

# 4-step method and picking the correct equation – 01-02 Notes

Unit 01, Physics Themed

# Solving problems (develop this skill, save your sanity!)

- A 30 m wave passes by going 0.40 m/s. What is the frequency of this wave?
- Below (right) are the equations from 1<sup>st</sup> semester. Above is a typical question you might have to solve at some point in the future.
- How are you going to know which one to use? Do you have to convert anything? How do you know the units in your final answer?
- We're going to solve this systematically using the "four step method" (*lower left*)

1. Picture what's going on (optional)
2. List all knowns and the unknown(s) in the following (CORRECT) format:  
*Symbol = value (ex.:  $v = 5 \text{ m/s}$ )*
3. List the correct equation by itself (by using the list in the CORRECT FORMAT)
4. Solve with units (if in doubt, convert everything to SI units and your answer will be in SI units too!)

$$f = 1/T$$

$$v = f \lambda$$

$$d = v t$$

$$v_{\text{sound}} = 331 + 0.6T(^{\circ}\text{C});$$

$$Q = ne$$

$$V = W/q = J/C$$

$$M = V_0/v_{\text{sound}}$$

$$\text{Series } R_e = R_1 + R_2$$

$$\text{Parallel } 1/R_e = 1/R_1 + 1/R_2$$

$$\text{Beats} = |f_1 - f_2|$$

$$F = k \frac{q_1 q_2}{r^2}$$

$$E = \frac{F}{q} = \frac{kq}{r^2}$$

**I  $\Delta$  inversely with  $r^2$**

$$\Delta: +10 \text{ dB} = 2x \text{ Vol} = 10x$$

$$I$$

$$i = \Delta Q / \Delta t$$

$$\Delta V = i R$$

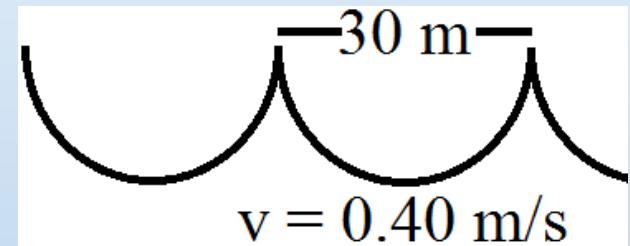
$$P = E/t$$

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$$P = V^2/R$$

# Solving problems: 4-step Example

- A 30 m wave passes by going 0.40 m/s. What is the frequency of this wave?
- **Step 1:** Picture the problem (optional). For some problems and for some people, drawing a picture can help a lot.
- Not drawing = keeping a lot of things in your head
- For some problems, drawing is silly (why it's optional)



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# Solving problems: 4-step Example

- A 30 m wave passes by going 0.40 m/s. What is the frequency of this wave?
- **Step 2:** List knowns and unknown(s) in CORRECT format (right)
- How do I know which variable to use (there are so many!)
  - Units! m/s is speed (velocity), with practice you will know those units mean  $V$
- How do I know 30 meters is wavelength ( $\lambda$ )?
  - There are a few options for meters, but only one has to do with waves directly!
- How do I know the unknown is equal to  $f$ ?
  - The problem directly asks for frequency. Notice no units. That's because they're all in SI units!
  - If you have non-SI units, list the units used

$$V = 0.40$$

$$\lambda = 30$$

$$f = ?$$

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## Reminder/Notice

- Step 2 (list knows and unknown(s)) is the MOST IMPORTANT step!
- A good list will lead to the correct equation choice
- A good list is good problem solving practice and will lead to the most partial credit on tests and a better chance of a good homework grade!

# Solving problems: 4-step Example

$$V = 0.40$$

$$\lambda = 30$$

$$f = ?$$

- A 30 m wave passes by going 0.40 m/s. What is the frequency of this wave?
- **Step 3:** List the correct equation by itself
- Step 3 comes directly from step 2
- Once you made your list, you knew  $v$ ,  $\lambda$  and  $f$  were in the problem
- You need an equation relating  $v$ ,  $\lambda$  and  $f$  to each other. There's only ONE!
- $V = f \lambda$ , see how step 2 leads to step 3?
- Why bother writing it out? Why not just start plugging in?
  - More likely to put a wrong number in; can't double check easily
  - Can't follow your work later on when reviewing
  - I can't follow your work either; it's just a jumble of numbers – not good, not so many partial credit points on test

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- **Step 4:** Solve with units
- $V = f \lambda$ ,  $.40 = f \times 30$
- $F = .40/30 = \underline{.01333 \text{ Hz}}$
- How did I know the units were Hz? When I learned about what frequency is, I found out the SI units for it (*1 Hz = 1/second...but, don't worry about knowing that unit yet!*)

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