ABRHS PHYSICS (CP) NAME: KEY

Average Speed Problems

Concepts

A. What is meant by the term *instantaneous speed*? How would *instantaneous velocity* be different?

Just means the speed (or velocity) you have at a moment in time. Your car's speedometer tells you the instantaneous speed.

B. Use the word *instantaneous* to explain what is meant by the terms constant speed and constant velocity.

Constant speed (or velocity) just means your instantaneous speed (or velocity) doesn't change.

C. Define the phrase *average speed* - give a words definition and a math definition.

Average Speed = $\frac{\text{distance traveled}}{\text{time of travel}}$ $v = \frac{d}{t}$

D. If all you know is how far something traveled and how long it took, which of the following could you calculate?

✓ average speed ____ constant speed ____ instantaneous speed

E. If all you know is the average speed of something and the time it moved, which of the following can you calculate?

✓ distance traveled ____ constant speed ____ instantaneous speed

F. If all you know is the constant speed of something and the time it moved, which of the following can you calculate?

✓ distance traveled ✓ average speed ✓ instantaneous speed

Problems (SHOW YOUR WORK: INCLUDE EQUATIONS!)

1. Let's say you move from Point A to Point B with a constant speed of 15 m/s for 10 seconds.
   a. How far did you travel?

$v = \frac{d}{t}$ $15 = \frac{d}{10}$ $d = 150\ m$

   b. Could you have sped up or slowed down at any point during the 10 seconds?

Nope. Because it said constant speed

   c. How fast were going at the 3 second mark? How about the 5 second mark?

15 m/s. 15 m/s. Always 15 m/s. It's constant so doesn't change.

   d. What was your average speed for the entire 10 seconds?

15 m/s.

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2. Now let's say you move from Point A to Point B with an <u>average</u> speed of 15 m/s for 10 seconds.
   a. How far did you travel?

$v = \frac{d}{t}$ $\quad 15 = \frac{d}{10}$ $\quad \boxed{d = 150\ m}$

   b. Could you have sped up or slowed down at any point during the 10 seconds?

Sure.

   c. How fast were going at the 3 second mark? How about the 5 second mark?

No idea. No idea.

3. You travel to Concord (10 km away) in 45 minutes, through a lot of traffic. What was your average speed for the trip in m/s?

$d = 10\,km = 10{,}000\ m$

$t = 45\,min = (45)(60) = 2700\,s$

$v = \frac{d}{t} = \frac{10{,}000}{2700} = \boxed{3.7\ m/s}$

4. Imagine you walked 10 meters in 15 seconds, then another 10 meters in only 5 seconds.
   a. What was your average speed for the first 10 meters?

$v = \frac{d}{t} = \frac{10}{15} = \boxed{0.67\ m/s}$

   b. What was your average speed for the second 10 meters?

$v = \frac{d}{t} = \frac{10}{5} = \boxed{2\ m/s}$

   c. What was your average speed for the whole 20 meters?

$v = \frac{d}{t} = \frac{10+10}{15+5} = \frac{20}{20} = \boxed{1\ m/s}$

Notice it's NOT the average of 0.67 & 2!

5. You walk 200 m down a hallway at 1.2 m/s and then run another 200 m at 2.5 m/s.
   a. How many seconds does it take you to travel the entire 400 m?

1st Part: $v = \frac{d}{t}$ $\quad 1.2 = \frac{200}{t}$ $\quad t = 166.7$

2nd Part: $v = \frac{d}{t}$ $\quad 2.5 = \frac{200}{t}$ $\quad t = 80\,s$

   b. What was your average speed for this entire trip?

So total time = 166.7 + 80 = 246.7 sec

$v = \frac{d}{t} = \frac{400}{246.7} = \boxed{1.62\ m/s}$

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6. You drive down the highway at 30 m/s for 20 minutes and then drive for an additional 10 km at a speed of 15 m/s.

   a. What was the total distance you traveled?

1st Part
t = 20 min = (20)(60) = 1200 s
$v = \frac{d}{t}$
$30 = \frac{d}{1200}$
d = 36,000 m

2nd Part
d = 10 km = 10,000 m

So total distance
= 36,000 + 10,000
= 46,000 m

   b. What was the total time you traveled?

1st Part
t = 1200 s

2nd Part
$v = \frac{d}{t}$
$15 = \frac{10{,}000}{t}$
t = 667 s

So total time
= 1200 + 667 = 1867 s

   c. What was your average speed for the entire trip?

$v = \frac{d}{t} = \frac{46{,}000}{1867} = 24.6$ m/s

Answers: 1. a) 150 m b) no c) both 15 m/s d) 15 m/s 2. a) 150 m b) sure! c) can't tell either 3) 3.7 m/s 4. a) 0.67 m/s b) 2.0 m/s c) 1.0 m/s 5. a) 247 s b) 1.62 m/s 6. a) 46 km b) 1867 s c) 24.6 m/s