Physics 1P Trager

Kinematics Problems 42-49 + 55-59

Use equation $V_f = V_0 + at$ to solve.

42) $V_f = 20\frac{m}{s}$ $V_i = 0\frac{m}{s}$ $t = 25s$ $a = ?$

$V_f = V_0 + at$ Rearrange equation to solve for a.

$$V_f = V_0 + at$$

$$V_f - V_0 = at \rightarrow \frac{V_f - V_0}{t} = \frac{at}{t} \therefore$$

$$a = \frac{V_f - V_0}{t} = \frac{20\frac{m}{s} - 0\frac{m}{s}}{25s} = \frac{20\frac{m}{s}}{25s} = \boxed{0.8\frac{m}{s^2}}$$

43) $a = 5\frac{m}{s^2}$ $t = 20s$ $V_0 = 0\frac{m}{s}$ $V_f = ?$

$V_f = V_0 + at$ $V_f = 0\frac{m}{s} + 5\frac{m}{s^2} \cdot 20s = \boxed{100\frac{m}{s}}$

44) $V_f = 230\frac{m}{s}$ ~~$V_i = 0\frac{m}{s}$~~ $t = 2.5s$ $a = 42\frac{m}{s^2}$ $V_0 = ?$

$V_f = V_0 + at$ $V_0 = V_f - at = 230\frac{m}{s} - (42\frac{m}{s^2} \cdot 2.5s)$

$V_0 = 230\frac{m}{s} - 105\frac{m}{s} = \boxed{125\frac{m}{s}}$

45) $t = 12.3s$ $a = 4.6\frac{m}{s^2}$ $V_0 = 0\frac{m}{s}$ $V_f = ?$

$V_f = V_0 + at = 0\frac{m}{s} + (4.6\frac{m}{s^2} \cdot 12.3s) = \boxed{56.58\frac{m}{s}}$

46) $V_0 = 22\frac{m}{s}$ $V_f = 36\frac{m}{s}$ $t = 5s$ $a = ?$

$V_f = V_0 + at \rightarrow at = V_f - V_0 \rightarrow a = \frac{V_f - V_0}{t}$

$$a = \frac{(36\frac{m}{s} - 22\frac{m}{s})}{5s} = \frac{14\frac{m}{s}}{5s} = \boxed{2.8\frac{m}{s^2}}$$

47) $V_0 = 5\frac{m}{s}$ $a = 0.6\frac{m}{s^2}$ $t = 10s$ $V_f = ?$

$V_f = V_0 + at = 5\frac{m}{s} + (10s \cdot 0.6\frac{m}{s^2}) =$

$= 5\frac{m}{s} + 6\frac{m}{s} = \boxed{11\frac{m}{s}}$

48) $V_0 = 52\frac{m}{s}$ $a = -9.8\frac{m}{s^2}$ $V_f = 0\frac{m}{s}$ $t = ?$

$V_f = V_0 + at \rightarrow V_f - V_0 = at \rightarrow t = \frac{(V_f - V_0)}{a} =$

$t = \frac{(0\frac{m}{s} - 52\frac{m}{s})}{-9.8\frac{m}{s^2}} = \frac{-52\frac{m}{s}}{-9.8\frac{m}{s^2}} = \boxed{5.3s}$

49) $a = -3.2\frac{m}{s^2}$ $V_f = 5\frac{m}{s}$ $t = 10s$ $V_0 = ?$

$V_f = V_0 + at \rightarrow V_0 = V_f - at$

$V_0 = 5\frac{m}{s} - (-3.2\frac{m}{s^2} \cdot 10s)$

$V_0 = 5\frac{m}{s} + 32\frac{m}{s} = \boxed{37\frac{m}{s}}$

55) $V_f = V_0 + at$ $a = -9.8\frac{m}{s^2}$ $t = 12s$ $V_0 = 0\frac{m}{s}$

$V_f = 0\frac{m}{s} + (-9.8\frac{m}{s^2} \cdot 12s) = \boxed{-117.6\frac{m}{s}}$

56) $V_0 = -12\frac{m}{s}$ $a = -9.8\frac{m}{s^2}$ $t = 2.0s$ $V_f = ?$

$V_f = V_0 + at = 12\frac{m}{s} + (-9.8\frac{m}{s^2} \cdot 2.0s)$

$V_f = -12\frac{m}{s} - 19.6\frac{m}{s} = $ ~~$\boxed{-7.6\frac{m}{s}}$~~

$= \boxed{-31.6\frac{m}{s}}$

57) $V_0 = 12\frac{m}{s}$ $t = 2.0s$ $a = -9.8\frac{m}{s^2}$ $V_f = ?$

$V_f = V_0 + at$ $V_f = 12\frac{m}{s} + (-9.8\frac{m}{s^2} \cdot 2.0s)$

$V_f = 12\frac{m}{s} - 19.6\frac{m}{s} = \boxed{-7.6\frac{m}{s}}$

58) $V_0 = 23.4\frac{m}{s}$ $V_f = 0\frac{m}{s}$ $a = -9.8\frac{m}{s^2}$ $t = ?$

at highest point

$V_f = V_0 + at \rightarrow V_f - V_0 = at \rightarrow t = \frac{(V_f - V_0)}{a}$

$t = \frac{(0\frac{m}{s} - 23.4\frac{m}{s})}{-9.8\frac{m}{s^2}} = \frac{-23.4\frac{m}{s}}{-9.8\frac{m}{s^2}} = \boxed{2.4s}$

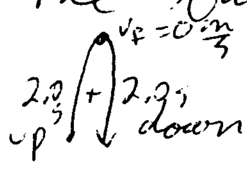
59) $V_0 = ?$ $t = 4.0s$ $a = -9.8\frac{m}{s^2}$ $V_f = 0\frac{m}{s}$

$V_f = V_0 + at \rightarrow V_0 = V_f - at$

~~$V_0 = 0\frac{m}{s} - (-9.8\frac{m}{s^2} \cdot 4.0s)$~~

~~$V_0 = 0\frac{m}{s} + 39.2\frac{m}{s} = \boxed{39.2\frac{m}{s}}$~~

The error here was in thinking total time was 4.0s. You need to use half of this time because we are using $V_f = 0\frac{m}{s}$ when the ball is at the top of its trajectory.



so, $V_0 = V_f - at = 0\frac{m}{s} - (-9.8\frac{m}{s^2} \cdot 2.0s)$

$V_0 = 0\frac{m}{s} + 19.6\frac{m}{s} = \boxed{19.6\frac{m}{s}}$