Whiteriver Unified School District

Eighth Grade Packet

May 4-8

Return May 11th

Name:

_____

25 Years Later, Hubble Sees Beyond Troubled Start

Dennis Overbye

SCIENCE ARTICLE

ESA/Hubble Heritage Team/NASA

This text is an alternate version of the original text, which appears in your student edition.

1 Against all odds, it's 25 years in space and counting for the Hubble Space Telescope this month.[1]

2 Few icons of science have had such a risky existence. The telescope survived political storms, physical disasters, and the simple passage of time in the service of cosmic exploration.

3 In 1946, the astronomer Lyman Spitzer, Jr., had a dream. A telescope in space would be above the unruly atmosphere. It would be able to see the stars unaffected by the storms that blur them and make them twinkle. It would be able to see ultraviolet and infrared discharges blocked by the atmosphere and invisible to astronomers on the ground.

4 It took more than 30 years for the rest of the astronomy community, NASA, and Congress to buy into this dream. It was done as a way to showcase the abilities of the space shuttle, which was still being developed then, and the ability of astronauts to be able to work routinely in space. By the time the telescope was sent into space from the space shuttle *Discovery* on April 25, 1990, it had been almost canceled at least twice. It had also been delayed following the explosion of the shuttle *Challenger* in 1986.

5 When the Hubble was finally placed in space, NASA's publicists were instantly at the top of their game. They hailed it as the greatest advance in astronomy since Galileo.[2]

6 And it might have been, except for one problem: They couldn't focus the telescope. So, within days, it became a laughingstock—a "technoturkey," said some critics.

7 Hubble had an eight-foot mirror designed using spy satellite technology. The mirror was just small enough to fit into the space shuttle cargo bay.

8 But because of a measuring error during a testing process that had been hurried to save money, that big mirror ended up out of shape. It was polished four-millionths of an inch too flat, so that the telescope now had blurry vision. It was the kind of mistake, known as a spherical

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1. **this month** This article was published in April 2015.
2. **Galileo** Galileo Galilei (1564–1642), an Italian scientist and scholar who was the first person to use a telescope to observe space.

aberration, that an amateur astronomer might make. A handful of astronomers first recognized the problem. The engineers and contractors working for NASA at first didn't believe them, and then they were sorry to learn that the astronomers were right.

9 For bright objects, astronomers could correct for the mistake with image-processing software. But for the blurry, or faint parts of the universe, the Hubble needed glasses.

10 NASA scientists let go of their heartbreak and worked to find a way to provide the correct lenses.

11 Three years later, the space shuttle *Endeavour* and a repair crew led by Story Musgrave—astronaut, pilot, surgeon, spacewalker, and Zen gardener—rode to the rescue.

12 In five tense days of spacewalks, they replaced the telescope's main camera. They also installed tiny mirrors designed to correct the Hubble's vision.

13 The rest of the universe snapped into clear focus. And NASA could stop holding its breath.

14 The Hubble was the first big-deal telescope of the Internet age. Its cosmic postcards captured the interest of the world. Trained on a patch of sky known as the Hubble Ultra Deep Field in 2010, the telescope's sharp eye found swarms of baby galaxies. They crawled out of the prehistoric darkness as early as only 600 million years after the Big Bang.

15 And it took one of the first visible-light photos of a distant planet, named Fomalhaut b, orbiting its star.

16 Perhaps its most iconic image is "Pillars of Creation." The Hubble recorded baby stars burning their way out of ancient-looking mountains of gas and dust in a starry nursery known as the Eagle nebula.

17 These postcards caused some debate. The Hubble's camera records in black and white. Its filters separate light from different atoms, such as sulfur, hydrogen, and oxygen. Then the different layers are given whatever colors look good to the eye. These colors also best show off the underlying astrophysics rather than their natural colors.

18 "Pillars of Creation," for example, is shown in earth tones of green and brown and is positioned to look like a Turner landscape.[3] Instead, the natural discharges from the nebula are shades of red.

19 Technological hiccups have also continued. In 1999, four of the six gyroscopes that keep the telescope pointed failed. The Hubble went into "safe mode." A crew was hastily sent to replace the gyros. That was the

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3. Turner landscape J.M.W. Turner was an artist famed for his use of color.

first of three trips to the telescope by John M. Grunsfeld, an astronaut, astronomer, and now NASA's associate administrator for science. He won the nickname "Hubble Repairman" for his efforts.

20 The telescope has been reborn again and again over the years, thanks to the efforts of astronaut servicing crews. Astronauts wearing what look like boxing gloves have gradually learned how to do things the telescope's designers had never dared dream of. Those tasks include fiddling with its insides, replacing circuit boards and performing a kind of eye surgery, as well as computer repairs—all done in space.

21 The Hubble was getting better and better. Then, the *Columbia* space shuttle exploded in 2003, killing all seven astronauts on board. That signaled the end of NASA's space shuttle dreams.

22 The agency's administrator, Sean O'Keefe, canceled what was to be the final Hubble servicing mission because it was too risky. Without it, the telescope would be doomed to die in orbit within two or three years, when its batteries and gyros failed again.

23 The decision was announced and defended by Dr. Grunsfeld. He was then NASA's chief scientist. "Being an astronaut, there are not a lot of things that have really shocked me in my life," Dr. Grunsfeld recalled later. "But I don't think anybody could ever prepare themselves for, you know, trying to bury something that they have said, 'Hey, this is worth risking my life for.'"

24 Mr. O'Keefe's decision set off a national outcry. Schoolchildren offered to send their pennies to NASA to help pay for the telescope.

