**SINDHI HIGH SCHOOL, HEBBAL**

**ANNUAL EXAMINATION-2024-25**

**PHYSICS (042)**

**SET I**

**Grade: XI Max. Marks:70**

**Date:10/02/25 Reading time: 8:30am-8:45am**

**No of sides: 5 Writing time: 8:45am- 11:45am**

**General Instructions:**

(1) There are 33 questions in all. All questions are compulsory.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and

Section E.

(3) All the sections are compulsory.

(4) **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of

1 mark each, **Section B** contains five questions of two marks each, **Section C** contains

seven questions of three marks each, **Section D** contains two case study based

questions(CBQ) of four marks each and **Section E** contains three long answer questions of

five marks each.

(5) There is no overall choice. However, an internal choice has been provided in one

question in Section B, one question in Section C, one question in each CBQ in Section D

and all three questions in Section E. You have to attempt only one of the choices in such

questions.

(6) Use of calculators is not allowed.

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| **SECTION A** | | |
| 1. | Which of the following pair does not have similar dimensions?  a) stress and pressure b) angle and strain  c) tension and surface tension c) Planck’s constant and angular momentum | **1** |
| 2. | If a freely falling body in the last second travels a distance travelled in the first three seconds, the time of its travel is  a) 3s b) 4s c) 5s d) 6s | **1** |
| 3. | Two particles having masses M and m are moving in a circular path having radii R and r respectively. If their periods are same, then the ratio of angular velocities will be.  a) r/R b) R/r c) 1 d) | **1** |
| 4. | A block of mass 0.1kg is held against a wall by applying a horizontal force of 5N on the block. If the coefficient of friction between the block and wall is 0.5, the magnitude of frictional force is  a) 0.98N b) 4.9N c) 2.5N d) 0.49N | **1** |
| 5. | A light string passes over a frictionless pulley. To one of ...A light string passes over a frictionless pulley. To one of its ends, a mass of 6kg is attached. To its other end, a mass of 10kg is attached. The tension in the string will be.  a) 24.5N b) 2.45N c) 79N d) 73.5N | **1** |
| 6. | A constant torque of 31.4Nm is exerted on a pivoted wheel. If the angular acceleration of the wheel is 4π rad/s2, then the moment of inertia of the wheel is  a) 3.5kgm2 b) 2.5kgm2 c) 4.5kgm2 d) 5.5kgm2 | **1** |
| 7. | What percent length of a wire will increase by applying a stress of 9.8N/mm2 on it?  Y= 1X1011N/m2.  a) 0.0078% b) 0.0088% c) 0.0098% d) 0.0067% | **1** |
| 8. | Water is filled in a flask upto a height of 20cm. The bottom of the flask is circular with radius 10cm. If atmospheric pressure is 1.013X105N/m2, what is the force exerted by water on the bottom? Take g=10ms-2 and density of water= 1000kg/m3.  a) 2754 N b) 3246 N c) 3102 N d) 1710 N | **1** |
| 9. | Two hail stones with radii in the ratio of 1:2 fall from a great height through the atmosphere. Then their terminal velocities are in the ratio of  a) 1:2 b) 2:1 c) 1:4 d) 4:1 | **1** |
| 10. | If the volume of a block of metal changes by 0.12% when it is heated through 200C ,the coefficient of linear expansion of the metal is  a) 2.0X 10-5 0C-1 b) 4.0X 10-5 0C-1  c) 3.2X 10-5 0C-1 d) 5.2X 10-5 0C-1 | **1** |
| 11. | Air 0.5m3 in volume is expanded three times at two atmospheric pressure. What will be the external work done?  a) 2X 10-5 J b) 5000J c) 500J d) 2X 105 J | **1** |
| 12. | Two sound waves have a phase difference of 600 have path difference of  a) b) 2λ c) d) | **1** |
| **For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.**  **a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.**  **b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.**  **c) If Assertion is true but Reason is false.**  **d) If both Assertion and Reason are false**  **e) If Assertion is false but Reason is true** | | |
| 13. | **Assertion (A):** Two masses in the ratio 1:2 are thrown vertically upwards with the same speed, reach the top simultaneously  **Reason (R):** Acceleration due to gravity is directly proportional to the mass of a body | **1** |
| 14. | **Assertion (A):** Circular motion is an example of variable acceleration and non uniform acceleration  **Reason (R):** The centripetal acceleration acts towards the centre of the circular path at every point. | **1** |
| 15. | **Assertion (A):** If masses are of equal magnitude, the centre of mass lies at the midpoint of the line joining them.  **Reason (R):** In a two body system, the centre of mass lies on the line joining them | **1** |
