

**NOTE:** Attempt all questions of Section-A by filling the corresponding bubble on the MCQ ANSWER SHEET and return it to the Superintendent within given time, even if you have not attempted any question.

**SECTION-A**

Time: 20 Minutes

Marks: 18

1. The accepted value of mechanical equivalent  $J = \dots\dots\dots$  A) 4.18 joule,  B) 4.18 J. calorie<sup>-1</sup>, C) 4.18 calorie, D) 4.18 joule-calorie
2. In an isothermal change, internal energy  $\dots\dots\dots$  A) is zero, B) decreases, C) increases,  D) is constant
3. Number of significant figures in 0.00035 are  $\dots\dots\dots$  A) two, B) three, C) four,  D) five
4. Dimension of speed is  $\dots\dots\dots$  A) [MLT], B) [MLT<sup>-1</sup>],  C) [M<sup>0</sup>LT<sup>-1</sup>], D) [M<sup>0</sup>LT<sup>-2</sup>]
5. If  $R_x$  is positive and  $R_y$  is negative then ' $\theta$ ' lies in  $\dots\dots\dots$  quadrant. A) 1st, B) 2nd, C) 3rd,  D) 4th
6. Range of a projectile 'R' will be maximum if  $\theta = \dots\dots\dots$  A) 180°, B) 90°,  C) 45°, D) 0°
7. Rate of change of distance is called  $\dots\dots\dots$  A) speed, B) velocity, C) displacement, D) acceleration
8. The equation  $|\vec{A} \cdot \vec{B}| = |\vec{A} \times \vec{B}|$  is correct for  $\theta = \dots\dots\dots$  A) 30°, B) 45°, C) 60°, D) 90°
9. Work done is zero when angle between 'F' and 'd' is  $\dots\dots\dots$  A) 0°, B) 45°,  C) 90°, D) 180°
10. An example of non-conservative force is  $\dots\dots\dots$  force. A) electric, B) gravitational,  C) frictional, D) magnetic
11. Angular form of centripetal acceleration  $a_c = \dots\dots\dots$  A)  $\omega^2 \vec{r}$ , B)  $\omega \vec{r}$ ,  C)  $-\omega^2 \vec{r}$ , D)  $-\omega \vec{r}$   $a_c = -\frac{v^2}{r} \hat{r}$
12. Moment of inertia for a solid rod is  $I = \dots\dots\dots$  A)  $MR^2$ , B)  $\frac{1}{2}MR^2$ , C)  $\frac{2}{5}MR^2$ ,  D)  $\frac{1}{12}Me^2$   $a_c = -\frac{(r\omega)^2}{r} \hat{r}$   
 $a_c = -\omega^2 \hat{r}$
13. The device used to measure the rate of flow of liquid in pipe is called  $\dots\dots\dots$   A) venturimeter, B) calorimeter, C) spectrometer, D) barometer
14. Equation of continuity is in accordance with law of conservation of  $\dots\dots\dots$  A) energy,  B) mass, C) momentum, D) charge
15. Tuning radio is an example of  $\dots\dots\dots$  resonance.  A) electrical, B) musical, C) mechanical, D) all of these
16. The speed of mechanical wave in a medium depends upon  $\dots\dots\dots$  of the medium. A) density, B) wavelength, C) elasticity,  D) both A&C
17. Wavelength of visible light is  $\dots\dots\dots$  A)  $10^{-8}$ m, B)  $10^{-10}$ m, C)  $10^{-6}$ m, D)  $10^{10}$ m
18. Grating spectrometer is used to calculate the  $\dots\dots\dots$  A) frequency, B) node,  C) wavelength, D) crest

P-518

11191  
PHYSICS  
PART-I

$T = I\alpha$   
 $T =$

Time: 2 Hours 40 Minutes

$T = mr^2\alpha$   $F = \frac{GMm}{R^2}$

SECTION-B

$Mg = \frac{GMm}{R^2}$   
 $g R^2 = GM$  Marks: 40

1. Attempt any ten of the following. All carry equal marks.

- i. What is minimum number of unequal vectors to result into a null vector? Explain with the help of diagram.
- ii. Define impulse and state how it is related to linear momentum.
- iii. Show that total work done in closed path in gravitational field is zero.
- iv. Define escape velocity and show that  $v_{esc} = \sqrt{2gR}$ .
- v. Show that rate of change of angular momentum is equal to torque.
- vi. Define terminal velocity and show that  $v_t \propto r^2$ .
- vii. Define and briefly explain "damped oscillations".
- viii. Why does a sound wave travel faster in solid than in gases.
- ix. State and explain Bragg's law.
- x. When two systems are in thermal equilibrium, do they have the same amount of kinetic energy?
- xi. Are radians and steradians the base units of S.I. Justify your answer.
- xii. Define moment of inertia. On what factors does it depend?
- xiii. Define projectile motion and show that maximum range covered by a projectile is given by  $R_{max} = \frac{v_1^2}{g}$ .

$W = F \cdot S$   
 $= mgd \cos \theta$   
 $\cos \theta = 1$

$P = E \cdot \frac{dP}{dE}$

SECTION-C

Marks: 27

NOTE: Attempt any three of the following questions. All questions carry equal marks.

- 2. i. What are organ pipes? Show that an open organ pipe is richer in harmonics than a closed organ pipe.
- ii. Water at 30°C falls from a height of 660 meters. If the whole energy is used in increasing the temperature, find out the final temperature.
- 3. i. Describe the construction and working of Michelson's interferometer.
- ii. A 600gm body vibrates SHM with amplitude 0.40m. The restoring force is 80N and displacement is 0.40m. Find out: (i) Time period "T" and (ii) Acceleration  $\bar{a}$ .
- 4. i. State equation of continuity and show that  $v \propto \frac{1}{A}$  where v is speed of fluid and A is area of cross section of pipe.
- ii. A cylinder of mass 7kg and radius 300cm is acted upon a force of 0.80N applied tangentially at the surface. Find torque produced in cylinder.
- 5. i. Define elastic collision. Derive mathematical equations for calculating the final velocities of the elasticity colliding bodies in one dimension.
- ii. An object is travelling with a constant acceleration of  $18m \cdot s^{-2}$ . How much distance will it travel in 3rd second of its journey?

$\alpha = r\omega$

$T = I\alpha$

$I = mr^2$

$T = rF$   
 $T = r$

$T =$

$\alpha =$

$T = I\alpha$   
 $T = mr^2\alpha$

$T = rF \sin \theta$

$I = I\alpha$

$\alpha = r\omega$