

Before:

18 correct } 1 hr  
2 wrong }

questions → 10-15 min.

Physics:

3 correct } 25-30 mins.  
3 ? \* }

question → 30 mins

try again → 15-20 minutes

22. A car traveling 80 km/h decelerates at a constant  $1.5 \text{ m/s}^2$ . Calculate
- the distance it goes before it stops.
  - the time it takes to stop.
  - the distance it travels DURING the first and third seconds (not between those two times but during the 1<sup>st</sup> second of travel, and then during the 3<sup>rd</sup> second of travel).

$v = 80 \frac{\text{km}}{\text{hr}}$   $a = 1.5 \frac{\text{m}}{\text{s}^2}$

**0-1s**  $x=0$   $t=0$   $t=1s$   $t=2s$   $t=3s$

$x_0 = 0$   $x = x_0 + v_0 t + \frac{1}{2} a t^2$   $x_0 = 0 \text{ m}$

$x =$   $x =$   $x =$

$v_0 = 80 \frac{\text{km}}{\text{hr}} = 22.2 \frac{\text{m}}{\text{s}}$   $v_0 = 19.2 \frac{\text{m}}{\text{s}}$

$v =$   $v =$   $v =$

$a = -1.5 \frac{\text{m}}{\text{s}^2}$   $a = -1.5 \frac{\text{m}}{\text{s}^2}$

$\Delta t = 1 \text{ s}$   $\Delta t = 1 \text{ s}$

"How fast is the car going 2s after it starts to slow down?"

**0-2s**  $x_0 = 0$

$x =$

$v_0 = 80 \frac{\text{km}}{\text{hr}} = 22.2 \frac{\text{m}}{\text{s}}$

$v = 19.2 \frac{\text{m}}{\text{s}}$

$a = -1.5 \frac{\text{m}}{\text{s}^2}$

$t = 2 \text{ s}$

$$v = v_0 + at$$

$$= 22.2 + (-1.5)(2)$$

$$= 19.2 \frac{\text{m}}{\text{s}}$$

37. A stone is dropped from the roof of a high building. A second stone is dropped 1.00 s later. How far apart are the stones when the second one has reached a speed of 23.0 m/s?

Diagram: A coordinate system with  $x=0$  at the roof and  $x$  pointing down. Two stones are shown: the first (red) is at  $x=0$  and the second (green) is below it at  $x=26.37\text{ m}$ . The second stone has a velocity  $v=23\text{ m/s}$  pointing down. A note says "difference is the answer".

Given:  $a_g = 9.8\text{ m/s}^2 \downarrow$

For the first stone (red):

$$x_0 = 0\text{ m}$$

$$x = 55\text{ m}$$

$$v_0 = 0\text{ m/s}$$

$$v =$$

$$a = 9.8\text{ m/s}^2$$

$$t = 3.34\text{ s}$$

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$= \frac{1}{2} (9.8) (3.34^2)$$

$$= 55\text{ m}$$

For the second stone (green):

$$x_0 = 0\text{ m}$$

$$x = 26.37\text{ m}$$

$$v_0 = 0\text{ m/s}$$

$$v = 23\text{ m/s}$$

$$a = 9.8\text{ m/s}^2$$

$$t = 2.34\text{ s}$$

Relationship between times:

$$t_1 = t_2 + 1$$

Velocity equation:

$$v = v_0 + at$$

$$t = \frac{v - v_0}{a}$$

$$t = \frac{23}{9.8}$$

$$t = 2.34\text{ s}$$

Position equation:

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$x = \frac{1}{2} (9.8) (2.34^2)$$

30. A runner hopes to complete the 5000-m run in less than 13.0 min. After exactly 11.0 min, there are still 800 m to go. The runner must accelerate at  $0.20 \text{ m/s}^2$  for how many seconds in order to achieve the desired time?

~~GACK.~~

~~$t = 11 \text{ min}$~~

~~$a = 0.20 \text{ m/s}^2$~~

~~$t < 13 \text{ min.}$~~

~~$x = 0$~~

~~$x_0 = 4200 \text{ m}$~~

~~$x = 5000 \text{ m}$~~

~~$v_0 =$~~

~~$v =$~~

~~$a = 0.20 \text{ m/s}^2$~~

~~$t = 2 \text{ min} = 120 \text{ s}$~~

~~$x = x_0 + v_0 t + \frac{1}{2} a t^2$~~

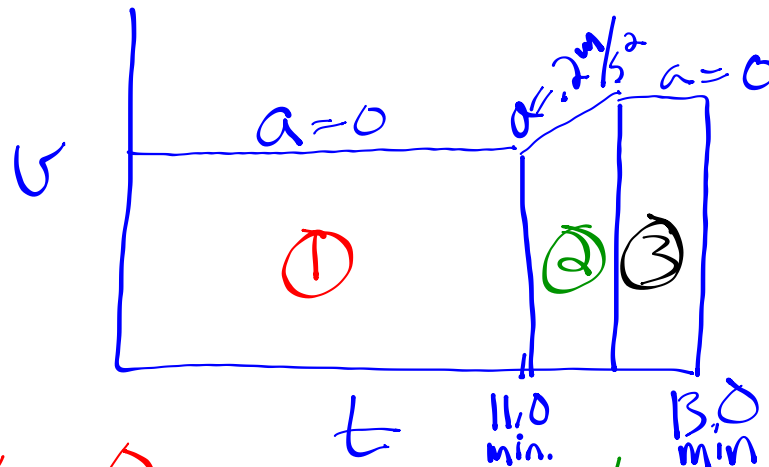
~~$5000 = 4200 + v_0 (120) + \frac{1}{2} (0.2) (120)^2$~~

~~$5000 - 4200 - (\frac{1}{2} \cdot 0.2 \cdot 120^2) = v_0$~~

~~$120$~~

~~$v_0 = -5.3 \text{ m/s}$~~

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$$\begin{aligned}
 x_0 &= 0 \text{ m} \\
 x &= 4200 \text{ m} \\
 v_0 &= 6.36 \frac{\text{m}}{\text{s}} \\
 v &= 6.36 \frac{\text{m}}{\text{s}} \\
 a &= 0 \\
 t &= 11 \text{ min} = 660 \text{ s}
 \end{aligned}$$

$$\begin{aligned}
 x_0 &= 4200 \text{ m} \\
 x &= \\
 v_0 &= 6.36 \frac{\text{m}}{\text{s}} \\
 v &= \\
 a &= 0.2 \frac{\text{m}}{\text{s}^2} \\
 t &=
 \end{aligned}$$

$$\begin{aligned}
 x_0 &= \\
 x &= 5000 \text{ m} \\
 v_0 &= \\
 v &= \\
 a &= 0 \frac{\text{m}}{\text{s}^2} \\
 t &=
 \end{aligned}$$