**SINDHI HIGH SCHOOL, HEBBAL**

**ANNUAL EXAMINATION-2024-25**

**PHYSICS (042)**

**SET II**

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

**Date: 10/02/24 Reading time: 8:30am-8:45am**

**No of sides:6 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) energy and torque  b) force and impulse  c) angular momentum and Planck’s constant  d) elastic modulus and pressure | **1** |
| 2. | A body dropped from a height h strikes the ground with a velocity of 3m/s. Another body of the same mass is dropped from the same height h with an initial velocity of 4m/s. Final velocity of the second mass with which it strikes the ground will be.  a) 3m/s b) 4m/s c) 8m/s d) 5m/s | **1** |
| 3. | The angular velocity of the seconds hand in a watch is  a) 0.053 rad/s b) 0.210 rad/s c) 0.105 rad/s d) 0.42 rad/s | **1** |
| 4. | A body of mass 100g is sliding from an inclined plane of inclination 300. What is the frictional force experienced if µ=1.7?  a) 1.7X X N b) 1.7X X N  c) 1.7X N d) 1.7X X N | **1** |
| 5. | A mass M of 100kg is suspended by strings A, B and C as shown in the figure, where W is vertical wall and R is a rigid horizontal rod. The tension in string B is  a) 100gN b) 0  c) 100 g N d) g N | **1** |
| 6. | The moment of inertia of a regular circular disc of mass 0.4kg and radius 100cm about an axis perpendicular to the plane of the disc and passing through its centre is  a) 0.2kgm2  b) 0.02kgm2 c) 2kgm2 d) 0.002kgm2 | **1** |
| 7. | A wire of length L and radius r is rigidly fixed at one end. On stretching the other end of the wire with a force F, the increase in length is l. If another wire of the same material but of length 2L and radius 2r is stretched with a force 2F, the increase in length is  a) l /4 b) l /2 c) l d) 2l | **1** |
| 8. | At what depth below the surface of water will the pressure be equal to two atmospheres? Take atmospheric pressure= 1000kg/m3 and g=9.8ms-2  a) 11.3m b) 9.4m c) 13.6m d) 10.2m | **1** |
| 9. | A metallic sphere of mass m falls through glycerine with terminal velocity v. if we drop a sphere of mass 8m of the same material into a column of glycerine, the terminal velocity of this sphere will be  a) 2v b) 4v c) 8v d) 16v | **1** |
| 10. | A sheet of brass is 50cm long and 10cm broad at 00C. The area of the surfaces increases by 1.9cm2 at 1000C. The coefficient of linear expansion of brass is  a) 1.9 X 10-5/0C b) 1.4 X 10-4/0C  c) 2.8 X 10-3/0C d) 4.0 X 10-4/0C | **1** |
| 11. | During adiabatic expansion of 2 moles of a gas, the internal energy of the gas is found to decrease by 2J. The work done by the gas during the process is  a) -2J b) -1J c) 2J d) 1J | **1** |
| 12. | If the tension and diameter of a sonometer wire of fundamental frequency n are doubled and density is halved, then its fundamental frequency will become  a) n/4 b) n c) n d) n/ | **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):** The position- time graph in uniformly accelerated motion is a parabola  **Reason (R):** An object can have non-zero acceleration while maintaining constant speed. | **1** |
| 14. | **Assertion (A):** When projectiles have the same velocity of projection, the maximum heights at angle θ and (900- θ) are in the ratio tan2 θ: 1  **Reason (R):** The range is same for angles of projection θ and (900- θ) for same velocity of projection. | **1** |
| 15. | **Assertion (A):** In the absence of external force no change in velocity of the centre of mass occur.  **Reason (R):** When all internal forces cancel each other only effect of external force is there. | **1** |
| 16. | **Assertion (A):** An open pipe can make a better musical instrument as compared to a closed pipe.  **Reason (R):** An open pipe can produce all harmonics while a closed pipe can produce odd harmonics. | **1** |
| **SECTION B** | | |
| 17. | The length, breadth and thickness of a rectangular sheet of metal are 4.234m, 1.005m and 2.01 cm respectively. Give the area and volume of the sheet to correct significant figures. | **2** |
| 18. | The displacement x of a particle moving in one dimension under the action of a constant force is related to time by the equation t= +3, where x is in meter and t is in second.  i) Find the displacement of the particle when the velocity is zero  ii) Find the work done by the force in the first 6 second.  **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. | A steel wire 8m long and 4mm in diameter is fixed to two rigid supports. Calculate the increase in tension when the temperature falls by100C. Given α=12X10-6/0C;  Y= 2 X1011N/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. | A stone after falling freely under the influence of gravity for 1 second strikes a glass plane held horizontally. In breaking through the glass pane, the stone loses half the velocity. How far will it travel in the next 2 seconds? | **2** |
| **SECTION C** | | |
| 22. | Observe the given picture. Deduce the expression for magnitude and direction of the resultant R. | **3** |
