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Mastering physics pdf solutions

Here's this week mastering physics responses to the waves... Wave notation: Part A: Travelling waves are spread at a constant speed usually referred to as v (but sometimes c). The waves are called _________________ if their waveform repeats every time T. Explanation and Solution: I'm not really sure how to explain this, its pretty straight forward. Just use what you are given, if a wave of travel is repeated every time the T then has a period between its peaks so we can assume it is a periodic wave. Part B: Solve this equation to find an expression for wavelength. Explanation and solution: If you honestly can't solve this yourself there's not much I can do for you, just rearrange the equation you were given above and you get the following: = v/f Part C: If the speed of the wave remains constant, then as the frequency of the wave increases, the wavelength .... Explanation and solution: So lets consider a wave moving at constant speed, try to imagine the graph of a sinusoidal wave like the ones we encounter in class. If the frequency of the wave increases, then it peaks faster and faster. Since it is still moving at constant speed we know that the wavelength must be reduced. Part D: The difference between frequency and frequency is that it is measured in cycles per second or hertz (abbreviated Hz), while the units for are _______ per second. Explanation and solution: Well you should know just that to be honest. Its in radians per second, just make sure you spell radians right. Part E: Find an expression for the period of a wave in terms of other kineal variables. Explanation and solution: Just try and logic it out. If frequency is the measure of how many waves pass per second (hertz, s^-1), then the time it takes for a wave to pass is only the inverse of f, or 1/f. Part F: What is the relationship between and? Explanation and solution: Since we already know that the difference between w and f is that w is in radians per second we can simply wonder what is usually the defining characteristic of anything that is in radians, its usually multiplied by 2 (pi). So we find that w = 2(pi) f Part G: What is the simplest relationship between the angular wave number and only one of the other kinematic variables? Explanation and solution: I feel pretty lazy right now so here's the books definition. The units are and indicate that the angular number of waves is a measure of the number of rays of the phase at a unit distance, which is times the number of complete wave cycles at that distance. For example, a of a wavelength is equivalent to a cycle, a period and. The angular wave number is often incorrectly named wavenumber, which is really, so be careful to determine how this term is defined when reading your book or reviewing your lecture k = 2(pi) / f Standard expression for a travel wave: Part A: Which of the following are independent variables? Explanation and Solution: The equation used to describe a wave movement appears to you on the right. Start by asking yourself which variables in this equation remain the same regardless of the state of the particular wave you are considering? The width, wave number and angular frequency are determined by the specific wave you are examining and you can examine the position and time of any wave because it is independent of the characteristics of the wave. Part B: Which of the following are parameters that determine the characteristics of the wave? Explanation and solution: As I explained above, the variable A k and w depend on the specific wave because they describe the characteristics of the wave. Part C: What is the phase of the wave? Explanation and solution: The wave phase must be in radians so that we can simply look at the units of variables used in the equation and see that the phase is given by k-x - wt. Part D: What is the wavelength of the wave? Explanation and Solution: wavelength = 2 (pi) / k Just get the answer, I don't really know who to explain this to you. Part E: What is the period of the wave? Explanation and solution: This looks a lot like the previous one, except for: T = 2 (pi) / w Part F: What is the speed of the wave? Explanation and solution: This is quite simple, can be found in the book if you read the chapter. The speed of a wave is just w/k, just think distance over time there you go. Conceptual Question 20.4: Part A: In which direction does the wave travel? Explanation and solution: Reading history and snapshot charts is very difficult, or at least I think so. But we're still going to find that. For this first question its quite simple to see where the wave moves. Start by looking at what point the story chart looks at, in this case 2 cm and the beginning of the wave reaches this point in 0.03 seconds. Now look at the snapshot chart, its in t = 0.01 seconds and at that time the beginning of the wave is at -2 cm. So it went from -2 cm to 0.01 seconds to 2 centimeters in 0.03 seconds making it move to the right. Part B: Explain. Explanation and solution: I explained it above. Part C: What is the speed of the wave? Using the information we got from the charts in the first part of this problem we know that the wave moved from -2 cm to 2 cm in .02 seconds. So, using our basic formula, distance over time, we can find the speed of the wave. v = 4 