**2B Practice**

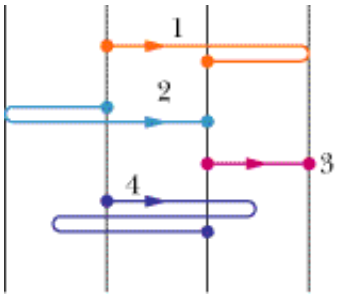
Answers are available in the classroom and on the website. Scan this QR code for a direct link.

# Uniform Acceleration (in Stages…)

1. Fiona drives 30 km at 60 km/h. She then encounters construction traffic and must slow to 45 km/h for the next 45 km.
   (a) What is her average speed over the entire trip?
   (b) Sketch a graph that shows her motion. Include key positions and times on the axes. Also show the average speed using a dashed line.

2. A man travels with his car 150 m to the east and then 70 m to the west, calculate the average speed and the average velocity of the car if the entire trip takes 10 seconds.

3. This figure shows four paths along which objects move from a starting point to a final point, all in the same time interval. The paths pass over a grid of equally spaced straight lines. Rank the paths according to
   (a) the average velocity of the objects, greatest first, and
   (b) the average speed of the objects, greatest first.




4. A train traveling through a town moves at 14 km/h for 6.0 minutes. When the train moves into an open area, its speed is 90 km/h for 9.0 minutes. What is its average speed (assuming that the change in speed is instantaneous)?

5. You are to drive to an interview in another town, at a distance of 300 km on an expressway. The interview is at 11:15 a.m. You plan to drive at 100 km/h, so you leave at 8:00 a.m. to allow some extra time. You drive at that speed for the first 100 km, but then construction work forces you to slow t o 40.0 km/h for 40.0 km. What would be the least speed (in km/h) needed for the rest of the trip to arrive in time for the interview?

An observer recorded the following data for the motion of a car undergoing constant acceleration.

| Time (s) | Speed (m/s) |
|---|---|
| 3.0 | 4.0 |
| 5.0 | 7.0 |
| 6.0 | 8.5 |

6. What was the magnitude of the acceleration of the car?
   A. 1.3 $m/s^2$
   B. 2.0 $m/s^2$
   C. 1.5 $m/s^2$
   D. 4.5 $m/s^2$

7. A car increases its speed from 9.6 meters per second to 11.2 meters per second in 4.0 seconds. The average acceleration of the car during this 4-second interval is
   A. 0.40 $m/s^2$
   B. 2.4 $m/s^2$
   C. 2.8 $m/s^2$
   D. 5.2 $m/s^2$

8. As a car is driven south in a straight line with decreasing speed, the acceleration of the car must be
   A. directed northward
   B. directed southward
   C. zero
   D. constant, but not zero

9. The speed of an object undergoing constant acceleration increases from 8.0 meters per second to 16.0 meters per second in 10 seconds. How far does the object travel during the 10 seconds?
   A. $3.6 \times 10^2$ m
   B. $1.6 \times 10^2$ m
   C. $1.2 \times 10^2$ m
   D. $8.0 \times 10^1$ m

10. A car traveling on a straight road at 15 meters per second accelerates uniformly to a speed of 21 meters per second in 12 seconds. The total distance traveled by the car in this 12-second time interval is
    A. 36 m
    B. 180 m
    C. 216 m
    D. 252 m

11. A race car starting from rest accelerates uniformly at 4.9 $m/s^2$. What is the car's speed after it has traveled 200 meters?
    A. 1960 m/s
    B. 62.6 m/s
    C. 44.3 m/s
    D. 31.3 m/s

12. If a car accelerates uniformly from rest to 15 meters per second over a distance of 100 meters, the magnitude of the car's acceleration is
    A. 0.15 $m/s^2$
    B. 1.1 $m/s^2$
    C. 2.3 $m/s^2$
    D. 6.7 $m/s^2$

13. The speed of a wagon increases from 2.5 meters per second to 9.0 meters per second in 3.0 seconds as it accelerates uniformly down a hill. What is the magnitude of the acceleration of the wagon during this 3.0-second interval?
    A. 0.83 $m/s^2$
    B. 2.2 $m/s^2$
    C. 3.0 $m/s^2$
    D. 3.8 $m/s^2$

14. A car traveling at a speed of 13 m/s accelerates uniformly to a speed of 25 m/s in 5.0 seconds.
    (a) Calculate the magnitude of the acceleration of the car during this 5.0-second interval.
    (b) A truck traveling at a constant speed covers the same total distance as the car in the same 5.0-second time interval. Determine the speed of the truck.

