① Part 1 $d_1 = vt$

$= (10\ Km/h)(1.5\ h)$

$d_1 = 15\ Km$

Part 2 $d_2 = vt$

$= (15\ Km/h)(0.5\ h)$

$d_2 = 7.5\ Km$

Total $v_{avg} = \frac{d_1 + d_2}{t_1 + t_2}$

$= \frac{15 + 7.5}{1.5 + 0.5}$

$v_{avg} = \boxed{11.25\ Km/h}$

② a) Speeding Up: 0 - 4 s, 10 - 12 s

Slowing Down: 5 - 10 s

b) $t = 10\ s$

c) $a_{avg} = \frac{\Delta v}{\Delta t}$

0 - 2 s

$a_{avg} = \frac{+8\ m/s}{2\ s}$

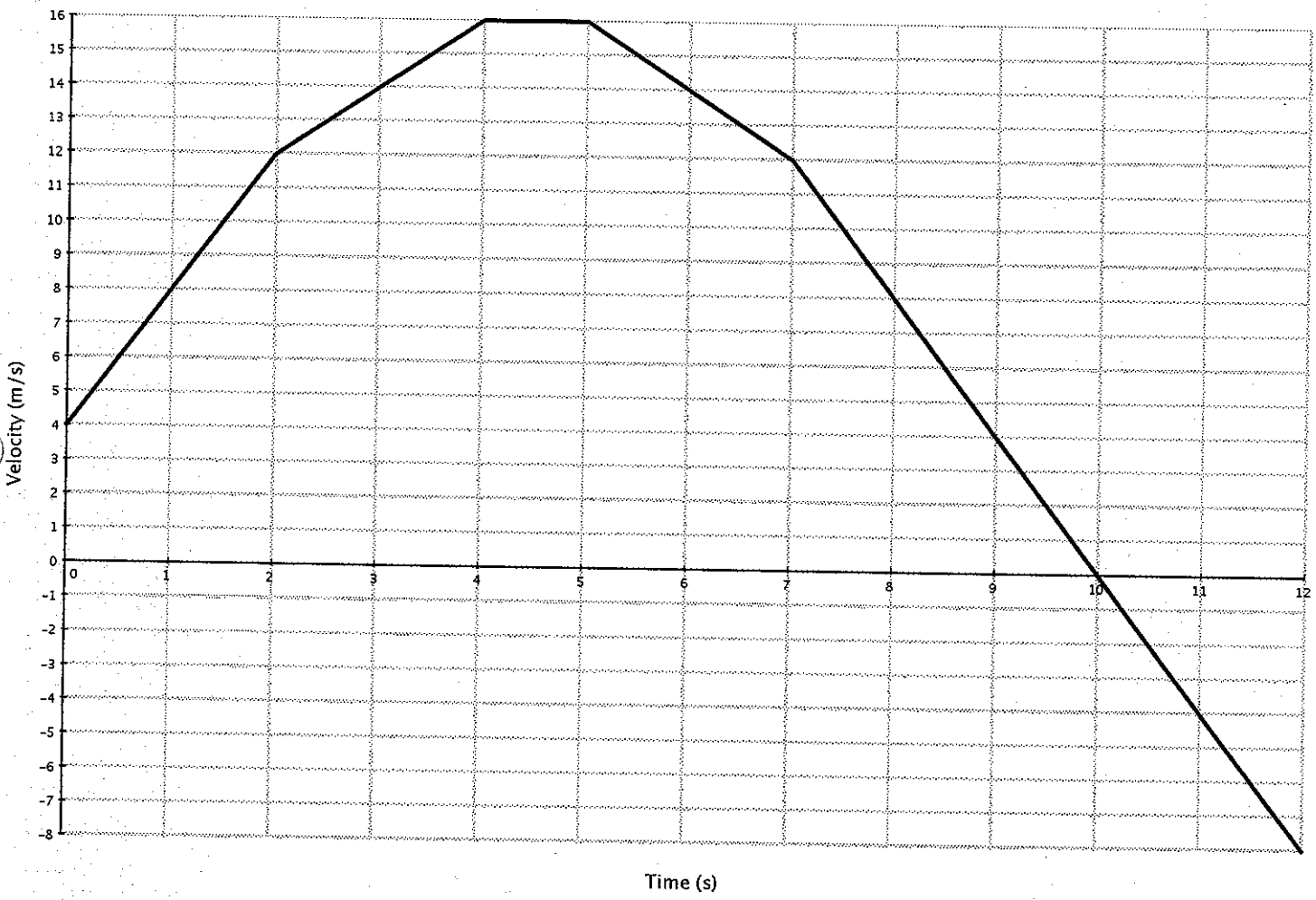
$= +4\ m/s^2$

7 - 12 s

$a_{avg} = \frac{-20\ m/s}{5\ s}$

$= -4\ m/s^2$

Same magnitude, opposite directions


Velocity (m/s)
Time (s)
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
0
1
2
3
4
5
6
7
8
9
10
11
12

