BHARATIYA VIDYA BHAVAN'S
V.M.PUBLIC SCHOOL, VADODARA
SA-II

CLASS : XI (SET-1)
SUBJECT : PHYSICS (042) **MAX MARKS: 70**
DATE : 29/2/2016 **TIME: 3HOURS**

GENERAL INSTRUCTIONS:
1.Section A contains 5 questions each of 1M
2. Section B contains 5 questions each of 2M
3. Section C contains 12 questions each of 3M
4. Section D contains 1 question 4M
5. Section E contains 3 questions each of 5M

SECTION A

1.Define the term stress. Write its SI unit.

2. What is reason for the falling down of fruits from a tree, when its branches are shaken.

3. A uniformly moving cricket ball is turned back by hitting it with a bat for a very short time interval. Show the variation of its acceleration with time.[Take acceleration in the backward direction as positive].

4. A famous relation in physics relates moving mass m to the rest mass m of a particle in terms of its speed v and the speed of the light c. [This relation arose as a consequence of special theory of relativity due to Albert Einstein].
A boy recalls the relation almost correctly but forgets where to put the constant c .
He writes $m=m_0/(1-v^2)^{1/2}$
Guess where to put the missing c.

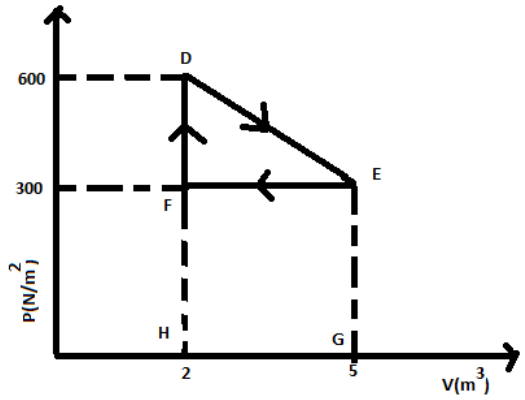
5. The two row boats on sailing parallel and the close to each other, experience a force which pulls them towards each other. Explain the reason for this statement.

SECTION B

6. Determine the waveform if a harmonically moving transverse wave on a string the particle has a maximum particle velocity and acceleration of $3ms^{-1}$ and $90ms^{-2}$, respectively. Velocity of the wave is $20ms^{-1}$.

7. Briefly explain on the basis of kinetic theory, why do the pressure of a gas is increased when the gas is heated?

8. A thermodynamic system is taken from an original state to an intermediate state by the linear process shown in the figure.



Its volume is then reduced to original value from E to F by an isobaric process. Calculate the work done by the gas from D to E and E to F.

9. Along a straight line, a particle executing SHM has a velocity of 4 m/s when it is at a distance of 3 m from the mean position and 3 m/s when it is at a distance of 4 m from it. Determine the time taken by the particle to travel 2.5 m from the positive extreme of the oscillation.

Or

The vertical motion of a big position in a machine is approximately simple harmonic with the frequency of 0.5 s , A block of 10 kg is placed on the piston. Find the maximum amplitude of the piston's SHM for the block and the piston to remain together.

10. Show that (i) $s=ut + ½ at^2$ (ii)$v=u +at$

SECTION C

11. A fighter plane is flying horizontally at an altitude of 1.5 km with speed of 720 km/h. At what angle of sight (w.r.t. horizontal] when the target is seen, should the pilot drop the bomb in order to attack the target?

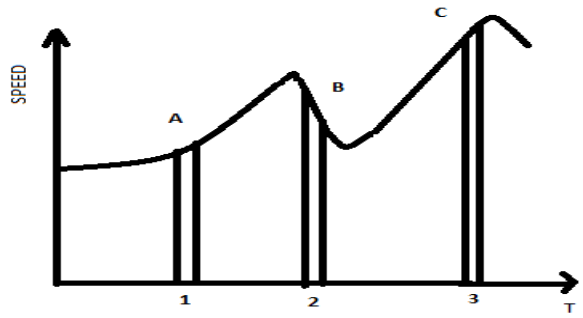
12. Derive the relation $\tau = I\alpha$ for the rotation of particle about the fixed axis.

