

Quiz 1 Key (Ave 90; High 100 (5); Low 70)
BI-102-2, Fall '07, Dr. C. S. Tritt

Problems worth 10 point each (total of 60 raw points). Raw scores were multiplied by 100/60 (1.67) to place them on a 100 point scale.

1. Briefly describe what *emergent properties* are and give a biology related example of emergent properties.

There are features of complex systems that cannot be localized or understood based on a purely reductive analysis of the system. Emergent properties are aspects a system (or hierarchy) that can't be understood in spite of an understanding of its component parts. The colloquial expression "the whole may be greater than the sum of the parts" is an acknowledgement of the existence of emergent properties. Biological examples include human self awareness and complex population dynamics in ecosystems.

2. Briefly describe two of the unifying themes of biology that are mentioned in your textbook and discussed in lecture.

Any **two** of the following: evolution explains unity and diversity of life; cell theory; the molecular basis of inheritance (DNA); Structures and functions are related. Making true statements that were not one of the themes was -2 points each.

3. Explain why Dr. Tritt thinks the periodic table of the elements is so cool (besides the oblivious fact that he's a complete geek).

The periodic table is cool because it **organized** a great deal of previously existing knowledge into a much more **useful** form.

4. Provide concise technical definitions of the terms "oxidation" and "reduction."

Oxidation is the removal of an electron from an atom, molecule or ion. Reduction is the addition of an electron to an atom, molecule or ion. Saying charges change was -3. Saying it oxidation involves or requires oxygen was -10.

5. Water has several attributes that makes it important to life on earth, name one of these attributes and explain in what way it makes water important to life.

Any of the following with any reasonable explanation:

- Cohesion (high surface tension).
- High specific heat (takes a lot of energy to change temperature).
- High heat of vaporization (takes a lot of energy to change phase).
- Volume increases (density decreases) on freezing.
- Very good solvent (high polarity).

6. Explain, in words and a chemical equilibrium equation if possible, why the bicarbonate buffer system is of such interest in biology.

The bicarbonate buffer system is important to maintaining pH because changes in carbon dioxide content of the plasma can be made via the respiration (-2 if connection to lungs, kidneys or respiration was not made) which in turn can change the pH via the following chemical equilibrium equation (reaction): $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{H}_2\text{CO}_3 \leftrightarrow \text{HCO}_3^- + \text{H}^+$. Just saying it regulates plasma pH was -5. Describing buffers in general was -10.