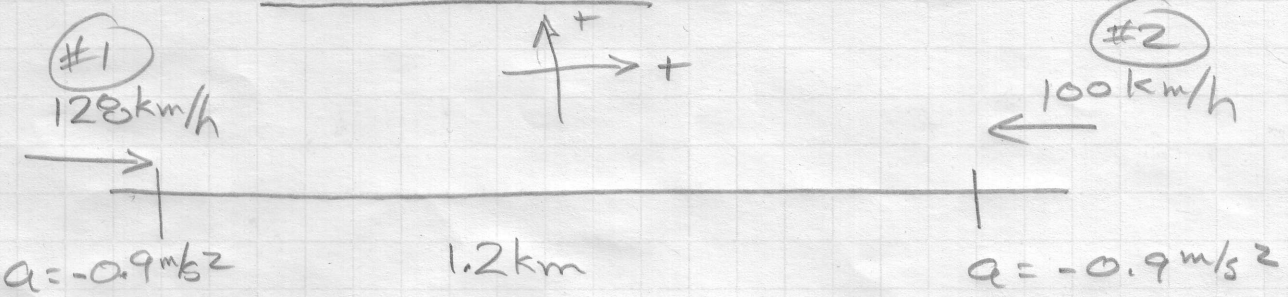
WORKSHEET #3

1.



Strategy - clarify/simplify problem (units)

128 km/hr → 35.56 m/s
100 km/hr → 27.78 m/s.
1.2 km → 1200 m

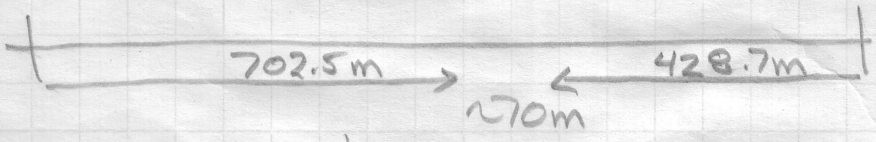
Find Δd when $V_2 = 0$ (for both trains) & verify that the two Δd's added up ≤ 1200m

#1 G: $V_1 = 35.56\ m/s$
$V_2 = 0$
$a = -0.9\ m/s^2$
R: Δd
S: $V_2^2 = V_1^2 + 2a\Delta d$

$$\Delta d = \frac{V_2^2 - V_1^2}{2a} = \frac{-(35.56\ m/s)^2}{-2 \times 0.9} = +702.5\ m$$

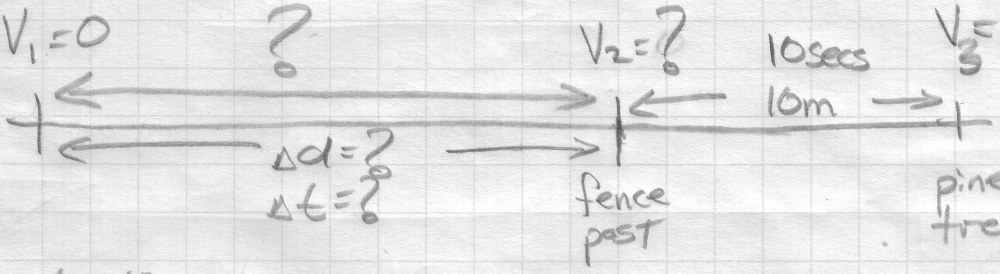
#2 G: $V_1 = -27.78\ m/s$
$V_2 = 0$
$a = +0.9\ m/s^2$
R: Δd
S: $\Delta d = \frac{V_2^2 - V_1^2}{2a}$

$$= \frac{-(-27.78\ m/s)^2}{2(0.9\ m/s^2)} = -428.7\ m$$



∴ no crash.

#2.



Part 1

G: $\Delta t = 10\ secs$

R $\Delta d = 10m$

$V_2 = 1.2\ m/s$

R: a & V_1

S: $\Delta d = \left(\frac{V_1 + V_2}{2}\right)\Delta t$

$V_1 = \frac{2\Delta d}{\Delta t} - V_2$

$= 0.8\ m/s$.

$\Delta d = V_2 \Delta t - \frac{1}{2} a \Delta t^2$

$a = \frac{2V_2}{\Delta t} - \frac{2\Delta d}{\Delta t^2}$

$= \frac{2(1.2\ m/s)}{10s} - \frac{2 \times 10m}{(10s)^2}$

$= 0.04\ m/s^2$.

Strategy - using given information find V_{fp} & a

- use calculated V_{fp} & a & $V_1 = 0$ to find Δd.

