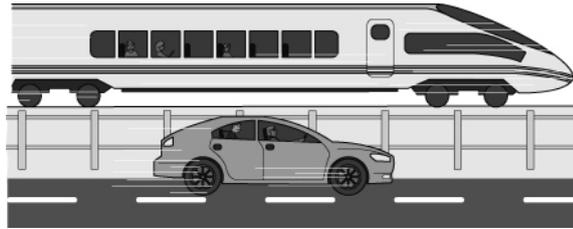


The train in the drawing is travelling at 120 mph. The car is travelling at 40 mph. If you are in the car, the train only seems to be travelling at 80 mph. We say that the speed of the train relative to the car is 80 mph.



Box X

For two vehicles moving in the same direction, you can find the speed of one relative to the other by finding the difference in their speeds. So, for the train and car in the drawing:

$$\begin{aligned} \text{speed of the train (the faster vehicle) relative to the car} &= 120 \text{ mph} - 40 \text{ mph} \\ &= 80 \text{ mph} \end{aligned}$$

Box Y

If you are looking out of the train at the car, the car seems to be moving backwards relative to the train.

$$\begin{aligned} \text{speed of the car (the slower vehicle) relative to the train} &= 40 \text{ mph} - 120 \text{ mph} \\ &= -80 \text{ mph} \end{aligned}$$

The minus sign shows that the car is moving backwards relative to the train.

- 1 A coach is travelling along the road at 60 mph. The train is still going at 120 mph. (Look at Box X to help you to work out your answers).
 - a How fast is the train going relative to the coach?
 - b How fast is the coach going relative to the car that is travelling at 40 mph?
- 2 A train is pulling out of a station and is travelling at 20 mph. A car on a nearby road is moving in the same direction at 45 mph. How fast is the car moving relative to the train?

Box Z

A car crashing into a barrier at 50 mph will be damaged much more severely than a car hitting the barrier at only 20 mph. The relative speed of two colliding objects is called the closing speed. So, for the first car, the closing speed between the car and the barrier is 50 mph.

- 3 A car travelling at 50 mph runs into the back of a car travelling in the same direction at 40 mph. What is the closing speed?
- 4 Car A is travelling at 30 mph along a motorway. Car B is travelling in the same direction at a speed of 55 mph. Show your working in your answers. What is the speed of:
 - a car B relative to car A
 - b car A relative to car B?
- 5 Explain the difference between your answers to question 4.

I can...

- explain what relative speed means
- calculate the relative speed between two objects moving along the same line.