| 16. | **Assertion (A):** An open organ pipe of certain length has the same fundamental frequency as closed organ pipe of half the length  **Reason (R):**In case of an open organ pipe at both ends antinodes are formed, while in the closed organ pipe at one end antinodes and at the other end nodes are formed. | **1** |
| **SECTION B** | | |
| 17. | Each side of a cube is 7.203m. Calculate the surface area and volume of the cube upto the correct number of significant figures. | **2** |
| 18. | The graph between resisting force F acting on a body and distance covered by the body is shown. The mass of the body is 25kg and initial speed is 2m/s. What are the kinetic energies of the body at distances 2m and 5m?  **OR**  Draw the graph of equation Fs=-kx, where Fs is the spring force, x is the displacement of the block from the equilibrium position. Using the graph, show that maximum work done by the spring at xm is  W= | **2** |
| 19. | In a large lecture hall, a pendulum is to be made by suspending a 40kg ball from the end of a steel wire 15m long  i) What cross-sectional area should the wire have if the applied stress in it is to be only 10% of its breaking stress  ii) How far will the ball stretch the wire?  Tensile strength of steel= 0.48X109N/m2 and Y= 200X109N/m2 | **2** |
| 20. | The velocity of a body which has fallen freely under gravity varies as gphq, where g is the acceleration due to gravity at the place and h is the height through which the body has fallen. Determine the values of p and q. | **2** |
| 21. | Breaks are applied to a train travelling at 72km/h. After passing over 200m; its velocity is reduced to 36km/h. At the same rate of retardation, how much further will it go before it is brought to rest? | **2** |
| **SECTION C** | | |
| 22. | Section 11 – Rotational MotionEstablish the relation between linear velocity and angular velocity of a body executing the motion shown in the picture. Also explain the direction of linear velocity of the body. | **3** |
| 23. | Establish the relation between torque and angular acceleration. Hence define moment of inertia. | **3** |
| 24. | An iron rod of length 50cm is joined at an end to an aluminium rod of length 100cm. All measurements refer to 200C. Find the length of the composite rod at 1000C and its average coefficient of linear expansion. The coefficient of linear expansion of iron and aluminium are 12X10-6/0C and 24X10-6/0C respectively. | **3** |
| 25. | A block of wood of mass 3kg is resting on the surface of a rough inclined plane, inclined at an angle θ as shown in the figure.  a) Name the forces (1,2,3)  b) If the coefficient of static friction is 0.2, calculate the value of all the three forces. (g=10ms-2) | **3** |
| 26 | State Stoke’s law. Derive an expression for the terminal velocity of a sphere falling through a viscous fluid. | **3** |
| 27. | What are the essential conditions for an ideal gas to undergo adiabatic process? Show analytically that the work done by one mole of an ideal gas during adiabatic expansion from temperature T1 to T2 is given by  W=  **OR**  In the given figure, an ideal gas changes its state from state A to state C by two paths ABC and AC.  (i) Find the path along which work done is less  (ii) The internal energy of gas A is 10J and amount of heat supplied to change its state to C through the path AC is 200J. Calculate the internal energy at C.  (iii) The internal energy of a gas at state B is 20J. Find the amount of heat supplied to the gas to go from A to B. | **3** |
| 28. | Discuss the various modes of vibration in a closed end pipe .Also, show that in a closed end pipe only odd harmonics are present. | **3** |
| **SECTION D** | | |
|  | **Case study** | |
| 29. | **Projectile motion**.  Projectile motion is a special case of two-dimensional motion. A particle moving in a vertical plane with an initial velocity and experiencing a free-fall (downward) acceleration, displays projectile motion. Some examples of projectile motion are the motion of a ball after being hit/thrown, the motion of a bullet after being fired and the motion of a person jumping off a diving board. For now, we will assume that the air, or any other fluid through which the object is moving, does not have any effect on the motion. In reality, depending on the object, air can play a very significant role. For example, by taking advantage of air resistance, a parachute can allow a person to land safely after jumping off an airplane.  