| 23. | Show that the moment of inertia of a body about the given axis of rotation is equal to twice the kinetic energy of rotation of the body rotating with unit angular velocity. | **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 truck of mass 1000kg is pulling a trailer of mass 2000kg as shown. The retarding (frictional) force on the truck is 500N and that on the trailer is 1000N. The truck engine exerts a force of 6000 N. Calculate i) Acceleration of the truck and the trailer. ii) The tension in the connecting rope. | **3** |
| 26 | A fluid is in streamline flow through a pipe of non-uniform cross section. Prove the sum of its kinetic energy, pressure energy and potential energy per unit volume remains constant. | **3** |
| 27. | (i) What are the essential conditions for an ideal gas to undergo isothermal process? Show analytically that the work done by one mole of an ideal gas during isothermal expansion from volume V1 to V2 is given by  W= RT loge  (ii) What is the change in the internal energy of the gas, which is compressed isothermally?  **OR**  As a result of isobaric heating by = 72K, one mole of a certain ideal gas obtains an amount of heat Q= 1.60kJ. Find (i) work done by the gas (ii) increment in its internal energy and (iii) the value of | **3** |
| 28. | Discuss the various modes of vibration in an open end pipe. Also, show that in an open ended pipe all the 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 of same mass have their maximum kinetic energies in ratio 4:1 and ratio of their maximum heights is also 4:1, then what is the ratio of their ranges?  a) 2:1 b) 4:1 c) 8:1 d) 16:1  ii) Which of the following is constant in a projectile motion?  a) Horizontal component of the velocity b) Vertical component of velocity  c) Velocity of projection d) All of these  iii) The maximum range of a gun on horizontal terrain is 16km. If g=10m/s2, the range of the missile is  a) 40m b) 50m c) 60m d) 20m  **OR**  A man throws balls with the same speed vertically upwards one after the other at an interval of 2s. What should be the speed of the throw so that more than two balls are in the sky at any time? (given g=9.8m/s2)  a) more than 19.6m/s b) atleast 9.8m/s  c) any speed less than 19.6m/s d) only with speed 19.6m/s    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 ) | **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) Root mean square speed of the molecules of an ideal gas is v. If pressure is increased two times at constant temperature, then the rms speed will become  a) v/2 b) v c) 2v d) 4v  ii) The average kinetic energy of a gas molecule at 270C is 6.27X 10-21J. The average kinetic energy of a gas molecule at 2270C will be  a) 52.2 X 10-21J b) 5. 22 X 10-21J c) 10.35 X 10-21J d) 11.35 X 10-21J  iii) vrms , vav and vmp are root mean square speed, average speed and most probable speed of molecules of a gas obeying Maxwellian velocity distribution. Which of the following statements is correct?  a) v rms < vav < v mp b) v rms > vav > v mp  c) v mp < v rms < vav d) vmp > v rms > vav  iv) The heat required to increase the temperature of 4 moles of a monoatomic ideal gas from 273K to 473K at constant volume is  a) 200R b) 400R c) 800R d) 1200R  **OR**  A closed vessel explodes at 15atm pressure if temperature of the vessel is 300K. At 10 atm pressure, the vessel will explode at a temperature  a) 250K b) 420K c) 200K d) 450K | **4** |
| **SECTION E** | | |
| 31. | a) Define the term orbital speed. Establish a relation for orbital speed of a satellite orbiting very close to the earth’s surface. Find the ratio of this orbital speed to the escape speed.  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) Deduce the expression for g at a depth d from the surface of the earth?  b) Draw a graph showing the variation of g with distance from the centre of the earth  c) If a body is taken 16km below the surface of the earth what will be the percentage change in the weight of the body? Radius of the earth=6400km. | **5** |
| 32. | a) Deduce an expression for change in kinetic energy for a perfectly inelastic collision  b) A particle of mass 1g moving with a velocity = 3 -2 experiences a perfectly elastic collision with another particle of mass 2kg and velocity = 4 -6. Find the velocity of the particle formed (both and v). and are in SI units.  **OR**  a) Derive an expression for the kinetic energy of a body by calculus method. Deduce its relation with linear momentum.  b) Two identical 5kg blocks are moving with the same speed 2m/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) Derive expressions for the kinetic and potential energies of a harmonic oscillator. Hence show the total energy is conserved in SHM.  b) The amplitude of a simple harmonic oscillator is doubled, how does it affect (i) time period (ii) total energy (iii) maximum velocity of the oscillator?  **OR**  a) Show that for small oscillations, the motion of a simple pendulum is simple harmonic. Derive an expression for its time period. Does the time period depend on the mass of the bob?  b) A simple pendulum has time period T1. The point of suspension is now moved upwards according to the relation y=Kt2 (K=1ms-2) where y is the vertical displacement. The time period now becomes T2. What is the ratio ? Given g=10ms-2 | **5** |