cm / .02 seconds v = 200 cm/s 20.13: The displacement of a wave moving in the negative direction y is = (4.40 cm) (6.20 y + 63.0 t), where y is in m and t is in s. Part A: What is the frequency of the wave? Explanation and solution: Let us hope that they would pay attention to the questions and formulas we used, because this problem is only the previous conceptual questions, but with numbers. To find the frequency of the wave we can simply use the following formula: f = w / 2(pi) f = 63 / 6.28 f = 10 Hz Part B: What is the wavelength? Explanation and solution: Once again, just use the formulas you have previously emerged in the conceptual questions and you will use the following equation: wavelength = 2(pi) / k wavelength = 1.01 m Part C: What is the speed of the wave? Explanation and solution: We are going to use the most basic of types, one of the first you learned in the laboratory: v = f (wavelength) v = 10.2 m / s 20.21 Part A: At 20 C, what is the frequency of a sound wave in the air with a wavelength of 18 cm? Explanation and solution: Once again we will use the first formula we learned about this chapter and once you connect the values given to us: f = v / (wavelength) f = (343 m/s) / (.18m) f = 1910 Hz Part B: What is the frequency of an electromagnetic wave at 18 cm? Explanation and solution: This is just like the above just make sure you understand what the speed of an electromagnetic wave is, its exactly the speed of light: f = v / (wavelength) f = (3 x 10 ^8 m/s) / (.18m) f = 1.67 GHz Part C: What would be the wavelength of a sound wave in the water with the same frequency as the wave in Part B? Explanation and solution: This is the same question, all you really need is the speed of sound in the water that can be found in the book as 1480 m/s. Simply rearrange the equation to suit your needs as follows: (wavelength) = v/f (wavelength) = (1480 m/s) / (1.67 x 10^9 Hz) (wavelength) = 888 nometers 20.31 A concert loudspeaker suspended high from the ground emits 30.0 W of sound power. A small microphone with a surface of 1.00 cm^2 is 50.0 m from the speaker. Part A: What is the volume in place of the microphone? Explanation and solution: Unfortunately for this chapter in physics the best way to get this is to read the book. Not too much of it is going to make sense intuitively other than how variables fit together in some of the simplest parts of equations. Thus, if you read this chapter you will find that the intensity of a spherical energy source is equal to the power above 4 (pi)r^2. So set up the following: I = p / (4(pi)(r^2)) I = (30W) / (4(pi) (50^2)) I = 9.55×10 ^-4 Part B: How much sound impacted the energy every second? Explanation and solution: If you read the book once again you will find the type you need. Use the following equation to resolve for p (where alpha is the range): P = I (alpha) P = (9.55 x 10^-4) (.0001 m^2) P = 9.55 x 10 ^-8 Shape is a snapshot chart in t = 0 s of a 5.0 Hz wave that travels to the left. Part A: What is the speed of the wave? Explanation and Solution: To find the speed of the wave we will use the simplest equation we have as well as our abilities reading charts. The speed of a wave is equal to the wavelength times of the frequency. Since the frequency is given to us we just need to read the graph to find out what the wavelength is. Looking at the graph we can see that the space between the peaks is 2 meters. Thus, by connecting to the following equation we have: v = (wavelength) f v = (2m) (5 Hz) v = 10 m/s Part B: What is the constant phase of the wave? Explanation and solution: To find the fixed phase of any wave I use a fairly simple method, I honestly never really hear the teachers or the method for solving things, mostly I follow the basic concepts, but I like to think about it in my own way because it makes more sense to me. So I look at where the wave crosses the x-intercept, as we see in the graph that crosses at .5. Because of this we know that the sine of the fixed phase is equal to 0.5. Now ask yourself, sine of what is equal to 0.5? You have to come up with (pi)/6 and since you want it in grades you can only say 30. Just remember that the unit circle is the best friend. Part C: Write the offset equation for this wave. Explanation and solution: This is a written problem solution so you can actually just write whatever you want, never check it anyway. But if you really want to learn how to do it I'll tell you how to do it. You will need to work out for each of the variables in a standard expression for a wave. Oh, mr. c. With these just plug them inot the equation and you're ready. Problem 20.45 String 1 in the image has a linear density of 2.90 g/m and string 2 has a linear density of 3.20 g/m. A student sends pulses in both directions by quickly pulling up the knot, and then releasing it. Think that the pulses are reaching the ends of the strings at the same time. Part A: What should be the length of the string L_1 is? Explanation and solution: This problem is quite difficult and its mainly to make assumptions based on what you are given and simply using your basic formulas to find what you need. We'll first assume that thinking about what formula we would usually use to solve a problem like this. We know that for problems related to mass length, intensity and speed we usually use the equation: v = [(T) / (mu)]^(1/2) We