

Assignment Summary

For this assignment, you will create a model of asexual reproduction and a model of sexual reproduction. To show the similarities, assume that both models represent a eukaryotic organism, or cells with nuclei. You will then answer a few questions on the Student Worksheet to help you compare the two and evaluate similarities and differences. Your final activity will be to write an essay that describes why asexual reproduction results in offspring that are identical to the original and why sexual reproduction results in diverse and unique offspring.

Background Information

Living things reproduce in two ways. Some reproduce by creating identical copies of themselves. This is known as asexual reproduction. Budding, fragmentation, and binary fission are types of asexual reproduction. Examples of organisms that reproduce asexually are hydra, bacteria, and planaria. Other living things reproduce by joining male and female sex cells. This is called sexual reproduction. Sexual reproduction allows for genetic differences between organisms of the same species. Examples of organisms that reproduce sexually are angiosperms, dogs, and humans.

These two methods of reproduction involve a process in which the DNA is replicated and the cell divides. For asexual reproduction, it is mitosis in eukaryotes; for prokaryotes, the method is similar to mitosis, but without a nucleus. Sexual reproduction requires meiosis to create the sex cells. In both mitosis and meiosis, before a cell can divide, the cell must grow in size and the DNA must be replicated. This phase is called interphase. After cell division, whether it be mitosis or meiosis, the cytoplasm of the cell splits as two new cells are formed. This is called cytokinesis. All the steps of the life of a cell, from interphase through cytokinesis, are referred to as the cell cycle. Mitosis and meiosis differ in the number of divisions that happen, the number of resulting cells produced, and how the resulting cells compare to the original cells.

Materials

- One piece of poster board
- Four markers or colored pencils; two colors of your choice as well as a brown and a blue

Assignment Instructions

Step 1: Prepare for the project.

- a) Read steps 2 through 8 so you know what you are expected to do during this project. If there is anything that is not clear to you, ask your teacher.

Step 2: Gather materials for the model.

- a) See your teacher or proceed to the designated location to retrieve your piece of poster board and at least four colors of markers or colored pencils. You can select two of your favorite colors, but should also have brown and blue available for the second part of the project.

Step 3: Create a model of asexual reproduction.

Student Guide (continued)

- a) Label this portion of your poster “Asexual Reproduction.”
- b) To keep things clear and simple, you will model only two pairs of chromosomes in the original cell. Use one color for one set of chromosomes and use a second color for the second set of chromosomes. This will make it easier to follow each chromosome as it moves through the cell cycle. You can choose any colors you like other than brown and blue.
- c) You will use the top third of your poster board to draw your model of asexual reproduction. The last two-thirds of the poster board will be used for sexual reproduction and fertilization. Start your model in interphase by drawing a single original cell. Structures such as the cell membrane and nucleus can be drawn in pencil. You may use your notes from the lesson, books, or online resources to help you determine what is needed in each illustration.
- d) Next, draw each of the phases of mitosis. Be sure you have replicated chromosomes! Include each of these phases:
 - a. Prophase
 - b. Metaphase
 - c. Anaphase
 - d. Telophase
- e) Show the division of the original cell into two new cells to represent cytokinesis.
- f) Check your diagrams before you proceed. Be sure you have labeled each of your drawings with the name of the phase. Also be sure that you have kept the chromosome colors you selected consistent throughout your drawings.
- g) Show your completed steps to your teacher before you move on to the next step.

Step 4: Create a model of sexual reproduction.

Part One: Modeling meiosis

- a) Label this portion of your poster “Sexual Reproduction.”
- b) As you did in your first model, include two sets, or pairs, of chromosomes. Use the same colors you did above, or select two new colors. Just avoid using brown and blue since you will use those two colors in the fertilization part of the model.
- c) Use the next third section of your poster board to draw your model for meiosis. Remember that in meiosis, each of the steps in division will happen twice. Allow enough room for all of the steps to flow in order. You may want to sketch the cells lightly in pencil before you apply any color. Now, begin your model in interphase by drawing a single original cell with a nucleus.
- d) Show this cell undergoing the phases of meiosis I. Be sure that you are representing chromosomes that have been replicated. Include each of these phases:
 - a. Prophase I
 - b. Metaphase I
 - c. Anaphase I
 - d. Telophase I
- e) Show the division of the original cell into two new cells to represent cytokinesis.
- f) Next, continue your model to demonstrate the phases of meiosis II. Be sure to include:
 - a. Prophase II
 - b. Metaphase II
 - c. Anaphase II

