

Time : 03 hrs.

MM = 70

General instructions :

- [1] All questions are compulsory. There are 37 questions in all.
  - [2] This question paper has four sections : Section-A, Section –B, Section –C and Section- D.
  - [3] Section – A contains 20 questions of one mark, section – B contains 7 questions of two marks , section – C contains 7 questions of three marks, section –D contains 3 questions of five marks each .
  - [4] There is no overall choice. However an internal choice has been provided in one question of one mark , in one question of two mark , in one question of three mark and in all three questions of five marks. You have to attempt only one of the choices in such questions.
  - [5] Use of calculator is not permitted .
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Section –A

- Q-1 What is the angle between two vectors if the ratio of their dot product and magnitude of cross product is  $\sqrt{3}$  ?  
[a]  $30^\circ$                       [b]  $90^\circ$                       [c]  $0^\circ$                       [d]  $45^\circ$
- Q-2 The Kinetic energy of a body of mass 2 Kg and having momentum of 2 Newton – sec will be  
[a] 1 Joule                      [b] 2 Joule                      [c] 3 Joule                      [d] 4 Joule
- Q-3 The escape velocity of a 10 gm object from the surface of earth is 11.2 Km/sec. the escape velocity of 10 Kg of an iron ball from the earth will be  
[a] 0.0112 km/sec      [b] 0.112 Km/sec      [c] 11.2 km/sec      [d] 0.56 Km/sec
- Q-4 At what Temperature , the Centigrade and Fahrenheit Scales are equal ?  
[a]  $40^\circ$                       [b]  $- 40^\circ$                       [c]  $37^\circ$                       [d]  $- 80^\circ$
- Q-5 The First Law of thermodynamics confirms the law of  
[a] Conservation of momentum                      [b] conservation of energy  
[c] conservation of Temperature                      [d] conservation of charge
- Q-6 The phase difference between Velocity and displacement at any Instant of a particle executing Simple Harmonic Motion is  
[a] zero                      [b]  $\pi/ 2$                       [c]  $\pi$                       [d]  $2\pi$
- Q-7 The ratio of nodes and Antinodes Points in a closed Organ pipe is  
[a] 1 : 1                      [b] 1 : 2                      [c] 1 : 3                      [d] 1 : 4
- Q-8 Which one of the following is not a unit of Young ' s Modulus ?  
[a] N /m                      [b] N/ m<sup>2</sup>                      [c] dyne / cm<sup>2</sup>                      [d] pascal

- Q-9 Doppler ' s Effect in sound takes place when sound source and Listener are  
 [a] stationary [b] in relative motion  
 [c ] moving with same velocity in same direction [d]None of these
- Q-10 An aeroplane gets its upward lift due to a Phenomenon described by the  
 [a] Archimede's Principle [b] Bernoulli 's Principle  
 [c] Principle of superposition [d] Pascal 's Law
- Q-11 Bernoulli 's equation is a consequence of law conservation of \_\_\_\_\_ .
- Q-12 There is no exchange of heat energy between system and surrounding during \_\_\_\_\_ process .
- Q-13 The angle of projection should be \_\_\_\_\_ for attaining maximum horizontal range.
- Q-14 A Force is conservative if \_\_\_\_\_ by the force in moving the particle around any closed path is \_\_\_\_\_ .
- Q-15 A Geostationary satellite revolve at a height of nearly \_\_\_\_\_ Km with time period of revolution \_\_\_\_\_ hours .
- Q-16 Mention two important properties of a medium for propagation of Mechanical wave .
- Q-17 State zeroth Law of Thermodynamics using a labeled diagram .
- Q-18 Find the coefficient of linear Expansion of Iron if the value of coefficient of cubical Expansion is  $6.0 \times 10^{-5} /^{\circ}\text{C}$
- Q-19 A girl is swinging in the sitting position. How will the time-period of the swing change if she stand up ?
- Q-20 Calculate the effective Length of Second's Pendulum?

**OR**

What will be the effect on Horizontal Range of a Projectile when its initial velocity is doubled, keeping the angle of projection same?

