



AP[®] Biology
2004 Sample Student Responses
Form B

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BIOLOGY
SECTION II

Time—1 hour and 30 minutes

Directions: Answer all questions.

Answers must be in essay form. Outline form is not acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read each question completely before you begin to write. Write all your answers on the pages following the questions in this booklet.

1. Prokaryotes are found throughout the biosphere. Answer two of the following.
- Provide three examples of adaptations found in various prokaryotes. Explain how these three adaptations have ensured the success of prokaryotes.
 - Discuss how prokaryotes early in Earth's history altered environments on Earth.
 - Discuss three ways in which prokaryotes continue to have ecological impact today.

c) Archaea ^{bacteria} are found in environments with extremely high temperatures. This adaptation helps them by far because in such environment there are no or not many competitors. Sexual reproduction in prokaryotes by conjugation of the ~~the~~ pilli ~~but~~ is a very good adaptation because this increases ~~genetic~~ variation. The rapid reproduction of bacteria by ~~binary~~ binary fission increases differential reproductive success. With the combination of fast reproduction and the ~~transfer~~ exchange in DNA, resistance to antibiotics can spread very fast in a population.

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ADDITIONAL PAGE FOR ANSWERING QUESTION 1

b) Endosymbiosis is what made the eukaryotic cells of today what they are. Chloroplasts and Mitochondria used to be individual cells. Evidence is shown by the organelles having their own DNA. Chloroplasts did photosynthesis in which O₂, needed for cellular respiration, is released. The mitochondria moved into the chloroplast cells making cellular respiration of the organism much more efficient. The Eukaryotes then evolved and began to move onto land.

Earth was originally a reducing atmosphere until photosynthetic prokaryotes produced massive amounts of O₂, making the atmosphere oxidizing. The Ozone (O₃) layer formed. Obligate anaerobes died. Some molecules of O₃ some species to lead to existing organisms denatured causing ~~the~~ ~~beginning~~ mass extinction.

~~c) Prokaryotes are excellent samples in which genetic engineering could be done on. ^{Prokaryote} ~~Genetic engineering~~ ~~is the~~ ~~one~~ are of the primary ~~experiments~~ subjects of gene expression. Some prokaryotes even clean up disasters such as oil spills. Prokaryotes also still cause ~~sicknesses~~ sicknesses such as food poisoning. Speciation and microevolution is also studied from prokaryotes because of things like resistance to antibiotics.~~



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~~In~~ some prokaryotes, specifically archaea bacteria, ~~they~~ can survive very extreme environments, such as extreme temperatures, or extreme salinity (halophiles). This is a good adaptation because it allows prokaryotes to live in places that no other organisms could live, such as in the hot springs of yellow stone National Park. It also allowed prokaryotes to be the first colonizers of earth. Another ~~example~~ is adaptation is that prokaryotes lack double membrane bound organelles ~~and a nucleus~~ and thus a nucleus. This ~~is~~ can be a good adaptation because ~~as~~ bacteria reproduce by binary fission, thus there ~~is~~ are no organelles to get in the way as the ~~bacteria~~

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ADDITIONAL PAGE FOR ANSWERING QUESTION 1

prokaryotes divide. Another adaptation is that ~~some~~ prokaryotes have a single circular strand of DNA which contains no introns. This allows for easy replication of the DNA before binary fission. Additionally, since genes that code for a metabolic pathway are side by side; operons are used ~~to~~ as a form of gene control. This means that some genes code for anabolic or catabolic pathways, and those genes are right by one another. Therefore the ~~entire~~ expression of ~~the~~ these genes can be controlled by ~~one thing~~. The ~~repressor~~ blocking the beginning first gene by repressing it.

Early prokaryotes in Earth's history altered the environments on Earth. ~~The~~ The early atmosphere of Earth contained little oxygen. Thus, when autotrophic prokaryotes (such as cyanobacteria) started to produce oxygen as a by product of photosynthesis, the amount of oxygen in the atmosphere greatly increased. Without prokaryotes in Earth's early history that were able to adapt to the harsh environments, such as archaeobacteria, ~~the~~ further life on Earth may not

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have evolved. ADDITIONAL PAGE FOR ANSWERING QUESTION 1

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- a) Provide three examples of adaptations found in various prokaryotes. Explain how these three adaptations have ensured the success of prokaryotes.
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- c) Discuss three ways in which prokaryotes continue to have ecological impact today.

In earth's history, one of the first prokaryotes found on the earth's surface was cyanobacteria (blue-green algae) this was one of the earliest photosynthetic organisms that (due to the oxidized atmosphere of the earth) used H_2S (hydrogen sulfide) instead of H_2O to break down the hydrogen atoms needed for photosynthesis. However, the cyanobacteria soon began using ~~water~~ water for photosynthesis since it was a much more abundant molecule. This resulted in the increased use of oxygen in the primitive earth and ~~allowed~~ allowed aerobes to sustain on earth's surface. This led to aerobic respiration and helped change the earth from the oxidizing atmosphere (unable to have O_2 in the atmosphere) to the present day reduced atmosphere (O_2 is diluted in the atmosphere).

The theory of endosymbiosis explains ~~how~~ ^{early in the earth's history} prokaryotes were engulfed (phagocytized) by heterotrophic eukaryotes and thus were engulfed ^{and thus were engulfed} the two ^{successful} examples of this are the chloroplast and the mitochondria.



ADDITIONAL PAGE FOR ANSWERING QUESTION 1

^{eukaryotes}
The early heterotroph[^] prokaryotes prokaryotes specialized mitochondria for cellular respiration and the chloroplast for photosynthesis, and as a result this adaptation still ensures the success of prokaryotes (they are still found in present day living organisms such as plants) proof for this theory of endosymbiosis is that the membranes^{and cytoplasm} of the mitochondria and the chloroplast more closely resemble the membranes^{and cytoplasm} of prokaryotes than of the eukaryotes in which they reside.

Another means of survival in ~~pro~~ some prokaryotic organisms is parasitism. Some prokaryotic parasites reside in their host cell and do not kill the host cell (as they need a place to live and absorb nutrients from the host) An example of this would be lichens and algae. As a result of living in the host, these prokaryotes ensure their own success.

