

2006 AP[®] BIOLOGY FREE-RESPONSE QUESTIONS

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 the pink booklet.

1. A major distinction between prokaryotes and eukaryotes is the presence of membrane-bound organelles in eukaryotes.
 - (a) **Describe** the structure and function of TWO eukaryotic membrane-bound organelles other than the nucleus.
 - (b) Prokaryotic and eukaryotic cells have some non-membrane-bound components in common. **Describe** the function of TWO of the following and **discuss** how each differs in prokaryotes and eukaryotes.
 - DNA
 - Cell wall
 - Ribosomes
 - (c) **Explain** the endosymbiotic theory of the origin of eukaryotic cells and **discuss** an example of evidence supporting this theory.

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Question 1

A major distinction between prokaryotes and eukaryotes is the presence of membrane-bound organelles in eukaryotes.

- (a) **Describe** the structure and function of TWO eukaryotic membrane-bound organelles other than the nucleus. **(4 points maximum)**

NOTE: One point is awarded for each bulleted item.

Organelle	Structure—1 point per box, Maximum—2 points	Function—1 point per box, Maximum—2 points
Mitochondria	<ul style="list-style-type: none"> Indicate two membranes <u>with either</u>: <ul style="list-style-type: none"> infolding of the inner membrane cristae, or matrix 	<ul style="list-style-type: none"> cellular or aerobic respiration (Krebs, ETS) production of ATP release of chemical energy
Chloroplasts	<ul style="list-style-type: none"> Indicate two membranes <u>with either</u>: <ul style="list-style-type: none"> flattened sacs (thylakoids). flattened stacks (grana). stroma. 	<ul style="list-style-type: none"> photosynthesis or description of photosynthesis production of 3-Carbon molecules (sugars, PGAL, glucose).
Endoplasmic Reticulum (ER)	<ul style="list-style-type: none"> interconnected membranes, vesicles or sacs rough ER has attached ribosomes and/or smooth ER without ribosomes 	<ul style="list-style-type: none"> synthesis of lipids (e.g., steroids) and/or proteins detoxification of poisons, alcohol transport calcium signaling/storage
		If rough and smooth ER are the two named organelles <ul style="list-style-type: none"> synthesis of proteins
Golgi apparatus	<ul style="list-style-type: none"> series of flattened sacs 	<ul style="list-style-type: none"> modification of molecules packaging molecules processing molecules vesicles (sacs) and their contents can be targeted for various locations in the cell and to its exterior
Lysosome	<ul style="list-style-type: none"> vesicle (bag, sac) with enzymes 	<ul style="list-style-type: none"> digestion or breakdown of molecules waste materials and food with digestive enzymes (e.g., nucleases). cell lysis recycling organelles
Peroxisome (glyoxysomes)	<ul style="list-style-type: none"> vesicle (bag, sac) with enzymes 	<ul style="list-style-type: none"> breakdown or detoxify free radicals or peroxides
Vacuoles	<ul style="list-style-type: none"> vesicle (bag, sac) 	<ul style="list-style-type: none"> water balance turgidity storage water, ions, nutrients, or waste
Contractile vacuole	<ul style="list-style-type: none"> vesicle (bag, sac) 	<ul style="list-style-type: none"> expulsion of water from cell
Vesicles	<ul style="list-style-type: none"> sac (bag, sac) 	<ul style="list-style-type: none"> transporting materials to/from ER, Golgi, or cell membrane
Leucoplast	<ul style="list-style-type: none"> Indicate two membranes with starch 	<ul style="list-style-type: none"> storing starch
Chromoplast	<ul style="list-style-type: none"> Indicate two membranes with pigments 	<ul style="list-style-type: none"> storing pigments

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Question 1 (continued)

(b) Prokaryotic and eukaryotic cells have some non-membrane-bound components in common.

Describe the function of TWO of the following and **discuss** how each differs in prokaryotes and eukaryotes.

- DNA
- Cell wall
- Ribosomes

(4 points maximum)

Component	Function—1 point	Difference between Prokaryotes and Eukaryotes—1 point
DNA	<ul style="list-style-type: none"> contains, stores, or transmits genetic information codes for proteins or traits 	<ul style="list-style-type: none"> single molecule vs. usually many molecules circular molecule vs. linear molecule on avg. smaller number of base pairs (bp) vs. 1,000 times the average number of prokaryote bp in cell's cytoplasm vs. within nucleus few/no proteins* vs. histone proteins no introns * vs. introns <p>*archaebacteria are an exception</p>
Cell wall	<ul style="list-style-type: none"> protects supports maintains turgidity maintains shape/ allows adherence 	<ul style="list-style-type: none"> Peptidoglycans (murein, amino acid, and sugar polymer) vs. Cellulose and/or Chitin
Ribosome	<ul style="list-style-type: none"> make protein site of translation 	<ul style="list-style-type: none"> smaller vs. larger free in cytoplasm vs. free and attached simultaneous transcription/translation vs. non-simultaneous contain different proteins, or RNAs different antibiotic sensitivity

(c) **Explain** the endosymbiotic theory of the origin of eukaryotic cells and **discuss** an example of evidence supporting this theory. **(2 points)**

Explain (1 point):

Prokaryotic cell was engulfed by another cell and formed a (symbiotic) relationship.

Evidence (1 point):

- Mitochondria and/or chloroplast contains own DNA.
- Mitochondria and/or chloroplast contains own ribosomes.
- Mitochondria and/or chloroplast contain double membrane.
- Mitochondria and/or chloroplast divides by binary fission.
- Mitochondria and/or chloroplast have a similar size to prokaryotic cells.