③ $v_f = v_i + at$

$96 = 32 + a(8)$

$64 = 8a$

$a = \boxed{8 \text{ m/s}^2}$

④ $v_f = v_i + at$

$= 22 + (1.6)(6.7)$

$v_f = \boxed{32.88 \text{ m/s}}$

⑤ a) $v_f = v_i + at$

$= 145 + (23.1)(20)$

$v_f = \boxed{607 \text{ m/s}}$

b) $\frac{607}{331} = \boxed{1.83}$ times greater

⑥ $v_f = v_i + at$

$= 2.35 \times 10^5 + (-1.1 \times 10^{12})(1.5 \times 10^{-7})$

$v_f = \boxed{70\,000 \text{ m/s}}$

⑦ $d = \left(\frac{v_f + v_i}{2}\right) t = \left(\frac{66 + 88}{2}\right) 12$

$d = \boxed{924 \text{ m}}$

(8) $d = \left(\frac{v_f + v_i}{2}\right) t = \left(\frac{145 + 75}{2}\right) 15$

$d = \boxed{1650 \text{ m}}$

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

$= (12)(6) + \frac{1}{2}(-1.6)(6)^2$

$d = \boxed{43.2 \text{ m}}$

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

$= (12)(9) + \frac{1}{2}(-1.6)(9)^2$

$d = \boxed{43.2 \text{ m}}$

The car passes the 43.2 m position once on its way up the hill (at 6 s) and again on the way back down the hill (at 9 s).

(10) $v_f^2 = v_i^2 + 2ad$

$= 0^2 + 2(5)(500)$

$v_f^2 = 5000$

$v_f = \boxed{70.7 \text{ m/s}}$

(11) a) $v_f = 0$ (stopping)

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

$0^2 = 55^2 + 2(-11)d$

$0 = 3025 - 22d$

$-3025 = -22d$

$d = \boxed{137.5 \text{ m}}$

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

$0^2 = 110^2 + 2(-11)d$

$0 = 12100 - 22d$

$-12100 = -22d$

$d = \boxed{550 \text{ m}}$

(12) a) $v_i = 0$

$v_f = v_i + at$

$61 = 0 + (25)t$

$t = \boxed{24.4 \text{ s}}$

b) $d = \left(\frac{v_f + v_i}{2}\right)t = \left(\frac{61+0}{2}\right)24.4$

$d = \boxed{744.2 \text{ m}}$

(13) a) $v_i = 0$

$v_f = 3.5 \text{ Km/s} = 3500 \text{ m/s}$

$d = 2 \text{ cm} = 0.02 \text{ m}$

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

$3500^2 = 0^2 + 2a(0.02)$

$12250000 = 0.04a$

$a = \boxed{306\,250\,000 \text{ m/s}^2}$

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

$0.02 = \left(\frac{3500 + 0}{2}\right)t$

$0.02 = 1750t$

$t = \boxed{1.14 \times 10^{-5} \text{ s}}$

(14) $a = -300 \text{ m/s}^2$

$v_i = 110 \text{ Km/h} = 30.\overline{5} \text{ m/s}$

$v_f = 0$

$d = ?$

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

$0^2 = (30.5)^2 + 2(-300)d$

$0 = 933.6 - 600d$

$-933.6 = -600d$

$d = \boxed{1.56 \text{ m}}$

(15) $v_f^2 = v_i^2 + 2ad$

$44^2 = 0^2 + 2a(3.5)$

$1936 = 7a$

$a = \boxed{276.6 \text{ m/s}^2}$

(16) a) $v_i = 0$
$v_f = 444$ m/s
$t = 1.80$ s

$v_f = v_i + at$

$444 = 0 + a(1.8)$

$a = \boxed{246.\overline{6} \text{ m/s}^2}$

b) $v_i = 444$ m/s
$v_f = 0$
$t = 2.15$ s

$v_f = v_i + at$

$0 = 444 + a(2.15)$

$-444 = 2.15a$

$a = \boxed{-206.5 \text{ m/s}^2}$

(17) a) Reaction

$v = 90$ km/h $= 25$ m/s
$t = 0.75$ s

$d = vt$
$= (25)(0.75)$

$d = 18.75$ m

Braking

$v_i = 25$ m/s $\quad a = -10$ m/s^2
$v_f = 0$

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

$0^2 = 25^2 + 2(-10)d$
$0 = 625 - 20d$
$-625 = -20d$

$d = 31.25$ m

Total $18.75 + 31.25 = 50$ m

The car hits the barrier.

(17) b) Reaction

$d = 18.75\ m$

Braking

$v_i = ?$ $\quad a = -10\ m/s^2$

$v_f = 0$

$d = 40\ m - 18.75\ m = 21.25\ m$

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

$0^2 = v_i^2 + 2(-10)(21.25)$

$0 = v_i^2 - 425$

$v_i^2 = 425$

$v_i = \boxed{20.6\ m/s}$

(18) a) Car

$v_i = 0$

$a = 6\ m/s^2$

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

$d = (0)t + \frac{1}{2}(6)t^2$

$d = 3t^2$

$t = \sqrt{\frac{d}{3}}$

Truck

$v = 21\ m/s$

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

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

$t = \frac{d}{21}$

The times will be equal.

$\therefore \quad \sqrt{\frac{d}{3}} = \frac{d}{21}$

$\frac{d}{3} = \frac{d^2}{441}$

$\frac{1}{3} = \frac{d}{441}$

$d = \frac{441}{3} = \boxed{147\ m}$