25 Behind the scenes, however, Dr. Grunsfeld and other astronomers and NASA engineers were working on ways to save the Hubble. They thought they might send robots to work on it.

26 A National Academy of Sciences panel turned down the use of robots. But the idea had served to keep the teams of engineers together. In the end, Mr. O'Keefe resigned. His replacement, Michael Griffin, restored a servicing mission.

27 In 2009, Dr. Grunsfeld led one last mission to the Hubble. He was the last human to touch the telescope. He patted it as the shuttle *Atlantis* prepared to let it go again. But that does not mean the telescope will no longer touch humanity. Instead, it continues to deliver news about this thing we are all part of—a universe—but barely understand.

28 Earlier this spring, astronomers announced that the Hubble had seen a sort of cosmic mirage known as an Einstein ring. This mirage allowed them to view multiple reruns of a star that died in a huge superstar explosion more than nine billion years ago on the other side of the cosmos.

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29 NASA is making a big deal of the Hubble anniversary. There will be a weeklong conference in Baltimore, where the Space Telescope Science Institute is based.

30 "This is a celebration partly about the telescope and partly about NASA," Dr. Grunsfeld said, "but much of it is a celebration of people doing science."

31 The Hubble today is more powerful than its designers ever dreamed. It has a good chance of living long enough to share the universe with its successor, the James Webb Space Telescope, due to launch in 2018. The Hubble's long life is something few would have imagined 10 years ago. Yet NASA is already planning a 30th-anniversary celebration in 2020, Dr. Grunsfeld said.

32 After a quarter-century, the telescope's future and promise are still as big as the sky and our ignorance of what lies behind it.

NOTES

Name		Week3	May 4, 2020
Day	Monday	Class	ELA 8
Standard	*RI.8.5 Analyze in detail the structure of a specific paragraph in a text, including the role of particular sentences in developing and refining a key concept.* *RI.8.6 Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.* *RI.8.1 Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.* *RI.8.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.*		

TEXT QUESTIONS

25 Years Later, Hubble Sees Beyond Troubled Start Dennis Overbye

DIRECTIONS: Respond to these questions. Use evidence from the text to support your responses.

1. **Analyze** (a) What is the author's purpose for writing this article? (b) How does the article's text structure help the author achieve his purpose?

2. **Analyze** What is the author's tone as he speaks of NASA in paragraphs 5 and 6? What details help to reveal that attitude?

3. **Evaluate** Is the information provided in paragraphs 14, 15, and 16 primarily fact or opinion? What basic idea do these details support?

4. **Make a Judgment** Do you agree with the author's final statement, posed in paragraph 32? Why or why not?

25 Years Later, Hubble Sees Beyond Troubled Start Dennis Overbye

SHORT-RESPONSE QUESTIONS

DIRECTIONS: Complete the following items after you have read the text.

1. **(a) Analyze the structure of a specific paragraph.**

   What is the structure of paragraph 3 of "25 Years Later, Hubble Sees Beyond Troubled Start"? How does paragraph 3 relate to the ideas in paragraphs 1 and 2?

(b) Analyze the role of particular sentences in developing and refining a key concept.

How does the last sentence in paragraph 3 further develop the idea expressed in the sentence before it?

2. **(a) Determine an author's point of view.**

   Explain the point of view toward the Hubble Space Telescope that the author expresses in paragraph 14 of "25 Years Later, Hubble Sees Beyond Troubled Start." Cite details in the text to support your explanation.

(b) Analyze how an author acknowledges conflicting viewpoints.

What conflicting point of view does the author recognize in paragraph 17?

3. **(a) Draw an inference from the text.**

   From the details in paragraph 20 of "25 Years Later, Hubble Sees Beyond Troubled Start," what inference can you draw about the work involved in repairing and maintaining the telescope?

(b) Cite textual evidence to support your inference.

Cite details from the text to support the inference you drew.

EXTENDED-RESPONSE ACTIVITY Word Choice and Tone

DIRECTIONS: Complete the following activity as either a written response or a group discussion.

4. Analyze how specific word choices reveal the author's tone, or attitude, in paragraphs 21 through 25 of the article "25 Years Later, Hubble Sees Beyond Troubled Start." Then, identify the author's tone and purpose.

   Use these guidelines in your writing or discussion.

   - Reread paragraphs 21 through 25 of "25 Years Later, Hubble Sees Beyond Troubled Start."
   - Look closely at the words that the author uses in these paragraphs to describe events that affected the Hubble Space Telescope. List words that stand out because they suggest an attitude toward the space telescope.
   - Identify the author's tone, or attitude, toward the space telescope and use an adjective to describe it.
   - Think about the tone you identified. Then, name the author's purpose for writing the article and explain how the author's tone reveals that purpose.

TIP FOR WRITTEN RESPONSE

Check your writing to be sure that you have used scientific or technical terms correctly.

TIP FOR DISCUSSION

Think beforehand about the ideas the discussion is about. Reread the text in advance if necessary.

Name		Week3	May 5, 2020
Day	Tuesday	Class	ELA 8
Standard	*L.8.4 Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, choosing flexibly from a range of strategies.* *L.8.4.b Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word*		

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A. DIRECTIONS: In each of the following items, think about the meaning of the italicized word or phrase, and then answer the question.

1. Would you feel *dismay* if you were injured before an important athletic competition?

   Explain. _____

2. True or false: There would be an *outcry* if a skilled artist was not paid for his or her work.

   Explain. _____

3. If there was much *controversy* surrounding the results of an election, would you say that people agreed on the outcome?

   Explain. _____

B. WORD STUDY: The Latin root *-vers-* means "to turn." For instance, the word *reverse* means "move backward." It comes from the Latin word *reverus*, meaning "turn back." Below, write three words that contain the Latin root *-vers-*. Then, use each world correctly in a sentence.

