

**Biology 150: Final examination**  
**December 12, 2012**

Name \_\_\_\_\_

Indicate the lab you are registered in:

Tuesday, 8-9:50 \_\_\_\_\_

Tuesday, 10-11:50 \_\_\_\_\_

Tuesday, 12-1:50 \_\_\_\_\_

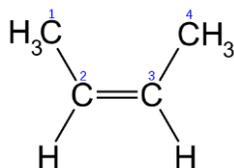
Tuesday, 3-4:50 \_\_\_\_\_

Tuesday, 5-6:50 \_\_\_\_\_

Thursday, 3-4:50 \_\_\_\_\_

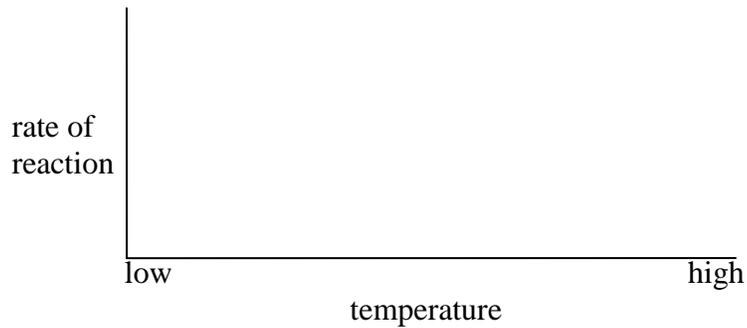
Answer the questions in the space provided and you may also use the back of the page to complete your response. There are 14 questions worth a total of 50 points (plus a couple of bonus questions worth three points total). The point value of individual questions appears in parentheses.

- Name the three most abundant elements in the human body. (1)
- Consider the atom  $^{14}\text{C}$ . (5)
  - what is its atomic number?
  - what is its atomic mass?
  - it contains \_\_\_\_\_ protons, \_\_\_\_\_ neutrons, and \_\_\_\_\_ electrons.
  - how many of its electrons normally reside in its outer electron shell?
  - name one other Carbon isotope.
- Molecules that contain polar covalent bonds or are ionic and are therefore quite water soluble are said to be \_\_\_\_\_, while those composed of non-polar covalent bonds and less water soluble are said to be \_\_\_\_\_. Those molecules that contain both entirely non-polar regions as well as polar/ionic regions are said to be \_\_\_\_\_. (3)
- For the following molecule draw its geometric isomer and label it cis or trans: (2)





13. Enzymes are temperature sensitive. In the chart below plot the effect of temperature on enzyme activity. (2)



14. Starting with a molecule of glucose, outline glycolysis. Name (and indicate quantities) of two intermediate molecules and the end molecules and the involvement of all energy carrier molecules. (4)

15. In aerobic respiration where (and how many)  $\text{CO}_2$  molecules are produced from each glucose entering glycolysis? (2)

16. Outline the path of electrons in non-cyclic photophosphorylation. (6)

17. The double helix model for the structure of DNA was first described by what two scientists? How did it account for each of the conclusions made by Rosalind Franklin? How did the model make sense of Chargaff's rules? (4)
18. Describe eukaryotic transcription. Where does it start? What does it? Where does it end? (3)
19. Describe and/or diagram the events of translation. In what order do the components come together? How is protein amino acid sequence determined? How is translation terminated? (5)
20. What is the effect of histone acetylation on chromatin structure? (1)
21. Cytokinesis typically takes one of two forms. Name and describe (or diagram) each and indicate the types of cells associated with each. (3)

22. What is binary fission? (1)
23. Sexual reproduction is essentially ubiquitous across eukaryote organisms. Obviously preserved by natural selection, sex appears to serve what function?(1)
24. The human karyotype consists of \_\_\_\_\_ chromosomes in \_\_\_\_\_ (homologous) pairs. \_\_\_\_\_ of these pairs are non-sex chromosomes referred to as \_\_\_\_\_. (4)
25. Describe three differences between prophase I (of meiosis I) and prophase of mitosis. (3)
26. When in meiosis do the homologs separate? (1)
27. When in meiosis do the chromatids separate? (1)
28. The chromosomes resulting from crossing over are referred to as \_\_\_\_\_ chromosomes. (1)
29. Describe how the diploid, haploid, and alternation of generations life cycles differ from each other and indicate which types of organisms are associated with each. (4)
30. Distinguish between the terms phenotype and genotype. (2)
31. The location a gene on both chromosomes of a homologous pair is called the \_\_\_\_\_ of the gene. Different forms of a gene are referred to as \_\_\_\_\_. Individuals with identical copies of a gene on its homologous chromosomes are said to be \_\_\_\_\_ while individuals with two different forms of the same gene are \_\_\_\_\_. (4)

32. Mendel's experiments with peas involved both cross pollination followed by self pollination what is the difference between cross pollination and self pollination? (1)
33. In Mendel's monohybrid crosses involving flower color, all the progeny of a cross between an individual true-breeding for purple flower color and another individual true-breeding for white flower color had purple colored flowers. This allowed Mendel to decide that the heritable purple genetic "factor" was \_\_\_\_\_ over the white "factor", which he termed \_\_\_\_\_. Growing up the seeds produced by his progeny produced plants with a mix of flower colors in an approximate ratio of \_\_\_\_\_. (3)
34. In the  $F_2$  generation of Mendel's dihybrid cross involving seed color and seed shape, what were *both* all the different genotypes and phenotypes produced and in what ratios? (6)
35. What is the name given to Mendel's second law and what does it state? (2)
36. In a cross between  $AaBbCcDd$  and  $AaBbCcDd$ : (3)
- what would be the proportion of the progeny that display the dominant phenotype for all four traits?
  - what would be the proportion of the progeny that would be homozygous dominant for all four traits?
  - what would be the proportion of the progeny that would be heterozygous for all four traits?

37. Describe an example of incomplete dominance. What is the distinguishing characteristic of incomplete dominance? (3)

38. Describe an example of co-dominance. What is the distinguishing characteristic of co-dominance? (3)

Bonus questions:

1) Match the individual with his accomplishment and the year(s) of its accomplishment. (5)

- |                 |                              |              |
|-----------------|------------------------------|--------------|
| a) G. Mendel    | _____ sex linkage            | _____ 1903   |
| b) A. Surtavent | _____ gene linkage           | _____ 1860's |
| c) F. Janssens  | _____ crossing over          | _____ 1906   |
| d) T.H. Morgan  | _____ gene mapping           | _____ 1909   |
| e) R.C Punnett  | _____ independent assortment | _____ 1911   |

2) It is often said that Mendel was lucky not to encounter the confusing complication of linkage in his dihybrid crosses. He experimented with seven traits (i.e. flower color, flower position, seed color, seed shape, pod shape, pod color, and stem length) and the pea has only seven chromosomes. Some have said that had he experimented with just one more trait, he would have had problems. It is probably not that simple. We will never know with certainty the identity of Mendel's gene pairs due to zealous office cleaning following his death, but it is likely that he worked with three genes on chromosome 4, two genes on chromosome 1, and one gene in each of chromosomes 5 and 7.

a. Soooooo.....Why didn't Gregor Mendel find linkage? (1)

b. If he had found linkage why would it have been so much more confusing for him than it was for Punnett? (1)