AP® BIOLOGY
2011 SCORING GUIDELINES

Question 3

Reproduction can be either asexual or sexual.

Note: Points must be earned from parts (a), (b), and (c) in order to earn a maximum score of 10.

(a) Using a specific example, **describe** how organisms can reproduce asexually.
(3 points maximum)

Specific examples (include but are not limited to)	**Describe corresponding reproduction (1 point each)**
Bacteria, archaea, protists	Binary fission splits cell into two cells.
Yeast, sponges, hydra, jellyfish	Budding by mitosis.
Fungi, conidia	Produce haploid spores.
Fungi, sponges	Fragments form new individual.
Rotifers, nematodes, flatworms, gastropods, insects, crustaceans, fish, amphibians, reptiles, bees, wasps, ants, Komodo dragon	Parthenogenic development of unfertilized eggs.
Strawberries	Runners or modified shoots.
Irises, bamboo, beach grasses, rushes, sand verbena	Modified shoots/stolons/rhizomes.
Potato tubers	Modified shoots with buds/eyes.
Kalanchoe leaves	Leaves generate new plants.
Black locust, pear, apple, cherry, blackberry, aspen	Runners/root sprouts/suckers.
Lilies, tulips, onions, daffodils, garlic	Bulbs or corms form modified underground buds.
Crocus, *Gladiolus*, *Cyclamen*, taro	Short, erect underground stems.
Dandelions, blackberries, citrus trees, Kentucky bluegrass	Apomixis produces seeds without pollination.
Agricultural crops	Grafting/cutting/cell culture.

Discuss TWO evolutionary advantages of asexual reproduction.
(2 points)

- It is successful at low population density.
- It eliminates the energy cost of finding a mate.
- It exploits stable environments.
- It is rapid and efficient.
- It eliminates the energy cost of fertilization/pollination.
- It eliminates the need for pollinators in plants.

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Question 3 (continued)

(b) **Identify** THREE ways that sexual reproduction increases genetic variability. For each, **explain** how it increases genetic diversity among the offspring.
(6 points maximum)

Identification (1 point each; 3 points maximum)	**Explanation (1 point each; 3 points maximum)**
Crossing over or recombination	Generates new combinations of alleles.
Independent assortment	Random alignment on metaphase plate during meiosis.
Random fertilization	Nonspecific gamete selection.
Random mating	Nonspecific mate selection.
Diploidy or polyploidy	Harmful recessive mutations may not be expressed.

(c) **Discuss** TWO prezygotic isolating mechanisms that prevent hybridization between two species. Include in your discussion an example of each mechanism.
(4 points maximum)

Discussion of isolating mechanism (1 point each) with a reasonable example (1 point each)	
Habitat/ecological isolation	Preferences for living/mating in different habitats/microenvironments.
Geographical isolation	Living or mating in different geographic areas with a physical barrier.
Mechanical isolation	Structural differences of reproductive organs.
Temporal isolation	Different mating time of day or season of year.
Behavioral isolation	Different mating rituals between species.
Gametic isolation	Molecular incompatibilities between sperm and egg OR Chemical incompatibilities limit sperm viability.

3. Reproduction can be either asexual or sexual.

   (a) Using a specific example, **describe** how organisms can reproduce asexually. **Discuss** TWO evolutionary advantages of asexual reproduction.

   (b) **Identify** THREE ways that sexual reproduction increases genetic variability. For each, **explain** how it increases genetic diversity among the offspring.

