Motion worksheet

For this worksheet use $g = 9.81\ ms^{-2}$.

1 A ball rolls down a 445 m slope from rest. If it accelerates at a rate of 3.16 ms^{-2}, determine the time it takes to reach the bottom of the slope and the ball's final velocity.

2 How far does a car travel in 45 seconds if it has an acceleration of 0.32 ms^{-2}? Assume that it starts from rest.

3 A toy car starts from rest and accelerates at a uniform rate of 4.0 ms^{-2} for 3.0 seconds. It then maintains a uniform speed for 12.0 seconds. Finally it takes 6.0 seconds to decelerate uniformly to rest. Find the total distance travelled and the average speed of the entire trip.

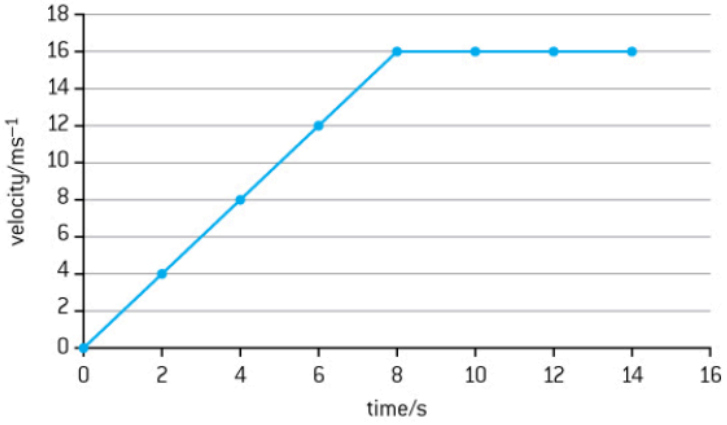
4 A car travels 25.0 km of a 50.0 km trip at an average speed of 40.0 kmh^{-1}. It travels the second half of its journey at an average speed of 80.0 kmh^{-1}. A truck makes the same trip but spends half of its time at an average speed of 40.0 kmh^{-1} and the other half of its time at an average speed of 80.0 kmh^{-1}. Which vehicle got there in the shortest period of time? Show your work.

5 A speeding car is travelling at a constant speed of 44 ms^{-1} when it passes a stationary police car. The police car immediately accelerates uniformly from rest at a rate of 2.2 ms^{-2}. If the car does not slow down and the police officer maintains the rate of acceleration, how long will it take the police car to catch the speeding car?

6 Two balls are 8.0 metres apart and moving directly towards each other. If the first ball is moving at a speed of 2.5 ms^{-1} with respect to the ground and the second ball 3.5 ms^{-1} with respect to the ground, where will they collide?

7 A helicopter is ascending at a constant speed of 12 ms^{-1} and drops a package from a height of 64 m. How long will it take the package to reach the ground? Assume there is no air resistance.

8 Use this graph to determine the following:



a the acceleration during the first 8 seconds.

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b the displacement of the whole trip.

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c the average velocity of the whole trip.

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9 A football is kicked from the ground with an initial speed of 16 ms^{-1} at an angle of 24° to the horizon. At what two times will the ball have a height of 1.0 m? Assume the kick happens at $t = 0$ s.

10 A rock is thrown from the top of a 36 m high cliff with an initial speed of 12 ms^{-1} at an angle of 52° to the horizon. How long will it take the rock to reach the bottom of the cliff?

1) **Time:** 16.8 s; **Velocity:** 53.1 ms^{-1}

2) **Speed:** 324 m

3) **Distance:** 200 m; **Average speed:** 9.4 ms^{-1}

4) The truck arrives 0.104 hours earlier than the car.

5) **Time:** 40 s

6) They collide 3.3 m from the starting position of the first ball.

7) **Time:** 5.0 s

8)
   a) **Acceleration:** 2 ms^{-2}
   b) **Displacement:** 160 m
   c) **Average velocity:** 11.4 ms^{-1}

9) **Times:** 0.18 s and 1.1 s

10) **Time:** 3.8 s