Kinematics Worksheet 2

(1) $v = 40.2$ m/s
$d = 18.4$ m
$a = 0$
$t = ?$

$d = vt$

$t = \frac{d}{v} = \frac{18.4}{40.2} = \underline{0.458\ s}$

(2) $v_i = 10.6$ m/s
$v_f = 50$ m/s
$a = 2.4\ m/s^2$
$t = ?$

$v_f = v_i + at$

$t = \frac{v_f - v_i}{a} = \frac{50 - 10.6}{2.4}$

$\underline{t = 16.4\ s}$

(3) $v_i = 10$ m/s
$v_f = 20$ m/s
$t = 5.0$ s

(a) $v_f = v_i + at$

$a = \frac{v_f - v_i}{t} = \frac{20 - 10}{5} = \underline{2\ m/s^2}$

(b) $d = \left(\frac{v_i + v_f}{2}\right)t$

$= \left(\frac{10 + 20}{2}\right)5 = \underline{75\ m}$

(4)

A	B
$V_A = ?$	$V_B = ?$
$a_A = 2\ m/s^2$	$a_B = 4.0\ m/s^2$
$t = 4\ s$	$t = 4\ s$
V_{fA}	$=$ V_{fB}

$$V_{fA} = V_A + a_A t \qquad V_{fB} = V_B + a_B t$$

$$V_A + (2)(4) = V_B + (4)(4)$$

$$V_A - V_B = 8$$

$$V_A > V_B$$

(5) $V_i = 0$

$V_f = 6\ m/s$

$t = 1.5\ s$

$d = ?$

$$d = \left(\frac{V_i + V_f}{2}\right) t$$

$$= \left(\frac{6}{2}\right)(1.5) = \underline{4.5\ m}$$

(6) $V_i = 0$

$V_f = 42.6\ km/h = 11.83\ m/s$

$t = 15.5\ s$

$d = ?$

$$d = \left(\frac{V_i + V_f}{2}\right) t = \left(\frac{11.83}{2}\right) 15.5 = \underline{91.7\ m}$$

(7) $v_i = 0$ $\quad d = \left(\frac{v_i + v_f}{2}\right) t$

$d = 100\ m$

$t = 6.34\ s$ $\quad v_f = \frac{2d}{t} = \frac{2(100)}{6.34} = \underline{31.5\ m/s}$

$v_f = ?$

(8) (a) $v_i = 0$ $\quad v_f^2 = v_i^2 + 2ad$

$v_f = 26\ cm/s$ $\quad a = \frac{v_f^2}{2d} = \frac{(26)^2}{2(2)} = 169\ cm/s^2$

$d = 2\ cm$ $\quad = \underline{170\ cm/s^2}$

$a = ?$

(b) $t = ?$ $\quad d = \left(\frac{v_i + v_f}{2}\right) t$

$t = \frac{2d}{v_f} = \frac{2(2)}{26} = \underline{0.15\ s}$

(9) $v_i = 30.6\ km/h = 8.5\ m/s$

$a = 3.98\ m/s^2$

$t = 6.83\ s$

$v_f = ?$

$v_f = v_i + at$

$= 8.5 + (3.98)6.83$

$= \underline{35.7\ m/s}$

(10) $v_i = 0$

$v_f = 28.9 \text{ m/s}$

$a = 5.56 \text{ m/s}^2$

$t = ?$

$v_f = v_i + at$

$t = \dfrac{v_f - v_i}{a}$

$= \dfrac{28.9}{5.56} = 5.198 = \underline{5.20 \text{ s}}$

(11) $v_i = 44.2 \text{ m/s}$

$v_f = 22.0 \text{ m/s}$

$t = 11.3 \text{ s}$

(a) $a = ?$

$v_f = v_i + at$

$a = \dfrac{v_f - v_i}{t} = \dfrac{22 - 44.2}{11.3} = \underline{-1.96 \text{ m/s}^2}$

(b) $d = ?$

$d = \left(\dfrac{v_i + v_f}{2}\right) t = \left(\dfrac{44.2 + 22}{2}\right) 11.3 = \underline{374 \text{ m}}$

