

**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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

Q.No.1

- (1) The dimensions of  $\sqrt{\frac{m}{k}}$  is same as that of:  
 (A) Momentum (B) Time (C) Acceleration (D) Force
- (2) The % uncertainty in the measurement of radius of a sphere is 2%. The % uncertainty in the volume of sphere is:  
 (A) 6% (B) 2% (C) 4% (D) 8%
- (3) If  $|\vec{A} \times \vec{B}| = |\vec{A} \cdot \vec{B}|$  then angle between vectors  $\vec{A}$  and  $\vec{B}$  is:  
 (A)  $60^\circ$  (B)  $90^\circ$  (C)  $45^\circ$  (D)  $30^\circ$
- (4) Projection of  $\vec{A}$  on  $\vec{B}$  is:  
 (A)  $B \cos \theta$  (B)  $A \sin \theta$  (C)  $\vec{B} \cdot \hat{A}$  (D)  $\vec{A} \cdot \hat{B}$
- (5) The horizontal acceleration of projectile is:  
 (A) Equal to "g" (B) Positive (C) Negative (D) Zero
- (6) In a typical rocket, the fuel burns at the rate of:  
 (A) 4000 kg/s (B) 1000 kg/s (C) 10,000 kg/s (D) 40,000 kg/s
- (7) The rotational K.E of solid sphere is:  
 (A)  $\frac{2}{5}mr^2\omega^2$  (B)  $\frac{1}{5}mr^2\omega^2$  (C)  $\frac{2}{3}mr^2\omega^2$  (D)  $\frac{1}{5}I\omega^2$
- (8) The ratio of orbital velocity to the escape velocity is:  
 (A)  $\sqrt{\frac{1}{2}}$  (B)  $\frac{1}{2}$  (C) 1 (D)  $\sqrt{2}$
- (9) The wavelength of waves produced in microwave oven is:  
 (A) 12 cm (B) 20 cm (C) 24 cm (D) 10 cm
- (10) The speed of sound in air at  $30^\circ C$  is approximately equal to:  
 (A) 332 m/s (B) 350 m/s (C) 340 m/s (D) 335 m/s
- (11) The distance between 1<sup>st</sup> node and 4<sup>th</sup> antinode is:  
 (A)  $\frac{5}{4}\lambda$  (B)  $\frac{13}{4}\lambda$  (C)  $\frac{7}{4}\lambda$  (D)  $\frac{11}{4}\lambda$
- (12) Escape velocity of object depends upon:  
 (A) Mass of object (B) Size of object (C) Shape of object (D) Radius of planet
- (13) A carnot engine operating between the temperatures has greatest efficiency:  
 (A) 40k and 20k (B) 60k and 40k (C) 80k and 60k (D) 100k and 80k
- (14) Which one is true for isothermal process?  
 (A)  $Q = 0$  (B)  $Q = W$  (C)  $W = 0$  (D)  $Q = \Delta \mu$
- (15) The term  $\frac{1}{2}\rho v^2$  in Bernoulli's equation represents:  
 (A) K.E of fluid (B) Pressure energy (C) K.E per unit volume (D) P.E of fluid
- (16) The phase difference between two points on the same wave front is:  
 (A)  $\frac{\pi}{2}$  (B)  $\pi$  (C)  $\frac{\pi}{4}$  (D) 0
- (17) Final image formed by compound microscope is:  
 (A) Real; Inverted; Magnified (B) Virtual; Erect; Magnified  
 (C) Real; Erect; Diminished (D) Virtual; Inverted; Diminished

