Physics Review

Key

A. Distance vs. Displacement

1. How are they similar? How are they different?

km, m, cm (both a unit of how far you went) → displacement has direction

2. If a person walks 20 m [E] and then ~~water~~ walks 35 m [W] – what is the person's total:
   a. distance 55m
   b. displacement 15m [W]

B. Speed and Velocity

1. How are they similar? How are they different?

both $\frac{m}{s}$ $\frac{\text{distance}}{\text{time}}$ ← direction for velocity

2. If a person drives a car 50 m [S] and then travels 10 m [N] in 35 seconds. What is the:
   a. Speed of the car $\frac{60m}{35s} = 1.7 \frac{m}{s}$
   b. Velocity of the car $\frac{40m\ [S]}{35s} = 1.1 \frac{m}{s}\ [S]$

C. Math Calculations

1. Drivers in a Volkswagen and a Cadillac take the same 140 km trip. The Volkswagen travels at 80 km/h for the entire trip. The Cadillac starts at the same time, driving at 100 km/h, but the driver stops for 10 min to fill the gas tank.
   a. Which car has the higher average speed? Cadillac
   b. Which car arrives first at the destination? Cadillac
   c. How many minutes separate the arrival times of the cars?

Volkswagen: $t = \frac{\Delta d}{v_{av}} = \frac{140km}{80\frac{km}{hr}} = 1.75\ hr.$

$1.75hr \times \frac{60\ min}{hr} = 105min$

Cadillac: $t = \frac{\Delta d}{v_{av}} = \frac{140km}{100\frac{km}{hr}} = 1.4\ hr. \times \frac{60min}{hr}$

$= 84\ min + 10\ min = 94\ min$

$v_{av} = \frac{\Delta d}{\Delta t} = \frac{140km}{1.56hr} = 89\frac{km}{hr}$

D. Graphing – position vs. time

1. Describes the butterfly's motion.

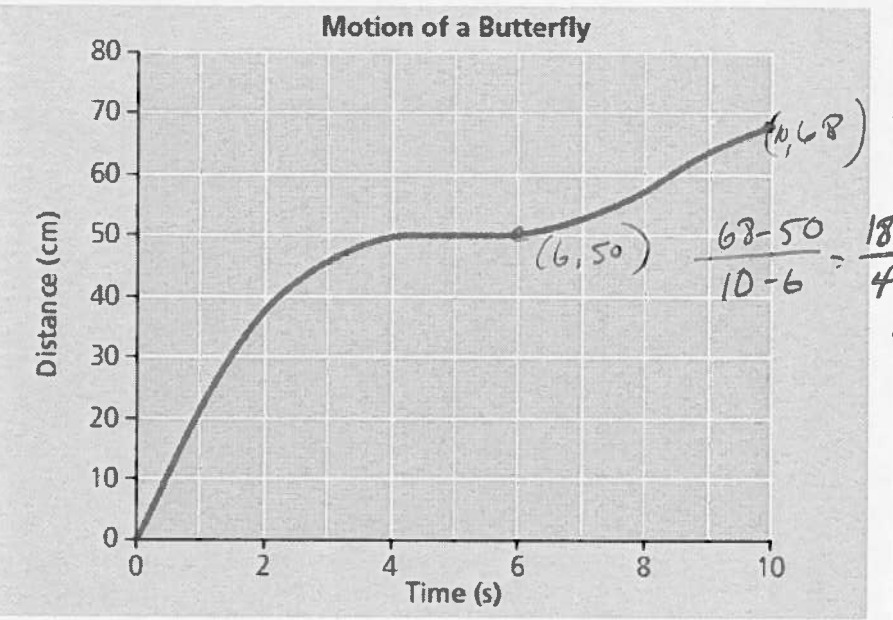
flies fast, slows down, stops
continues @ constant speed

2. What is the average speed of the butterfly from 4 to 6 seconds?

$\frac{0cm}{5}$

3. What is the average speed of the butterfly from 6 to 10 seconds?

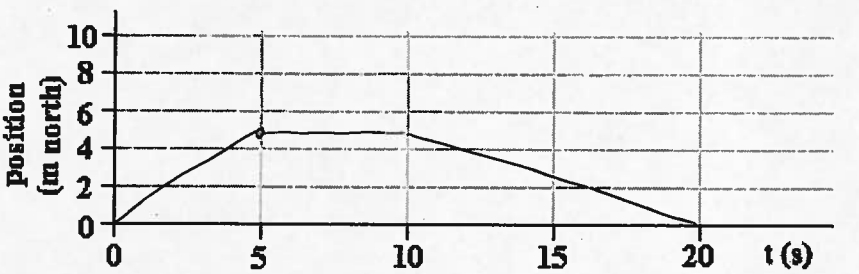
$\frac{45cm}{5}$.