Part 2

$V_1 = 0$ $\quad a = 0.04\ m/s^2$ $\quad V_2 = 0.8\ m/s$

find Δd

$V_2^2 = V_1^2 + 2a\Delta d$

$\Delta d = \frac{V_2^2 - V_1^2}{2a}$

$= \frac{(0.8\ m/s)^2}{2 \times 0.04\ m/s^2}$

$\boxed{\Delta d = 8m}$

$\Delta t = (V_2 - V_1)/a$

$\Delta t = 20\ secs$

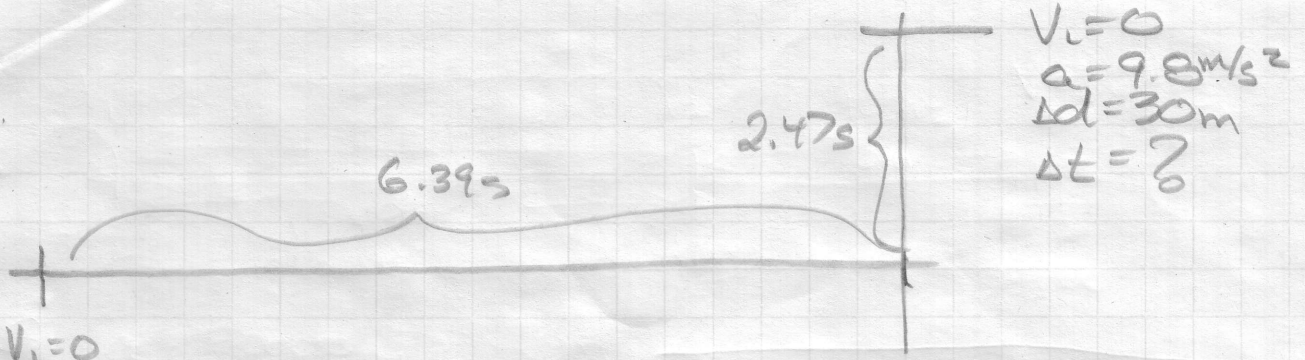
$\Delta d = V_{avg} \Delta t$

$= 0.4\ m/s \times 20$

$= 8m$

check.

#3.



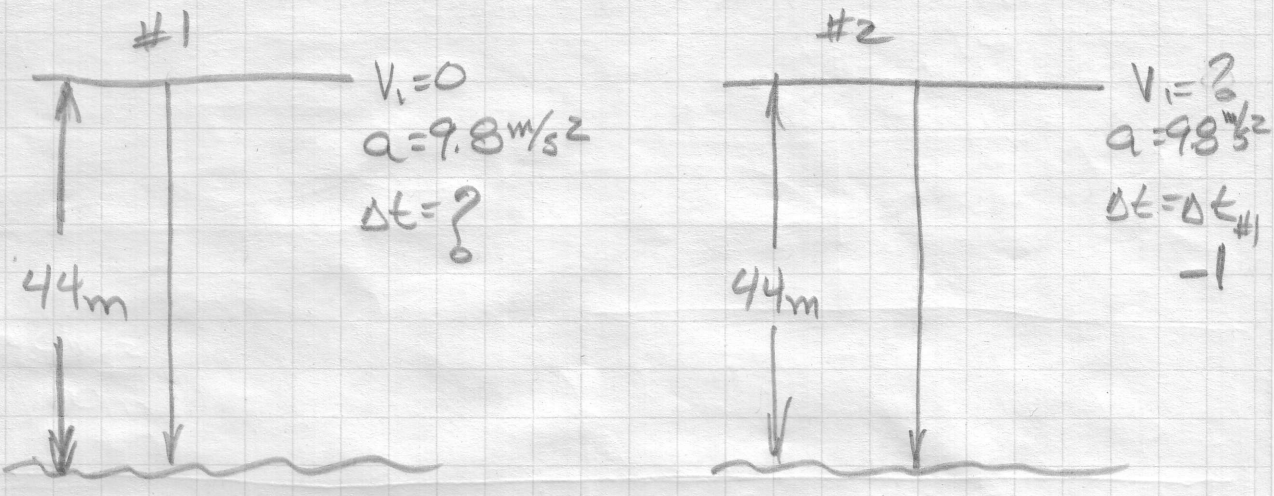
Strategy: break into two simpler problems
① time taken for parcel to hit truck.
② how long did it take for truck to get to intersection point.

① G: $V_i = 0$, $a = 9.8\ m/s^2$, $\Delta d = 30m$
R: Δt
S: $\Delta d = V_i t + \frac{1}{2} a t^2$ $\Delta t = \sqrt{2d/a} = 2.47s.$

② G: $V_i = 0$, $a = 4.9\ m/s^2$, $\Delta d = 100m$
R: Δt
S: $\Delta t = \sqrt{2\Delta d/a} = 6.39\ s.$

∴ must drop parcel after truck has accelerated for $(6.39 - 2.47) = 3.92\ s.$

#4.



Strategy ① Calculate time for first stone.
② subtract 1 sec from this time as time for 2nd stone, use this time to calculate V_1.

Stone 1: G: $V_1 = 0$, $\Delta d = 44m$, $a = 9.8\ m/s^2$
R: Δt
S: $\Delta d = V_1 t + \frac{1}{2} a t^2$

$$t = \sqrt{\frac{2\Delta d}{a}} = \sqrt{\frac{2 \times 44m}{9.8\ m/s^2}} = 3.0\ s.$$

Stone 2: G: $\Delta t = 2.0\ s$, $\Delta d = 44m$, $a = 9.8\ m/s^2$
R: V_1
S: $\Delta d = V_1 t + \frac{1}{2} a t^2$

$$V_1 = \Delta d/t - \frac{1}{2} a t$$
$$= 44m/2.0s - \frac{1}{2}(9.8\ m/s^2)(2.0s)$$
$$= 12.2\ m/s.$$