**INTERMEDIATE PART-I (11<sup>th</sup> CLASS)**

**PHYSICS PAPER-I GROUP-I MTN-41-21**

TIME ALLOWED: 2.40 Hours

**SUBJECTIVE**

MAXIMUM MARKS: 68

**NOTE: Write same question number and its part number on answer book, as given in the question paper.**

**SECTION-I**

**2. Write short answers to any eight parts.**

**8 × 2 = 16**

- (i) Show that the expression  $v_f = v_i + at$  is dimensionally correct where  $v_i$  is the velocity at  $t = 0$ ,  $a$  is the acceleration and  $v_f$  is the velocity at time  $t$ .
- (ii) Write the dimensions of (i) Pressure (ii) Density
- (iii) Define Precision and Accuracy.
- (iv) Find the dimensions and hence the S.I units of coefficient of viscosity  $\eta$  in relation of stokes law for the drag force  $F$  for a spherical object of radius  $r$  moving with velocity  $v$  given as  $F = 6\pi\eta r v$
- (v) Define position vector and write its general formula in three dimension.
- (vi) Prove that  $\vec{A} \cdot \vec{B} = \vec{B} \cdot \vec{A}$
- (vii) If all the components of the vectors  $\vec{A}_1$  and  $\vec{A}_2$  were reversed, how would this alter  $\vec{A}_1 \times \vec{A}_2$ .
- (viii) Water flows out from a pipe at  $3\text{kgs}^{-1}$  and its velocity changes from  $5\text{ms}^{-1}$  to zero on striking the wall, then find the force due to flow of this water.
- (ix) Derive the formula for the vertical distance covered by the projectile when it is thrown from a certain height  $h$ .
- (x) Define the range of projectile and show that the range of projectile is maximum when projectile is thrown at an angle of  $45^\circ$  with the horizontal.
- (xi) A 100 g golf ball is moving to the right with a velocity of  $20\text{ms}^{-1}$ . It makes a head on collision with a 8 kg steel ball initially at rest. Compute velocities of the balls after collision.
- (xii) Define Torricelli's theorem and write the formula for the speed of efflux.

**3. Write short answers to any eight parts.**

**8 × 2 = 16**

- (i) Prove that  $P = \vec{F} \cdot \vec{V}$
- (ii) Calculate the work done in kilo joules in lifting a mass of 10kg (at a steady velocity) through a vertical height of 10m.
- (iii) Differentiate between conservative and non conservative force.
- (iv) Show that  $1 \text{ rad} = 57.3^\circ$
- (v) Why does a diver change his body position before and after diving in the pool?
- (vi) What do you mean by orbital velocity? Write down its formula.
- (vii) What happens to the period of simple pendulum if its length is doubled? What happens if the suspended mass is doubled?
- (viii) Why soldiers are advised to break their steps when marching on bridge?
- (ix) What is driven harmonic oscillator? Give example.
- (x) Define beats and explain with one example.
- (xi) Explain why sound travel faster in warm air than in cold air.
- (xii) Speed of sound in air at  $0^\circ\text{C}$  is  $332\text{ms}^{-1}$ . Find its speed at  $20^\circ\text{C}$ .

4. Write short answers to any six parts. **MTN-G1-21** **6 × 2 = 12**
- (i) Under what conditions, two or more sources of light behave as coherent sources?
  - (ii) Could you obtain Newton's rings with transmitted light if yes, would the pattern be different from that obtained with reflected light?
  - (iii) What is meant by fringe spacing?
  - (iv) What do you understand by linear magnification and angular magnification?
  - (v) What is the length of the telescope in state of normal adjustment?
  - (vi) Why is the average velocity of the molecules in a gas zero but the average of square of velocities is not zero?
  - (vii) What is meant by reversible process? Give its example.
  - (viii) Find the average speed of oxygen molecule in the air at STP.
  - (ix) Why does the pressure of gas in a car tyre increase when it is driven through some distance?

### SECTION-II

**NOTE: Attempt any three questions.**

**3 × 8 = 24**

- 5.(a) Define and explain vector product of two vectors. Also write down the four characteristics of vector product of two vectors. 5
- (b) A ball is thrown horizontally from a height of 10m with velocity of  $21 \text{ ms}^{-1}$ . How far off it hit the ground? 3
- 6.(a) What is Gravitational field? Show that gravitational field is a conservative field. 5
- (b) The frequency of the note emitted by a stretched string is 300 Hz. What will be the frequency of this note when the tension is increased by one-third without changing the length of the wire? 3
- 7.(a) Define centripetal force. Derive its relation. 5
- (b) A tiny water droplet of radius 0.01 cm descends through air from high building. Calculate its terminal velocity. Given that  $\eta$  for air is  $19 \times 10^{-6} \text{ kg m}^{-1} \text{ s}^{-1}$  and density of water is  $\rho = 1000 \text{ kg m}^{-3}$ . 3
- 8.(a) Define and explain the phenomenon of resonance with an example. 1 + 3 + 1 = 5
- (b) A mechanical engineer develops an engine working between  $327^\circ \text{C}$  and  $27^\circ \text{C}$  and claims to have an efficiency of 52%. Does he claim correctly? Explain. 3
- 9.(a) What is diffraction grating? Calculate the wavelength of light used by diffraction grating. 5
- (b) A telescope is made of an objective of focal length 20 cm and an eye piece of 5.0 cm. Both are convex lenses. Find the angular magnification. 3

OBJECTIVE

**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 bubble in front of that question number, on bubble sheet. Use marker or pen to fill the bubbles. Cutting or filling two or more bubbles will result in zero mark in that question. No credit will be awarded in case BUBBLES are not filled. Do not solve question on this sheet of OBJECTIVE PAPER.

