

PHYSICS

GROUP : FIRST

DGK-91-21

OBJECTIVE

TIME: 20 MINUTES

MARKS: 17

NOTE: You have four choices for each objective type question as A , B , C and D . The choice which you think is correct , fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

QUESTION NO. 1

- 1 Acceleration of a pendulum of length $\ell = 1$ m and displacement of 5 cm having S.H.M is
(A) 0.29 m/s^2 (B) 0.19 m/s^2 (C) 0.69 m/s^2 (D) 0.49 m/s^2
- 2 If radius of droplet becomes half then its terminal velocity will be
(A) One fourth (B) Four times (C) Half (D) Double
- 3 When both ends of organ pipe are open then the frequency of stationary waves of nth harmonic is given by
(A) $f_n = \frac{nv}{4\ell}$ (B) $f_n = \frac{v}{2n\ell}$ (C) $f_n = \frac{nv}{2\ell}$ (D) $f_n = \frac{2v}{n\ell}$
- 4 The value of constant γ for the mono-atomic gas is
(A) 1.67 (B) 1.40 (C) 1.29 (D) 2.45
- 5 In youngs double slit experiment the position of bright fringe is given by
(A) $y = \frac{m\lambda d}{L}$ (B) $y = \frac{mLd}{\lambda}$ (C) $y = \frac{m\lambda}{Ld}$ (D) $y = \frac{m\lambda L}{d}$
- 6 In Michelson method time taken by the rotational mirror to rotate through an angle $\frac{2\pi}{8}$ (If f is the frequency of rotation) is
(A) $\frac{1}{4f}$ (B) $\frac{1}{2f}$ (C) $\frac{1}{8f}$ (D) $\frac{1}{6f}$
- 7 Sadi Carnot described an ideal engine in
(A) 1640 (B) 1740 (C) 1940 (D) 1840
- 8 A system does 600 J of work and at the same time internal energy increases by 320 J , The heat supplied is
(A) 200 J (B) 600 J (C) 280 J (D) 920 J
- 9 The dimensions of volume flow rate of a fluid are
(A) $[LT^{-1}]$ (B) $[L^2T^{-2}]$ (C) $[L^3T^{-1}]$ (D) $[L^3T^{-2}]$
- 10 Time taken by light to travel from sun to earth is
(A) 8 min 20 s (B) 1 min 20 s (C) 5 h 20 s (D) 4 h 20 s
- 11 At what angle Dot product and Cross product have the same magnitude
(A) 0° (B) 45° (C) 30° (D) 60°
- 12 Magnitude of cross product of two perpendicular vectors is
(A) $\vec{A} \cdot \vec{B}$ (B) $AB \hat{n}$ (C) 0 (D) AB
- 13 A 1500 kg has its velocity reduced from 20 ms^{-1} to 15 ms^{-1} in 3.0 sec. How large was the retarding force ?
(A) 500 N (B) 2500 N (C) 1500 N (D) 1000 N
- 14 When a massive body of mass m_1 collides with lighter stationary body of mass m_2 , the velocity of massive body after collision will be
(A) $V_1' = 2V_1$ (B) $V_2' = V_1$ (C) $V_1' = V_1$ (D) $V_2' = 2V_2$
- 15 Which one of the following is conservative force
(A) Electric force (B) Air resistance (C) Frictional force (D) Tension in string
- 16 A hoop is rolled down on an inclined plane having height of 10 m. Its velocity at the bottom will be
(A) 4.91 m/sec (B) 9.89 m/sec (C) 28.31 m/sec (D) 31.31 m/sec
- 17 Apparent weight of an object in a lift moving down with acceleration $a = g$ is
(A) $T = w + ma$ (B) $T = 0$ (C) $T = w$ (D) $T = \text{Infinity}$