1. _____

   _____

2. _____

   _____

3. _____

   _____

WORD STUDY **LATIN ROOT *-VERS-***

The Latin root *-vers-* means "to turn." For instance, the word *subversive* means "to undermine or overthrow." It comes from the Latin word *subversius,* meaning "from below to turn."

C. DIRECTIONS: Each word below uses the Latin root *-vers-*. Choose the word that fits in each sentence, and write the letter on the line.

A. versus **B.** universe **C.** reverse **D.** diversification **E.** version **F.** conversation

1. The _____ of the program became a top priority for the head of the department.
2. The judge did not _____ his decision after hearing new evidence in the appeal.
3. We had a vigorous debate about the health benefits of running _____ using an elliptical machine.
4. My _____ of the story was much better than my brother's.
5. I hadn't seen Dawson in a couple years so it was nice to sit at a coffee shop and just let the _____ flow.
6. I felt you could see the whole _____ from sitting on top of that mountain.

D. DIRECTIONS: Reread the sentences in Practice A. Then, match each word below with its definition, drawing a line between each pair.

1. versus	**A.** to go the opposite way
2. universe	**B.** the act of making something more varied
3. reverse	**C.** all existing matter and space considered as a whole
4. diversification	**D.** the informal exchange of ideas by spoken words
5. version	**E.** an account from a particular person's point of view
6. conversation	**F.** as opposed to; in contrast to

E. DIRECTIONS: Select the correct word from the box on the right to complete each sentence.

1. Cobb showed his _____ by playing every position on the field.
2. Ray had a difficult time coming up with the third _____ of his song.
3. The decision to end the game was very_____and was debated among experts for months afterward.
4. Han created a _____ so Luke could find the princess.

versatility
verse
diversion
controversial

F. DIRECTIONS: Use each of the following words in a complete sentence.

1. adversary: _____
2. universally: _____
3. diverse: _____
4. reversion: _____

G. DIRECTIONS: The word *adversity* comes from the Latin *adversitas* meaning "turn toward." How does this meaning relate to the modern definition of "difficulties; misfortune"? Describe a time when you or someone you know faced adversity. Use the space below to provide your answers.

_____

_____

_____

_____

Name		Week3	May 6, 2020
Day	Wednesday	Class	ELA 8
Standard	*RI.8.6 Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.* *L.8.4.a Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, choosing flexibly from a range of strategies.*		

ANALYZE CRAFT AND STRUCTURE ▸ **DICTION AND TONE**

25 Years Later, Hubble Sees Beyond Troubled Start Dennis Overbye

An author's style is his or her particular way of writing. All writing has a style, regardless of whether it is a novel or an editorial. Writers use these elements to create style:

Diction: Depending on purpose and audience, a writer may use highly formal words or more ordinary, easily understood words.

Example: Ben plays on lots of sports teams. (informal)
Ben participates in several competitive sports. (formal)

Length and Rhythm of Sentences: Some writers use simple, straightforward sentences, while others write longer, more elaborate sentences. These sentences can affect the mood of a piece and can leave a strong impression on a reader.

Example: The game was almost over. I was tired. I tried as hard as I could. (simple)

Toward the end of the fourth quarter of the game, I felt exhausted.
However, I was determined to do my best. (complex)

Tone: The writer's attitude toward the audience and subject can play a strong role in the voice he or she uses on the page.

A. DIRECTIONS: Answer these questions about "25 Years Later, Hubble Sees Beyond Troubled Start." Use textual evidence from the article to support your responses.

1. How would you describe the word choice of the selection? Are the words easy to understand or more formal?

_____

2. Are the sentences in the selection generally short, generally long, or of mixed lengths?

_____

3. How would you describe the author's attitude toward readers? How would you describe his attitude toward the subject?

_____

4. What effect is the author trying to achieve with diction and tone?

_____

B. DIRECTIONS: Read the passage below. Then, answer the questions that follow.

> Please sit down. Do not talk. Just listen to me. You must stop being mean to your little sister. It's against the rules. She can be a pest, I know. But you must be patient. She's just a little girl. Please try to be kind to her.

1. How would you describe the writer's diction?

   _____

2. How would you describe the writer's tone?

   _____

3. What do you observe about the length of the sentences?

   _____

C. DIRECTIONS: Read the passage below. Then, answer the questions that follow.

> Believe it or not, we had to wake up at 4 A.M. to catch the bus to catch the train to catch the ferry! But the Statue of Liberty was totally worth it. It was awesome. We saw people sailing around it in fancy yachts. I kept thinking of the people who had looked at this same statue from overcrowded ships.

1. How would you describe the diction of this paragraph?

   _____

   _____

2. What are one or two words or phrases that characterize the diction of this paragraph?

   _____

3. Locate the shortest sentence in the passage. What effect, if any, does its length have on your understanding of the passage?

   _____

D. DIRECTIONS: Read the passage below. Then, answer the questions that follow.

I found our trip to the Statue of Liberty really fascinating and also surprisingly emotional. It was a long and draining trip. Any amount of travel was worth seeing this awe-inspiring sight, though. I was reminded of the waves of immigrants who had sailed past her on their way to Ellis Island.

1.How would you describe the style of this paragraph?