## Q.No.1

- (1) If velocity and mass of a moving object are doubled then K.E becomes:  
 (A) Double (B) 4 times (C) 6 times (D) 8 times
- (2) If a body is moving counter clockwise, then angular displacement is:  
 (A) Minimum (B) Zero (C) Negative (D) Positive
- (3) The direction of angular momentum  $\vec{L} = \vec{r} \times \vec{p}$  is:  
 (A) Along the direction of  $\vec{p}$  (B) Along the direction of  $\vec{r}$   
 (C) Parallel to the plane containing  $\vec{r}$  and  $\vec{p}$  (D) Perpendicular to the plane containing  $\vec{r}$  and  $\vec{p}$
- (4) Venturi relation is given by:  
 (A)  $P_1 + P_2 = \frac{1}{2} \rho v_2^2$  (B)  $P_1 - P_2 = \frac{1}{2} \rho v_2^2$  (C)  $P_1 + P_2 = \frac{1}{2} \rho v_2^2$  (D)  $P_1 - P_2 = \frac{1}{2} \rho^2 v_2$
- (5) The frequency of the first pendulum is:  
 (A) 2.0 Hz (B) 1.5 Hz (C) 1.0 Hz (D) 0.5 Hz
- (6) Speed of sound in air at S.T.P is:  
 (A) 280 m/s (B) 330 m/s (C) 331 m/s (D) 332 m/s
- (7) When the stretched string is plucked from one quarter of length, then stretched string will vibrate in:  
 (A) One loop (B) Two loops (C) Three loops (D) Four loops
- (8) The regular array of atoms in a crystal forms a natural diffraction grating with spacing of the order of:  
 (A)  $10^{-8} m$  (B)  $10^{-9} m$  (C)  $10^{-10} m$  (D)  $10^{-11} m$
- (9) Compound microscope consist of:  
 (A) Two convex lens (B) Two concave lens  
 (C) Convex lens and concave mirror (D) Concave lens and convex mirror
- (10) If one mole of an ideal gas is heated at constant pressure; then:  
 (A)  $Q_p = C_p \Delta T$  (B)  $\Delta U = C_p \Delta T$  (C)  $\Delta U = C_v \Delta T$  (D)  $Q_p = C_v \Delta T$
- (11) In carnot engine, each process is:  
 (A) Reversible (B) Perfectly reversible (C) Irreversible (D) Perfectly irreversible
- (12) The appropriate precision on addition of following masses 0.089, 2.189, 5.32, 11.8 in kg is:  
 (A) 19.398 kg (B) 19.39 kg (C) 19.4 kg (D) 19.41 kg
- (13) Dimension of coefficient of viscosity are:  
 (A)  $[ML^{-1}T]$  (B)  $[ML^{-1}T^{-1}]$  (C)  $[ML^{-1}T^{-2}]$  (D)  $[ML^2T^{-1}]$
- (14) The resultant magnitude of two forces 6N and 8N acting at right angle to each other is:  
 (A) 10N (B) 8N (C) 6N (D) 4N
- (15) The angle between the vectors  $\hat{i} + 3\hat{j} - 2\hat{k}$  and  $\hat{i} - \hat{j} - \hat{k}$  is:  
 (A)  $0^\circ$  (B)  $45^\circ$  (C)  $90^\circ$  (D)  $180^\circ$
- (16) When a shell explodes in mid-air, the total momentum of its fragments:  
 (A) Becomes zero (B) Decreases (C) Increases (D) Remains constant
- (17) An Un-powered and unguided missile is:  
 (A) Remote control (B) Long range (C) Powered (D) Ballistic

NOTE: Write same question number and its part number on answer book, as given in the question paper.

