Physics 204 Extra Credit

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INSTRUCTIONS (READ THEM):

Answer as many of the questions below as you choose.
But, if you choose to answer a question, answer it ***thoroughly***.
Take time, be careful & thoughtful.
If you do them hastily, you are unlikely to receive any extra credit points.

I. You and a friend are studying physics together. You are working on this problem:
An SHO constructed of a block on a spring is pulled back a distance of 3 cm from equilibrium and released. It oscillates at a frequency of 10 Hz. If the same block is now brought to rest and pulled back a distance of 6 cm and released, at what frequency will it oscillate?

Your friend says, "The answer is 5 Hz, because the block now has twice as far to go to complete one cycle."

Is your friend correct? Partly correct? Totally wrong? Explain ***thoroughly***. Do not just say ***what*** is true, explain ***why*** and ***how***.

II. Explain in detail how a standing wave occurs. Why does the wave not seem to move?

III. You are discussing Doppler with three friends, Eliphaz, Bildad, and Zophar.

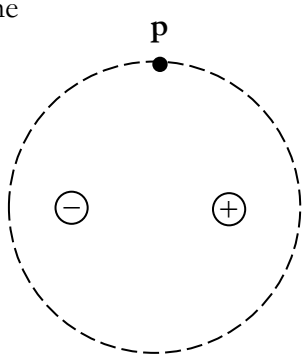
Eliphez says: "The Doppler effect happens because frequency decreases with distance. So when you move towards a source, the pitch goes up. When you move away from a source, the pitch goes down."

Bildad says: "No, no—Doppler happens the waves bunch up as the two objects get closer together and spread out as they get further apart. Therefore, the closer the two objects get, the higher the pitch; and the farther away, the lower the pitch."

Zophar says: "You're both wrong. It's because of your motion relative to the wave. As you move towards the source, you're moving towards the oncoming waves, so you hit more per second, so pitch goes up. When you're moving away from the source, it's the opposite."

Who is right? Anyone? Is any of them partly right and partly wrong? Does pitch increase the closer you get to the source? Does it decrease the further away you get? Explain ***thoroughly***.

IV. A negative charge –Q and a positive charge +Q are held in place one meter apart, as shown below. You are wondering about the field at point ***p***. Another of these "friends" of yours looks at the situation and says, "there's no field at point ***p***, and I can prove it. Check it out. Draw a Gaussian sphere around the two charges that goes through ***p*** like this. The net enclosed charge is zero. Therefore the field through that shape is zero. Therefore the electric field at point ***p*** is zero. QED."



Is your "friend" right? Is he partly right? Is he not at all right? Explain thoroughly.

V. Your enemy makes the following claim: "Magnetic field lines always go in loops. Therefore, if a moving charge is pulled by a magnetic force for a long enough period of time, it will always be pulled in a loop."

What's wrong with your enemy's claim? What's right about it? Explain thoroughly.

VI. Gauss's Law for Magnetic Fields says that magnetic flux is always zero. Faraday's Law says that a changing magnetic flux through a closed surface is equal to the induced electric field around that surface. But if magnetic flux is always zero, how can it ever change? Explain in detail. Use diagrams.