_____

_____

2. What is a phrase that characterizes the style of this paragraph?

_____

3. How would you describe the diction of the paragraph?

_____

Name		Week3	May 7, 2020
Day	Thursday	Class	ELA 8
Standard	*L.8.2.a Use punctuation (comma, ellipsis, dash) to indicate a pause or break.* *L.8.2.b Use an ellipsis to indicate an omission.*		

CONVENTIONS ▸ **DASHES AND ELLIPSES**

25 Years Later, Hubble Sees Beyond Troubled Start Dennis Overbye

Dashes indicate an abrupt change of thought, a dramatic interruption, or a summary statement. Use a dash:

- to indicate an abrupt change of thought
- to set off an interrupting idea
- to set off a summary statement

Ellipses (. . .) usually indicate:

- a pause in thought because of uncertainty or confusion
- words that have been left out of a quotation
- a series that continues beyond the items mentioned
- action occurring or time passing in a narrative

A. DIRECTIONS: Insert dashes where needed in the following sentences.

1. It's amazing the space shuttle was ever launched it was almost canceled twice before being sent off.
2. The telescope was given a nickname the technoturkey because it couldn't be focused.
3. The leader of the space shuttle *Endeavor* was Story Musgrave astronaut, pilot, surgeon, spacewalker, and Zen gardener.
4. Fomalhaut b a distant planet was photographed by the Hubble telescope.
5. Hubble's successor the James Webb Space Telescope is scheduled to be launched in 2018.

B. DIRECTIONS: For each item, insert ellipses where needed.

1. Astronomer Lyman Spitzer Jr. had a dream and many years later he fulfilled it.
2. Many had to be convinced to believe in the space shuttle: NASA, the astronomical community, Congress
3. The Hubble telescope was able to capture images beyond our wildest imaginations
4. I wonder what was it was like to be Dr. Grunsfeld, the last human to touch the telescope?
5. Who knows the Hubble telescope may capture even more interesting images in the years to come.

Dashes indicate an abrupt change of thought, a dramatic interruption, or a summary statement. For example:

- **An abrupt change of thought:** We offer the best service in town—and the fastest.
- **To set off an interrupting idea:** Call Mike—he's a math genius—to tutor you.
- **To set off a summary statement:** India, Korea, and China—all are important markets.

Ellipses (. . .) usually indicate (1) words that have been left out of a quotation, (2) a series that continues beyond the items mentioned, (3) a pause in thought due to uncertainty or confusion, or (4) action occurring or time passing in a narrative.

Examples: You know, you'll need paper, pencils . . . the usual. "I will be a star," she thought, "someday . . . "

C. DIRECTIONS: Insert dashes where needed in the following sentences.

1. I did all the work for the party she gets the credit.
2. Roy he is always late will not make it to the party by 7:00.
3. Becca her friends call her Lolly will try to remember to bring the paper goods.
4. As always, Ty will do the grilling a good thing for all of us.
5. Gregory wants eggs for breakfast he is hungry now.

D. DIRECTIONS: For each item, insert ellipses where needed.

1. Cal wondered what would summer be like without Nina around?
2. The mayor said, "We will clean up the waterfront we will fix the streets."
3. The beach was as we had expected crowded with too many people.
4. I think I would like to play football.
5. He would get the scholarship, maybe

E. DIRECTIONS: Insert dashes where needed in the following sentences. Put a C for "correct" next to any sentences that do not need dashes

1. _____ Barry if you could believe him told us that he would help.
2. _____ Math, science, and social studies all are subjects I enjoy.
3. _____ The speakers and the food at the banquet were superb.
4. _____ The teacher would not change the due date I wonder if begging would help.
5. _____ My cat the one who caught the mouse just brought me a bird.

F. DIRECTIONS: For each item, insert ellipses where needed.

1. Jessie thought she had done the right thing but she couldn't be sure
2. Donald wondered what that ticking sound could be
3. For sure, there would be cake and ice cream and favors and
4. Lincoln's speech begins, "Four score and seven years ago"
5. "You you can't blame me," he stammered.

G. DIRECTIONS: Make any necessary corrections to each sentence, adding a dash, ellipses, both, or neither.

1. I was invited to the party, but I'm not sure I want to go
2. "You can't travel there because" he shouted before the driver cut him off.
3. Lemons, grapefruits, and oranges all are citrus fruits.
4. He should have been here by now the play started ten minutes ago
5. She had to rush to the gas station she'd never make it home on empty.

H. Describe what you have learned about inventors and inventions in this unit using dashes and ellipses. You may use lines from the level texts provided as long as you cite them properly.

Name		Week3	May 8, 2020
Day	Friday	Class	ELA 8
Standard	RI.8.5 Analyze in detail the structure of a specific paragraph in a text, including the role of particular sentences in developing and refining a key concept. RI.8.6 Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. RI.8.1 Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text. RI.8.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. L.8.4 Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, choosing flexibly from a range of strategies. L.8.4.b Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word RI.8.6 Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. L.8.4.a Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, choosing flexibly from a range of strategies. L.8.2.a Use punctuation (comma, ellipsis, dash) to indicate a pause or break. L.8.2.b Use an ellipsis to indicate an omission.		

READING INFORMATIONAL TEXT

DIRECTIONS: Complete each item, responding to the prompt or identifying the choice that best answers the question. Your teacher may instruct you to respond to prompts on a separate sheet of paper.

1. The following question has two parts. Answer Part A first, and then answer Part B.

_____ **Part A** Which statement **best** expresses the author's point of view of the Hubble Space Telescope in "25 Years Later, Hubble Sees Beyond Troubled Start"?

a. The Hubble Space Telescope is a worthwhile project.

b. The Hubble Space Telescope has outlived its usefulness.

c. The Hubble Space Telescope is too dangerous to maintain.

d. The Hubble Space Telescope has been a waste of taxpayers' money.

