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1. A chemist wants to prepare a pH 7.4 buffer with a high buffer capacity. A 100ml sample of the buffer must be able to maintain its 7.4 pH after addition of 10ml of 6M HCl. Describe a preparation that would achieve this goal. Show all work necessary to justify that the preparation is chemically sound.
2. Rank the following acids in order of acid strength. Justify your ranking with appropriate calculation.
 - a. Unknown A: it has a molecular weight of 158.67 amu and lower pH of neutral water to 4.3 when .25g of the compound are added to 250ml of water.
 - b. Unknown B: Its conjugate base has a pK_b of 5.
 - c. Unknown C: by mixing it in a 4:5 ratio with its conjugate base, you can prepare a pH 6.7 buffer.
3. The US patent office receives numerous patents application each year in which the innovator claims to have invented a perpetual motion machine. Explain why these inventions are impossible based on the law of thermodynamic.
4. An archeologist discovers a wooden item that appear to have been owned by Julius Caesar. The relic was found to have a C-14 to C-12 ratio .785 that of living plant. Base on this information, is it possible that the relic is authentic? Explain your answer with an appropriate calculation.
5. Give an example with explanation of each of the following or explain why it is impossible to do so:
 - a. A bronsted acid that is also a Bronsted base
 - b. A lewis acid that is not a bronsted acid
 - c. A bronsted base that is not a lewis base.

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