No: of printed pages: 4

INDIAN SCHOOL SOHAR

PRE-FINAL EXAMINATION (2018)

Date: 08-2-2018 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.

Use of calculator is not permitted.

Section A

1. What is the difference between these two numbers: 4.0 and 4.000?

2. What is Least Count Error?

3. Why do we place handles at maximum possible distance from the hinges in a door.

4. What is the cause of the excess pressure inside a soap bubble?

5. If the total energy of a SHM is E what is the kinetic energy at x=A/3?

Section B

6. A man runs across the roof of a tall building and jumps horizontally with the hope of landing on the roof of the next building which is of a lower height than the first. If his speed is 9 m/s, the (horizontal) distance between the two buildings is 10m and the height difference is 9m, will he able to land on the next building?

OR

Prove that $V_{AB} = V_A - V_B$ where symbols have their usual meaning. (V_{AB} – relative velocity of A with respect to B)

7. Name the physical quantity corresponding to force in rotational motion. How is it related to force and give its unit?

8. Define gravitational field strength. What is the field strength at a point distant r from a mass M?

9. What happens to the change in internal energy of a gas during (i) Isothermal expansion, and (ii) Adiabatic expansion?

10. Write the statements of second law of thermodynamics applicable to (1) Heat engine (2) Refrigerator.

Section C

11. Derive a relation for the time taken by a projectile to reach the highest point and the maximum height attained?

12. A hammer of mass 1 kg moving with a speed of 6 m/s strikes a wall and comes to the rest in 0.1s. Calculate (i) the impulse of force

(ii) The retardation of the hammer, and

(iii) The retarding force that stops the hammer.

13. Discuss the elastic collision in one dimension. Obtain the expression for velocities of two bodies after such a collision.

14. A cylinder of mass 10 kg and radius 15 cm is rolling perfectly in a plane of inclination 30^0. The coefficient of static friction is $\mu_s = 0.25$

(a) How much is the force of friction acting on the cylinder?

(b) What is the work done against friction during rolling?

(c) If the inclination '**θ**' of the plane is increased, at what value of '**θ**' does the cylinder begin to skid, and roll perfectly?

15. What is the phenomenon of capillarity? Derive an expression for the rise of liquid in a capillary tube.

16. Derive an expression for terminal velocity of a metal sphere of radius 'a', density ρ falling through a viscous fluid of viscosity η and density σ.

17. State newton's law of cooling. Derive the expression for time of cooling of a body through a particular range of temperature.

18. A Thermocole ice box is a cheap and efficient method for storing small quantities of cooked food in summer in particular. A small cubical icebox of side 30 cm has a thickness of 5.0 cm, if 4.0 kg of ice is put in the box, estimate the amount of ice remaining after 6h. The outside temperature is 45^0C and coefficient of thermal conductivity of thermocole is 0.01 $Wm^{-1}K^{-1}$. Heat of fusion of water is 335×10^3J/kg.

19. Define first law of thermodynamics. Using this derive the relationship between C_p and C_v.

20. Define an adiabatic process. Derive an expression for work done during an adiabatic process

21. The motion of a simple pendulum is approximately simple harmonic for small angle oscillations. Derive an expression for the time period and frequency of a simple pendulum.

22. A cylindrical piece of cork of density 'ρ', base area A and height 'h' floats in a liquid of density σ. The cork is depressed slightly and then released. Show that the cork oscillates up and down simple harmonically with a period $T = 2\pi\sqrt{\frac{\rho h}{\sigma g}}$

OR

a) A harmonic oscillator is represented by $y = 0.34\cos(3000t + 0.74)$ where y and t are in meter and second respectively. Deduce :

(i) The amplitude
(ii) The frequency and angular frequency
(iii) The period and the initial phase.

b) A body is executing SHM of amplitude 1m. Its velocity while passing through the mean position, is 10 m/s. Find its frequency.

Section D

23. Construction of metro line was carried out day and night. One night, when the work was in full swing, suddenly chain of the crane, lifting a heavy concrete block, snapped and it fell down. Local people acted promptly, saved many lives,

(i) What values of people should be appreciated
(ii) A crane having steel ropes is used to lift heavy loads upto 10^4 kg. The elastic limit for steel is $3\times10^8 N/m^2$. What should be the radius of the steel rope used?
(iii) Which is more elastic rubber or steel?

Section E

24. a) State Kepler's laws on planetary motion.

b) State Newton's universal law of gravitation and deduce Kepler's third law (Law of Period) from Newton's law of gravitation.

OR

a) What is the difference between gravitational potential and gravitational potential energy? Deduce an expression for gravitational potential energy of a planet of mass M.
b) Find the potential energy of a system of mass m placed at the vertices of square of side a. Also obtain potential at the center of the square.

25. a) prove that velocity of efflux of an ideal liquid through an orifice is equal to the velocity attained by a freely falling body from the surface of the liquid to the orifice . Also calculate the horizontal range efflux in terms of height. When the range is the maximum?

b) The speed of efflux is determined by the container pressure. Give one application which uses this principle?

OR

a) The venture meter is a device to measure the flow speed of in compressible fluid. Derive the expression for the same using Bernoulli's theorem
b) Give two applications of venture- channel. Briefly explain their working.

26. a) consider the small oscillation of a block of mass m , fixed to a spring , on a frictionless horizontal surface . Shows that the block executes SHM. Derive the time period of oscillation.

b) A 5kg body is attached to a spring of spring constant 500 Nm^{-1}. It slides without friction over a horizontal rod. The body is displaced from its equilibrium position by 10.0 cm and released. Calculate

(a) The period of oscillation

b) The maximum speed

c) Maximum acceleration of the body.

OR

a) The projection of uniform circular motion on a diameter of the circle follows SHM. Derive the expression for the (i)Displacement (ii) Velocity and (iii) Acceleration
b) Plot displacement , velocity and acceleration versus time graphs and give phase difference of each relative to displacement
c) Find the total energy of SHM and then show that for an ideal oscillator it is independent of time.