AP® Biology 2000 — Scoring Standards

Question 1 Scoring Guide

Each bullet is worth one point:

Part a. (maximum 6 points)

- **Optimum** temperature and pH *concept* [must include both temp and pH]
- **Enzyme/Substrate Fit** *concept*
  (function dependent on conformation complementarity between enzyme and substrate)
- **Tertiary** (and sometimes quarternary) structure **determines** function
- Description of enzyme **structure or function**, e.g.

Structure	Function
Elegant description of primary to tertiary or primary to quarternary levels of structure	Increases rate of reaction
Protein folding/coiling	Increases proximity of reactants
Co-enzymes/co-factors	Decreases activation energy of the catalyzed reaction
Zymogens	Decreases time to reach equilibrium
Allosteric effectors	Induced fit and/or orbital steering ("bond stress")

- **Denaturation** *concept* [temp and/or pH] linked to decreased enzyme activity
  (e.g. "denaturation" in context or unfolding or change in 3D shape, **not** "enzyme breaks down")
- **How temperature affects** conformation
  (increased temperature breaks specific bonds, e.g. hydrogen, Van der Waals, disulfide bridges)
- **How pH affects** conformation
  (change in H^+ concentration causes a change in specific bond interactions, e.g. hydrogen; ionic; R-group interactions)
- **Kinetics** (increased or decreased molecular movement) linked to effect on enzyme activity due to increase or decrease in temperature up to the optimum

Part b. maximum 6 points

Experimental design must be relevant to the data shown in the graphs

- **What is measured** (e.g. product formed or substrate used)
- **How is it measured** (titration or spectrophotometry or color change or bubbles counted, etc.)
- The **independent variable** (temperature/pH) is **manipulated** to produce the results [at least 3 data points are identified]
- The described experiment **could produce these data**
  (Experimental design included sufficient range, varied the temp/pH of the reaction mix not the enzyme, what was measured, and how it was measured)
- Held **experimental factors constant** (specified at least one)
- Specified a **control group for comparison** (no enzyme or boiled enzyme or no substrate)
- **Verified** results (e.g. repeated trials; results represent an average)
- **Hypothesis** clearly related to experiment of choice, and clearly identified as a hypothesis; can use the if/then... form.

AP® Biology Scoring Standards
Question 2 Scoring Guide

2a. Explain how unique properties of carbon account for the diversity of organic compounds that exist, and discuss why a neon or aluminum-based life form was not likely to develop on earth. (6 points maximum); must respond to the following subparts

4 points for any of the following bullets
- Carbon has a valence electron number of 4
- Valence number of 4 leads to small tendency to gain or lose electrons to form ionic bonds; four strong covalent bonds can be formed by Carbon instead
- Stable tetrahedral shape (109°)
- Ability to single bond, double bond, or triple bond with a variety of elements
- Variation in the carbon skeleton in length, branching, ring formation
- Possibilities of geometric isomers (differ in spatial arrangements with the same covalent partnerships), structural isomers (differ in covalent arrangements) or enantiomers (mirror images). *Terms must be defined*

2 points for any of the following bullets about the element. Student must discuss either neon or aluminum. Points awarded only for the first element discussed; but not both.

Neon	Aluminum
- Nobel gas - Decreased likelihood of being either in the liquid or solid state - Full valence electron shell; Not likely to react with other elements	- Valence number of three - Reduced versatility in bounding (can only form 3 bonds), compared to Carbon's valence of four - Less stable structure and spatial arrangements of bonds compared to tetrahedral shape

2b. Many organic compounds are polymers. Explain the synthesis, breakdown, and composition of these polymers. (6 points maximum); must respond to each of the following subparts.

1 point for any of the following: (3 points max)
- Monomers are smaller subunits that make up polymers
- Synthesis of polymers due to dehydration synthesis (process must be explained)
- Breakdown of polymers due to hydrolysis (process must be explained)

Examples of monomers that make up each polymer (2 points max)

Monomers	**Polymers**
Monosaccharides	Di or polysaccharides
Amino Acids	Polypeptide (protein)
Glycerol + 3 Fatty Acids	Triglyceride
Glycerol + 2 Fatty Acids + Phosphate Group	Phospholipid
Nucleotides	Nucleic Acids

Elaboration Point: at least one example must be listed (1 point maximum)
- Glycosidic bonds join monosaccharides.
- Ester bonds join glycerol and fatty acids
- Peptide bonds join amino acids.