

“All Aboard!” (35,000 points)

2.) On Friday morning, Mrs. Dr. Phil boarded Amtrak train 371 in Holland. When the train began to move, Dr. Phil moved along with it on the platform, staying next to Mrs. Dr. Phil’s window for the first 4.00 seconds up until the train was moving at about 2.00 m/s. (a) Find the acceleration of the train.

If the train continues on with this constant acceleration until the train reaches 45.0 mph (20.1 m/s), then (b) how long (time) and (c) how far (distance) will this take?

(d) It is 151 miles (243 km) from Holland to Chicago. It takes from 8:17am EDT to 10:30am CDT to get there. That’s 3 hours 13 minutes (remember there’s a time zone change). Find the average speed of the train in our SI units of meters/second.

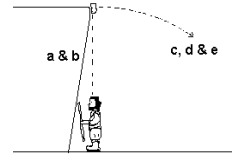
(e) Traveling at 60 m.p.h. (26.8 m/s), the train needs to be brought smoothly to a “quick” stop in a distance of 1.00 miles (1609 meters). What acceleration a is required?

Chicago...Benton Harbor...Holland...Grand Rapids

Pere Marquette	◀ Train Name ▶		Pere Marquette
370	◀ Train Number ▶		371
Daily	◀ Days of Operation ▶		Daily
◀ On Board Service ▶			
Read Down ▼		Mile	Symbol
5 29P Dp	Chicago, IL—Union Sta. ● (CT)	0	Ⓢ
5 47P	Hammond-Whiting, IN (CT)	16	Ⓢ
7 35P	New Buffalo, MI (ET)	62	●
8 05P	St. Joseph-Benton Harbor, MI	89	●
8 41P	Bangor, MI (South Haven)	116	●
9 29P	Holland, MI	151	●
10 15P Ar	Grand Rapids, MI (ET)	176	●
			Read Up ▲

Ice Age (35,000 points)

3.) While watching the three hour finale of *Survivor Marquesas* (doing research for Physics exams, of course – Dr. Phil wouldn’t watch trash TV) there was a commercial for Sierra Mist™ soft drinks, featuring a caveman who gets hit on the head by a chunk of ice. Now that chunk of ice fell from a good height, so it probably wouldn’t have just knocked the caveman out. (a) Suppose a chunk of ice falls from rest ($v_{0y} = 0$) at a height of 25.0 feet (7.63 m). How fast is it going just before it hits the ground?



(b) How long (time) does it take to fall? *This answer can be found without the answer to (a).*

(c) If the chunk of ice was kicked off the cliff 7.63 m above the ground, it wouldn’t just fall down, but also landed at $+8.00\text{ m}$ from $x_0 = 0$. What is v_x ?

(d) Find the final vector velocity, \vec{v} , when the kicked chunk of ice reaches the ground. Give the answer in Standard Form.

(e) Find the vector acceleration, \vec{a} , as the kicked chunk of ice flies through the air. Give the answer in Standard Form.