



**AP[®] Biology
2004 Scoring Guidelines
Form B**

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**AP[®] BIOLOGY
2004 SCORING GUIDELINES (Form B)**

Question 1

a) Provide three examples of adaptations found in various prokaryotes. **Explain** how these three adaptations have ensured the success of prokaryotes. (**Max. 6 points**)

- 1 pt for each example of an adaptation (3 are asked for)
- 1 pt for each explanation of how that adaptation ensured success

Some sample answers are:

Sample	Explanation
• fast reproduction • asexual reproduction • genetic transfer (conjugation, transduction, transformation) • plasmids • diverse metabolism (N₂ fixation, anaerobes, chemoautotrophs, variety of substrates) • extremophiles	• out-compete other organisms • no need to risk change if environment constant • can increase species variation • provide new phenotypic capabilities • can colonize habitats inhospitable to others • can colonize habitats inhospitable to others or explanation (thermophiles have altered enzymes so can live at high temperatures, halophiles have altered cell wall and compatible solutes to live in high salt concentrations)
• endospores • cell walls • small • restriction enzymes	• resist harsh conditions • protect from osmotic lysis, protect from some chemicals • high SA/Vol ratio, large number in small space • protection from viruses

b) **Discuss** how prokaryotes early in Earth's history altered environments on Earth. (**Max. 6 points**)

- 1 pt for each identification of an impact on early Earth
- 1 pt for explanation of how environment was altered
- 1 pt for elaboration

Some sample answers are:

Early Impact	Explanation	Elaboration
• provided oxygen • production of usable organics • nitrogen fixation • origin of organelles	• cyanobacteria produced oxygen that was previously not present • converted CO₂ (or methane) to sugars, proteins, etc. • converted N₂ to usable form • endosymbiotic origin of mitochondria/chloroplasts	• discussion of how photosynthesis produces oxygen, discussion of ozone • discussion of Calvin cycle • discussion of nitrogen cycle • discussion of evidence for endosymbiont theory

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Question 1 (continued)

c) **Discuss** three ways in which prokaryotes continue to have ecological impact today. (Max. 6 points)

- 1 pt for each impact on Earth today (3 are asked for)
- 1 pt for explanation

Note: Most answers for part B will also work here. *Some* sample answers are:

Current Impact	Explanation
• chemical cycling (decomposition) • pathogenesis • biotechnology	• explanation of role in a specific cycle (N, C, O, etc.) • specific example; example linked to ecology • food industry, bioremediation; example must link to ecology

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Question 2

Using measurements of dissolved oxygen concentration to determine primary productivity, design a controlled experiment to test the hypothesis that primary productivity is affected by either the intensity **or** the wavelength of light. In your answer, be sure to include the following.

Hypothesis (1 point)

- A statement of the specific hypothesis that you are testing (reasonable, testable and measurable)

Note: No points for just stating which independent variable (IV) they are choosing
Explanations provided in hypothesis may apply to last bullet

Experimental design (1 point each, **Maximum 8 points**)

A description of your experimental design (be sure to include a description of what data you would collect and how you would present and analyze the data using a graph)

Note: to get max. must earn at least one graph point

- identify/define control
- identify independent variable (IV)
- specify IV levels/range
- identify dependent variable (DV)
- explain how to measure DV
- identify constant (only one needed to earn point)
- identify appropriate aquatic organism (not limited to species name, e.g. phytoplankton ok)
- specify length of experiment or frequency of measurements
- specify number of replications
- specify statistical analysis
- graph - correct possible line graph setup (axis, labels-units not necessary)
- graph - correct line(s) (must imply comparison)

Results (1 point)

- A description of results that would support your hypothesis/explanation that relates to primary productivity

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Question 3

Homeostasis of 3 parameters (Maximum of 4 points for each parameter chosen). Within each Parameter:

- mechanism appropriate for organism (1 point)
- explanation appropriate for mechanism (1 point)

Parameter 1 Blood glucose level		
<i>Example of an organism</i>	Mechanism	How homeostasis is maintained.
Any appropriate animal	Insulin	Lowers blood glucose
	Glucagon	Raises blood glucose
	Hunger	Changes behavior (finding food)
Parameter 2 Body Temperature		
<i>Example of an organism</i>	Mechanism	How homeostasis is maintained.
Any appropriate animal	Sweating	Evaporative cooling
	Shivering	Generates metabolic heat
	Dilation of peripheral blood vessels	Increases surface of blood vessels exposed
	Constriction of peripheral blood vessels	Increases surface of blood vessels exposed
	Piloerection (not in humans)	Traps air to insulate against heat loss
	Countercurrent heat exchange	Appropriate description for animal choice
An Ectotherm	Behavioral mechanisms	Appropriate link of behavior to change
An Endotherm	Behavioral mechanisms	Appropriate link of behavior to change
Parameter 3 pH of blood		
<i>Example of an organism</i>	Mechanism	How homeostasis is maintained.
Any appropriate animal	Breathing Rate	Altering carbon dioxide concentration
	Hb-buffer	Altering H ion concentration
	Protein buffer	Altering H ion concentration
	Kidney secretion	Altering H ion concentration
Parameter 4 Osmotic concentration of blood		
<i>Example of an organism</i>	Mechanism	How homeostasis is maintained.
Any appropriate animal	Kidney	Filtration, reabsorption
	Secretion of ADH	Water reabsorption in CD
	Take in water through mouth	Replaces water lost (hypertonic environment)
	Excrete dilute urine	Removes water gained (hypotonic environment)
Parameter 5 Neuron resting-membrane potential (Note: either restoring or maintaining resting potential)		
<i>Example of an organism</i>	Mechanism	How homeostasis is maintained.
Any appropriate animal	Na ⁺ /K ⁺ pump	Restores the ion gradient
	Gated channels	Repolarizes membrane

Question 4

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Same chosen kingdoms must be used for parts a, b, and c

a) Select two kingdoms and briefly describe three characteristics used to distinguish between members of one kingdom and members of the other. (**Max 4 points**)

- First distinguishing characteristic for kingdom 1 and kingdom 2
- Second distinguishing characteristic for kingdom 1 and kingdom 2
- Third distinguishing characteristic for kingdom 1 and kingdom 2
- Elaboration

Note: accept “has/does not have” as distinguishing

Describe three characteristics (at least one molecular and one cellular) that members of these two kingdoms share. (**Max 4 points**)

- Similar characteristics of same kingdom 1 and kingdom 2 – molecular level
- Similar characteristics of same kingdom 1 and kingdom 2 – cellular level
- Similar characteristics of same kingdom 1 and kingdom 2 – any category
- Elaboration

c) Propose an explanation for the existence of similarities and differences between the two kingdoms. (**Max 3 points**)

- Explanation of difference
- Explanation of similarity
- Elaboration of either difference or similarity in both kingdoms

Note: Could be functional or evolutionary explanation

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