   (c) **Discuss** TWO prezygotic isolating mechanisms that prevent hybridization between two species. Include in your discussion an example of each mechanism.

a) A specific example of how an organism can reproduce asexually is by binary fission of cells by mitosis. Mitosis includes prophase, prometaphase, metaphase, anaphase, and telephase. Cells spend the most time in prophase. For binary fission to happen, the chromosomes have to replicate themselves. In metaphase, the chromosomes line up in the middle and get pulled apart in anaphase. Binary fission is when one cell makes 2 daughter cells, where one cell just buds off the first cell. One evolutionary advantage for asexual reproduction is that everyone are clones of each other so they are good in stable, unchanging environments. Also, asexual reproduction doesn't need a lot of energy and its quicker. So, they don't waste a lot of energy ~~reproducing~~ reproducing.

b) One way that sexual reproduction increases genetic variability is when crossing over occurs. ~~It increases~~ in prophase I of meiosis. It increase genetic variability because ~~the~~ even the sister chromatids are not the same so they have different genes. Independent assortment also increases genetic variability, because the chromosomes in a random assortment when they line up during metaphase I and II of meiosis. So, each offspring will be similar to their parents but slightly different. Lastly, random fertilization also increases genetic variability. Already, you have gametes that are all different from one another. and when you add to gametes that are completly different ~~from~~ from different people, you have an offspring that is one in a 64 million possibility.

Part c →

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c) One prezygotic isolating mechanism that prevent hybridization is behavioral isolation. One species may not understand the mating call of another species, therefore they will not willingly interbreed. Like the noises that crickets make will not be understood by a stinkbug. Another prezygotic isolating mechanism is the habitat isolation, which means that two species live in different regions so they will not interbreed. Like terrestrial snakes will not mate w/ snakes that live in the water, because they are different habitats.

3. Reproduction can be either asexual or sexual.

(a) Using a specific example, **describe** how organisms can reproduce asexually. **Discuss** TWO evolutionary advantages of asexual reproduction.

(b) **Identify** THREE ways that sexual reproduction increases genetic variability. For each, **explain** how it increases genetic diversity among the offspring.

(c) **Discuss** TWO prezygotic isolating mechanisms that prevent hybridization between two species. Include in your discussion an example of each mechanism.

Coral reproduce asexually by using budding, where a portion of the organism grows a genetic copy of itself on it's own structure. Asexual reproduction allows for an organism to reproduce ~~[illegible]~~ in the absense of a mate of the opposite sex. Asexually reproduction also allows the organism to reproduce throughout it's lifetime, where as, sexually reproducing organisms go through cycles. Sexual reproduction almost always produces offspring that are genedically unique because of the random mix & variation of alleles. There is also an outside source of genetic information so genetic information is never a copy of the parent. Sexually reproducing organisms also have the ability to mate multiple times with organisms of the same species but with different genes, thes allows for multiple offspring with many varying genotypes and randomley organized alleles, providing for unique

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organisms.

Behavioral isolation is a prezygotic isolation mechanism which prevents the opposete sex of an organism from recognizing a potential because of a defference in mating rituals. Different species of birds have differene mating calls, whech alert them as to whether a fellow organism is a potential mate. Mechanical isolation is when the genetalia of two organisms of defference species do not coordenate. A pig has a corkscrew-leke canal for a vagina, a horse or human penis would not be able to fit.

3C1

3. Reproduction can be either asexual or sexual.

(a) Using a specific example, **describe** how organisms can reproduce asexually. **Discuss** TWO evolutionary advantages of asexual reproduction.

(b) **Identify** THREE ways that sexual reproduction increases genetic variability. For each, **explain** how it increases genetic diversity among the offspring.

(c) **Discuss** TWO prezygotic isolating mechanisms that prevent hybridization between two species. Include in your discussion an example of each mechanism.

A) A cell may ~~can~~ reproduce asexually through mitosis. In this process, ~~cells~~ chromosomes are replicated, move to opposite ends of the ~~cell~~ cell, and the cell seperates. Evolutionary advantages of asexual reproduction ~~include~~ include: a more effiecent way of multiplying ~~because~~ because fertilization is not required and the process of finding a mate is not necessary.

B) Sexual reproduction increases genetic variability because it allows the genetic material of two parents to be equally ~~incorporated~~ incorporated into one offspring. This, in turn, can increase genetic diversity because the offspring is now able to repeat the process with a mate of it's own. Also, if a animal immigrates into a population and breeds with another animal, the offspring will again have a combination of both genes. This, also, ~~creates~~ creating genetic diversity.

