

Exercises

Lesson 1: Living Organisms

1. What is science?
2. What do scientists do if their conclusions go against what they used to think?
3. What are some observations you have made today?
4. Why are hypotheses sometimes called educated guesses?
5. Your friend has a hypothesis that some plants die because witches cast evil spells on them. Is this a good hypothesis? Why or why not?
6. If a scientist's hypothesis is wrong, does that mean their experiment was bad?
7. Why should you do research before starting an investigation?
8. How can you tell if you can trust a particular web site, when doing research?
9. A student does an experiment to see if rap music helps plants grow. She takes 10 plants, waters them, gives them sunlight, and plays rap music for them. They all grow beautifully. Has she proven that rap music helps plants grow? Why or why not?
10. In question 9, what important group is missing? Describe what the student would (or would not) do to this group?
11. What are some ways scientists communicate results?
12. Why is it important to communicate results?
13. Why do scientists use models?
14. What is one thing our body does to keep a constant temperature?
15. Why do offspring tend to look like their parents?
16. What are cells?
17. How are autotrophs and heterotrophs different?
18. Why do we need to classify organisms?
19. If two animals were in the same phylum, would they be more or less similar than two animals in different phyla? (Phyla is the plural of phylum.)
20. What is the first word in an organism's scientific name?
21. Why are scientific names useful?

Exercises

Lesson 2: Cell Exercises

1. Why are cells called the “building blocks” of life?
2. Anton van Leeuwenhoek discovered animals no one had ever seen before. How was he able to do this?
3. You leave some bread on your counter. After a few days, you notice some mold growing on the bread. According to the cell theory, where did the cells that make this mold come from?
4. How does the shape of a nerve cell help it do its job?
5. If a cell had no cell membrane, what might happen to it? Why?
6. Where are the organelles found in a cell?
7. If a cell was making proteins, but the proteins were not the type the cell needed, what organelle is most likely not working properly? Why?
8. How are prokaryotes different from eukaryotes?
9. What are three places ribosomes are found?
10. How is the endoplasmic reticulum like a freeway?
11. What might happen in a cell if the Golgi Apparatus was not working properly?
12. What does the mitochondrion do in the cell?
13. How are vesicles and vacuoles similar? How are they different?
14. Name two organelles found in plant cells, but not animal cells.
15. What might happen to a plant if its cells didn't have cell walls?
16. Thinking about the organelles they have, why can't animals undergo photosynthesis?
17. Imagine that the wall of a dam breaks, and water begins rushing through the hole in the wall. Explain this in terms of concentration.
18. Nutrient X has a higher concentration inside a cell than outside a cell. Will active or passive transport be required to get nutrient X into the cell? Explain.
19. Is it possible for a protein to assist something cross the cell membrane, and have it still be considered passive transport? Explain.
20. Why is photosynthesis important to plants? Why is it important to animals?

21. Your friend tells you that photosynthesis “creates” energy for plants. How would you correct this statement?
22. How is glucose used differently than ATP in the cell?
23. What is the purpose of cellular respiration?
24. Name two types of cell division used by prokaryotes.
25. Why does the nucleus need to break down during mitosis?

Exercises

Lesson 3: Genetics

1. Define "genetics" in your own words.
2. Describe Mendel's experiments with peas.
3. What do P, F1, and F2 represent?
4. What were Mendel's findings regarding tall vs short crosses?
5. According to Mendel's law of segregation, what are dominant and recessive traits?
6. What is a Punnett Square?
7. An orange amoeba and a red amoeba walk into a bar. Several years later they get married and have a batch of beautiful, red kids. The kids then marry each other and have kids. 75% of that last generation is red, and 25% is blue. According to Mendel's theories, which color is dominant? Which is recessive? How do we know?
8. What are genes?
9. What is the difference between phenotypes and genotypes?
10. What is the difference between incomplete dominance and codominance?
11. What are genetic disorders?
12. If a gene is sex-linked, which chromosomes could it be found on?
13. In a study on the gene that gives flies wings, 30 of the F1 generation were wingless, and 100 looked like normal flies. How many were wild-type?
14. What are restriction enzymes?
15. What did the Human Genome Project accomplish?