_____ **Part B** Which of these quotations from the text **most clearly** illustrates the answer you identified in Part A?

a. … within days it became a laughingstock—a "technoturkey," in the words of some of its critics.

b. The agency's administrator, Sean O'Keefe, canceled what was to be the final Hubble servicing mission on the grounds that it was too risky.

c. … it has a good chance of living long enough to share the universe with its designated successor, the James Webb Space Telescope, due to be launched in 2018.

d. After a quarter-century, the telescope's future and promise are still as big as the sky and our ignorance of what lies behind it.

_____ **2.** What do the details suggest is the author's **main** purpose in writing "25 Years Later, Hubble Sees Beyond Troubled Start"?

a. to explain how the Hubble Space Telescope works

b. to provide a history of the Hubble Space Telescope

c. to persuade the U.S. Congress to fund the Hubble Space Telescope

d. to pay tribute to astronauts who worked on the Hubble Space Telescope

3. Read the following passage from "25 Years Later, Hubble Sees Beyond Troubled Start." Then, write a brief paragraph about how the author acknowledges and responds to conflicting viewpoints about a continuing problem with the Hubble Telescope.

> Technological hiccups have also continued. In 1999, four of the six gyroscopes that keep the telescope pointed failed, and the Hubble went into "safe mode." A crew was hastily dispatched to replace the gyros. That was the first of what would be three trips to the telescope by John M. Grunsfeld, an astronaut, astronomer, and now NASA's associate administrator for science, who would win the sobriquet "Hubble Repairman" for his feats.
>
> The telescope has been reborn again and again over the years, thanks to the efforts of astronaut servicing crews. Astronauts wearing the equivalent of boxing gloves have gradually learned how to do things the telescope's designers had never dared dream of, fiddling with its innards, replacing circuit boards and performing the equivalent of eye surgery and computer repairs in space.

LANGUAGE

DIRECTIONS: Complete each item, responding to the prompt or identifying the choice that best answers the question. Your teacher may instruct you to respond to prompts on a separate sheet of paper.

4. The following question has two parts. Answer Part A first, and then answer Part B.

____ **Part A** Read this sentence and then answer the question.

> Rock and roll music has been popular for more than fifty years, its <u>longevity</u> surprising many people.

What does the context suggest is the meaning of the word *longevity?*

a. feeling of astonishment; shock
b. great span of life or usefulness
c. inspiration to others; influence
d. a type of popular music

_____ **Part B** Which words in the sentence in Part A provide the **best** context clue to the meaning of *longevity?*

a. has been popular

b. rock and roll music

c. for more than fifty years

d. surprising many people

5. The prefix *a-* can mean "from." Briefly explain what it means if Ada is *averse* to attending the picnic. Include the meaning of the Latin root *-vers-* in your explanation.

_____ **6.** Read this sentence and the dictionary entry that follows it. Then, answer the question.

Today the actress is considered an icon of Hollywood, but in the past, few people dreamed she would become so famous.

icon (Ī kahn) ***n.*** **1.** a figure; an image **2.** a painting of a holy figure used in the Eastern Orthodox Church **3.** a symbol displayed on a computer screen **4.** a person or thing regarded as representative

Which dictionary definition **best** clarifies the meaning of the word *icon* as it is used in the sentence?

a. definition 1

b. definition 2

c. definition 3

d. definition 4

_____ **7.** Read this sentence and then answer the question.

> The idea of a lightning rod a device to protect buildings in thunderstorms originated with Benjamin Franklin.

In which of these ways should the sentence be changed so that it uses correct punctuation?

a. Add a dash after *lightning rod* only.

b. Add a dash after *lightning rod* and another after *buildings.*

c. Add a dash after *lightning rod* and another after *thunderstorms*.

d. No change is necessary; the sentence is already correctly punctuated.

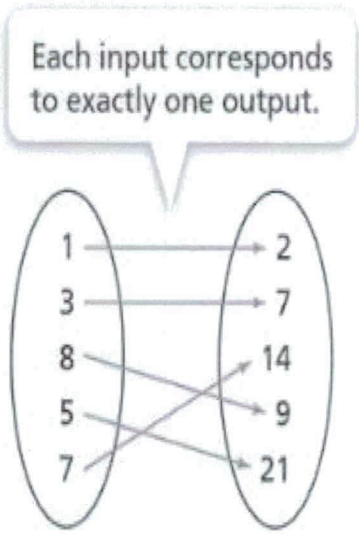
8. Explain what the ellipsis shows in this sentence.

> The Declaration of Independence concludes, "And for the support of this Declaration,... we mutually pledge our Lives, our Fortunes, and our sacred Honor."

LESSON 3-1 UNDERSTAND RELATIONS AND FUNCTIONS

A relation is a function if each input corresponds to exactly one output. You can use an arrow diagram or a table to determine whether a relation is a function.

This relation is a function.



This relation is not a function.

Input	Output
2	4
5	10
4	8
2	6

One input is assigned two different outputs.

EXAMPLE 1 Identify Functions with Arrow Diagrams

Scan for Multimedia

Jonah is shipping five boxes for his uncle. Each box is the same size but a different weight. The cost to ship each box is shown. Should Jonah expect that the cost to ship a 15-pound box will be a unique cost?

Use Structure Is there a relationship between the weight of the box and the cost to ship the box?

STEP 1 Organize the data using ordered pairs.

(input (weight), output (cost))

(8, 8.56)

(9, 8.72)

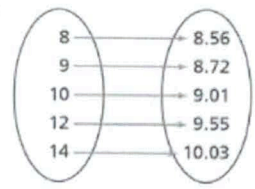
(10, 9.01)

(12, 9.55)

(14, 10.03)

Any set of ordered pairs is a **relation**.

STEP 2 Use an arrow diagram to match each input value to its output value.