will first assume that the tensions in the two strings are equal, this is not really a hypothesis, more than a result of the given information. Assuming this will have the following equation: [(v_1)^2](mu_1) = [(v_2)^2](mu_2) Now we wonder what speed is? His distance travelled during the Using this sub definition in rope lengths and the time it takes to travel as follows: ([(L_1)^2](mu_1)) / t^2 = ([(L_2)^2] (mu_2)) / t^2 Now we can simply manipulate this equation to solve the lengths knowing that the whole length is 4m: L_1 / L_2 = (mu_2 / mu_1)^(1/2) (3.2/2.9)^(1/2) (L_2) = L_1 We know that L_1 + L_2 = 4m so: so: (L_2) + L_2 = 4 L_2 = 2.05 m From there L_1 is simply subtraction: 4m – 2.05 m = 1.95 m = L_1 Two speeds on a wave journey: Wave movement is characterized by two speeds: the speed at which the wave moves in the middle (e.g., air or string) and the speed of the medium (the air or the string itself). Part A: Find the propagation speed of this wave. Explanation and solution: This is just like the problem we had before the Standard Expression for a wave trip so I'm not going to explain it, but just tell you to look back on your answer and re-read the explanation if necessary to answer this question. v = w/k Part B: Find the y speed of a point in the string as a function of t and x. Explanation and solution: This is quite funny because in the hints they tell you to take the partial derivative of the function, but some of us who take this category have not received diff. eq. or multi D, so kind of unfair. They talk about it in the book somewhere I'm sure so if you read this chapter we'll explain it to you somewhere. At the moment I'm not going to explain anything because I don't want to be wrong, so I'm going to give you the answer. v_y = -A w cos(kx-wt) Part C: Which of the following statements about v_x (x,t) , the x element of string speed, is true? Explanation and solution: This question requires some thought. Try to imagine a string with a wave passing through it. Is the string really moving anywhere in the x direction? You can also try and think about the history and snapshot charts we use a lot. Imagine a single point in the string as the wave travels through it rises to the width of the wave and skins back down as the wave passes. The point does not move anywhere in the x direction, so v_x (x,t) is equal to 0. Part D: Find the string gradient as a function of location and time. Explanation and solution: This is like part B, you need some math skills that not all of us have so I will once again just give this to you because it is necessary to solve the last part. A k cos(kx – wt) Part E: Find the ratio of the y-speed of the string to the slope of the string calculated in the previous part. Explanation and solution: Give pretty much this to you, it will show you how to do it with the question. Just divide your response from Part B with that of Part D, cancel, and then you have your answer. 20.62: A range below 47.0 B of intensity has a linear density of 5.30 g/m. A sinusoidal wave with a width of 3.40 cm and a wavelength of 2.20 m travels along the string. Part A: What is the maximum speed of a particle in the string? Explanation and First we want to start by finding the speed of the wave as it moves through the string. To do this we will use a formula that we have used in some of these problems: v = = v = ((47 N) / .0053)^(1/2) v = 94.16 m/s At first you may think that this is all we need, however, we need to find the maximum speed of a particle in the string, not the wave itself. To do this we will use a formula that can be found in the book for v_y max: v_y max = wA (subbing in for w) v_y max = 2(pi)f A (subbing in for f) v_y max = 2(pi) (v/(wavelength)) A v_y max = 2(pi) (94.16 / 2.2) (.034) v_y maximum = 9.14 m/s Doppler Shift: Part A: The source speed is positive if the source is ________________________ Note that this equation may not use the contract symbol you are used to. Think about fitness before you answer. Explanation and solution: This whole section is just like the lab you did last week so I'm not going to go out of my way to explain it, you need to understand or at least just know the answers to it. Travelling away from the listener Part B: The speed of the source is measured in relation to __________. Explanation and solution: middle part C: The listener's speed is positive if the listener is _____________________ Explanation and solution: travelling to the source Part D: The listener's speed is measured in relation to __________ Explanation and Solution: middle part E: Imagine that the source is to the right of the listener, so that the positive reference direction (from the listener to the source) is in the +x direction f_l. Explanation and Solution: (1/2)f_s Part F: Now, imagine that the source is to the left of the listener, so that the positive reference direction is in the direction -x. If the source is constant, what value f_l approach as the listener speed (moving in the +x direction) approaches the speed of sound? Explanation and solution: 0 Part G: In this last case, imagine that the listener is stationary and the source moves towards the listener at the speed of sound. (Note that it doesn't matter if the source moves to the right or left.) What is f_l sound waves reach the listener? Explanation and solution: Infinity approaching infinity