate of g?

10. Explain the term relative velocity with the help of position - time graph.

Section C (3 marks)

11. If the velocity of light c, Planck's constant **h** and gravitational constant G are taken as fundamental quantities, then express Mass, Length and Time in terms of dimensions of these quantities.

12. A motor car moving at a speed of 72 km/h cannot come to a stop in less than 3.0s while for a truck this time interval is 5.0s. On a highway the car is behind the truck, both moving at 72 km/h. The truck gives a signal that it is going to stop at emergency. At what distance the car should be from the truck so that it does not bump on to (collide with) the truck. Human response time is 0.5s.

OR

Two towns A and B are connected by a regular bus service with a bus leaving in either direction every T minutes. A man cycling with a speed of 20km/h in the direction A to B notices that a bus goes past him every 18 min in the direction of his motion, and every 6 min in the opposite direction. What is the period T of the bus service and with what speed (assumed constant) do the buses ply on the road?

13. Consider a mass m attached to a string of the length L performing vertical circle. Prove that the minimum velocity at the lower most point to perform vertical circle is $\sqrt{5gL}$.

14. What is torque? Establish a relation between angular momentum and the torque.

15. a) What do you mean by equilibrium of a rigid body?

    b) Show that moment of a couple does not depend on the point about which you take the moments.

16. What is escape velocity? Obtain the expression for the escape velocity on earth.

17. A star 2.5 times the mass of the Sun collapsed to a Neutron star of size 12 km rotates with a speed of 1.2 rev. per second. Will an object placed on its Equator remains stuck to its surface due to gravity? ($M_{sun} = 2 \times 10^{30}$ kg, $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$).

18. A 400 kg satellite is in a circular orbit of radius 2R about the earth. How much energy is required to transfer it to a circular orbit of radius 4R? What are the changes in the kinetic and potential energies? (Radius of Earth=6400km)

19. Draw a typical stress strain curve for a metal and hence explain the terms

    a) Elastic limit. b) Yield point. c) Tensile strength.

20. Stress-strain curve of two materials are given:
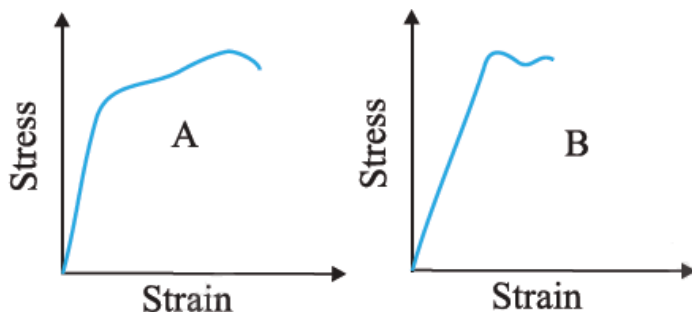
a) State Hooke's law

b) Which of the materials has the greater Young's modulus? Why?

c) Which of the two is stronger material?

21. Prove that the work done per unit volume in stretching a wire for every type of strain $= \frac{1}{2} \times$ stress $\times$ strain.

22. A non-uniform bar of weight W is suspended at rest by two strings of negligible mass as shown in fig. the angles made by the strings with the vertical are 36.9^0 and 53.1^0 respectively. The bar is 2 m long. Calculate the distance d of the centre of gravity of the bar from its left end. (given $\cos36.9^0=0.800$)
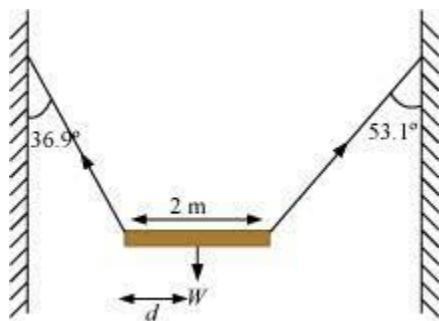
Section D (4 marks)

23. Ravi used to live in a remote village of Rajasthan which didn't have electricity. He was a good student and studied very hard to become an engineer in spite of all hardships. While studying he came to know that solar energy can be converted to electrical energy by solar panels. He told the villagers that Govt gives subsidy for it. Later the village became a model village which uses solar energy for electricity.

a) What are the values displayed by Ravi.

b) If direct solar energy is incident on the surface at an average rate of 200 watt per square metre and 20% of this energy can be converted to use electrical energy, how much area is needed to supply 8KW of electrical energy?

c) Why is solar energy a better source of energy?

Section E (5 marks)

24. a) Derive the kinematic equations of rotational motion.

b) The angular speed of a motor wheel is increased from 1200 rpm to 3120 rpm in 16 seconds. What is its angular acceleration, assuming the acceleration to be uniform? How many revolutions does the engine make during this time?

OR

a) What is the difference between rotational kinetic energy and rolling kinetic energy? Derive an expression for kinetic energy of a rolling body of radius R and radius of gyration **k**.

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

25. State and prove Bernoulli's principle

<center>Or</center>

a) State the Pascal's law for transmission of fluid pressure.

b) Draw a schematic diagram illustrating the principle behind the hydraulic lift. Explain the working of it.

c) What does the term mechanical advantage suggest?

d) In a car lift compressed air exerts a force on a small piston having a radius of 5.0 cm. This pressure is transmitted to a second piston of radius 15 cm. If the mass of the car is 1350 kg what is the pressure necessary to accomplish this task?

26. The remarkable thing about the acceleration due to gravity is that it is the maximum on its surface and decreasing whether you go up or down. Substantiate this statement. Also draw graph showing the variation of g with height and depth.

<center>OR</center>

i) What are geostationary satellites? Derive the expression for the height of the orbit above the surface of the earth in which a satellite, if placed, will appear stationary.

ii) What are the uses of geostationary satellites?