

Science 9 Connections – 1.3 Checking Your Understanding KEY (pg 57 of textbook)

1. How are the terms *gamete*, *fertilization*, and *zygote* related?

A gamete is a haploid cell produced through meiosis. Examples of gametes include sperm cells (produced in testes in males) and egg cells (produced in ovaries in females). In humans, gametes have 23 chromosomes.

In fertilization, two gametes (one sperm and one egg) fuse to form a diploid zygote with the correct number of chromosomes. In humans, zygotes have 46 chromosomes.

2. Each body cell of a cat has 38 chromosomes.
a. How many chromosomes will be in each sperm cell of a male cat? Explain why it is this number.

Male cat sperm cells will have half the body cell number of chromosomes: $38/2=19$. Sperm cells are gametes which have a haploid number of chromosomes; that way, fertilization (the fusion of two gametes) produces zygotes with the correct diploid number of chromosomes.

- b. How many chromosomes will be in a zygote of a cat? Explain your answer.

A cat zygote will have the diploid number of chromosomes: 38. This is the same as the number of chromosomes in the body cells of cats. (All body cells have the diploid number; only gametes have the haploid number.)

3. Why is meiosis important?

Meiosis is important because it produces haploid gametes. This way, during sexual reproduction, fertilization (fusion of gametes from two different parents) produces zygotes with the correct diploid number of chromosomes → correct amount of DNA! :)

4. Copy and complete the following table in your notebook by answering the questions about meiosis.

Question	Result of Meiosis
How many cells are produced for every cell that undergoes meiosis?	4
How do parent and daughter cells differ genetically?	Each daughter cell has half the number of chromosomes as the parent cell.
How do daughter cells compare to each other?	Daughter cells are different from each other. However, daughter cells will have the same number of chromosomes (haploid). All chromosomes in each

	daughter cell will have a homolog in each of the other daughter cells.
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5. A breed of dog called a labradoodle was developed from the mating of a Labrador retriever and a poodle. Use this example and your knowledge of sexual reproduction to explain why this can happen.

(Note: this is a tricky question. It is more vague than the questions you will get on your test.)

This can happen because Labradors and poodles have the same number of chromosomes. This way, their gametes have the same number of chromosomes. Labradors and poodles also happen to be part of the same species of “dog” → all the chromosomes in their genome will have homologs in the other dog breed’s genome, leading to successful fertilization and production of offspring.

(Note: infertile offspring can sometimes be produced during matings of different species which may or may not have different number of chromosomes. In this case, they are infertile because their chromosomes are so different that their chromosomes do not ‘pair up’ during Prophase 1, leading to impaired gamete formation.)

6. The word *twins* refers to two offspring being produced in the same pregnancy. In humans, twins can be identical or fraternal. As their names imply, identical twins are genetically identical, and therefore, they are the same sex. Fraternal twins are not genetically identical and can be different sexes.
- One type of twin forms when two eggs are individually fertilized. Another type of twin forms when a single fertilized egg divides into two separate bodies in the first few days of embryo development. Identify which represents fraternal twin development and which represents identical twin development. Explain your answer.

The first case (two fertilized eggs) will result in fraternal twins. These twins will have different DNA because they are produced from the fusion of two different sets of gametes; no two gametes from the same parent are alike.

The second case (single fertilized egg) will result in identical twins. These twins will have the same DNA because they are produced from the equal division of a single cell.

- Fraternal twins are called dizygotic twins and identical twins are called monozygotic twins. Why are those names appropriate? Hint: think of the meanings of the prefixes *mono-* and *di-* and the meaning of the word *zygote*.

These names are appropriate. A zygote is the single diploid cell that is formed through fertilization (sperm + egg = zygote). In dizygotic twins, two different zygotes are formed through two separate fertilization events. In monozygotic twins, a single zygote is formed.

7. Some plants can self-pollinate. This means pollen, which contains sperm cells, is transferred from the male reproductive structure to the eggs in the female reproductive structure within the same flower. In your opinion, is this sexual or asexual reproduction? Why?

Recall that sexual reproduction involves two parents and results in offspring that are different. Asexual reproduction involves a single parent and results in offspring that are identical to the parent.

Either answer could be justified, though the **best answer** is provided below.

Best answer: This is sexual reproduction. In sexual reproduction, parents produce haploid gametes through meiosis, and offspring are produced through the fusion of two haploid gametes. In self-pollinating plants, meiosis is required to produce the sperm and egg cells, and the zygotes are formed through fusion of the pollen (sperm cells) and the eggs from a single plant.

Sexual reproduction results in offspring that are different from each other and different from the parents. Because the sperm and egg cells in this plant were all produced through meiosis, no two offspring will be exactly alike to each other or to the parent, just like in sexual reproduction.

One key difference is that typical cases of sexual reproduction involve two parents, while asexual reproduction involves a single parent only. Self-pollinating plants only involve a single parent. However, because of the points outlined above (gametes produced through meiosis; offspring are different), self-pollinating plants are still most similar to sexual reproduction. The implication of the gametes being produced from a single parent is that the offspring will be more similar than if they had been produced through fertilization of gametes from two different parents.

(Fun fact: most plants are able to self-pollinate **and** to cross-pollinate. Self-pollination is a great strategy for plants that are very sparse, while cross-pollination is a better strategy for plants that are growing densely where it is likely that pollen will land on a different plant. In most cases, self-pollination will be used as a backup strategy if the plant's eggs are not fertilized by a different plant.)