13. (i) With the help of a suitable diagram, show that in an elastic one- dimensional collision, the relative velocity of approach is equal to the relative velocity of separation after the collision .

14. Explain the term beats. Also, define the term of beat frequency. Mention any two of its applications

15. Draw a diagram and with its help, show that the surface energy per unit area numerically equals to the surface tension.

16. (i) Figure shows as speed time graph of particle in motion along a constant direction. Three equal intervals of time are shown. In which interval is the average acceleration greatest in magnitude? In which interval is the average speed greatest? Choosing the positive direction as the constant direction of motion , give the signs of v and a in the three intervals. What are the accelerations at the points A, B,C, and D?

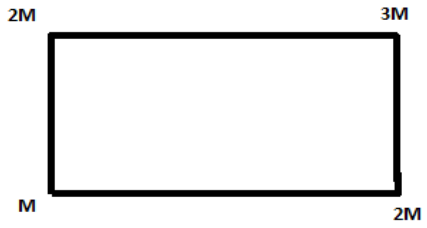


(ii) On the straight road, if a car is moving with the speed of 180 km/h and the drive stops the car in 25 s by applying brakes, then determine the distance covered by the car during the time brakes are applied. Assume, acceleration of the car be uniform throughout the retarding motion.

17.Calculate Cp and Cv for a molecule of hydrogen gas.

18. Derive an expression for the work done during the adiabatic expansion of an ideal gas.

19. Four bodies have been arranged at the corners of a rectangle shown in figure. Find the centre of mass of the system.



20.Derive the differential equation of SHM. Calculate the position and velocity of a particle oscillating with a phase of ∏ radian.

21. (i) Show that $\mathbf{V_{AB}} = \mathbf{V_A} - \mathbf{V_B}$, where the symbols have their usual meaning

(ii) When a ball is thrown vertically upwards, draws its velocity- time curve and acceleration-time curve.

22. (i) Explain any two factor, which affect the speed of sound in a gas.

(ii) Discuss briefly about a harmonic progressive wave and standing wave.

Or

(i) What is meant by phase of a wave?

(ii) Prove that the oscillations performed by a simple pendulum are Simple harmonic in nature.

SECTION D

23. From village, an old person once come to Gurgaon to visit his son, who worked in a software company there and lived on the top floor apartment of a 35 storey building complex. One day, the old man and his grandson Sunil, who was doing a basic degree course in Physical science, visited a market and purchased a weighing machine. When they came to their building complex and entered in the lift , Sunil put the weighing machine on the floor of the lift and asked his grandfather to stand on it.The weight show by it was 48 Kg.

Then the lift started to move upward. The old man observed that weight shown by weighing machine increased to 72 Kg and after few seconds became 48 Kg again. Then the lift approached 35^{th} floor, the reading shown by weighing machine was only 16 Kg. When Sunil and his grandfather came out of the lift and entered their apartment, the old man again checked his weight by using the weighing machine. It was again 48 Kg. He was confused and said that the weighing is faulty and we must return it to the shopkeeper.

When Sunil came to know about this incident, he explained to his grandfather that there is no fault in the weighing machine and weight shown varied on account of the fact that motion of lift was sometime accelerated one, sometime with constant velocity and sometime with a retardation. His grandfather was then convinced.

(i) In which way did Sunil convinced his grandfather that there was no fault in machine. Explain the reason.

(ii) Determine the acceleration of lift when reading shown by weighing machine is (a) 72 Kg and (b) 16 Kg.

(iii) A man weighs 70 Kg as he stands on a weighing machine in a lift, which is moving upwards with uniform speed of 10 m/s .What would be the reading on the scale in this case?

(iv) Mention the values that were shown by Sunil.

SECTION E

24. Derive an expression for escape and orbital velocity of a satellite. Also establish a relation between two velocities.

Or

(i) Deduce a relation for the work done in a gravitational field. Using it, find the potential difference between a pair of points.

