1. A car is moving at a constant velocity when it is involved in a collision. The car comes to rest after 0.450 s with an average acceleration of 65.0 m/s² in the direction opposite that of the car’s velocity. What was the speed, in km/hr, of the car before the collision?

(1) 29.2  (2) 164  (3) 105  (4) 70.2  (5) 44.8

2. The jetstream of the air blows east at 50 m/s. A plane travels at 100 m/s relative to the air. The pilot aims the plane so that it travels directly north (relative to the ground). How much time, in s, is required for the plane to travel from city A to city B that is 100 km directly north of A?

(1) 820  (2) 625  (3) 1155  (4) 740  (5) 930

3. A projectile is shot from ground level at an angle of 30° above the horizontal. When it reaches a wall that is a horizontal distance of 100 m away, its velocity vector is horizontal. What is the magnitude of the initial velocity of the projectile, in m/s?

(1) 48  (2) 41  (3) 26  (4) 17  (5) 32
4. A projectile is hurled out with speed 20 m/s from the top of a tower of height 30 m, at an angle of 45° above the horizontal. What is the projectile’s horizontal speed in m/s when it reaches the ground?

\[ \text{(1) } 12.5 \quad \text{(2) } 16.4 \quad \text{(3) } 8.2 \quad \text{(4) } 10.3 \quad \text{(5) } 14.1 \]

5. A plane flies 10 miles north, then 20 miles northeast, then 15 miles southeast, and finally 30 miles south. How far (in miles) is it from the starting point?

\[ \text{(1) } 75.0 \quad \text{(2) } 16.5 \quad \text{(3) } 24.7 \quad \text{(4) } 29.7 \quad \text{(5) } 15.0 \]

6. An auto accelerates at a constant rate from 0 to 30 m/s in 7 s. How far in m does the auto travel during the process?

\[ \text{(1) } 208 \quad \text{(2) } 175 \quad \text{(3) } 84 \quad \text{(4) } 105 \quad \text{(5) } 140 \]

7. At \( t = 0 \) ball A is dropped from a height of 10 m. At the same moment, ball B is thrown straight up from the ground with initial velocity 15 m/s. At what time in s are the two balls at the same height?

\[ \text{(1) } 0.25 \quad \text{(2) } 1.43 \quad \text{(3) } 0.67 \quad \text{(4) } 0.5 \quad \text{(5) } 1 \]

8. A ball is thrown vertically into the air. What is the magnitude of the acceleration (in m/s\(^2\)) of the ball when it is at its highest point?

\[ \text{(1) } 19.6 \quad \text{(2) } 9.8 \quad \text{(3) } 4.90 \quad \text{(4) } \text{zero} \quad \text{(5) } 3.13 \]

9. An auto traveling at a constant velocity of 50 m/s passes a police cruiser that is traveling in the same direction with an initial velocity of 10 m/s at the moment the auto passes it. At this moment the cruiser chases the auto, accelerating at a constant rate of 3 m/s\(^2\). How much time, in s, is required for the cruiser to catch up with the auto?

\[ \text{(1) } 17.3 \quad \text{(2) } 26.7 \quad \text{(3) } 13.3 \quad \text{(4) } 8.2 \quad \text{(5) } 20 \]
10. Two trains, A and B, are heading directly at each other along a straight track. At time $t = 0$, A is traveling at 30 m/s and B is traveling at 20 m/s. At this moment, A initiates constant deceleration of magnitude $3 \text{ m/s}^2$, while B maintains constant speed. The trains collide at $t = 7 \text{ s}$. How far apart in m are the trains at $t = 0$?

(1) 315 (2) 350 (3) 277 (4) 213 (5) 105

11. A river flows at a speed of 6 m/s. A canoeist paddles her canoe at speed 4 m/s relative to the river. The canoeist crosses the river by aiming her canoe downstream at an angle of 45° relative to the flow direction of the river. The canoeist requires 100 s to cross the river. How far downstream, in m, does she travel while crossing the river?

(1) 883 (2) 483 (3) 368 (4) 683 (5) 989

12. Car A, starting from rest, takes 20 sec to arrive at the finish line which is 1000 m away. How long (in seconds) does it take car B, whose acceleration is half that of car A, to reach the finish line?

(1) 10 (2) 40 (3) 28 (4) 20 (5) 14

13. An airplane is traveling horizontally with speed 100 m/s. The airplane’s altitude is 500 m. The airplane drops a bomb. What is the length of the displacement vector, in km, from the position where the airplane drops the bomb to the position on the ground where the bomb lands?

(1) 0.82 (2) 1.36 (3) 0.91 (4) 0.71 (5) 1.13

14. A plane is flying at 3000 m with a speed of 100 m/s. The plane is diving at an angle of 20° with the horizontal. The pilot wants to drop a food package to refugees on the ground at point A. At what angle of sight $\alpha$ (degrees) must he drop the package?

(1) 76 (2) 54 (3) 36 (4) 48 (5) 42
15. An airplane traveling north at 400 m/s is accelerated due east at a rate of 50 m/s$^2$ for 6 s. If the effects of air resistance and gravity are ignored, what is the final speed of the plane, in m/s?

(1) 700  (2) 300  (3) 400  (4) 800  (5) 500

16. A boat that can travel at 4.0 km/h in still water crosses a river with a current of 2.0 km/h. At what angle must the boat be pointing upstream (that is, relative to its actual path) to go straight across the river?

(1) 30°  (2) 27°  (3) 60°  (4) 90°  (5) 63°

17. A ball requires 3 seconds to fall half the distance to the ground. From what height (in meters) was it dropped?

(1) 176.4  (2) 44.1  (3) 22.05  (4) 88.2  (5) 29.4

18. A car traveling along a road begins accelerating with a constant acceleration of 1.5 m/s$^2$ in the direction of motion. After traveling 392 m at this acceleration, its speed is 35 m/s. Determine the speed of the car (in m/s) when it began accelerating.

(1) 49  (2) 25.2  (3) 2.3  (4) 7  (5) 1.5

19. A rock is thrown out from a tower with initial velocity 10 m/s, at an angle of 30° above the horizontal. The rock is in the air for 10 s. What is the height of the tower in m? Neglect air friction.

(1) 498  (2) 302  (3) 342  (4) 440  (5) 398

20. Two automobiles are 250 km apart and traveling toward each other. One automobile is moving at 65 km/hr and the other is moving at 105 km/hr. In how many hours will they meet?

(1) 1.56  (2) 1.67  (3) 1.95  (4) 1.47  (5) 3.84