QUESTION NO. 2 Write short answers of any Eight (8) parts of the following

16

- (1) Show that the expression $V_f = V_i + at$ is dimensionally correct. Where V_i is the velocity at $t = 0$, a is acceleration and V_f is the velocity at time t
- (2) What are the rules for assessment of uncertainty in case of a power factor ?
- (3) Three students measured the length of a needle with a scale on which minimum divisions is 1 mm and recorded as (i) 0.2145 (ii) 0.21 m (iii) 0.214 m. which record is correct and why ?
- (4) Write the dimensions of (i) Force (ii) Velocity
- (5) The vector sum of three vectors give a zero resultant. What can be the orientation of the vectors ?
- (6) Define torque. Write its unit (7) What is the unit vector in the direction of the vector $\vec{A} = 4\hat{i} + 3\hat{j}$
- (8) Does a moving object have impulse ? (9) Explain the difference between elastic and inelastic collision.
- (10) What is the effect on the speed of a fighter plane chasing another when it open fire ? What happen to the speed of pursued plane when it returns the fire ?
- (11) Define an Isolated system. Give example
- (12) Two row boats moving parallel in the same direction are pulled towards each other. Explain

QUESTION NO. 3 Write short answers of any Eight (8) parts of the following

16

- (1) Explain what do you understand the work done by Gravitational field ?
- (2) An object has one joule of potential energy. Explain what does its mean ?
- (3) When a rocket re-enters the atmosphere, its nose cone become very hot. Where does heat energy come from ?
- (4) Define the terms (a) Rotational Kinetic Energy (b) Orbital velocity
- (5) State the direction of the following vectors in simple situation ; angular velocity and angular momentum
- (6) Why does a diver change his body positions before and after diving in the pool ?
- (7) What should be the length of a simple pendulum whose period is 1.0 second at a place where $g = 9.8 \text{ ms}^{-2}$?
- (8) Under what conditions does the addition of two simple harmonic motions produce a result, which is also simple harmonic ?
- (9) Describe two common phenomena in which resonance plays important role
- (10) What features do transverse periodic waves have common with longitudinal periodic waves ?
- (11) What is the effect of density on the speed of sound ? Explain
- (12) What happen when a jet plane like Concorde flies faster than the speed of sound ?

QUESTION NO. 4 Write short answers of any Six (6) parts of the following

12

- (1) Can visible light produce interference fringes ? Explain
- (2) Explain whether the Young's experiment is an experiment for studying interference or diffraction effect of light
- (3) Why the centre of the Newton's ring is dark ?
- (4) How convex lens is used as a magnifier ? What limits the magnification of an optical instrument ?
- (5) If a person was looking through a telescope at the full moon, how would the appearance of the moon be changed by covering half of the objective lens ?
- (6) Specific heat of a gas at constant pressure is greater than specific heat at constant volume. Why ?
- (7) What is meant by irreversible process ? Give its example
- (8) Calculate the work done during isothermal process ?
- (9) Draw PV-diagram which show four steps of Carnot engine

SECTION-II

Note: Attempt any Three questions from this section

8 x 3 = 24

- Q.5 (A) What is projectile motion ? Derive expressions for its height and range ? 5
(B) Find the projection of $\vec{A} = 2\hat{i} - 8\hat{j} + \hat{k}$ in the direction of the vector $\vec{B} = 3\hat{i} - 4\hat{j} - 12\hat{k}$ 3
- Q.6 (A) What is the effect of temperature on speed of sound ? Show that $v_t = v_o + 0.61 t$ 5
(B) How large a force is required to accelerate an electron ($m = 9.1 \times 10^{-31} \text{ kg}$) from rest to a speed of $2 \times 10^7 \text{ ms}^{-1}$ through a distance of 10 cm. 3
- Q.7 (A) Derive Bernoulli's equation for a non-viscous, incompressible fluid which flows in a steady state manner 5
(B) A 1000 kg car traveling with a speed of 144 km h^{-1} rounds a curve of radius 100 m. Find the necessary centripetal force 3
- Q.8 (A) Prove Law of Conservation of energy in SHM in mass spring system 5
(B) Estimate the average speed of Nitrogen molecules in air under standard conditions of pressure and temperature. 3
- Q.9 (A) Define diffraction of light. Describe it through a diffraction grating to derive diffraction equation to determine wavelength of light. 5
(B) An astronomical telescope having magnifying power 5.0 consists of two thin lenses 24 cm apart. Find focal lengths of the lenses 3

PHYSICS
GROUP : SECONDDGK-52-21
OBJECTIVETIME: 20 MINUTES
MARKS: 17

NOTE: You have four choices for each objective type question as A , B , C and D . The choice which you think is correct , fill that circle in front of that question number. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero mark in that question.