(ii) Express whether the gravitational force is conservative or non-conservative.

25. Define stationary waves, Write a note on (a) node and (B) antinodes.
Explain the term.
(i) transverse stationary waves.
(ii)longitudinal stationary waves.
Discuss the necessary condition for the formation of stationary waves.

Or

(i) What do you meant by energy of harmonic oscillator? Deduce an expression for the kinetic and potential energies of a simple harmonic oscillator.
Hence, prove that total energy is conserved in SHM.

(ii) Define simple harmonic motion. Give some examples.

26. (i)State the Newton's laws of motion and show the dependence of first and third law on the second law of motion.

(ii) State the law of conservation of momentum. Derive it for the n body system.

Or

(i)Define rolling friction. Discuss with the help of a suitable diagram. What is the cause of rolling friction?

(ii)Derive an expression for maximum safe speed of a vehicle on a banked circular track.

BHARATIYA VIDYA BHAVAN'S
V.M.PUBLIC SCHOOL, VADODARA
SA-II

CLASS : XI (SET-2)
SUBJECT : PHYSICS **MAX MARKS: 70**
DATE : 21/3/2016 **TIME: 3HOURS**

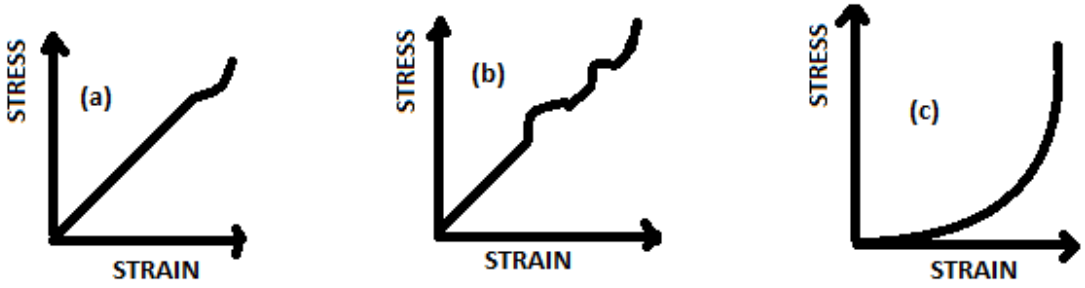
GENERAL INSTRUCTIONS:
1.Section A contains 5 questions each of 1M
2. Section B contains 5 questions each of 2M
3. Section C contains 12 questions each of 3M
4. Section D contains 1 question 4M
5. Section E contains 3 questions each of 5M

SECTION A

1.If an observer is standing on the earth, then the trees and houses appear stationary to him, but when he is sitting in a moving train, all these objects appear to move in the backward direction. Explain , why?

2.Why do we have different units for the same physical quantity?

3.Given below are the graphs of elastic materials. Mention which one of them corresponds to that of brittle material?



4. If a person jumps out of a boat on the bank of a river, the boat is pushed back in the river. Explain the reason for this statement.

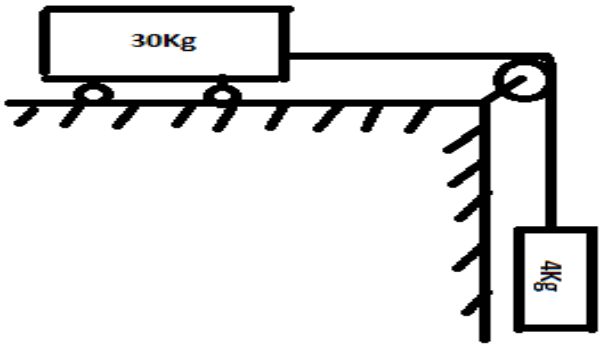
5.What is Young's modulus of elasticity?

SECTION B

6. The driver of a three wheeler with a speed of 36Km/h, sees a child standing in the middle of the road and brings the vehicle to rest in 4s just in time to save the child. What is the average retarding force on the vehicle? The mass of the three wheeler is 400Kg and the mass of the driver is 65Kg.