A relation is a **function** when each input is assigned exactly one output. For each input above, there is exactly one output. So, the relation is a function.

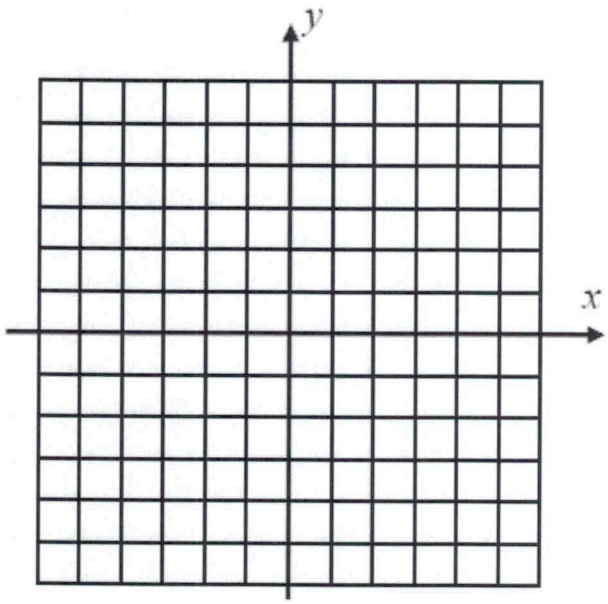
Jonah can expect that the cost to ship a 15-pound box will be a unique cost.

LESSON 3-1 UNDERSTAND FUNCTIONS AND RELATIONS

SWBAT: **(1) Match simple graphs with situations**
(2) Identify the domain and range of relations and functions

Warm – Up:

Exercise #2: Given the points $A(1, 2), B(-3, 4), C(2, -5)$, and $D(-4, -6)$, plot and label them on the grid given below and state the quadrant that each point lies in.



QUADRANTS

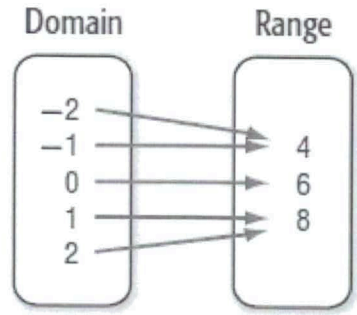
A: _____

B: _____

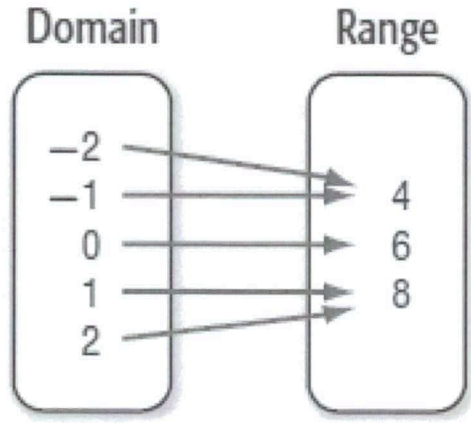
C: _____

D: _____

A set of ordered pairs is called a_____. A relation can be depicted in several different ways. An equation can represent a relation as well as_____, _____, and_____.



Use the map below, write the ordered pairs that represent this relation.



(___,___), (___,___), (___,___), (___,___), (___,___).

Study the different representations of the same relation below.

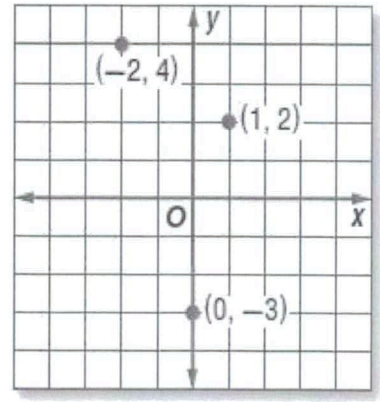
Ordered Pairs

(1, 2)
(−2, 4)
(0, −3)

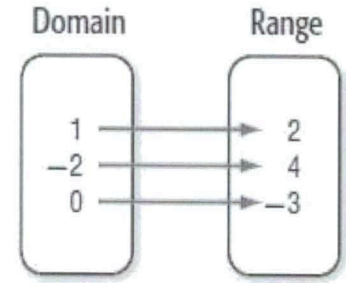
Table

x	y
1	2
−2	4
0	−3

Graph



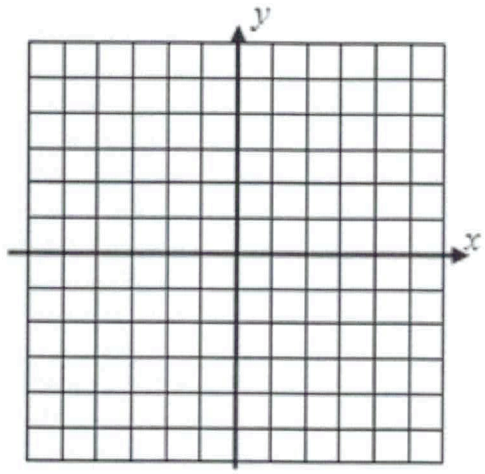
Mapping

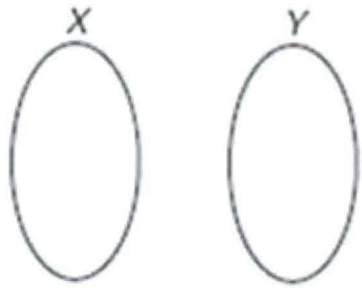


The x-values of a relation are members of the domain and the y-values of a relation are members of the range. In the relation above, the domain is { , , } and the range is { , , }.

