Accelerated Motion Example Problem Key

1) $V_0 = 0\ m/s$
$\Delta X = 40\ m$
$t = 5s$

(a) EQ2 $\Delta X = V_0 \Delta t + \frac{1}{2} a (\Delta t)^2$

$40m = 0 + \frac{1}{2} a (5s)^2$

$\frac{40m\ (2)}{25s^2} = \boxed{a = 3.2\ m/s^2}$

(b) EQ4 $\Delta X = \frac{1}{2} (V_f + V_0) \Delta t$

$40m = \frac{1}{2} (V_f + 0\ m/s)(5s)$

$\frac{(40m)(2)}{5s} = \boxed{V_f = 16\ m/s^2}$

(c) EQ2 $\Delta X = V_0 \Delta t + \frac{1}{2} a t^2$

at $t = 1s$

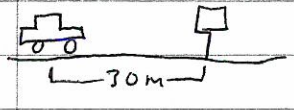
$\Delta X = 0 + \frac{1}{2} (3.2 m/s^2)(1s)^2 = \boxed{1.6\ m}$

at $t = 2s$

$\Delta X = 0 + \frac{1}{2} (3.2 m/s^2)(2s)^2 = 6.4\ m$; ΔX from $t_1 \rightarrow t_2$ $6.4m - 1.6m = \boxed{4.8\ m}$

. . . .

2) $V_0 = 20\ m/s$
$a = -2\ m/s^2$



(a) 30m left or −30m

(b) $t = 8s$; EQ1 $V_f = V_0 + a \Delta t$
$V_f = ?$ $V_f = 20m/s + (-2m/s^2)(8s)$
$= 20m/s - 16m/s$
$\boxed{V_f = 4\ m/s}$

(c) $t = 8s$ EQ2 $\Delta X = V_0 \Delta t + \frac{1}{2} a t^2$
$\Delta X = ?$
$\Delta X = (20m/s)(8s) + \frac{1}{2}(-2m/s^2)(8s)$
$= 160m - 64m =$
$\boxed{\Delta X = 96m}$ right

(d) $96m - 30m = \boxed{66m \text{ right of sign}}$

$\Delta X = X_f - X_0$
$= 96m - 30m$

3) $V_0 = -4\,m/s$
$V_f = 3\,m/s$
$t = 0.35s$

(a) $\bar{a} = \frac{\Delta V}{\Delta t} = \frac{3\,m/s - (-4\,m/s)}{0.35\,s}$ (t)

$\boxed{a = 20\,m/s^2}$

(b) EQ 1 ; $V_f = 0$, $t = ?$

$V_f = V_0 + a\Delta t$

$0 = -4\,m/s + (20\,m/s^2)\Delta t$

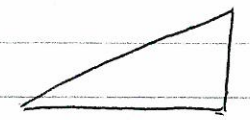
$\frac{4\,m/s}{20\,m/s^2} = \boxed{\Delta t = 0.2s}$

(c) $\Delta X = \frac{1}{2}(V_f + V_0)\Delta t$

$= \frac{1}{2}[0 + (-4\,m/s)](0.2s)$

$\boxed{\Delta X = -0.4\,m \text{ or } 0.4\,m \text{ left}}$

4)



$V_0 = 4\,m/s$

$a = -2\,m/s^2$

(a) $V_f = 0\,m/s$, $\Delta t = ?$

EQ1

$V_f = V_0 + a\Delta t$

$\frac{V_f - V_0}{a} = \Delta t = \frac{0 - 4\,m/s}{-2\,m/s^2}$

$\boxed{\Delta t = 2s}$

(b) $\Delta X = 1m$, $V_f = ?$

EQ3 $V_f^2 = V_0^2 + 2a\Delta X$

$= (4\,m/s)^2 + 2(-2\,m/s^2)(1m)$

$= 16\,m^2/s^2 + (-4\,m^2/s^2)$

$V_f^2 = 12\,m^2/s^2$

$\boxed{V_f = \pm 3.5\,m/s}$

$\boxed{\text{speed} = 3.5\,m/s}$

(c) $\Delta X = 0m$

$\Delta t = ?$

EQ2 $\Delta X = V_0\Delta t + \frac{1}{2}a(\Delta t)^2$

$0m = (4m/s)\Delta t + \frac{1}{2}(-2m/s^2)\Delta t^2$

$0m = 4\Delta t - \Delta t^2$

$0m = t(4 - t)$

$\boxed{t = 0 \text{ or } 4s}$

$t \neq 0$ so 4s works

Or double the time it takes for Δt to get to $V_f = 0m/s$ b/c acceleration does not change.