Average Speed, Instantaneous Speed, & Acc. Lab

Questions

① a) $v = \frac{d}{t}$

$v = \frac{3400 \text{ miles}}{68 \text{ hours}}$

$\boxed{v = 50 \frac{\text{miles}}{\text{hr}}}$

b) $50 \frac{\text{miles}}{\text{hr}} \cdot 1 \text{ hr} = 50 \text{ miles}$

$50 \frac{\text{miles}}{\text{hr}} \cdot (2 \text{ hr}) = 100 \text{ miles}$

$50 \frac{\text{miles}}{\text{hr}} (7.5 \text{ hr}) = 375 \text{ miles}$

$50 \frac{\text{miles}}{\text{hr}} (10 \text{ hr}) = 500 \text{ miles}$

$50 \frac{\text{miles}}{\text{hr}} (3 \text{ days} \cdot \frac{72 \text{ hr}}{3 \text{ days}}) = 3600 \text{ miles}$

② a) $v = \frac{d}{t} = \frac{107 \text{ ft}}{5.35 \text{ months}} = \boxed{20 \frac{\text{ft}}{\text{month}}}$

b) $20 \frac{\text{ft}}{\text{month}} \cdot 6 \text{ months} = \boxed{120 \text{ ft}}$

$20 \frac{\text{ft}}{\text{month}} (1 \text{ year} \cdot \frac{12 \text{ months}}{1 \text{ year}}) = \boxed{240 \text{ ft}}$

$20 \frac{\text{ft}}{\text{month}} (60 \text{ months}) = \boxed{1200 \text{ ft}}$

$20 \frac{\text{ft}}{\text{month}} (3600 \text{ months}) = \boxed{72{,}000 \text{ ft}} \approx 13.6 \text{ miles}$

$20 \frac{\text{ft}}{\text{month}} (8 \text{ months}) = 160 \text{ ft}$

⑥ $v = \frac{d}{t} = \frac{61 \text{ ft} - 35 \text{ ft}}{4.45 \text{ months} - 1.50 \text{ months}} = \frac{26 \text{ ft}}{2.95 \text{ months}} = 8.8 \frac{\text{ft}}{\text{month}}$

2c) $8.8 \frac{ft}{month} \left(\frac{12 \text{ months}}{1 \text{ yr}}\right) = \boxed{105.6 \text{ ft}}$

2d) No. You would need to time the glacier over a very short interval of time to get a good estimate of the instaneous speed. The shortest interval would be from 2.75 months to 5.35 months ---- this is a difference of 2.6 months which is not a very small interval of time --- the speed could do a lot of changing in 2.6 month

(3) a) $v_{inst.@1.68s} \approx v = \frac{d}{t} = \frac{6.71yd - 3.78yd}{1.92s - 1.44s} = \frac{2.93yd}{.48s} = \boxed{6.1 \text{ yd/s}}$

b) $v_{inst.@.48s} \approx v = \frac{d}{t} = \frac{1.24yd - .36yd}{.72s - .24s} = \frac{.88 \text{ yd}}{.48s} = \boxed{1.8 \text{ yd/s}}$

c) $\text{acc.} = a = \frac{\Delta v}{\Delta t} = \frac{6.1 \frac{yd}{s} - 1.8 \text{ yd/s}}{1.68s - .48s} = \frac{4.3 \text{ yd/s}}{1.20s}$

$= \boxed{3.6 \text{ yd/s}^2}$

④ a) $a = \frac{\Delta v}{t}$

$a = \frac{-72 \text{ mph}}{24 \text{ s}}$

$\boxed{a = -3 \frac{\text{mph}}{\text{s}}}$

b)

time	0	1s	2s	3s	10s	15.4s	24s
instant. speed	72mph	69 mph	66mph	63 mph	42 mph	25.8 mph	0

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⑤ a) $v = \frac{d}{t}$

$v = \frac{43\text{m} - 0\text{m}}{30\text{s} - 0\text{s}}$

$\boxed{v = 1.4 \text{ m/s}}$

b) $v = \frac{d}{t}$

$v = \frac{30\text{m} - 15\text{m}}{10\text{s} - 5\text{s}} = \frac{15\text{m}}{5\text{s}} = \boxed{3 \text{ m/s}}$

c) The answers are different because the skier's speed is not constant.

