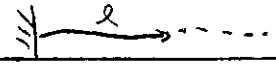
Physics 3 Homework Due 27 Jun 03 YJB

4. $v = 3 \times 10^{-9}$ m/s



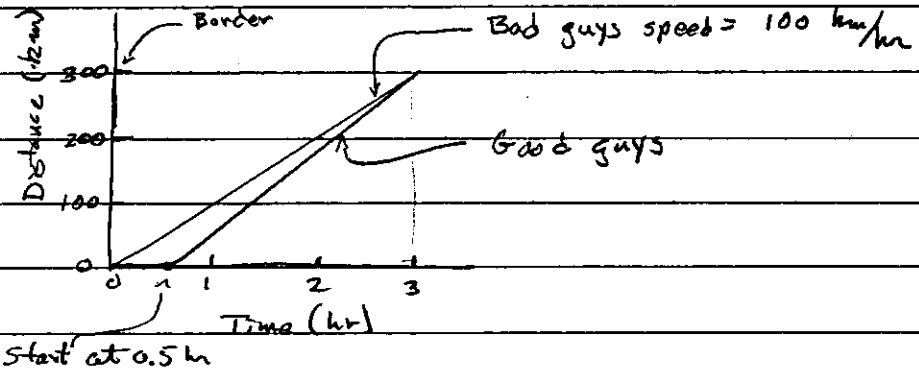
$l = vt$

$t = \frac{l}{v} = \frac{10\text{ cm} \times 10^{-2}\text{ m/cm}}{3 \times 10^{-9}\text{ m/s}} = 3 \times 10^{7}$ sec

Sanity check: $3 \times 10^{7}\text{ sec} \times \frac{1}{3.6 \times 10^{3}}\frac{\text{hr}}{\text{sec}} \times \frac{1}{24}\frac{\text{day}}{\text{hr}} =$

$= 10^{7} \times 10^{-3} \times 10^{-1} = 10^{3}$ days Slow hair

15.



Good guys speed is $\frac{200\text{ km}}{2.5\text{ hr}} = 120$ km/hr

20. $\Delta l = v\,\Delta t$ at constant speed.

$v = 96.5 \times 10^{3}$ m/hr $\times \frac{1}{3600}\frac{\text{hr}}{\text{sec}} = 26.8$ m/sec

$\Delta t = 1.00$ sec

$\Delta l = 26.8\text{ m/s} \times 1.00\text{ sec} = 26.8$ m

21. a. $1\ \text{ft} \times 12\ \text{in/ft} \times 2.54\ \text{cm/in} \times 10^{-2}\ \text{m/cm} = 3.048\ \text{m}$

$\Delta l = v \Delta t$

$\Delta t = \frac{\Delta l}{v} = \frac{3.048\ \text{m}}{2.998 \times 10^8\ \text{m/s}} = 1.017 \times 10^{-8}\ \text{sec}$

10 nanosec per foot !

b. $\Delta t = \frac{\Delta l}{v} = \frac{1.000 \times 10^3\ \text{m}}{2.998 \times 10^8\ \text{m/s}} = 3.336 \times 10^{-6}\ \text{sec}$

$= 3.336\ \mu\text{s}$

3 μs per km !

23. Speed is const fm $t = 2\ \text{sec}$ to $t = 3\ \text{sec}$
During this time $v = 2.0\ \text{m/s}$.
During this 1 second interval the cat traveled

$\Delta l = v \Delta t = 2.0\ \text{m/s} \times 1.0\ \text{sec} = 2.0\ \text{m}$

Min speeds on graph are

$v(0) = 0\ \text{m/s}$ $v(7\ \text{sec}) = 0\ \text{m/s}$

Max speed

$v(4\ \text{sec}) = 4.0\ \text{m/s}$

Speed was nonzero and constt fm 2.0 - 3.0 sec and fm 4.0 - 5.0 sec.

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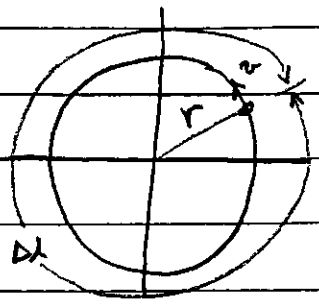


$d = 2r = 1.276 \times 10^7 \text{ m}$

$\Delta t = 23 \text{ hr } 56 \text{ min}$

$\Delta l = \pi d = \pi \times 1.276 \times 10^7 \text{ m} = 4.009 \times 10^7 \text{ m}$

$\Delta t = 23 \text{ hr} \times 3600 \text{ sec/hr} + 56 \text{ min} \times 60 \text{ sec/min}$

$= 8.616 \times 10^4 \text{ sec}$ (last sig fig dicey)

Assuming constant speed

$$v = \frac{\Delta l}{\Delta t} = \frac{4.009 \times 10^7 \text{ m}}{8.616 \times 10^4 \text{ sec}} = 4.653 \times 10^2 \text{ m/s}$$

40. $v(0) = 0.0 \text{ m/s}$

$v(1.0) = 0.9 \text{ m/s}$

$v(2.0) = 2.0 \text{ m/s}$

$v(4.5) = 4.0 \text{ m/s}$

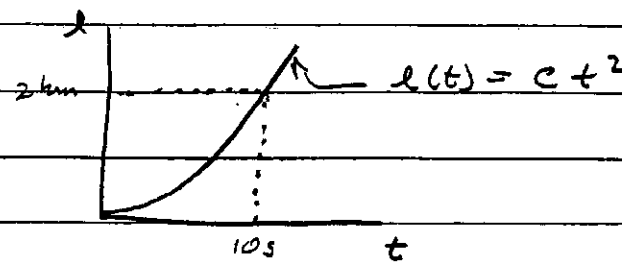
$v(6.0) = 1.4 \text{ m/s}$

$v(7.0) = 0.0 \text{ m/s}$

Increasing 1 - 1.5 sec 3.5 - 4.0 sec

Decreasing 5.0 - 7.0 sec

42.



Find c from boundary condition

$$\ell(t) = c t^2$$

$$c = \frac{\ell(t)}{t^2} = \frac{\ell(10\,\text{sec})}{(10\,\text{sec})^2} = \frac{2\,\text{km}}{(10\,\text{sec})^2} = 2\times10^{-2}\ \text{km/se}$$

units of c are km/sec^2

Now find speed at time $t = 10$ sec

$$v(t) = \frac{d\ell}{dt}$$

$$= \frac{d}{dt} c t^2$$

$$v(t) = 2ct$$

$$v(10\,\text{sec}) = 2 \times 2\times10^{-2}\ \text{km/sec}^2 \times 10\ \text{sec} = 0.4\ \text{km/sec}$$

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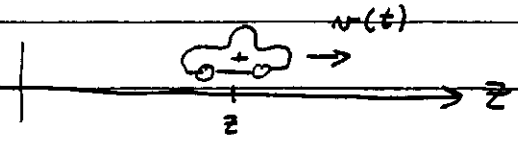

$z(t) = C(A + Bt^2)$

$v(t) = ?$ $\quad v(4\,sec) = ?$ $\quad v(t) = 0\,;\ t = ?$

$$v(t) \equiv \frac{dz(t)}{dt}$$

$$= \frac{d}{dt}(CA + CBt^2)$$

$$\boxed{v(t) = 2CBt}$$

$v(4\,sec) = 2CB \times 4\,sec = 8CB\ m/s$

units: $[m][m^2/s^2][sec] = [m/s]$ OK

When is speed zero?

$v(t_0) = 0\ ;\ t_0 = ?$

$0 = 2CBt$

$$\boxed{t_0 = 0\ m/s}$$