

2004 AP® BIOLOGY FREE-RESPONSE QUESTIONS

4. Organisms rarely exist alone in the natural environment. The following are five examples of symbiotic relationships.

- Plant root nodules
- Digestion of cellulose
- Epiphytic plants
- AIDS (acquired immune deficiency syndrome)
- Anthrax

Choose FOUR of the above and for each example chosen,

- (a) **identify** the participants involved in the symbiosis and describe the symbiotic relationship, and
- (b) **discuss** the specific benefit or detriment, if any, that each participant receives from the relationship.

END OF EXAMINATION

**AP® BIOLOGY
2004 SCORING GUIDELINES**

Question 4

- (a) **Identify** the participants involved in the symbiosis and describe the symbiotic relationship, and
 (b) **Discuss** the specific benefit or detriment, if any, that each participant receives from the relationship.

1 point maximum is awarded for a correct pair of participants involved in each example given.

Participants must be organisms.

1 point maximum is awarded for describing a correct symbiotic relationship to each example.

1 point maximum is awarded for discussing how **each** participant is involved in a specific benefit or detriment from the relationship.

Wrong participants: NO points for participants, relationship, or discussion.

Nonspecific participants: 2 points maximum for relationship and discussion.

1 point maximum for elaborating on any **one** of the four choices used. 10 points awarded only if 4 choices attempted.

Example of Symbiotic Relationship	Participants Involved	Relationship Involved	Discussion on Each Participant
Plant root nodules	Plants/legumes + <i>Rhizobium</i> /bacteria	Mutualism/both organisms benefit	Plants receive nitrogen (not N ₂) while bacteria receive CHO's and other nutrients/water and shelter/hospitable environment
Digestion of cellulose	Termites/ruminants + microorganisms (bacteria, protozoa, fungi) Plants + pathogenic bacteria/fungi	Mutualism/both organisms benefit Parasitism/one member is harmed, the other benefits	Host is able to use cellulose as a nutrient (energy source) while symbiont gains food/shelter/hospitable environment Host is infected, bacteria/fungi receives nutrients
Epiphytic plants	Large trees (plants) + epiphyte/bromeliads/orchids/some mosses/ferns Epiphyte + ants/frogs/small animals Dodder/mistletoe + plant	Commensalism/one member benefits, the others are not harmed Mutualism/both organisms benefit Parasitism/one member is harmed, the other benefits	Host is not affected or given any benefit. Symbiont has a substrate for anchoring/access to sunlight & pollinators Bromeliads provide water, shelter free of predation to many insect larva, frogs, etc.../a source of nitrogen is given to plant Host has nutrients removed while epiphyte receives nutrients
AIDS	Human + Virus/HIV/retrovirus	Parasitic/one member is harmed, the other benefits	HIV uses host to replicate while host/immune system is harmed or killed
Anthrax	Human/ruminant/horse/pig + <i>Bacillus anthracis</i> /bacteria/spores	Parasitic/one member is harmed, the other benefits	Illness or death to host; bacteria receives nutrients, habitat