QUESTION NO. 1

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|----|---|
| 1 | When droplet of water has terminal velocity the acceleration is
(A) Maximum (B) Minimum (C) Zero (D) Constant |
| 2 | If the mass of the bob of a pendulum is doubled then its time period is
(A) Halved (B) Doubled (C) Four times (D) Unchanged |
| 3 | Speed of sound in lead at 20 °C is
(A) 1320 m/s (B) 1330 m/s (C) 1340 m/s (D) 1350 m/s |
| 4 | It becomes difficult to recognize the beats when the difference between the frequencies of two sounds more than about
(A) 8 Hz (B) 10 Hz (C) 12 Hz (D) 6 Hz |
| 5 | In Michelson interferometer by moving the mirror through a distance of $\lambda/4$, the path difference changed by
(A) $\lambda/4$ (B) $\lambda/2$ (C) $\frac{3}{4}\lambda$ (D) λ |
| 6 | The unit of magnifying power of a lens are
(A) Watt (B) Joule (C) No unit (D) N - m |
| 7 | The value of Boltzmann constant k is
(A) $1.38 \times 10^{-23} \text{ J K}^{-1}$ (B) $1.38 \times 10^{-25} \text{ J K}^{-1}$ (C) $1.38 \times 10^{-27} \text{ J K}^{-1}$ (D) $1.38 \times 10^{-29} \text{ J K}^{-1}$ |
| 8 | If one mole of an ideal gas is heated at constant volume then
(A) $Q_p = C_v \Delta T$ (B) $W = C_v \Delta T$ (C) $Q_v = C_p \Delta T$ (D) $\Delta U = C_v \Delta T$ |
| 9 | In order to reduce the uncertainty in finding time period of a vibrating body, it is advised to count
(A) Small number of swings (B) Large number of swings (C) Infinite number of swings
(D) Both A and C |
| 10 | The dimensions of Einstein equation are $E = mc^2$
(A) $[MLT^{-2}]$ (B) $[ML^{-1}T^2]$ (C) $[ML^2T^{-2}]$ (D) $[ML^{-2}T^2]$ |
| 11 | The magnitude of a vector $\vec{v} = 3\hat{i} + 6\hat{j} + 2\hat{k}$
(A) 3 (B) 6 (C) 7 (D) 8 |
| 12 | When line of action of applied force passes through the axis of rotation , then the torque is
(A) Zero (B) 1 (C) Maximum (D) Minimum |
| 13 | If a force of 20 N acts on a body for 5 seconds then the change in momentum will be
(A) 5 NS (B) 20 NS (C) 50 NS (D) 100 NS |
| 14 | A typical rocket eject the burn gases at speed of over
(A) 400 m/s (B) 4000 m/s (C) 8000 m/s (D) 10,000 m/s |
| 15 | Which one the following is non-conservative force
(A) Gravitational force (B) Electric force (C) Elastic spring force (D) Frictional force |
| 16 | One radian is equal to
(A) 57.2° (B) 57.3° (C) 57.4° (D) 57.7° |
| 17 | The moment of inertia of solid disc or cylinder is
(A) mr^2 (B) $\frac{1}{2} mr^2$ (C) $\frac{1}{4} mr^2$ (D) $\frac{1}{2} m^2r$ |