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c) A prezygotic barrier is a mechanism that does not allow two organisms to produce a offspring even with the act of mating. ~~A prezygotic barrier~~ A example of a prezygotic barrier would be a geological location which seperates two species. For instance, a crow from California would not be able to mate with a crow from Africa because they are seperated. Also, another barrier would be significant species difference. For example, a elephant would not be able to mate with a fly.

AP® BIOLOGY
2011 SCORING COMMENTARY

Question 3

Overview

Question 3 offered the opportunity to compare asexual and sexual reproduction in specific organisms. Part (a) requested the description of a specific organism that reproduces asexually, along with a discussion of two evolutionary advantages to this type of reproduction. Part (b) requested the identification of three ways that sexual reproduction increases genetic variability, as well as discussion of how each increases genetic diversity among the offspring. Part (c) requested the discussion of two prezygotic isolating mechanisms in sexual reproduction, along with the provision of examples in the discussion.

Sample: 3A
Score: 10

In part (a) 1 point was earned for discussing how the formation of clones in a stable environment is an evolutionary advantage for asexual reproduction, and 1 point was earned for discussing how asexual reproduction is rapid and efficient.

The response earned the maximum of 6 points in part (b). One point was earned for identifying crossing over as a way that sexual reproduction increases genetic variability, and 1 point was earned for explaining how this increases genetic diversity among offspring. Another point was earned for identifying independent assortment as a way that sexual reproduction increases genetic variability, and 1 more point was earned for explaining how this increases genetic variability by making the offspring slightly different from their parents. One point was earned for identifying random fertilization as a way to increase genetic diversity, and 1 point was earned for explaining how this increases genetic diversity when gametes meet.

In part (c) 1 point was earned for discussing behavioral isolation as a prezygotic isolating mechanism, and 1 point was earned for citing "the noises that crickets make," which are not recognized as mating calls by other insects, as an example of behavioral isolation. Two more points could have been earned — 1 for the discussion of habitat isolation as a prezygotic isolating mechanism and 1 for the example of habitat selection among snakes — but 10 points had already been earned.

Sample: 3B
Score: 8

In part (a) 1 point was earned for a description of budding, using coral as an example. One point was earned for discussing how asexual reproduction does not require a mate, which is an evolutionary advantage. No point was earned for a discussion of a second evolutionary advantage of asexual reproduction.

In part (b) 1 point was earned for the explanation that sexual reproduction increases the genetic diversity of offspring because it creates a "mix & variation of alleles," but no point was earned for specifically identifying this process, because it is not referred to as either recombination or crossing over. Similarly, 1 point was earned for the explanation that mating "multiple times with organisms of the same species but with different genes" allows for multiple offspring with many varying genotypes, but no point was earned for the identification of this concept, as there is no specific mention of random mating.

Question 3 (continued)

The response earned the maximum of 4 points in part (c). One point was earned for a discussion of behavioral isolation as a prezygotic isolating mechanism, and 1 point was earned for including an example of behavioral isolation in birds. One point was earned for a discussion of mechanical isolation as a prezygotic isolating mechanism, and 1 more point was earned for using the reproductive structures of pigs as an example.

Sample: 3C
Score: 6

In part (a) 1 point was earned for discussing how asexual reproduction is an "effiecent [*sic*] way of multiplying," and 1 point was earned for discussing how asexual reproduction eliminates the need to find a mate.

In part (b) 1 point was earned for explaining that sexual reproduction "allows the genetic material of two parents to be equally incorporated into one offspring," but because the response does not identify independent assortment, random mating, or random fertilization, no identification point was earned.

In part (c) 1 point was earned for discussing geographical isolation as a prezygotic isolating mechanism, and 1 point was earned for including an example of crows that are separated (in California and Africa). No point was earned for a discussion of mechanical isolation as a prezygotic isolating mechanism, but 1 point was earned for including an example of mechanical isolation (between elephants and flies).