Phys 110C: Problems for HW 2

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1 Homework Problems from Griffiths

1. Griffiths 9.2

2. Griffiths 9.4

3. Griffiths 9.5. Assume that the incident wave and the reflected and transmitted waves are sinusoidal: $g_I = A_I \exp(i(kz - \omega t))$, etc. This simplifies the math quite a bit. (Answers: $A_T/A_I = 2v_2/(v_1 + v_2)$, $A_R/A_I = (v_2 - v_1)/(v_1 + v_2)$).

Are the coefficients derived using the assumption of sinusoidal waves less general, than those using waves of arbitrary shape? Explain your answer.

4. Griffiths 9.7. For part b), you may assume that the wave in molasses takes the form $\tilde{A}e^{i(\tilde{k}z-\omega t)}$, where $\tilde{k}$ is complex, and $\tilde{A}$ is an arbitrary complex constant. Answers:

$$a) \quad \frac{\partial^2 f}{\partial z^2} = \frac{\mu}{T}\frac{\partial^2 f}{\partial t^2} + \frac{\gamma}{T}\frac{\partial f}{\partial t} \tag{1}$$

$$b) \quad \mathrm{Re}[k] = \omega\sqrt{\frac{\mu}{2T}}\sqrt{1+\sqrt{1+(\gamma/\mu\omega)^2}} \tag{2}$$

$$\mathrm{Im}[k] = \frac{\gamma}{\sqrt{2T\mu}}\frac{1}{\sqrt{1+\sqrt{1+(\gamma/\mu\omega)^2}}} \tag{3}$$

$$d) \quad \text{Hint : Use } 9-5 \text{ with complex } k. \tag{4}$$

5. Griffiths 9.10. An active human in the industrialized world metabolizes about 2000 Cal per day (1 Cal = 10^3 cal). Convert this to Joules, and then to the sunlight-capturing area required to support one human's personal energy needs.

6. Griffiths 9-11