(12) $v_i = 0$

$a = 3.13 \text{ m/s}^2$

$t = 20.3$

$d = ?$

$d = \cancel{v_i t} + \frac{1}{2} a t^2$

$= \frac{1}{2}(3.13)(20.3)^2$

$= 644.9 = \underline{645 \text{ m}}$

(13) $v_i = 0$

$d = 110\ m$

$t = 5\ s$

$a = ?$

$d = v_i t + \frac{1}{2} a t^2$

$a = \frac{2d}{t^2} = \frac{2(110)}{(5)^2} = \underline{8.8\ m/s^2}$

(14) $v_i = ?$

$a = -8.73\ m/s^2$

$d = 484\ m$

$v_f = 0$

$v_f^2 = v_i^2 + 2ad$

$v_i = \sqrt{-2ad}$

$= \sqrt{-2(-8.73)(484)}$

$v_i = \underline{91.9\ m/s}$

(15) $v_i = 0$

$v_f = 8.0\ m/s$

$t = 5.0\ s$

$v_f = v_i + at$

$a = \frac{v_f}{t} = \frac{8}{5} = \underline{1.6\ m/s^2}$

(16) $v_i = 22.4\ m/s$

$v_f = 0$

$t = 2.68\ s$

(a) $a = ?$ $\quad v_f = v_i + at$

$a = \frac{-v_i}{t} = \frac{-22.4}{2.68} = \underline{8.36\ m/s^2}$

(b) $d = ?$ $\quad d = \left(\frac{v_i + v_f}{2}\right) t = \left(\frac{22.4}{2}\right) 2.68$

$= \underline{30.0\ m}$

(17)

A		B
$v_A = 5800\ m/s$		$v_B = 8600\ m/s$
$a_A = -15\ m/s^2$		$a_B = ?$
d	$=$	d
$t = 15\ min = 900\ s$	$=$	$t = 900\ s$

$$d = v_A t + \frac{1}{2} a_A t^2 \qquad d = v_B t + \frac{1}{2} a_B t^2$$

$$v_A t + \frac{1}{2} a_A t^2 = v_B t + \frac{1}{2} a_B t^2$$

$$v_A - v_B + \frac{1}{2} a_A t = \frac{1}{2} a_B t$$

$$a_B = \frac{2\left(v_A - v_B + \frac{1}{2} a_A t\right)}{t}$$

$$= \frac{2\left(5800 - 8600 + \frac{1}{2}(-15)(900)\right)}{900}$$

$$a_B = -21.22 = \underline{-21\ m/s^2}$$

(18)

Reaction

$V_i = 20\ m/s$

$a = 0$

$t = 0.530\ s$

$d = ?$

$d = V_i t + \frac{1}{2} a t^2$

$= 20(.530)$

$d = 10.6\ m$

braking

$V_i = 20\ m/s$

$a = -7\ m/s^2$

$V_f = 0$

$d = ?$

$V_f^2 = V_i^2 + 2ad$

$d = \frac{-V_i^2}{2a} = \frac{-(20)^2}{2(-7)}$

$d = 28.57$

Total stopping distance is the sum of the two above distances.

$10.6 + 28.57 = 39.17 = \underline{39.2\ m}$

(19)

1	2
$v_1 = 0$	$v_2 = 0$
$a = 0.50\ m/s^2$	$a = 0.30\ m/s^2$
$d = x$	$d = 48 - x$
t	$=$ t

(a) $d = v_i t + \frac{1}{2} a t^2$ $\qquad$ $d = v_i t + \frac{1}{2} a t^2$

$x = \frac{1}{2} a_1 t^2$ $\qquad$ $48 - x = \frac{1}{2} a_2 t^2$

$48 - \frac{1}{2} a_1 t^2 = \frac{1}{2} a_2 t^2$

$48 = \frac{1}{2} a_1 t^2 + \frac{1}{2} a_2 t^2$

$t = \sqrt{\frac{48}{\frac{1}{2} a_1 + \frac{1}{2} a_2}}$

$= \sqrt{\frac{48}{\frac{.5}{2} + \frac{.3}{2}}}$

$t = 10.95 = \underline{11 s}$

19 (b) $x = \frac{1}{2} a_1 t^2$

$= \frac{1}{2}(.5)(10.95)^2$

$x = 30.\ m$

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(20)

1	2
$V_1 = 33$ m/s	$V_2 = 0$
$a_1 = 0$	$a_2 = ?$
$d = 2500$ m	$d = 2500$
$t =$	$t =$

$d = V_i t + \frac{1}{2} a t^2$

$t = \frac{d}{V_1}$

$d = V_i t + \frac{1}{2} a t^2$

$a = \frac{2d}{t^2}$

$a = \frac{2d}{d^2} V_1^2$

$a = \frac{2(33)^2}{2500} = 0.87\ m/s^2$