

**SBOA School & Junior College, Chennai**  
**Half – Yearly Examination      2016 – 2017**  
**Physics**  
**Code – A**

**Std: XI**  
**Time:3hrs**

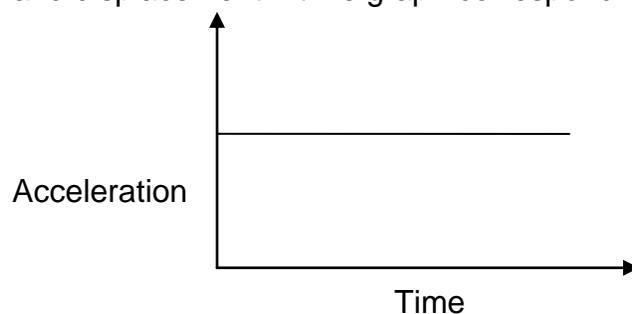
**Marks: 70**

**General Instructions:**

- 1) All questions are compulsory
- 2) 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 a value based question of four marks and section E contains three questions of five marks each.
- 3) 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 the three questions of five marks. You have to attempt only one of the choices in such question.

**Section – A**

1. In a submarine equipped with a SONAR, the time delay between the generation of a probe wave and the reception of its echo after reflections from an enemy submarine is found to be 77 s. What is the distance of enemy submarine?  
(speed of sound in water = 1450m/s).
2. Acceleration – time graph of a moving object is shown in the figure. Draw velocity – time and displacement – time graph corresponding to this type of motion.



3. The maximum range of projectile is  $\frac{2}{\sqrt{3}}$  times actual range. What is the angle of projection for the actual range.
4. Two bodies A and B of masses  $m_1$  and  $m_2$  have equal momenta such that  $m_1 > m_2$ . Which one has more kinetic energy.
5. What is an elastomer? Give an example.

**Section – B**

6. A wire stretches by a certain amount under a load. If the load and radius both are increased to four time, find the stretch caused in the wire.

(or)

Two wires of same length and material but of radii in the ratio 1 : 2 are suspended from a rigid support. Both carry the same load. Find the ratio of stress, strain and extension in them.

7. The escape velocity ' $v$ ' of a body depends upon:
- Acceleration due to gravity of the planet ( $g$ ) and
  - Radius of the planet ' $R$ '. Establish dimensionally the relationship between  $v$ ,  $g$  and  $R$ .
8. What are conservative forces? Show that gravitational force is a conservative force?
9. One mole of an ideal gas undergo a cyclic change ABCD where the ( $p$ ,  $v$ ) coordinates are A(5, 1) B(5, 3) C(2, 3) D(2, 1).  $p$  is in atmosphere and  $v$  is in litre. Calculate the net workdone in the process. Given  $1\text{atm} = 1.01 \times 10^5\text{N/m}^2$ .
10. Why spokes are provided in a bicycle wheel?

### Section – C

11. a) A simple harmonic motion is represented by  $x = 10 \sin(20t + 0.5)$ .  
Write down its amplitude, angular frequency, frequency, time period and initial phase, if displacement is measured in metres and time in second?
- b) What is the main difference between forced oscillations and resonance.
12. What is meant by the mean free path of a gas molecule? Derive an expression for it. On which factors does the mean free path depend?
13. a) State four postulates of the kinetic theory of gases?  
b) Derive the relation between pressure and kinetic energy of a gas.
14. Explain briefly the working principle of a refrigerator and obtain an expression for the coefficient performance.
15. a) State and Prove the first law of thermodynamics.  
b) State Kelvin – planck statement of second law of thermodynamics.  
c) The source temperature of a heat engine is  $127^\circ\text{C}$ . It takes 500 cal of heat from the source and rejects 400 cal to the sink during each cycle. What is the temperature of the sink?
16. What is meant by coefficient of linear expansion, superficial expansion and cubical expansion of a solid. Derive the relationship.
17. a) Distinguish between conduction, convection and radiation.  
b) Why are two thin blankets warmer than a single blanket of double the thickness?  
c) Two rods A and B are of equal length. Each rod has its ends at temperature  $T_1$  and  $T_2$ . What is the condition that will ensure equal rates of flow of heat through the rods A and B?
18. What is meant by the term coefficient of viscosity? State stoke's law? Define Terminal Velocity and find an expression for the terminal velocity in case of a sphere falling through a viscous liquid such as glycerine.
19. a) Explain the principle and working of hydraulic lift with the help of a schematic diagram.

b) As shown in the figure, water flows from P to Q. Explain why is height  $h_1$  of column of water greater than height  $h_2$  of column of water.

20. a) Show that the moment of inertia of body about the given axis of rotation is equal to twice the kinetic energy of rotation of the body rotating with unit angular velocity.

b) State parallel axes theorem on moment of inertia.