Answers to Exercises

Answers to Lesson 1: Living Organisms Exercises

1. What is science? **A method of answering questions based on evidence**
2. What do scientists do if their conclusions go against what they used to think? **They must change their way of thinking**
3. What are some observations you have made today? **Answers could include anything noticed using the five senses**
4. Why are hypotheses sometimes called educated guesses? **They are guesses because they haven't been proven, but they are educated because they are based on some research.**
5. Your friend has a hypothesis that some plants die because witches cast evil spells on them. Is this a good hypothesis? Why or why not? **No, because it is not provable (Remember that the problem is not that you might think this hypothesis is silly. If you could somehow prove it, it would be a valid hypothesis to test.)**
6. If a scientist's hypothesis is wrong, does that mean their experiment was bad? **No**
7. Why should you do research before starting an investigation? **This allows you to see what scientists already know about the topic**
8. How can you tell if you can trust a particular web site, when doing research? **It is useful to look at what person or organization made the site, and determine if they are trustworthy and knowledgeable.**
9. A student does an experiment to see if rap music helps plants grow. She takes 10 plants, waters them, gives them sunlight, and plays rap music for them. They all grow beautifully. Has she proven that rap music helps plants grow? Why or why not? **No, they plants might have grown just as well without the rap music**
10. In question 9, what important group is missing? Describe what the student would (or would not) do to this group? **It is missing a control group. This group of plants should get the sunlight and water, but not the rap music.**
11. What are some ways scientists communicate results? **Creating web sites, writing scientific articles, or giving lectures**

12. Why is it important to communicate results? **This allows other scientists to do their own experiments based on the first scientist's results.**
13. Why do scientists use models? **To represent things that can't easily be seen**
14. What is one thing our body does to keep a constant temperature? **Answers could include reducing blood flow, sweating, or shivering.**
15. Why do offspring tend to look like their parents? **Parents pass on traits to their offspring**
16. What are cells? **The smallest parts of living things still considered alive**
17. How are autotrophs and heterotrophs different? **Autotrophs create their own food; heterotrophs do not**
18. Why do we need to classify organisms? **Because there are so many of them, they have to be organized in some way**
19. If two animals were in the same phylum, would they be more or less similar than two animals in different phyla? (Phyla is the plural of phylum.) **More similar**
20. What is the first word in an organism's scientific name? **The phylum**
21. Why are scientific names useful? **They are the same everywhere in the world, no matter what language is spoken**

Answers to Exercises

Answers to Lesson 2: Cell Exercises

1. Why are cells called the “building blocks” of life? **All living things are made of them**
2. Anton van Leeuwenhoek discovered animals no one had ever seen before. How was he able to do this? **Using his microscope, he was able to see things smaller than those things that can be seen with the naked eye**
3. You leave some bread on your counter. After a few days, you notice some mold growing on the bread. According to the cell theory, where did the cells that make this mold come from? **All cells come from other cells, so the mold cells must have come from cells in the bread itself**
4. How does the shape of a nerve cell help it do its job? **By having long extensions, the nerve cell can send messages to other cells**
5. If a cell had no cell membrane, what might happen to it? Why? **The cell could not survive because there would be nothing to stop harmful substances from entering.**
6. Where are the organelles found in a cell? **In the cytoplasm**
7. If a cell was making proteins, but the proteins were not the type the cell needed, what organelle is most likely not working properly? Why? **The nucleus, because it is the organelle that determines which proteins are made**
8. How are prokaryotes different from eukaryotes? **Prokaryotes do not have nuclei; eukaryotes do**
9. What are three places ribosomes are found? **Alone, in groups, or on the endoplasmic reticulum**
10. How is the endoplasmic reticulum like a freeway? **The ER transports proteins and lipids throughout the cell.**
11. What might happen in a cell if the Golgi Apparatus was not working properly? **Proteins would not get to the correct destination**
12. What does the mitochondrion do in the cell? **Provide energy**
13. How are vesicles and vacuoles similar? How are they different? **Both of these organelles hold and transport proteins and other nutrients. Vesicles are smaller than vacuoles.**