SECTION-I

2. Write short answers to any eight parts.

8 × 2 = 16

- (i) Show that  $T = 2\pi\sqrt{\frac{\ell}{g}}$  is dimensionally correct.
- (ii) Describe the principle homogeneity of dimensional analysis.
- (iii) Write the dimensions of (i) Pressure (ii) Density
- (iv) What are dimensions and units of  $G$  in the formula  $F = G\frac{m_1m_2}{r^2}$ ?
- (v) Can you add zero to null vector.
- (vi) Define Torque, give its units and dimensions.
- (vii) What is method to find the direction of cross product of two vectors, describe it.
- (viii) Define horizontal range and time of flight of projectile.
- (ix) Define impulse and show that how it is related to linear momentum.
- (x) What is isolated system, state law of conservation of linear momentum?
- (xi) Write down three equations of motion.
- (xii) State Bernoulli's theorem. Give its mathematical form.

3. Write short answers to any eight parts.

8 × 2 = 16

- (i) Derive the relation of power in term of  $P = \vec{F} \cdot \vec{V}$ .
- (ii) A person holds a bag of groceries while standing still, talking to a friend. A car is stationary with its engine running. From the stand point of work, how are these two situations similar?
- (iii) A girl drops a cup from a certain height, which breaks into pieces. What energy changes are involved?
- (iv) What do you understand by real and apparent weight? Explain.
- (v) What is meant by angular momentum? Show angular momentum in mathematical form.
- (vi) A disc and a hoop start moving down from the top of an inclined plane at the same time. Which one will be moving faster on reaching the bottom?
- (vii) What should be the frequency of a simple pendulum whose period is one second at a place where  $g = 9.8 \text{ ms}^{-2}$ ?
- (viii) If a mass-spring system is hung vertically and set into oscillations, why does the motion eventually stops.
- (ix) What is meant by phase angle? Does it define angle between maximum displacement and the driving force?
- (x) How much greater is the speed of sound in hydrogen to that of oxygen? Explain.
- (xi) What do you mean by quantization of frequency for stationary waves?
- (xii) How are beats useful in tuning musical instruments?

4. Write short answers to any six parts.

6 × 2 = 12

- (i) What is meant by diffraction of light? Explain with an example.
- (ii) Explain whether the Young's experiment is an experiment for studying interference or diffraction effects of light.
- (iii) Could you obtain Newton's rings with transmitted light? If yes, would the pattern be different from that obtained with reflected light?

(2) MTN-92-21

- (iv) Define magnifying power and resolving power of optical instruments.
- (v) A telescope is made of an objective of focal length 20 cm and an eye piece of 5 cm, both convex lenses. Find the angular magnification.
- (vi) Can the mechanical energy be converted completely into heat energy? If so give an example.
- (vii) A mechanical engineer develops an engine, working between 600k and 300k claims to have efficiency of 52%. Does he claim correctly? Explain.
- (viii) Define molar specific heats of a gas at constant pressure and constant volume.
- (ix) Why is the average velocity of the molecules in a gas zero but the average of the square of velocities is not zero?

### SECTION-II

**NOTE: Attempt any three questions.**

**3 × 8 = 24**

- 5.(a) Differentiate between Elastic and Inelastic Collision. Derive the expressions for the velocities of two spherical bodies  $m_1$  and  $m_2$  after elastic collision in one dimension. 5
- (b) Given that  $\vec{A} = \hat{i} - 2\hat{j} + 3\hat{k}$  and  $\vec{B} = 3\hat{i} - 4\hat{k}$ , find the projection of  $\vec{A}$  on  $\vec{B}$ . 3
- 6.(a) Define gravitational field. Show that work done in gravitational field is independent of path followed. 5
- (b) Find the temperature at which the velocity of sound in air is two times its velocity at  $10^\circ\text{C}$ . 3
- 7.(a) Define centripetal force and derive its relation for an object travelling with uniform speed  $V$  in a circle of radius  $r$ . 1 + 4
- (b) What gauge pressure is required in the city mains for a stream from a fire hose connected to the mains to reach a vertical height of 15.0m. 3
- 8.(a) What is Carnot engine? Calculate the efficiency of Carnot engine. 5
- (b) A block of mass 4.0kg is dropped from a height of 0.80m, on to a spring of spring constant  $k = 1960\text{ Nm}^{-1}$ . Find the maximum distance through which the spring will be compressed. 3
- 9.(a) Define pressure of gas. Derive relation of pressure of gas. Show that  $P \propto \langle K.E \rangle$  of gas molecules. 5
- (b) An astronomical telescope having magnifying power 5. Consistants of two thin lenses, 20cm apart. Find the focal lengths of the lenses. 3

18-2021(A)-20000 (MULTAN)