21. What is a projectile? A projectile is fired with a velocity 'u' making an angle  $\theta$  with the horizontal. Show that its trajectory is a parabola. Derive expression for its (i) time of flight and, (ii) maximum height.

22. a) Draw the position – time graph for uniformly accelerated motion. What does its slope give.

b) A body travels from A to B at 40 m/s and from B to A at 60 m/s. Calculate the average speed and average velocity.

(or)

a) Draw the velocity – time graph for an object in uniform motion. Show that the area under that graph give the displacement of the object in the given time interval.

b) A player throws a ball upwards with an initial speed of 29.4m/s.

(i) What is the direction of acceleration during the upward motion of the ball?

(ii) What are the velocity and acceleration of the ball at the highest point of its motion.

#### Section – D

23. Kyra, younger sister of Arjun was playing in the terrace in a clear night. Suddenly Kyra observed a light flare in the sky. She was frightened and asked her brother what was it about? Will it either hurt her or the earth's surface? Arjun explained that it was a meteorite?

a) What are the values displayed by Arjun?

b) What is a meteorite? What happens to it while reaching the earth's surface.

**Section – E**

24. A body tied to one end of a string is made to revolve in a vertical circle. Derive the expression for the velocity of the body and the tension in the string at any point. Hence find a) tension at the bottom and the top of the circle, b) minimum of velocity at the lowest point so that it is just able to loop and c) the maximum velocity at the top.

(or)

- a) What is friction? Why is it called a necessary evil.
- b) State the laws of limiting friction?
- c) Why is it easier to pull a lawn roller than to push? Explain.
- d) The coefficient of friction between the ground and the wheels of a car moving on a horizontal road is 0.5. If the car starts from rest, what is the minimum distance in which it can acquire a speed of 72km/hr? Take  $g = 10\text{m/s}^2$ .

25. a) Two soap bubbles have radii in the ratio 2 : 3. Compare the excess pressure inside these bubbles. Also compare the works done in blowing these bubbles.

- b) Deduce an expression for the excess pressure inside a soap bubble.

(or)

- a) What is a venturimeter? Explain its construction and working to determine the speed of an incompressible fluid?
- b) Water flows through a horizontal pipe where internal diameter is 2.0cm at a speed of 10m/s. What should be the diameter of the nozzle, if the water is to emerge at a speed of 4.0m/s?

26. Find the total energy of a particle executing SHM and show graphically the variation of P.E and K.E with time in SHM. What is the frequency of these energies with respect to the frequency of the particle executing SHM.

(or)

- a) Prove that the displacement equation.

$x(t) = a \sin(\omega t + \phi)$  represents a simple harmonic motion. Using that obtain the expression for velocity and, acceleration of a particle executing SHM. Explain the relation in phase between displacement, velocity and acceleration in SHM graphically.

- b) A particle executing linear SHM has a maximum velocity of 40cm/s and a maximum acceleration of 50cm/s<sup>2</sup>. Find its amplitude and the period of oscillation.



**SBOA SCHOOL & JUNIOR COLLEGE, CHENNAI – 600 101**

**HALF YEARLY EXAMINATION – 2016-17**

**PHYSICS**

**CODE – B**

**STD: XI**

**MARKS: 70**

**TIME:3hrs**

**GENERAL INSTRUCTIONS**

- 1) All questions are compulsory
- 2) 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 a value based question of four marks and section E contains three questions of five marks each.
- 3) 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 the three questions of five marks. You have to attempt only one of the choices in such question.

**SECTION – A**

- (1) When a copper sphere is heated, what will be the maximum percentage change observed ?
- (2) What is the acceleration of a body when its velocity-time graph is parallel to time axis ?
- (3) The maximum and minimum magnitudes of the resultant of two vectors are 17 units and 7 units respectively. If these two vectors are at right angles to each other what is the magnitude of their resultant ?
- (4) Two coolies lift same load from the road to the roof of a bus. One of them takes 1 min. and the other takes two min. to do the same job. Who has done more work. Why ?
- (5) A wire is replaced by another wire of same length and material but of twice diameter. What will be the effect on the increase in its length under a given load ?