QUESTION NO. 2 Write short answers of any Eight (8) parts of the following 16

- (1) Three students measured the length of a needle with a scale on which minimum divisions is 1 mm and recorded as (i) 0.2145 m (ii) 0.21 m (iii) 0.214 m. which record is correct and why ?
- (2) Find the dimensions and hence, the SI units of co-efficient of viscosity η in the Stoke's law $F = 6 \pi \eta r v$
- (3) Check the correctness of the relation $V = \sqrt{\frac{F \times l}{m}}$ dimensionally
- (4) Write the dimensions of (i) Force (ii) Acceleration
- (5) Define the terms (i) Unit vector (ii) Position vector
- (6) Suppose the sides of a closed polygon represent vector arranged head to tail. What is the sum of these vectors ?
- (7) What is the vector product of two vectors, give its two characteristics
- (8) Define projectile motion. Derive an expression for the time of flight
- (9) At what point or points in its path does a projectile have its minimum speed, its maximum speed ?
- (10) Define impulse and show how it is related to linear momentum
- (11) Find the velocities of two elastically colliding bodies when $m_1 = m_2$ after collision
- (12) Explain the difference between laminar flow and turbulent flow

QUESTION NO. 3 Write short answers of any Eight (8) parts of the following 16

- (1) How can you find the work done by variable force by graphical method ?
- (2) What will be the velocity of the particle if its momentum and kinetic energy are equal in magnitudes ?
- (3) When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from ?
- (4) Prove that $a_t = r\alpha$
- (5) What is meant by angular momentum ? Explain the law of conservation of angular momentum
- (6) When mud flies off the tyre of a moving bicycle, in what direction does it fly ? Explain
- (7) What is the distance travelled by an object moving with simple harmonic motion in a time equal to its period, if its amplitude is A ?
- (8) Does the acceleration of a simple harmonic oscillator remain constant during its motion ? Is acceleration ever zero ? Explain
- (9) If equation for simple harmonic motion is $x = 10 \sin\left(\frac{\pi}{6}\right)t$, then calculate the instantaneous displacement after 3 seconds
- (10) Explain why sound travels faster in warm air than in cold air
- (11) Write the characteristics of stationary waves (12) Explain the terms node and anti-node

QUESTION NO. 4 Write short answers of any Six (6) parts of the following 12

- (1) Can the mechanical energy be converted completely into heat energy ? If so give an example
- (2) Specific heat of a gas at constant pressure is greater than specific heat at constant volume. Why ?
- (3) Derive Boyle's law using kinetic theory of gases
- (4) A system absorbs 100 J heat at absolute temperature of 300 K. Calculate the change in entropy
- (5) If the magnifying glass has magnifying power 6 then find the focal length of convex lens
- (6) Explain the difference between angular magnification and resolving power of an optical instrument. What limits the magnification of an optical instrument ?
- (7) If 5000 lines/cm are ruled on a diffraction grating then find its grating element.
- (8) Under what conditions two or more sources of light behave as coherent sources ?
- (9) How would you manage to get more orders of spectra using a diffraction grating ?

SECTION-II

Note: Attempt any Three questions from this section

8 x 3 = 24

- Q.5 (A) Define projectile motion. If a projectile is fired in a direction angle θ with the horizontal by velocity V_i then find the relations for (i) time of flight (ii) range of projectile 1+2+2
- (B) The magnitude of dot and cross product of two vectors are $6\sqrt{3}$ and 6 respectively. Find the angle between the vectors 3
- Q.6 (A) Derive the relation for absolute potential energy to lift a body from certain position to infinity 5
- (B) An organ pipe has a length of 50 cm. Find the frequency of its fundamental note and next harmonic when it is open at both ends 3
- Q.7 (A) Define rotational kinetic energy, derive its relation. Also derive it for a disc and hoop 5
- (B) How large must be a heating duct if air moving at 3.0 m/s along, it can replenish the air in the room of 300 m³ volume every 15 min. Assume air's density remains constant 3
- Q.8 (A) What is Carnot engine ? Discuss Carnot cycle. Also derive the relation for its % efficiency 5
- (B) A block of mass 4.0 kg is dropped from a height of 0.80 m on to a spring of spring constant $k = 1960 \text{ Nm}^{-1}$. Find the maximum distance through which the spring will be compressed. 3
- Q.9 (A) How compound microscope is formed ? Derive an expression for its total magnification 2+3
- (B) In a double slit experiment the second order maximum occurs at $\theta = 0.25^\circ$, the wave length is 650 nm. Determine slit separation 3