Ch. 4. Describing Motion: Acceleration Review Worksheet

1. A motorbike accelerates uniformly from 7.8 m/s to 15.2 m/s in a time of 3.7 s. What is its acceleration?

2. How much time does it take for a cheetah to accelerate from 3.2 m/s to 27.4 m/s while accelerating at 4.5 m/s²?

3. A train accelerates from a speed 3.4 m/s for 14.2 s while undergoing an acceleration of 1.3 m/s². What is the train’s final speed?

4. Examine the following graph of an object accelerating:

   a) What is the acceleration for this object?
   b) What was the distance travelled by this object over the first 10 seconds?

5. A car is travelling at 5.6 m/s when it increases its speed to 17.8 m/s over a time of 6.7 s. How much distance is covered during this acceleration?

6. The initial speed of a plane is 45 m/s. The plane accelerates at 2.3 m/s² over a distance of 670 m. What is the final speed of the aircraft?

7. Two cars are involved in a race. Car 1 travels at a constant speed of 17 m/s. Car 2 is initially at rest but accelerates at 3.6 m/s². Assume both cars start from the same point at the same time.
   a) Who has travelled the greatest distance after 14.0 s?
   b) At which distance does Car 2 catch up to Car 1? (Careful this is a toughie!)

8. A driver of a car going 110 km/h (30.6 m/s) suddenly sees the lights of a barrier 53 m ahead. The reaction time for the driver is 0.45 s. When the brakes are applied the acceleration of the car is -10.1 m/s². Determine if the car hits the barrier. Prove with calculations.

9. A stone falls freely from a height of 167 m. (Ignore effects due to air friction.)
   a) How much time elapses before the stone hits the bottom?
   b) What is the maximum speed of the stone (impact speed)?

10. A rock falls for a time of 6.7 s. From what height was the rock dropped from? What was its impact velocity?

11. A ball is hit straight up into the air with an initial speed of 34 m/s. (Ignore effects due to air friction.)
    a) How much time elapses before the ball reaches its maximum height?
    b) What is the total time for the ball to be in the air?
    c) What is the maximum height of the ball?
    d) What is the maximum speed of the ball (impact speed)?
12. A small stone is thrown straight up into the air with an initial speed of 78 m/s up over a 45 m high cliff. \textit{(Ignore effects due to air friction.)}

a) What is the maximum height of the stone above the cliff top?

b) How much time elapses before the stone hits the bottom?

c) What is the maximum speed of the stone (impact speed)?

13. A helicopter is rising straight up with some constant initial speed. An object is let go out of the helicopters window and takes 4.3 s to fall a distance of -45 m to the ground. At what speed was the helicopter rising at?

14. A weather balloon is floating at a constant height above the Earth when it releases a pack of instruments.

a) What was the height of the balloon if the pack hits the ground with an impact speed of -89.3 m/s?

b) How much time does it take the instrument pack to fall this distance?

15. A car is launched off a 25 m high cliff with an horizontal speed of 15 m/s.

a) How much time will it take the car to hit the bottom of the cliff?

b) What is the range of the car (distance from the base of the cliff)?

c) What is the maximum vertical speed of the car (vertical impact speed)?

16. A dog leaps horizontally off a 12 m high cliff and lands in the water at a range of 21 m. With what horizontal speed did the dog leap into the water?

17. Examine the graph of velocity vs time for a moving object:

\begin{center}
\begin{tabular}{|c|c|}
\hline
\textbf{Time (s)} & \textbf{Velocity (m/s)} \\
\hline
0 & 0 \\
2 & 10 \\
4 & 20 \\
6 & 30 \\
8 & 30 \\
10 & 20 \\
12 & 10 \\
14 & 0 \\
\hline
\end{tabular}
\end{center}

a) What is the acceleration during the first 3 seconds?

b) What is the average acceleration between 2.0 and 10.0 s?

c) During what times was the velocity constant?

d) What was the maximum velocity reached by this object?

e) During what times was the object “braking” (or slowing down or having (-) acceleration)?