

HOW TO SOLVE A MOTION PROBLEM!

STEP # 1

READ THE PROBLEM!

READ CAREFULLY FOR MEANING

TRY TO UNDERSTAND WHAT IS PHYSICALLY
HAPPENING. YOU CAN NOT JUST
PULL OUT THE NUMBERS!

STEP # 2

DRAW A PICTURE

USE ARROWS TO SHOW DIRECTION

PUT IN VARIABLES WITH/WITHOUT NUMBERS

LOOK FOR IMPLIED INFO:

COMES TO A STOP MEANS $v_f = 0$

STARTS FROM REST MEANS $v_i = 0$

etc.

STEP # 3

MAKE A LIST OF THE VARIABLES

CAREFULLY FILL IT IN

PAY ATTENTION TO INITIAL AND FINAL VALUES

PAY ATTENTION TO UNITS i.e. s IS A TIME UNIT
m/s IS A VELOCITY UNIT

DO ANY UNIT CONVERSIONS

IDENTIFY THE UNKNOWN

STEP # 4

PICK THE CORRECT EQUATION

USE THE LIST

NOTE:

EACH OF THE EQUATIONS DOESN'T USE 1 VARIABLE

$$v = \frac{x_f - x_i}{t} \quad \text{NO } a$$

$$x_f = x_i + v_i t + \frac{1}{2} a t^2 \quad \text{NO } v_f$$

$$a = \frac{v_f - v_i}{t} \quad \text{NO } x$$

$$x_f = x_i + \frac{1}{2} (v_f + v_i) t \quad \text{NO } a$$

$$v_f^2 = v_i^2 + 2a(x_f - x_i) \quad \text{NO } t$$

STEP # 5

SOLVE THE EQUATION FOR THE UNKNOWN!

STEP # 6

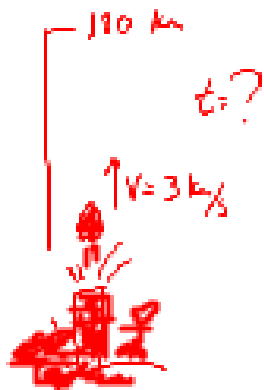
CHECK YOUR ANSWER

CORRECT UNITS

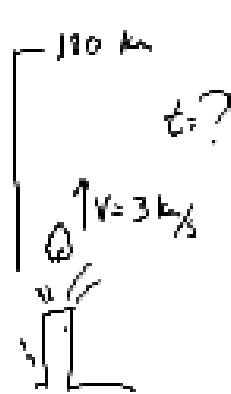
REASONABLE VALUE

IN A SCIENTIFIC TEST CONDUCTED IN ARIZONA, A SPECIAL CANNON CALLED HARP (HIGH ALTITUDE RESEARCH PROJECT) SHOT A PROJECTILE STRAIGHT UP TO AN ALTITUDE OF 180 km. IF THE PROJECTILE'S INITIAL SPEED WAS 3 km/s, HOW LONG DID IT TAKE THE PROJECTILE TO REACH ITS MAXIMUM HEIGHT?

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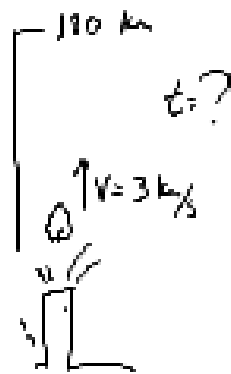


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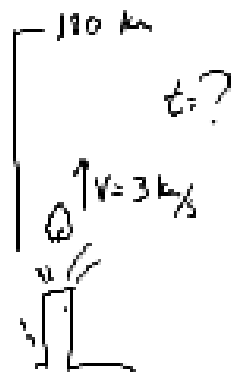
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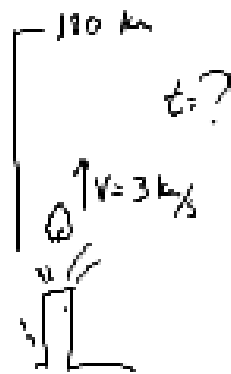
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$$\begin{aligned}x_i &= 0 \\x_f &= 180 \text{ km} = 180,000 \text{ m} \\v_i &= 3 \text{ km/s} = 3000 \text{ m/s} \\v_f &= 0 \\a &= \text{---} \\t &= ?\end{aligned}$$

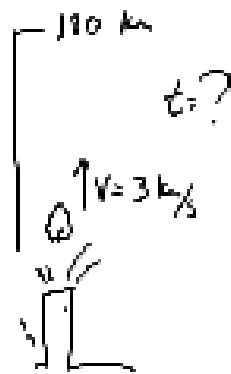
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 \end{aligned}$$

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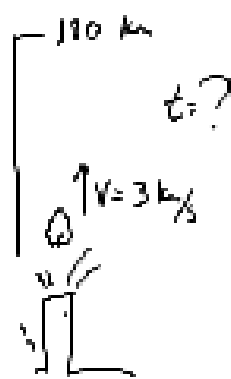
$$x_f = x_i + \frac{1}{2} (v_f + v_i) t$$

$$x_f - x_i = \frac{1}{2} (v_f + v_i) t$$

$$2(x_f - x_i) = (v_f + v_i) t$$

$$t = \frac{2(x_f - x_i)}{(v_f + v_i)}$$

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 t &= \frac{2(x_f - x_i)}{(v_f + v_i)}
 \end{aligned}$$

$$\begin{aligned}
 t &= \frac{2(x_f - x_i)}{(v_f + v_i)} \\
 &= \frac{2(180,000 + 0)}{(0 + 3000)} \\
 &= \underline{\underline{120 \text{ s}}}
 \end{aligned}$$

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UNKNOWN

EQUATION

SOLVE EQUATION

SUBSTITUTE & SOLUTION