15. A skater increases her speed uniformly from 2.0 meters per second to 7.0 meters per second over a distance of 12 meters. The magnitude of her acceleration as she travels this 12 meters is
    A. 1.9 $m/s^2$
    B. 2.2 $m/s^2$
    C. 2.4 $m/s^2$
    D. 3.8 $m/s^2$

16. A car, initially traveling east with a speed of 5 meters per second, is accelerated uniformly at 2 meters per $second^2$ east for 10 seconds along a straight line. During this 10-second interval, the car travels a total distance of
    A. 50 m
    B. 60 m
    C. $1.0 \times 10^2$ m
    D. $1.5 \times 10^2$ m

17. A child riding a bicycle at 15 meters per second accelerates at -3.0 meters per $second^2$ for 4.0 seconds. What is the child's speed at the end of this 4.0-second interval?
    A. 12 m/s
    B. 27 m/s
    C. 3.0 m/s
    D. 7.0 m/s

Base your answers to 18 and 19 on the following information:

A car starts from rest and travels for 10 seconds with a constant acceleration of 3.0 $m/s^2$. The driver then applies the brakes causing a constant deceleration of magnitude 4.0 $m/s^2$. Assume the brakes are applied for 2.0 seconds.

18. How fast is the car going at the end of braking?

19. How far has the car gone at the end of braking?

20. Design an experiment to determine the acceleration of a student on inline skates coasting straight down a gentle incline. The incline has a constant slope. You have tape measures, traffic cones, and stopwatches available to you.
    (a) Describe a clear procedure to obtain the measurements necessary for this experiment.

    (b) Indicate what calculations you would use to determine the student's acceleration, including the specific equations you would use.

21. Zoe throws a 50-gram superball at a brick wall so that it impacts the wall at 11.0 m/s and rebounds at 8.0 m/s. A high-speed camera records this event. If the ball is in contact with the wall for 20.0 ms (milliseconds), what is the acceleration of the ball during the bounce? Ignore the effects of gravity in this problem.

22. A top fuel dragster accelerates from a rest with an acceleration of 5.10 g's. Once the dragster reaches its top velocity of 145 m/s, it travels at a constant speed for the rest of the 1/4-mile track. How much time did it take for the dragster to travel the length of the track?

23. Suppose that while traveling at 12.0 m/s, a driver sees a traffic light turn red. After 0.510 s has elapsed (the reaction time), the driver applies the brakes and the car slows at -6.20 $m/s^2$. What is the stopping distance of the car, as measured from the point where the driver first notices the red light?

24. A particle travels according to the following function for the first 3.0 seconds of its motion:

$$x(t) = 2.8t^2 + 0.15t^3 - 4.8t$$

It then continues with constant speed for another 5.0 s.

(a) Determine the instantaneous speed of the particle at the end of its first 3.0 seconds of motion.
(b) Calculate the distance traveled by the particle for the final 5.0 seconds of its motion.
(c) Calculate the average speed of the particle for the entire 8.0 seconds.

25. A drag racer accelerates from rest at an average rate of +13.2 $m/s^2$ for a distance of 100. m. The driver coasts for 0.500 seconds and then uses the brakes and parachute to decelerate until the end of the track. If the total length of the track is 180. meters, what minimum deceleration rate must the racer have in order to stop prior to the end of the track?

26. A car travels up a hill at a constant speed of 40 km/h and returns down the hill at a constant speed of 60 km/h. Calculate the average speed for the round trip.

27. At the instant a traffic light turns green, a yellow jeep traveling 20.0 m/s passes a blue van that had been stopped at the light. The blue van accelerates at 3.50 $m/s^2$.
    (a) Write individual equations relating *x and t* for the yellow jeep and for the blue van.
    (b) Use your equations to determine how long will it take the blue van to overtake the yellow jeep.
    (c) What is their displacement at this time?
    (d) Sketch a graph of *x vs. t* for the two vehicles.

28. In the Savannahs of Africa a gazelle is running in a straight line with a constant velocity is 16.25 m/s. A cheetah is startled by the gazelle when she runs past. At the instant the cheetah and gazelle are side by side, the cheetah accelerates after the gazelle from rest at 12.00 $m/s^2$.

    (a) How much time does it take for the cheetah to catch up to the gazelle?
    (b) How much distance is covered when the from the start line to when the cheetah catches up to the gazelle?
    (c) What is the speed of the cheetah when it catches up to the gazelle?

29. A pedestrian is running at his maximum speed of 6.0 m/s to catch a bus stopped at a traffic light. When he is 15 m from the bus, the light changes and the bus accelerates uniformly at 1.00 $m/s^2$. Does he make it to the bus? If so, how far does he have to run in order to catch it? If not, how close does he get?