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 $\sqrt{\dfrac{m}{k}}$ 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 $\left|\vec{A} \times \vec{B}\right| = \left|\vec{A} \cdot \vec{B}\right|$ then angle between vectors $\vec{A}$ and $\vec{B}$ is:

(A) 60° (B) 90° (C) 45° (D) 30°

(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) $\dfrac{2}{5}mr^2\omega^2$ (B) $\dfrac{1}{5}mr^2\omega^2$ (C) $\dfrac{2}{3}mr^2\omega^2$ (D) $\dfrac{1}{5}I\omega^2$

(8) The ratio of orbital velocity to the escape velocity is:

(A) $\sqrt{\dfrac{1}{2}}$ (B) $\dfrac{1}{2}$ (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 $30^{o}C$ is approximately equal to:

(A) 332 m/s   (B) 350 m/s   (C) 340 m/s   (D) 335 m/s

(11) The distance between 1st node and 4th antinode is:

(A) $\dfrac{5}{4}\lambda$ (B) $\dfrac{13}{4}\lambda$ (C) $\dfrac{7}{4}\lambda$ (D) $\dfrac{11}{4}\lambda$

(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 $\dfrac{1}{2}\rho v^2$ 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) $\dfrac{\pi}{2}$ (B) π (C) $\dfrac{\pi}{4}$ (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

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.** $8 \times 2 = 16$

(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 η 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 $3 kgs^{-1}$ and its velocity changes from $5 ms^{-1}$ 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° with the horizontal.

(xi) A $100 g$ golf ball is moving to the right with a velocity of $20 ms^{-1}$. 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.** $8 \times 2 = 16$

(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 rad = $57 \cdot 3^o$

(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 $0^o C$ is $332 ms^{-1}$. Find its speed at $20^o C$.

4. **Write short answers to any six parts.** MTN-G1-21 $6 \times 2 = 12$

(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. $3 \times 8 = 24$

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 $21 ms^{-1}$. 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 η for air is $19 \times 10^{-6} \, kg \, m^{-1} s^{-1}$ and density of water is $\rho = 1000 \, kgm^{-3}$. 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 $327^{\circ}C$ and $27^{\circ}C$ 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