AP® Biology
2003 Scoring Guidelines
Form B

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Question 1

A difference between prokaryotes and eukaryotes is seen in the organization of their genetic material.
(a) **Discuss** the organization of the genetic material in prokaryotes and eukaryotes.
(b) **Contrast** the following activities in prokaryotes and eukaryotes
- Replication of DNA
- Transcription or translation
- Gene regulation
- Cell division

(a) 4 points maximum
(1 point for each bullet; each contrast pair must include 1 bullet from prokaryote and 1 bullet from eukaryote)

Prokaryote	Eukaryote
• No introns	• Introns
• Location: not in nucleus	• Location: nucleus (and Mito&Chloro)
• Circular	• Linear
• No histones	• Histones
• One chromosome, usually	• >one chromosome, usually
• Plasmids common	• Plasmids rare (yeast)
• Supercoiled DNA	• Chromatin DNA

(b) 8 points maximum
(each activity has a maximum of 2 points; each contrast pair must include 1 bullet from prokaryote and 1 bullet from eukaryote)

Activity	**Prokaryote**	**Eukaryote**
DNA Replication	Single origin	Multiple origin
	No telomeres	Telomeres
	Location: Cyto/Cell Memb	Location: Nucleus (and Mito & Chloro)
Transcription	No RNA Processing	RNA processing
	Location:Cyto	Location: Nucleus (and Mito & Chloro)
	Monocistronic	Polycistronic
	Initiation:sigma	Initiation: initiation factors
or	1 RNA polymerase	3 RNA polymerase
Translation	T+T coupled	T+T not coupled
	30s/40s	40s/60s
	Location: cyto	Location:also in Mito & Chloro
Gene Regulation	Operon	No operon
	+&- control	+control, primarily
	Enhancers rare	Enhancers common
	none	Methylation, acetylation, Barr bodies
Cell Division	No mitosis/Meiosis	Mitosis/Meiosis
	Rapid	Slower
	No spindles	Spindles

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Question 2

Hormones play important roles in regulating the lives of many living organisms.

(a) For TWO of the following physiological responses, **explain** how hormones cause the response in plants.
- increase in height
- adjustment to change in light
- adjustment to lack of water

(b) For TWO of the following physiological responses, **explain** how hormones cause the response in animals.
- increase in height
- adjustment to change in light
- adjustment to lack of water

(c) **Describe** TWO different mechanisms by which hormones cause their effects at the cellular level.

Note: Tables only provide examples. They are not inclusive.

(a) 4 points maximum (Each bullet 2 points maximum).

Activity	Response	How Hormone Causes Response
• Increase in Height	Stem elongation (meristem)	Lowers pH increasing osmosis Loosens cell wall (cellulose x-links)
• Adjustment to change in light	Tropism Stomatal closing Flowering Seed germination Shade avoidance Decrease light – increase height	Disproportionate cell elongation Causes loss of guard cell turgor Phytochrome shift Phytochrome shift Phytochrome shift Disproportionate cell elongation
• Adjustment to lack of water	Stomates close Root branching Dormancy	Causes loss of guard cell turgor Differential cell growth Production of dehydration tolerance proteins

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Question 2 (continued)

(b) 4 points maximum (Each bullet 2 point maximum)

	Response	**How Hormone Causes Response**
• Increase in Height	Growth (identify a tissue influenced)	Stimulates cell proliferation Stimulates liver-->IGF
• Adjustment to change in light	Biorhythms (repro/sleep) Skin Pigmentation	Day/night fluctuations in production Melanin prod/distribution fluctuations
• Adjustment to lack of water	Antidiuresis Thirst	Nephron increases water reabsorbtion Nephron increases Na^+ reabsorbtion Stimulates Hypothalamus

(c) 4 points maximum

Mechanism	**Effect**
• receptor in cell	• Primarily influences transcription
• receptor in cell membrane	• Primarily activates proteins already present (through signal transduction)

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Question 3

Water is important for all living organisms. The functions of water are directly related to its physical properties.

(a) **Describe** how the properties of water contribute to TWO of the following.
- transpiration
- thermoregulation in endotherms
- plasma membrane structure

(b) Water serves as a reactant and a product in the carbon cycle. **Discuss** the role of water in the carbon cycle.

(c) **Discuss** the impact of one human activity on the water cycle.

(a) 4 point maximum

2 points for each process / one point per category in the context of linking property to contribution

Process	Property	Contribution to Process
Transpiration	polarity/cohesiveness	water movement
	high heat of vaporization	reduces water loss
	water potential	water movement
Thermoregulation	high heat of vaporization	evaporative cooling
	high specific heat	heat buffer
Plasma membrane	polarity	arrangement of phospholipids

(b) 4 points maximum

- Reactant in photosynthesis or equation ($H_2O + CO_2 \leftrightarrow C_6H_{12}O_6 + O_2$)
- Specific role of water in photosynthesis
- Product in respiration or equation ($H_2O + CO_2 \leftrightarrow C_6H_{12}O_6 + O_2$)
- Specific role of water in respiration
- Oceanic carbon storage $CO_2 + H_2O \leftrightarrow H_2CO_3$
- Role of hydrolysis in catabolism
- Solvent for carbon based metabolism

(c) 3 points maximum (only **one** activity may be scored)

Activity	Description of impact on the water cycle	Elaboration of either activity or description (clear linkage)
ground water diversion	decreased transpiration	possible climate effects
deforestation	decreased transpiration	possible climate effects
acid rain production*	decreased transpiration	disruption of weather patterns
global warming*	increased evaporation	disruption of weather patterns
	melt ice cap	rise in sea level causing flooding

* Did not score activity point for mention of these terms unless they were properly linked to an impact on the water cycle

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Question 4

Biologists are interested in preserving the diversity of living organisms on the planet.

(a) **Explain** THREE of the following processes or phenomena, using an appropriate example for each.
- Mutation
- adaptive radiation
- polyploidy
- population bottlenecks
- growth of the human population

(b) For each process or phenomenon you selected in (a), **discuss** its impact on the diversity of life on Earth.

One point for each definition, example, impact and explanation.

	Definition	Example	Impact on diversity of life on earth	Explanation
mutation	change in DNA	deletion/insertion point mutation chromosomal aberration	increase or decrease	altered proteins new geno/phenotypes raw material for selection
adaptive radiation	multiple species from 1 ancestor	Galapagos finches mammals angiosperms	increase	new species co-existence of species
polyploidy	more than 2 complete chromosome sets	plants (common) animals (rare e.g., fish, amphibians)	increase	development of new species (autoploidy speciation, alloploidy speciation)
population bottlenecks	sudden/drastic decrease in population size (usually natural)	cheetahs northern elephant seals	decrease	random/not adaptive population not representative of original smaller gene pool
growth of human population	near carrying capacity exponential evidence from age pyramid	rapid increase – developing countries slow growth - U.S. no growth - Italy	decrease	Use of resources leads to extinction of other species

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