PHYSICS – HALF YEARLY EXAMINATION
HAMDARD PUBLIC SCHOOL
CLASS – XI

TIME: 3 Hours **Max. Marks: 70**

General Instructions

1. **All questions are compulsory.**
2. **Q. No. 1 – 8 are very short answer types carrying 1 mark each.**
3. **Q. No. 9 – 15 are short answer types carrying 2 marks each.**
4. **Q. No. 16 – 26 are of short answer type carrying 3 marks each.**
5. **Q. No. 27 – 29 are of short answer type carrying 5 marks each.**

PHYSICS

SECTION-A [1 MARK QUESTIONS]

1. Distinguish between fundamental & derived units.
2. Which of the length measurement is most accurate & why?
   (i) 500.0 cm (ii) 0.000 5 cm (iii) 6.00 cm
3. Two masses of ratio 1: 2 are thrown vertically up with the same speed. Which mass will return to ground earlier?
4. The position of a particle is given by $x = 6 + 18t + 9t^2$ (x in metres and t in sec). Find the velocity at t = 2s.
5. If $|\vec{A}+\vec{B}|=|\vec{A}-\vec{B}|$, what is the angle between $\vec{A}$ and $\vec{B}$?
6. What will be the effect on horizontal range & height of a projectile when its initial speed is doubled keeping its angle of projection same?
7. A unit vector is represented by $a\hat{i}+b\hat{j}+c\hat{k}$. If the values of 'a' and 'b' are 0.6 and 0.8 respectively, find the value of c?
8. The changes in a function y and the independent variable 'x' are related as $\frac{dy}{dx} = x^2$. Find the y as a function of x.

SECTION-B [2 MARKS QUESTIONS]

9. Find $\frac{dy}{dx}$ if $y = e^x \sin x$.
10. A jet airplane travelling at the speed of 500 km/h ejects its exhaust gases at a speed of 1500 km/h relative to the jet itself. What is the speed of gases w.r.t to ground?
11. Find the maximum & minimum values of the function $y = x + \frac{1}{x}$ for $x > 0$.
12. If the percentage error in measurement of radius R of sphere is 0.2%, then calculate the percentage error in its volume.
13. A lady walking due east on a road with a speed of 10 m/s encounters rain falling vertically with velocity of 30 m/s. At What angle she should her umbrella to protect herself from rain?
14. The angle between $\vec{A}$ and $\vec{B}$ is 60^0. What is the ratio of $\vec{A}.\vec{B}$ and $|\vec{A}\times\vec{B}|$.
15. A swimmer can swim with velocity of 10 km/h w.r.t the water flowing in a river with velocity of 5 km/h. In what direction should be swim to reach the point. If width of river in 1 km, find time taken to cross the river.

SECTION-C [3 MARKS QUESTIONS]

16. The period of oscillation of a simple pendulum is $T = 2\pi\sqrt{L/g}$. Measured value of L is 20.0 cm known to 1 mm accuracy and time for 100 oscillations of the pendulum is found to be 90 s. using a wrist watch of 1 s resolution. What is the accuracy in the determination of g?

17. Find the derivative of following functions w.r.t x

(i) $y = x^2 \sin x$ (ii) $y = \frac{\sin x}{x}$ (iii) $y = \sin(x^2)$

18. A particle starts from rest with constant acceleration. Plot a – t, v – t & s – t graphs for its motion.

19. Determine a unit vector perpendicular to both $\vec{A} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = \hat{i} - \hat{j} + 2\hat{k}$.

20. Find the area enclosed by the curve $y = \sin x$ and the x-axis between x = 0 and $x = \pi$.

21. A physics quantity Q is given by $Q = \frac{A^2 B^{3/2}}{C^4 D^{1/2}}$. If percentage error in A, B, C & D is 1%, 2%, 4% and 2%. Find the percentage error in Q.

22. A balloon is ascending at a rate of 14 m/s at a height of 98 m above the ground when a packet is dropped from the balloon. After how much time and with what velocity does it reach the ground?

23. Two parallel rail tracks run north-south. Train A moves north with a speed of 54 km h^{-1}, and train B moves south with a speed of 90 km h^{-1}. What is the (a) velocity of B with respect to A?, (b) velocity of ground with respect to B ?, and (c) velocity of a monkey running on the roof of the train A against its motion (with a velocity of 18 km h^{-1} with respect to the train A) as observed by a man standing on the ground ?

24. From the top of a building 19.6 m high, a ball is projected horizontally. After how long does it strike the ground? If the line joining the point where it hits the ground makes an angle 45^0 with the horizontal, what is the initial velocity of ball?

25. (a) Find the magnitude and direction of $\hat{i} + \hat{j}$ & $\hat{i} - \hat{j}$?

(b) What are the components of a vector $\vec{A} = 2\hat{i} + 3\hat{j}$ along $\hat{i} + \hat{j}$ & $\hat{i} - \hat{j}$?

26. The position of a particle is given by $\vec{r} = 3t\hat{i} - 2t^2\hat{j} + 4\hat{k}$ m

(a) Find $\vec{v}$ and $\vec{a}$ of the particle.

(b) What is the magnitude & direction of $\vec{v}$ at t = 2s?

SECTION-D [5MARKS QUESTIONS]

27. A body is projected with a velocity u at an angle θ with the horizontal. Derive relations for

(i) Path followed. (ii) Maximum height

(iii) Time of flight (iv) Range (v) Final velocity

OR

Prove the following:

(a) For two angle of projection θ and (90 – θ) with same velocity.

(i) Range is same (ii) Heights are in ratio $\tan^2\theta : 1$.

(b) If range and maximum height are same the angle of projection is $\tan^{-1}(y)$.

28. Explain the parallelogram law of vector addition & derive an expression form magnitude and direction of resultant angle θ on a body simultaneously have a resultant F. Show that $\theta = \cos^{-1}((F^2 - F_1^2 - F_2^2)/2F_1F_2)$

OR

(a) Show that for a projectile the angle between the velocity and the x-axis as a function of time is given by

$$\theta = \tan^{-1}\left(\frac{v_y - gt}{v_x}\right)$$

(b) Show that he projection angle Q_0 for a projectile launched from the origin is given by

$$\theta_0 = \tan^{-1}\left(\frac{4h_m}{R}\right)$$

Where h_m = maximum height

R= horizontal range

29. Derive the 3 equations of motion by calculus method. Express conditions under which they can be used.

OR

Derive an equation for the distance travelled by a uniformly accelerated body in nth second of the last motion. A body travels half its total path in the last second of its fall from rest. Calculate its time of fall.