i) Two projectiles are projected with the same velocity. If one is projected at an angle of 300 and the other at 600 to the horizontal, then the ratio of maximum height reached is  a) 3:1 b) 1:3 c) 1:2 d) 2:1  ii) A body is projected horizontally with a velocity of 4 m/s. The velocity of the body after 0.2 second (g=10m/s2) will be nearly  a) 10m/s b) 9m/s c) 19m/s d) 11m/s  iii) At the uppermost point of a projectile, its velocity and acceleration are at an angle of  a) 00  b) 450 c)900 d) 1800  iv) The velocity of a projectile at the initial point A is (2 + 3 ) m/s. Its velocity in m/s at point B is  a) (-2 - 3 ) b) (-2 + 3 )  c) (2 - 3 ) d) (2 + 3 )  **OR**  A particle A is dropped from a height and another particle B is projected in horizontal direction with speed of 5 m/s from the same height. The correct statement is?  a) Particle A will reach at ground first with respect is particle B  b) Particle B will reach at ground first with respect to particle A  c) Both particles will reach at ground simultaneously  d) Both particles will reach at ground with same speed | **4** |
| 30. | **Kinetic Theory of Gases**  The kinetic theory of gases describes a gas as a large number of small particles (atoms or molecules), all of which are in constant, random motion. The rapidly moving particles constantly collide with each other and with the walls of the container. Kinetic theory explains macroscopic properties of gases, such as pressure, temperature, viscosity, thermal conductivity and volume, by considering their molecular composition and motion. The theory postulates that gas pressure is due to the impact of molecules or atoms moving at different velocities on the walls of a container.  i) 3 mole of hydrogen is mixed with 1 mole of neon. The molar specific heat at constant pressure is  a) b) c) d)  Physics Question Imageii) Pressure versus temperature graph of an ideal gas is shown in the figure. Density of gas at point A is ρ0 . Density at point B will be.  a) ¾ ρ0 b) 3/2 ρ0  c) 4/3 ρ0 d) 2 ρ0  iii) In a vessel, the gas is at a pressure P. If the mass of all the molecules is halved and their speed is doubled, then their resultant pressure will be  a) 4P b) 2P c)P d) P/2  iv) Average velocity of gas becomes 4 times, then what will be the change in temperature?  a) 1.4times b) 4 times c) 3times d) 2times  **OR**  An absolute zero is the temperature at which  a) efficiency of engines become infinity b) all liquids freeze  c) molecular motion ceases d) liquid changes its state. | **4** |
| **SECTION E** | | |
| 31. | a) Define escape velocity. Obtain an expression for the escape speed of a body from the surface of the earth.  b) The escape velocity of a projectile on the earth’s surface is 11.2km/s. A body is projected out with thrice its speed. What is the speed of the body far away from the earth? Ignore the presence of the sun and the other planets.  **OR**  a) Derive an expression for the total energy of a satellite orbiting the earth. What is the significance of negative total energy?  b) A 400kg satellite is in a circular orbit of radius 2RE about the earth. How much energy is required to transfer it to a circular orbit of radius 4RE? What are the changes in its kinetic and potential energies? | **5** |
| 32. | a) Prove work-energy theorem for a variable force.  b) A locomotive of mass m starts moving so that its velocity varies according to the law v=α, where α is constant and s is the distance covered. Find the total work done by all the forces acting on the locomotive during first 1 second after the beginning of the motion.  **OR**  a) Derive an expression for the kinetic energy of a body calculus method. Deduce its relation with linear momentum  b) Two identical 5kg blocks are moving with same speed 2 m/s towards each other along a frictionless horizontal surface. The two blocks collide, stick together and come to rest. Consider the two blocks as a system. Calculate work done by (i) external forces and  (ii) internal forces. | **5** |
| 33. | a) In SHM of a particle, draw graphs showing the variation in (i) displacement, (ii) velocity and (iii) acceleration with time. Hence discuss the phase relationship between  them using proper equations  b) If the following functions represents SHM of a particle, find the amplitude of oscillation,  f(t) = (sinωt - cosωt) unit  **OR**  a) Show that when a body is suspended from a spring and is pulled down a little and released, at executes SHM. Also find the expression for it's time period. Does it depend on acceleration due to gravity?  b) A mass M is suspended from a spring of negligible mass. The spring is pulled a little and released so that it executes SHM of time period T. If the mass is increased by m, the time period becomes 5T/3. What is the ratio m/M? | **5** |