Example 1: Express the relation {(–4, –1), (–1, 2), (1, –4), (2, –3), (4, 3)} as a table, a graph, and a mapping. Then, state the domain and range of the relation.

x	y





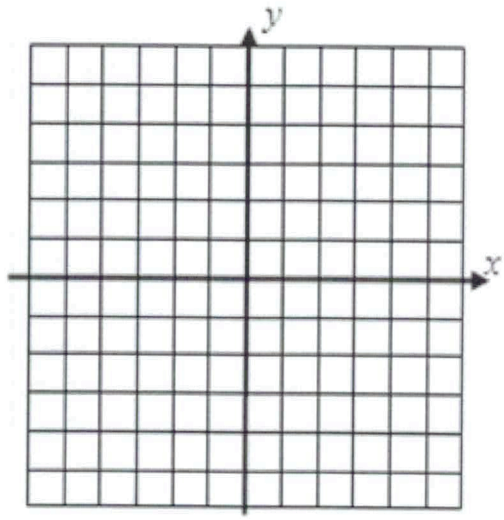
Domain: _____

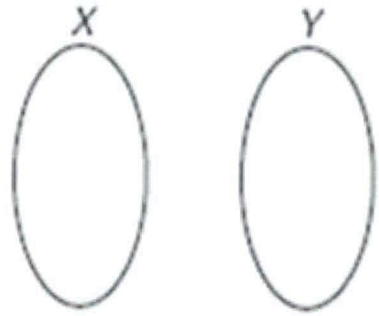
Range: _____

Practice Problems:

a) Express the relation {(–2, 1), (–1, 0), (1, 2), (2, –4), (4, 3)} as a table, a graph, and a mapping. Then, state the domain and range of the relation.

x	y



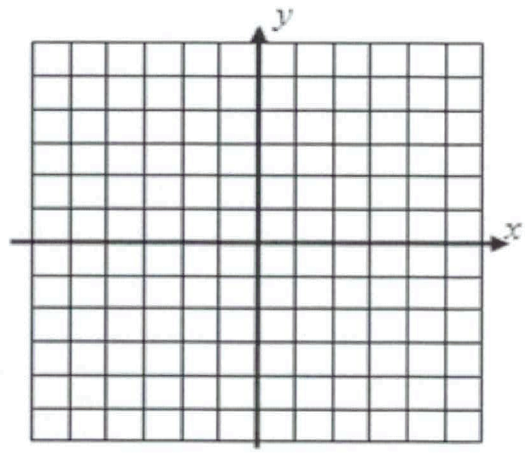


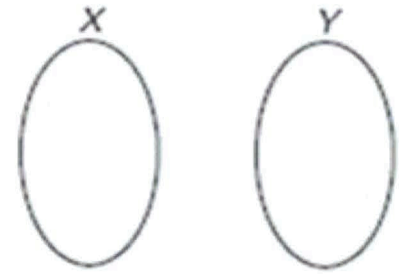
Domain: _____

Range: _____

b) Express the relation {(–3, –3), (–1, 1), (0, 2), (2, –3), (2, 3)} as a table, a graph, and a mapping. Then, state the domain and range of the relation.

x	y





Domain: _____

Range: _____

LESSON 3-2 COMPARE LINEAR AND NONLINEAR FUNCTIONS

EXAMPLE 1 Compare Two Linear Functions

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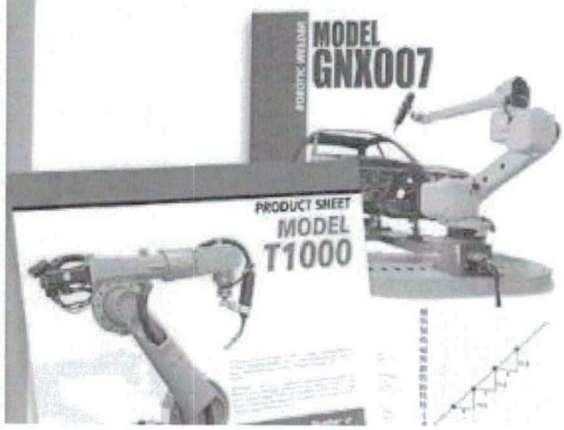
An auto assembly factory needs to purchase new welding robots. The factory manager has information on two different models of welding robots. The welding rates for each model are shown below. How do the welding rates for the two robots compare?



STEP 1 Find the welding rate, or the constant rate of change, for each robot.

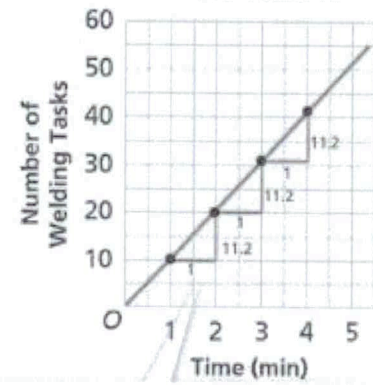
Model T1000

Time (minutes)	Number of Welding Tasks
2	20.8
5	52
7	72.8
12	124.8

$\frac{52 - 20.8}{5 - 2} = \frac{31.2}{3} = 10.4$

The constant rate of change is 10.4.

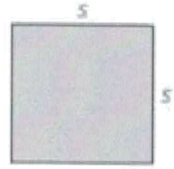
Model GNX007



The constant rate of change is 11.2.

EXAMPLE 2 Compare a Linear and a Nonlinear Function

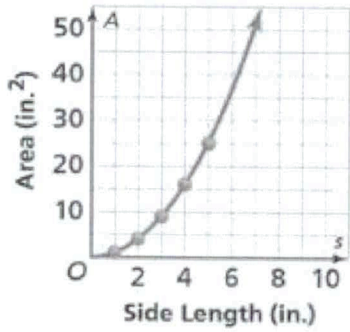
A square with side length s is shown. The table shows the relationship between the side length and perimeter as the side length increases. The graph shows the relationship between the side length and area. How do the two relationships compare?



