**Practice Questions Based on CBSE Physics class IX Chapter Motion and Rest**

1. A jogger runs with a constant 2.2 m/s speed for 15 minutes. What distance does she travel during that time?
2. After 15 minutes, the jogger in problem 1 gets tired, and during the next 2 seconds, she reduces her speed to 1.8 m/s. What was her average acceleration during these 2 seconds?
3. Assuming she moves during these 5 seconds with an average speed of 2.0 m/s, what distance does she travel while decelerating?
4. Add the results in problems 1 and 3, and using the total time of the motion, 15 minutes and 5 seconds, find the overall average speed of the jogger.
5. What is the acceleration of a tennis ball if initially it comes toward the player's racquet at 20 m/s, and it leaves in the opposite direction at 24 m/s? A high-speed camera indicates the time of impact of 4.0m s.
6. How long does it take the ball in problem 5 to travel 15 meters after being played? Neglect the gravitational effect, and suppose the ball travels along a straight line and assume a speed of 24 m/s.
7. A racecar driver steps on the gas, and his car travels 16 meters in 2 seconds, starting from rest. What is the average velocity in m/s and in km/h?
8. What is the average acceleration of the racecar in problem 7 in $m/s^2$?

Refer to Figure 3.1 for numerical values needed to solve the following problems.

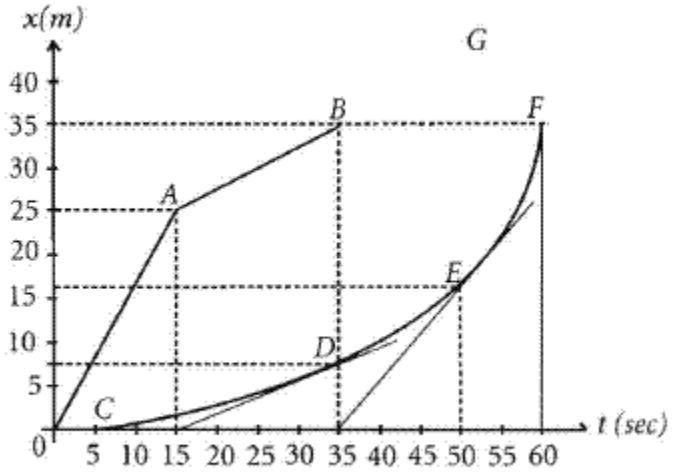


**Figure 3.1**

9. Find the overall average speed of swimmer number one during the race.
10. Find the overall average speed of the second swimmer from the time he starts swimming until he ends his race.
11. What is the instantaneous speed of the second swimmer at time $t$ = 25 s during the race?
12. What is the average acceleration of the second swimmer during the time interval starting at$t_i$ = 25 s and ending at $t_f$ = 50 s?

13. What is the average acceleration of the second swimmer during the time interval starting at$t_i$ = 25 s and ending at $t_f$ = 35 s?
14. What is the average acceleration of the first swimmer during the time interval starting at $t_i$ = 10 s and ending at $t_f$ = 30 s?
15. A car brakes from 60 mi/h to a full stop in 4 seconds. Find the acceleration of the car during this time interval in m/s$^2$.
16. What distance did the car in problem 15 travel in the time since first applying the brakes?
17. A cheetah resting in the savanna sees her prey and accelerates from rest to 70 mi/h in 6.2 seconds. Assuming she moves with a constant acceleration, find this acceleration and the distance she ran when she first reaches 30 mi/h.
18. After what distance did the cheetah reach 70 mi/h?
19. Find the fall time for an object dropped from an altitude of 25,000 meters, neglecting air drag (i.e., the time it takes the bullet in the previous · example to return to the starting point, from the time it reached its maximum height).
20. Suppose the bullet is still effective in piercing sheet metal at a speed of 100 m/s. What is the maximum altitude at which you could still use this bullet to fight an aerial attack?
21. To find the depth of a well, you drop a small pebble and time its fall until you hear the splash of the pebble on the water surface below. What is the depth of the well if the time you got is 3.25 seconds? Consider that sound propagates almost instantaneously from the surface of the water to your ear.
22. What is the depth of the well if we take into account the finite sound speed in air of 334 m/s?
23. A mouse is dropped from an eagle's claws starting at an altitude of 150 meters. What distance does it fall in the first second after it is dropped?
24. What distance does the mouse in problem 23 travel in the third second of its free fall?
25. At what speed does the mouse in problem 23 hit the ground?
26. A bullet blasts from the barrel of a gun upward in the vertical direction with an initial speed of 700 m/s. Find the maximum altitude reached by this bullet and the time needed to reach it.

**Answers**

1. 1,980 m
2. –0.2 m/s$^2$
3. 4m
4. 2.192 m/s
5. 1.1 × 10$^4$ m/s$^2$
6. 0.625 s
7. 8 m/s or 28.8 km/h
8. 4 m/s$^2$
9. 1 m/s
10. 0.636 m/s
11. 0.25 m/s
12. 0.034 m/s$^2$

13. 0.005 m/s$^2$
14. 0.055 m/s$^2$
15. 6.705 m/s$^2$
16. 53.64 m
17. $a$ = 5.046 m/s$^2$ and 17.81 m
18. 96.95 m
19. 71.43 s
20. 24,489.8 m
21. 51.756 m
22. Let $t$ = 3.25 s and let $ts$ = time for sound propagation. Obviously, one condition is that $ts < t$ (from causality). Let the depth of the well be $d$, and let $v_s$ be the speed of sound in air. We have
    $d = 1/2g(t - ts)^2$
    $d = v_s t_s$
    Eliminating $d$ and solving for $t_s$, we find $t_s$ = 0.142 $s$, and therefore $d$ = 47.428 m.
    Neglecting the finite sound speed introduces a 9.125% error.
23. 4.9 m
24. 4.9 (9 – 4) = 24.5 m
25. 54.221 m/s
26. $h$ = 25,000 m = 25 km, $t$ = 71.43 s
27.