7.Define random errors. Mention the ways through which their effect can be eliminated.

8.Determine the acceleration of the block and trolley system as given in the figure. If the coefficient of kinetic friction between the trolley and surface is 0.04, find tension in the string.



9.Define adiabatic process and write an equation for the work done during such a process.

Or

Define isothermal process and write an equation for the work done during such a process.

10. State and prove Archimedes principle.

SECTION C

11.What is a projectile? Show that the path traced by it is parabolic.

12.Differentiate between vector and scalar quantity. Identify scalar quantities from the following: work, time, torque, angular momentum.

13.Define the term centre of mass of a body and derive an expression for it.

14. Write down the differential equation for simple harmonic motion. The time period of a simple pendulum is 2s and it can go from the equilibrium position to a maximum distance of 5cm during the beginning of the motion. The pendulum is in the position of maximum displacement towards the equilibrium position, write the displacement equation of the pendulum.

15.Why Cp is greater than Cv? Find values of Cp and Cv for a monoatomic gas.

16. Explain stress vs strain curve for a metallic wire.

17.Prove that the total energy of the stretched string remains conserved when it is released. Derive the expression for the maximum speed.

18. In changing the state of a gas adiabatically from an equilibrium state A to B, an amount of work equal to 22.3J is done on the system. If the gas is taken from state A to B via a process in which the net heat absorbed by the system is 9.35cal, how much is the net work done by the system in the latter case.(take 1 cal = 4.19J)

19.Derive the kinematic equations of motion.

20. Derive a relation between angular momentum and moment of inertia of a rigid body. Also, define the two terms.

21.State and explain Doppler effect.

22.i)What will be the conditions under which the distance and the displacement of moving object have the same magnitude?
ii)State whether a body subjected to a uniform acceleration always move in straight line?

Or

i)At highest point of its trajectory , the direction of motion of a projectile becomes horizontal. Give reason.
ii)Explain the reason why does a stone tied to the end of the string is whirled in a circle, if the string breaks, the stone flies away tangentially.

SECTION D

23.Adam was a good cricket player but since last few days, he was getting pain in his stomach. His parents took him to doctor who examined him and asked him to get an ultrasound done to detect the cause. Adam got scared and refused to go for it. His parents made him understand that the scanner uses ultrasonic rays which go inside and detect any problem inside the body. So, he got it done and the scanner showed a small tumour in his stomach that has to be operated as soon as possible. He was operated and he became fine again in a month's time.
i)State the conclusion that you extract from the above incident.
ii)What is the wavelength of sound in tissue, if the ultrasound scanner used the operating frequency of 4.2MHz and the speed of sound in tissues is 1.7Km/s
iii)On which principle does the ultrasound scanner work?
iv)What will be the values show here by Adam

SECTION E

24.i)Derive an equation showing that the acceleration due to gravity decreases with depth
ii)Derive an expression of the total energy of a satellite revolving around the earth's surface. Discuss the significance of negative sign in the expression.

Or

i)If a particle is projected vertically upwards from the earth's surface of radius R with a kinetic energy equal to half of the minimum value needed for it to escape. Determine the height to which it rises above the earth's surface.
ii)Derive an expression for the gravitational potential energy at a point in the gravitational field of the Earth.

25. With the help of a graph, briefly explain how the impulse of a force can be measured.
i)What is impulsive force? Give the practical uses from daily life which make use of the concept of impulse.
ii)Define : rolling friction, limiting friction
'An athlete runs some steps before taking a jump'- Explain why?

Or

i)Write the statement of law of conservation of linear momentum and derive its expression from Newton's second law of motion.
ii)Explain any three practical applications of law of conservation of linear momentum.

26.State and prove the Bernoulli's principle. If a fully loaded aircraft has mass 3.3×10^5Kg and its total wing area is $500m^2$, it is in level flight with a speed of 960Km/h then estimate the pressure difference across the upper and lower surfaces of the wings.

Or

Define surface tension. Calculate the excess pressure inside a liquid drop.