Tuesday, October 2/12
Science 10

Announcements

1. Quizzes - Returned

2. Understanding Concepts - Page 358: #3-6, 8 (To Be Done By All)

Optional → *Page 358: #7, 9
Page 359: #10

Stopped Here

3. Section 9.6 - Investigation: Balloon Car Contest (Page 360)

Problems.

1. list variables $v_{ave} =$, $t =$, $d =$ } 1

$v_{ave} \Rightarrow \frac{km}{h}, \frac{m}{s}$

$d \Rightarrow km, m$

$t \Rightarrow h, s$

2. $v_{ave} = \frac{d}{t}$ ①

3. rearrange formula ①

4. substitute values.

$v_{ave} = \frac{10km}{2h}$ <- ①

5. $v_{ave} = 5\frac{km}{h}$ } SD + unit ①

6. W.S. $\Rightarrow$ The average speed is $5\frac{km}{h}$. ①

$5\frac{km}{h}$ ①

Average Speed (Page 354)

average speed = $\frac{\text{total distance}}{\text{total time}}$

$$v_{ave} = \frac{\Delta d}{\Delta t}$$

v_{ave} - average speed (m/s)

Δd - change in distance (m)
- elapsed distance
- distance

Δt - change in time (s)
- elapsed time
- time

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Sample Problem 1

Eiko skates to school, a total distance of 4.5 km (Figure 2). She has to slow down twice to cross busy streets, but overall the journey takes her 0.62 h. What is Eiko's average speed during the trip?

$d = 4.5\text{ km}$

$t = 0.62\text{ h}$

$v_{ave} = ?$

$$v_{ave} = \frac{d}{t}$$

$$v_{ave} = \frac{4.5\text{ km}}{0.62\text{ h}}$$

$$v_{ave} = 7.258064516\ \frac{\text{km}}{\text{h}}$$

$$v_{ave} = 7.3\ \frac{\text{km}}{\text{h}}$$ ⇐ 2 SD + units

The average speed was $7.3\ \frac{\text{km}}{\text{h}}$.

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Sample Problem 2

Imagine that you are riding on the Cariboo Dayliner, in the dome car of course (**Figure 3**), and you see a sign that reads 120 km. You decide, after seeing several such signs, that you are going to measure the elapsed time between the next two signs, which are 10 km apart. You read the elapsed time as 390.6 s. Determine the speed of the train in kilometres per hour during the elapsed time.

$d = 10\text{ km}$

$t = 390.6\text{ s} \times \frac{1\text{ h}}{3600\text{ s}} = 0.1085\text{ h}$

$v_{ave} = ?$

$$v_{ave} = \frac{d}{t}$$

$$v_{ave} = \frac{10\text{ km}}{0.1085\text{ h}}$$

$$v_{ave} = 92\ \frac{\text{km}}{\text{h}}$$ 2 SF + units

The speed of the train was $92\ \frac{\text{km}}{\text{h}}$.

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Sample Problem 3

Kira is trying to predict the time required to ride her bike to the nearby beach. She knows that the distance is 45 km and, from other trips, that she can usually average about 20 km/h, including slowing down for climbing hills. Predict how long the trip will take.

$d = 45\,km$

$v_{ave} = 20\,\frac{km}{h}$

$t = ?$

$v_{ave} = \frac{d}{t}$

$t = \frac{d}{v_{ave}}$

$t = \frac{45\,km}{20\,\frac{km}{h}}$ 2SD

$t = 2.3\,h$ 2SD + units

The trip will take 2.3 h.

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Sample Problem 4

Janna has a summer job helping with bison research (**Figure 4**). She notes that they graze (move and eat grass) at an average speed of about 110 m/h for about 7.0 h/d. What distance, in kilometres, will the herd travel in two weeks (14 d)?

$V_{ave} = 110\,\frac{m}{h} \times \frac{1\,km}{1000\,m} = 0.110\,\frac{km}{h}$

$t = 7.0\,\frac{h}{d} \times 14\,d = 98\,h$

$d = ?$

$V_{ave} = \frac{d}{t}$

$d = V_{ave}\,t$

$d = 0.110\,\frac{km}{h} \times 98\,h$

3 SD 2 SD

$d = 11\,km$ ← 2 SD + units

The herd will travel 11 km.

Understanding Concepts - Page 358: #3-6, 8

* OPTIONAL: Page 358: #7, 9, 10

Understanding Concepts

1. **(a)** How is average speed different from instantaneous speed?
   (b) When are they the same?
2. A car and a truck travel along the same highway with the car moving faster than the truck.
   (a) How do their distances travelled compare after the same length of time?
   (b) How do their times compare after travelling the same distance?
3. Holidays might mean a multiday trip to be taken by foot, boat, train, or automobile. The Trans Canada Trail (**Figure 5**), for example, has become a popular hiking and cycling vacation route.

Figure 5

   (a) If two hikers walk the Trans Canada Trail for 6.0 h, and covered 31 km, what is their average speed for the day?
   (b) If three bike riders on the Trail cycle for 6.0 h one day, and cover 85 km, what is their average speed for the day?
   (c) Mary walked for 2.1 h along a portion of the Trans Canada Trail at a speed of 3.6 km/h. What distance did Mary travel?
   (d) What length of time would it take a hiker to travel a total distance of 25.0 km at an average speed of 5.2 km/h?
4. The cruise control of a car is set at 90.0 km/h. What distance is travelled by the car during 2.50 h?
5. Show that 1 m/s = 3.6 km/h.
6. Use the conversion factor in question 5 to convert
   (a) 92 km/h to m/s;
   (b) 21 m/s to km/h.
7. **(a)** The *Breitling Orbiter 3* balloon (**Figure 6**) set world records in 1999 by travelling 40 814 km in 19 d, 21 h, and 47 min. On March 1, 1999, the balloon lifted off from a village in the Swiss Alps. It eventually landed in Egypt on March 21. Calculate the average speed of the balloon.
   (b) Using the average speed you calculated in **(a)**, what length of time did it take the *Breitling Orbiter 3* to cross the Atlantic Ocean, a distance of 6670 km?
   (c) In the final leg of the round-the-world trip, the balloon flew for 18 h at an average speed of 210 km/h. How far did it travel?

Figure 6

8. In 1997, *Thrust SSC*, the world's fastest jet-engine car, travelled 604 m at an average speed of 341 m/s.
   (a) What length of time did this take?
   (b) Convert 341 m/s to kilometres per hour.
9. In a marathon race, one runner moving at 5.0 m/s passes a second runner moving at 4.5 m/s. What is the distance between the runners 10 min after the one runner passed the other?

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10. The "hand" of the Canadarm (**Figure 7**) used on the space shuttle can move up to 60 cm/s without a load attached.

(a) What is the minimum time for the Canadarm's hand to move 1.20 m?

(b) When the Canadarm is moving an object, the speed is slightly less than 60 cm/s. To move the same distance of 1.20 m, will the time be more or less than your answer to **(a)**? Explain your answer.

(c) The Canadarm takes 30 s to move some equipment from the cargo bay. During this time, the space shuttle moves 232 km through space. What is the speed of the space shuttle in kilometres per second? in kilometres per hour?

Figure 7