**SECTION-B [Each of two marks]**

- Q-21 What do you mean by Beats formation. If two sound sources produce 12 beats in 4 seconds , by how much do their frequencies differs ?
- Q-22 Railway lines are laid with gaps to allow for expansion. If the gap between steel rails 66 mtr long be 3.63 cm at  $10^{\circ}\text{C}$ , then at what temperature will the lines just touch?  
 (Given that coefficient of linear expansion of steel =  $11 \times 10^{-6} \text{ }^{\circ}\text{C}^{-1}$ )
- Q-23 What are Transverse and Longitudinal waves? Give two examples for each.
- Q-24 A race car accelerates on a straight road from rest to a speed of 180 Km/hour in 25 seconds. Assuming uniform acceleration of the car throughout, Find the distance covered in this time ?

- Q-25 State second Law of Thermodynamics, Draw the block diagram for heat Engine and write expression for its efficiency.
- Q-26 Two trains 120 Meter and 80 meter long are running in opposite direction with velocity 42 Km/hr and 30 km/hr. Find the relative velocity and in what time they will completely cross each other?
- Q-27 What do you mean by resonance Phenomenon, mention one example from observation in daily life.

**OR**

How far does the sound travels in air when a tuning fork of frequency 256 Hz. Makes 64 vibrations ? [ velocity of sound in air = 320 m/sec. ]

**SECTION –C [ each of three marks ]**

- Q-28 State principle of superposition. Mathematically prove that whenever two plane progressive waves superimposing each other then affected particle of medium also vibrates Simple harmonically.
- Q -29 What do you mean by Doppler 's Effect. Obtain expression for Apparent frequency when sound source is moving towards a stationary Listener .
- Q- 30 In the given P-V diagram for a thermodynamics system.
- (a) Name the process along AB,BC and CA .
- (b) Find the work-done along AB,BC and CA .
- (c) Total work done by system in one cycle .
- Q-31 Obtain the Expression for excess pressure in liquid drop in terms of Surface tension and radius of liquid drop using labeled diagram.
- Q -32 State Parallelogram law of vector addition and using vector diagram obtain general expression for magnitude and direction of resultant vector of co-initial vectors P and Q inclined at angle  $\theta$ .
- Q -33 State law of conservation of energy. How high must a body be lifted to gain an amount of potential energy equal to the kinetic energy it has when moving at speed 20 m/sec ?
- ( take value of  $g = 9.8 \text{ m/sec}^2$  )
- Q-34 State conditions for Simple Harmonic Motion (S.H.M.), and derive formula for time – period of oscillation for a simple pendulum of effective length L.

**OR**

Two vectors given by  $A = 2i + j + k$  and  $B = i - j + 2k$  , find the value of

- [a]  $A \cdot B$                       [b]  $A \times B$                       [c] unit vector perpendicular to both A and B.

**SECTION – D [ each of five marks ]**

Q-35 [a] Define two specific heats of gas. Using P-V diagram, derive a relation between specific heats of gas.

[b] An electric heater supplies heat to a system at a rate of 100 watt, if the system perform work at a rate of 75 joules per second. Calculate at what rate is the internal energy increasing?

**OR**

[a] Derive expression for variation of acceleration due to gravity ( $g$ ) with depth from the surface of Earth using labeled diagram .

[b] At what height above the earth's surface, the value of ' $g$ ' is same as in a mine 80 km deep?

Q- 36 [a] Derive an formula for the height of liquid in a capillary tube (Ascent-formula) using suitable labeled diagram.

[b] A U – shaped wire is dipped in a soap solution and removed. The soap film formed between the wire and light slider supports a weight of  $1.5 \times 10^{-2}$  Newton. The length of slider is 30 cm . Calculate the surface tension of the soap solution?

**OR**

[a] Derive Terminal velocity of a spherical object in a viscous medium and expression for it using a labeled diagram .

[b] Water flows through a horizontal pipe whose internal diameter is 2 cm at a speed of 1 m/sec. What should be the diameter of the nozzle if the water is to emerge at a speed of 4 m/sec?

Q -37 [a] Obtain expression for Kinetic energy, potential energy and total Mechanical energy of a body executing simple harmonic motion .

[b] A bob of simple pendulum of mass 1 gm is oscillating with a frequency 5 vibration per second and its Amplitude is 3 cm. Find the Kinetic energy of the bob in the lowest position.

**OR**

[a] Define stationary waves, mathematically show that only odd harmonics are present in a closed organ pipe using labeled diagram.

[b] What would be minimum length of an open organ pipe for producing a fundamental tone of 110 hertz? (Given that speed of sound is 330 m /sec.)

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