UNIT-2 ONE DIMENSIONAL KINEMATICS

1   A dog trots back to its owner with an average speed of 1.40 m/s from a distance of 2.3 m. How much time does it take for the dog to reach its owner?
[1.6 s]

2   (a) A certain car can go from 0 to 30 m/s in 8.50 s. What is the average acceleration of this car in meters per second squared?   [3.52 m/s^2]
(b). An airplane has an average acceleration of 4.2 m/s^2 during takeoff. If the aircraft starts at rest, how long does it take to reach a speed of 180 km/h?
[11.9 m/s]

3.   A ball is thrown straight upward with an initial velocity of 19.6 m/s. Find the velocity of the ball after (a) 0.45 s and (b) 1.90 s.   [15.2 m/s, 0.98 m/s]

4.   A lemon drops from a tree and falls to the ground 3.15 m below. (a) How much time does it take for the lemon to reach the ground? (b) What is the lemon's speed just before it hits the ground?   [0.81 s, 7.86 m]

5   A bullet is moving at a speed of 120 m/s when it embeds into a lump of moist clay. The bullet penetrates for a distance of 62 cm. Determine the acceleration of the bullet while moving into the clay.   [-1.16 x 0^4 m/s^2]

6   A stone is directly thrown vertically upward. It takes 30 sec to return to the ground, how high does the stone go?   [1.1 x 10^3 m]

7   A minibus starts moving from a position of the rest at a bus stop with uniform acceleration. During the 10th seconds of its motion, it covers a distance of 95 meters. Calculate its acceleration and the total distance it covers.
[10 m/s^2 , 500 m]

8   A car starts from rest and moves with a constant acceleration. During the 5th second of its motion it covers a distance of 36m; calculate:
(i) The acceleration of the car   (ii) The total distance covered by the car during this time.   [8 m/s^2 , 100 m]

9   A boy throws a ball upward from the top of a tower with a speed of 12m/s. On the way down it just misses the thrower and falls to the ground 50m below. Find how long the ball remains in the air.   [4.64 s]

10   A stone is dropped from the peak of a hill. It covers a distance of 30m in the last second of its motion, find the height of the peak.   [62 m]

11   A car starts from rest and moves with a constant acceleration. During the 4th second of its motion, it covers a distance of 24 meters. Calculate the acceleration and the total distance covered by the car during this time.
[6.86m/s2, 54.86m]

12   A ball is thrown vertically upward from the ground with a speed of 25m/s. On the way down it is caught at a point 5m above the ground. How long did the trip take?
[4.89 s]

SCALARS AND VECTORS

1. Find the value of 'p' for which the following vectors are perpendicular to each other: $\vec{A} = \hat{i} + P\hat{j} + 3\hat{k}$ and $\vec{B} = 3\hat{i} + 3\hat{j} - 4\hat{k}$ [p = -3]

2. Find the work done in moving an object along a vector $\vec{r} = 3\hat{i} + 2\hat{j} - 5\hat{k}$ if the applied force is $\vec{F} = 2\hat{i} - \hat{j} - \hat{k}$ [9 J]

3. Two forces of equal magnitude are acting at a point; find the angle between the two forces when the magnitude of the resultant is also equal to the magnitude of either of these forces.   [120^0]

4. Two forces of magnitude 10N and 15N are acting at a point. The magnitude of their resultant is 20N; find the angle between them.   [75.5^0]

5. If one of the rectangular components of a force of 100N is 50N, find the other component.   [86.6 N]

6. Prove that $\left|\vec{A} \times \vec{B}\right|^2 + (A.B)^2 = A^2B^2$.

7. Two vectors A and B are such that $\left|\vec{A}\right| = 4$ and $\left|\vec{B}\right| = 6$ and $\theta = 60^0$. Find $\left|\vec{A} + \vec{B}\right|$ and $\left|\vec{A} - \vec{B}\right|$

PROJECTILE MOTION

1. At what suitable angle is the maximum height of the projectile 1/3 of its range?   [53.1^0]

2. At what suitable angle is the maximum height of the projectile equal to its range.   [75.9^0]

3. Find the initial velocity of a rocket if it hits the maximum target 100 km away.   [990 m/s]

4. A shell is shot from a gun with a speed of 120 m/s at an angle of 60° with the horizontal. Find the following:
(i) Time taken to reach the maximum height   (ii) Total time of flight
(iii) Horizontal range   [10.6 s, 21.2 s, 1.27×10^3 m]

5. A mortar shell is fired at a ground-level target 490m away with an initial velocity of 98m/s. Find the two possible values of the launch angle. Calculate the minimum time to hit the target.   [15°, 75°, 2.588 sec]

6. A bullet was fired horizontally at 20m/s from the top of a building 20m high. When the bullet was 10m above ground, accidentally it hit a bird. Find the time taken to hit the bird and the velocity of the bullet when it hits the bird.   [1.42sec, 24.4 m/s]

7. Two possible angles to hit a target by a mortar shell fired with an initial velocity of 98 m/s are 15° and 75°. Calculate the range of the projectile and the minimum time required to hit the target.   [490m, 5.176s]

8. What is the take-off speed of a locust if its launching angle is 55° and its range is 0.8m?   [2.88m/s]