

Physics 261

Homework # 9

Remember to show your work.

1. For questions a & b, select the appropriate answer(s) from among the four given possibilities. In the fish tank comparator example, which quality or qualities of the comparator makes it possible to...

- | | |
|-------------------------------|-----------------------|
| (a) Power the pump? | High input impedance |
| (b) Not electrocute the fish? | Low input impedance |
| | High output impedance |
| | Low output impedance |

(c) The input resistor I used for the water sensor was $1\text{ M}\Omega$. If this value is chosen wisely, what other resistance should it be *greater* than? What other resistance should it be *less* than?

2. Consider the inverting Schmitt trigger (the same type as in lecture, and in Faissler figure 34-5). Given $V_L = 0\text{ V}$, $V_H = 3\text{ V}$, and $R_2 = 2\text{ k}\Omega$, choose V_b and R_1 so that the thresholds are at 1 V and 2 V .
3. The illustration below shows a *non-inverting* variant of the Schmitt trigger. Assume that the op amp is ideal.

- (a) Find V_+ in terms of V_{in} , V_{out} , and the resistors.
- (b) Assuming $V_+ > V_b$, find V_{out} and the corresponding range of V_{in} in terms of V_H , V_L , V_b , and the resistors.
- (c) Assuming $V_+ < V_b$, find V_{out} and the corresponding range of V_{in} in terms of V_H , V_L , V_b , and the resistors.
- (d) Sketch the relationship between V_{out} and V_{in} , including arrows on the vertical parts of the hysteresis loop.