**SECTION – B**

- (6) The resistance  $R = V/I$ , Where  $V = (100 \pm 5) V$  and  $I = (10 \pm 0.2) A$ . Find the percentage error in  $R$ .
- (7) a) A long spring is stretched by 2 cm. Its potential energy is  $V$ . If the spring is stretched by 10 cm, what would be its potential energy?  
b) A force ( $m v^2/r$ ) is acting on a body of mass  $m$  moving with a velocity  $v$  in a circle of radius  $r$ . What is the work done by the force in moving the body over half the circumference of the circle ?
- (8) a) Define poisson's ratio.  
b) An elastic wire is cut to half its original length. How would it affect the maximum load that the wire can support ?
- (9) a) A Wheel of radius  $R$  rolls on the ground with a uniform velocity  $v$ . What is the velocity at the topmost point relative to bottommost point ?  
b) Define angular momentum.
- (10) a) An ideal gas is compressed at a constant temperature, will its internal energy increase or decrease. Why ?  
b) Ice at  $0^\circ C$  is converted into steam at  $100^\circ C$ . State the isothermal changes in this process ?

(or)

What is meant by reversible process ? Explain why the efficiency of a reversible engine is maximum?

**SECTION – C**

- (11) A table clock has its minute hand 4.0cm long. Find the average velocity of the tip of the minute hand (a) between 6 a.m to 6.30 p.m and (b) 6 a.m to 6.30 a.m.
- (12) Read each statement below carefully and state, with reasons, if it is true or false.  
(a) The velocity vector of a particle at a point is always along the tangent to the path of the particle at that point.  
(b) The net acceleration of a particle in circular motion is always along the radius of the circle towards the centre.
- (13) Define Orbital Speed of a satellite and derive an expression for the same.

- (14) (a) Define surface tension. Give its SI unit.  
 (b) A liquid is contained in a vertical tube of semi-circular cross section. The angle of contact is zero. What is the ratio of the force of surface tension on the curved part and the flat part of the tube?

(or)

- (a) Define angle of contact.  
 (b) A soap bubble of radius  $r$  is blown up to form a bubble of radius  $3r$  under isothermal conditions. What is the energy spent in doing so if the surface tension of soap solution is  $S$ .
- (15) State Pascal's law for the transmission of fluid pressure. Explain the construction and working of hydraulic lift with a neat diagram.
- (16) a) State Wien's displacement law.  
 b) A black body at 2000 K, emits maximum energy at a wavelength of  $1.56 \mu\text{m}$ . At what temperature will it emit maximum energy at a wavelength of  $1.8 \mu\text{m}$ ?
- (17) a) Define Latent heat of fusion of ice.  
 b) From what height should a piece of ice fall so that it melts completely? Only one quarter of the heat produced is absorbed by the ice. Latent heat of ice is  $3.4 \times 10^5 \text{ J kg}^{-1}$  and  $g = 10 \text{ ms}^{-2}$ .
- (18) Explain the working of Refrigerator with a neat diagram.
- (19) a) State second law of thermodynamics.  
 b) If on giving 40 joule of heat to a system, work done on the system is 10 joule, what will be the change in internal energy of the system?
- (20) a) What is known as resonance?  
 b) Why soldiers are asked to go out of their steps when they cross the bridges?
- (21) From kinetic Theory of gases, explain kinetic interpretation of temperature and absolute zero.
- (22) State the law of Equipartition of energy. Calculate the ratio of specific heat capacities at constant pressure and volume for a mono atomic gas molecule.

#### SECTION – D

- (23) Whenever a body is thrown vertically upwards with a certain velocity, the upward motion is opposed by gravitational pull of earth and resistance of air. The velocity of a body goes on decreasing at a constant rate ( $= -g$ ). As soon as upward velocity of a body becomes zero, it cannot rise any more. The height it has attained is the maximum height. The body then begins to fall downwards with an acceleration  $=g$ .
- Read the above passage and answer the following questions:  
 (i) A body is thrown upwards with a velocity of  $19.6 \text{ m/s}$ . What is the maximum height attained?  
 (ii) With what velocity will the body hit the ground?  
 (iii) What are the implications of this study in day today life?

#### SECTION – E

- (24) a) State and prove the law of conservation of linear momentum.  
 b) A thief jumps from the roof of a house with a box of weight  $W$  on his head. What will be the weight of the box as experienced by the thief during jump?  
 c) Action and reaction forces do not balance each other, Why?
- (or)
- a) Obtain an expression for minimum velocity of projection of a body at the lowest point when rotating in a vertical circular loop.  
 b) A bucket containing water is rotated in a vertical circle. Explain why water does not fall?
- (25) State Torricelli's law and derive an expression for the speed of efflux by considering a closed container with a given liquid.

(or)

- a) Define Terminal velocity.  
 b) Derive an expression for Terminal velocity of a viscous liquid.  
 c) The diameter of ball A is twice of that of B. What will be the ratio of their terminal velocities in water
- (26) a) What is a simple pendulum? Derive expression for the time period and frequency of a simple pendulum.  
 b) A girl sitting on a swing stands up. What will be the effect on the periodic time of the swing?

(or)

Find the total energy of the particle executing SHM and show graphically the variation of P.E and K.E. with displacement in SHM.