14. Name two organelles found in plant cells, but not animal cells.
Chloroplast and cell wall
15. What might happen to a plant if its cells didn't have cell walls?
The plant would lose its structure and rigidity
16. Thinking about the organelles they have, why can't animals undergo photosynthesis? **Chloroplasts are needed for photosynthesis, and animal cells don't have them.**
17. Imagine that the wall of a dam breaks, and water begins rushing through the hole in the wall. Explain this in terms of concentration.
The water is moving from an area of high concentration, behind the dam, to an area of low concentration, on the other side of the wall
18. Nutrient X has a higher concentration inside a cell than outside a cell. Will active or passive transport be required to get nutrient X into the cell? Explain. **Active, because we are going from an area of low to high concentration**
19. Is it possible for a protein to assist something cross the cell membrane, and have it still be considered passive transport? Explain.
Yes, as long as energy is not used, it is passive transport
20. Why is photosynthesis important to plants? Why is it important to animals? **Photosynthesis provides energy for plants and oxygen for animals**
21. Your friend tells you that photosynthesis "creates" energy for plants. How would you correct this statement? **Energy cannot be created, but photosynthesis does change light energy into chemical energy that can be used by the plant.**
22. How is glucose used differently than ATP in the cell? **Glucose is the form in which the energy is stored. ATP is the form in which it is used.**
23. What is the purpose of cellular respiration? **To change chemical energy in glucose to ATP**
24. Name two types of cell division used by prokaryotes. **Binary fission and budding**
25. Why does the nucleus need to break down during mitosis? **A complete set of DNA, which is found in the nucleus, needs to go to each daughter cell.**

Answers to Exercises

Answers to Lesson 3: Genetics Exercises

1. Define “genetics” in your own words. **Something close to: the science of heredity, dealing with resemblances and differences of related organisms resulting from the interactions of their genes and the environment.**
2. Describe Mendel’s experiments with peas. **Mendel observed traits in pea plants over many generations. He kept careful note of which traits appeared in each generation.**
3. What do P, F1, and F2 represent? **P represents the parental generation, F1 represents the generation of the offspring of P, and F2 represents the generation of the offspring of F1.**
4. What were Mendel’s findings regarding tall vs short crosses? **In the F1 generation was 100% tall, and the F2 generation was 75% tall and 25% short.**
5. According to Mendel’s law of segregation, what are dominant and recessive traits? **Dominant traits are always expressed when present, recessive traits are only expressed when they both alleles are recessive.**
6. What is a Punnett Square? **A table used for keeping track of the inheritance of genes.**
7. An orange amoeba and a red amoeba walk into a bar. Several years later they get married and have a batch of beautiful, red kids. The kids then marry each other and have kids. 75% of that last generation is red, and 25% is blue. According to Mendel’s theories, which color is dominant? Which is recessive? How do we know? **Red. Orange. Mendel’s law of segregation predicts that dominant genes when crossed with the recessive allele will only express the dominant genes in the F1 generation, then express the dominant gene 75% of the time in the F2.**
8. What are genes? **The individual codes for making proteins located in the DNA.**

9. What is the difference between phenotypes and genotypes?
Phenotypes are the appearance of the organism—the physical traits.
Genotypes are the genes that produce the trait.
10. What is the difference between incomplete dominance and codominance? Incomplete dominance is a shared expression of two traits. Codominance is the dual expression of two dominant traits.
11. What are genetic disorders? Inherited genetic disorders—defective genes or chromosomes.
12. If a gene is sex-linked, which chromosomes could it be found on? X or Y.
13. In a study on the gene that gives flies wings, 30 of the F1 generation were wingless, and 100 looked like normal flies. How many were wild-type? 100.
14. What are restriction enzymes? Enzymes used to cut specific sequences of DNA.
15. What did the Human Genome Project accomplish? The Human Genome Project successfully sequenced over 20,000 human genes and mapped them on the 23 human chromosomes.