Student Guide (continued)

- d. Telophase II
- g) Show the division of each of the two cells into two new cells to represent cytokinesis.
- h) Check your diagrams before you proceed. Be sure you have labeled each of your drawings with the name of the phase. Also be sure that you have kept the chromosome colors you selected throughout your drawings.
- i) Show your completed steps to your teacher before you move on to the next part.

Step 5: Modeling fertilization.

You now have a model with four cells, which in humans could be eggs or sperm. For the purpose of this project, assume that these represent egg cells. To complete the modeling of sexual reproduction, we must fuse an egg cell with a sperm cell. Use the remaining space at the bottom of your poster board to draw fertilization.

- a) Label this portion of your poster "Fertilization."
- b) Gather your brown and blue markers or colored pencils to complete this part of the model.
- c) Draw a male sperm cell with one brown and one blue chromosome.
- d) Draw one of your egg cells from the "Sexual Reproduction" section above next to the sperm cell.
- e) Draw an arrow from the sperm and egg cells. Draw the resulting zygote.
- f) Keep each of the chromosome colors in your cell drawings.
- g) Show your completed steps for fertilization to your teacher before you move on to the next step.

Step 6: Complete the Student Worksheet.

- a) Use your diagrams to answer the questions found in the Student Worksheet at the end of this guide. Use these responses to help you summarize what you have learned in the essay portion. Answer the questions using complete sentences. Recheck your work to make sure that you followed grammar, punctuation, and capitalization rules.
- b) Check that all questions are answered.

Step 7: Evaluate your work using this checklist.

If you can check each criterion below, you are ready to submit your project.

- Do you have a model of asexual reproduction?
 - Does it include two pairs of chromosomes?
 - Is each of the pairs shown in a different color?
 - Are all steps of the cell cycle clearly shown in order?
 - Interphase
 - Prophase
 - Metaphase
 - Anaphase
 - Telophase
 - Cytokinesis
- Do you have a model of sexual reproduction?
 - Does it include two pairs of chromosomes?
 - Is each of the pairs shown in a different color?
 - Are all steps of the cell cycle labeled and shown in order?

Student Guide (continued)

- Interphase
 - Prophase I
 - Metaphase I
 - Anaphase I
 - Telophase I
 - Cytokinesis
 - Prophase II
 - Metaphase II
 - Anaphase II
 - Telophase II
 - Cytokinesis
- Do you have a model of fertilization?
 - Is fertilization represented with the fusing of a female egg cell and a male sperm cell?
 - Have you answered all of the questions on the Student Worksheet, including the essay?
 - Did you write your answers in complete sentences?
 - Did you use proper grammar, punctuation, and spelling?
 - In your essay, did you explain why asexual reproduction produces offspring that are identical to the parent?
 - In your essay, did you explain why sexual reproduction produces offspring that are different from the parents?
 - In your essay, did you reference information from your models to support your explanations?

Step 8: Revise and submit your project.

- a) If you were unable to check off all of the requirements on the checklist, go back and complete that work.
- b) Save the edits to your Student Worksheet before you submit it.
- c) When you have completed your worksheet, return to the Virtual Classroom and use the “Browse for file” option to locate and submit your assignment, or turn it in to your teacher if required.

Step 9: Clean up your workspace.

- a) Clean up your workspace, making sure to throw away any trash. Return your markers and colored pencils to the normal storage location. Congratulations! You have completed your project.

Student Guide (continued)

Essay:

Use what you have learned about asexual and sexual reproduction from this modeling activity to explain why asexual reproduction produces offspring that are identical to the originals, and sexual reproduction produces offspring that are unique from their originals. Be sure your essay is at least one paragraph long, but you are welcome to write more. Be specific in your response by referencing chromosomes and cell phases to support your explanation. You may look back at your summary questions to help you complete this essay.

Please provide your answer in the space below.