d) $v = \frac{d}{t}$

$v = \frac{30\text{m} - 30\text{m}}{20\text{s} - 12\text{s}} = \frac{0\text{m}}{8\text{s}} = \boxed{0}$

@ 18s the skier was not moving

or

$v = 0$ @ 18s (maybe he fell down)

Questions for Meas. Ave. Speed & Inst. Speed Lab

(5) $a = \frac{v_2 - v_1}{t_2 - t_1} = \frac{10\frac{m}{s} - 0}{5s - 0s} = \boxed{+2\,m/s^2}$ ⓐ

b) displacement = area under v vs t graph

$\Delta d = \frac{1}{2} b \cdot h = \frac{1}{2}(5s)(10\frac{m}{s}) = {}^{+}25m$

$\Rightarrow$ Car is $\boxed{25m \text{ east of the stop sign}}$

c) displacement = area under v vs t graph

$t = 5s$ to $t = 10s$

$\Delta d_{5s \to 10s} = 5s(10\,m/s) = {}^{+}50m$

displ. $t = 10s$ to $15s$ = area under v vs t graph

$\Delta d_{10s \to 15s} = \frac{1}{2} b \cdot h = \frac{1}{2}(5s)(10\,m/s) = +25m$

$25m + {}^{+}50m + {}^{+}25m = {}^{+}100m$ ← displacement btwn

$\Rightarrow$ Car is $\boxed{100m \text{ east of the stop sign}}$ ⓒ

d) displ. = area under v vs t graph

$t = 15s$ to $20s$

$\Delta d = -\frac{1}{2}(5s)(5\frac{m}{s}) = -12.5m \Rightarrow$

$100m + -12.5m = \boxed{+87.5m \text{ east of stop sign}}$ ⓓ

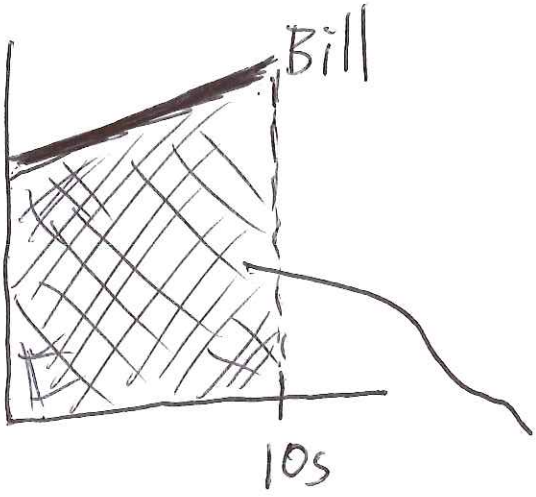
⑥ slope of d vs t graph = ave. vel ⇒ **Suzie** has the greatest ave. vel.

⑦ slope of v vs t graph = ave. acc. ⇓

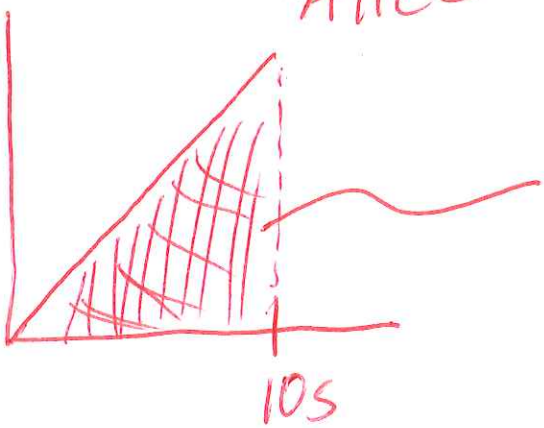
a) **Alice has the largest acc.**

b) displ. = area under v vs t graph ⇓

Bill has the larger displacement



larger area ⇒ larger Δd



smaller area ⇒ smaller Δd