E. Drawing a graph

Plot the following on the graph provided:

- Going 1 m/s for the first 5 seconds.
- Stopping for the next 5 seconds.
- Returning to the start in 10 seconds after he stopped.



1. What is the total distance? 10 m

2. What is the total displacement? 0m [N]

3. What is the velocity for the last 10 second interval? $V = \frac{\Delta d}{\Delta t} = \frac{-5m}{20s} = -0.25\frac{m}{s}[N]$

or

$0.25\frac{m}{s}[S]$

F. Acceleration – vocabulary

1. What are the similarities and differences between:
   a. Positive acceleration faster
   b. Negative acceleration slower — all change in velocity
   c. Zero acceleration ← No change.
2. Mary accelerates her car from 80 km/h [E] (22 m/s) to 100 km/h [E] (28 m/s) in 5.0 s.

What is the acceleration?

$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t} = \frac{28\ m/s - 22\ m/s}{5s} = \frac{6\ m/s}{5s} = 1.2\ \frac{m}{s^2}[E]$

G. Acceleration calculations

1. A ball is thrown upward from the top of a tall building at an initial vertical speed of 14.0 m/s. The acceleration of gravity on the ball is 9.8 m/s2 down. What is the velocity of the ball 2.50s later?

$v_i = 14.0\ \frac{m}{s}[up]$

$a = -9.8\ \frac{m}{s^2}[up]$

$v_f = ?$

$t = 2.50s.$

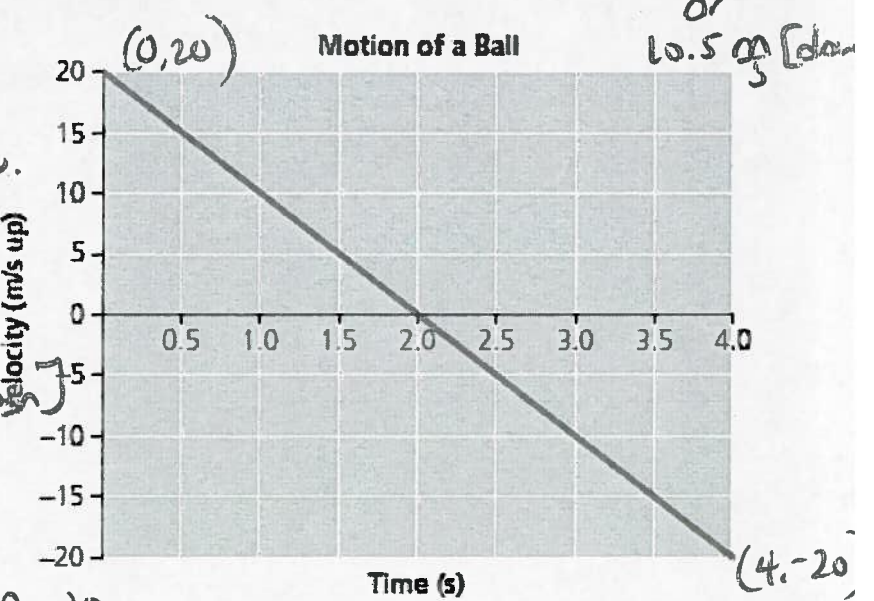
$v_f = v_i + \Delta v$ ← $a \cdot \Delta t$

$= v_i + a\Delta t$

$= 14.0\ \frac{m}{s}^{up} + -9.8\ \frac{m}{s^2}[up](2.50s) = -10.5\ \frac{m}{s}[up]$

or $10.5\ \frac{m}{s}$ [down]

H. Reading Velocity graphs



1. Describe the motion of the ball.
   slow down, stop, go backwards.
2. What is the velocity of the ball at:
   a. 1 sec $10\ \frac{m}{s}[up]$
   b. 2 sec $0\ \frac{m}{s}[up]$
   c. 3 sec $-10\ \frac{m}{s}[up]$ or $10\ \frac{m}{s}$ [down]
3. What is the acceleration of the ball?

$a = \frac{\Delta v}{\Delta t} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-20 - 20}{4 - 0}$

$= \frac{-40}{4} = -10\ \frac{m}{s^2}[UP]$

or

$10\ \frac{m}{s}$ [down]

I. Graphing velocity and acceleration

Graph the following data on the grid to the right.

Work

Velocity (m/s)	13	15	18	24	25	22	20	19
Time (s)	0	2	4	6	8	10	12	14

1. What is the acceleration for the first 8 seconds? $\frac{25-13}{8-0} = \frac{12}{8} = 1.5 \frac{m}{s^2}$ N
2. What is the acceleration for the next 6 seconds? $\frac{19-25}{14-8} = \frac{-6}{6} = -1 \frac{m}{s^2}$ N
3. Sketch an acceleration graph that would be related to this graph.