Side Length, s (in.)	Perimeter, P (in.)
0	0
1	4
2	8
3	12
4	16

+1, +1, +1, +1 (side length) +4, +4, +4, +4 (perimeter)

This relation is a function. It has a constant rate of change. It is a *linear* function.



This relation is a function, but it does not have a constant rate of change. It is a *nonlinear* function.

Both relationships are functions. Both perimeter and area are functions of side length.

KEY CONCEPT

You can compare functions in different representations by using the properties of functions.

Compare the constant rate of change and the initial value.

x	1	2	3	4
y	4	7	10	13

+1, +1, +1 (x) +3, +3, +3 (y)

$y = 3x + b$

$4 = 3(1) + b$

$4 = 3 + b$

$1 = b$

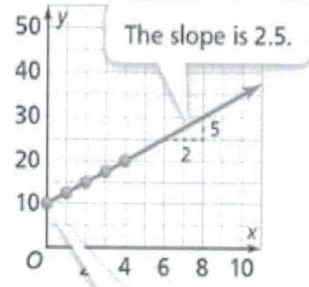
The slope is 3.

The y-intercept is 1.

The slope is $\frac{2}{3}$.

$y = \frac{2}{3}x - 4$

The y-intercept is -4.



The slope is 2.5.

The y-intercept is 10.

Practice & Problem Solving

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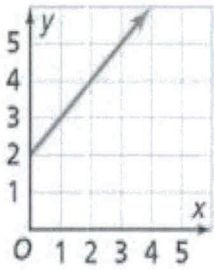
6. Two linear functions are shown below. Which function has the greater rate of change?

Function A



Function B

x	y
0	0
2	3
4	6
6	9

7. Two linear functions are shown below. Which function has the greater initial value?

Function A

x	y
−1	6
0	4
1	2
2	0

Function B

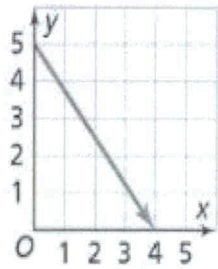
$y = 7x + 3$

8. Tell whether each function is *linear* or *nonlinear*.

Function A

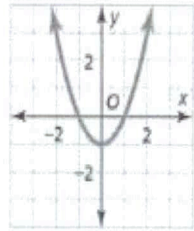
x	y
0	1
1	2
2	5
3	10

Function B



9. Tell whether each function is *linear* or *nonlinear*.

Function A

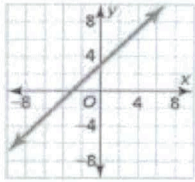


Function B

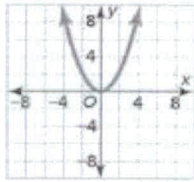
$y = x$

10. Determine whether each function is *linear* or *nonlinear* from its graph.

Function I



Function II



11. **Look for Relationships** Justin opens a savings account with $4. He saves $2 each week. Does a linear function or a nonlinear function represent this situation? Explain.

Justin's Savings Account

Week	0	1	2	3	4	5
Money in Account	4	6	8	10	12	14

12. **Reasoning** The function $y = 4x + 3$ describes Player A's scores in a game of trivia, where x is the number of questions answered correctly and y is the score. The function represented in the table shows Player B's scores. What do the rates of change tell you about how each player earns points?

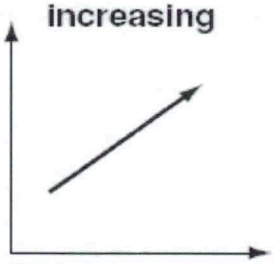
Player B's Trivia Scores

Correct Answers	Score
1	4
2	5
3	6
4	7

LESSON 3-3 Intervals of Increase and Decrease

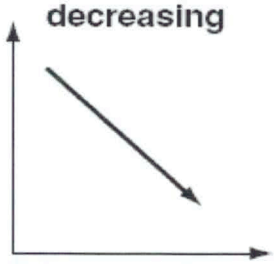
Graphs are a way to turn words into pictures. Be sure to read the graphs from left to right.

increasing



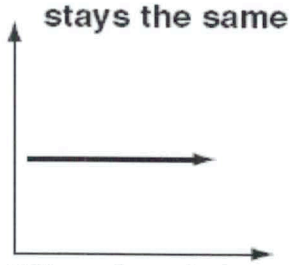
Other descriptions:
rose
gained
grew

decreasing



Other descriptions:
fell
lessened
diminished

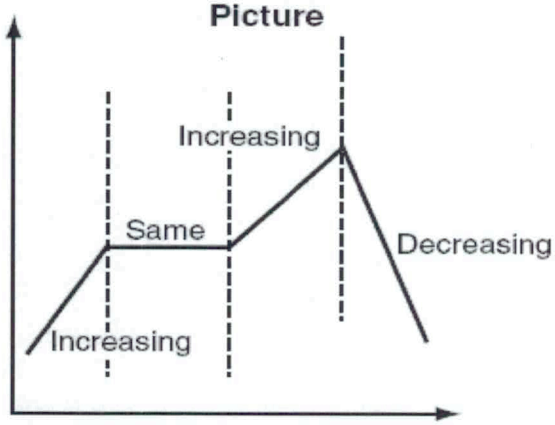
stays the same



Other descriptions:
constant
steady
continuous

You can divide the graph into sections every time the graph changes directions. Then label each section.

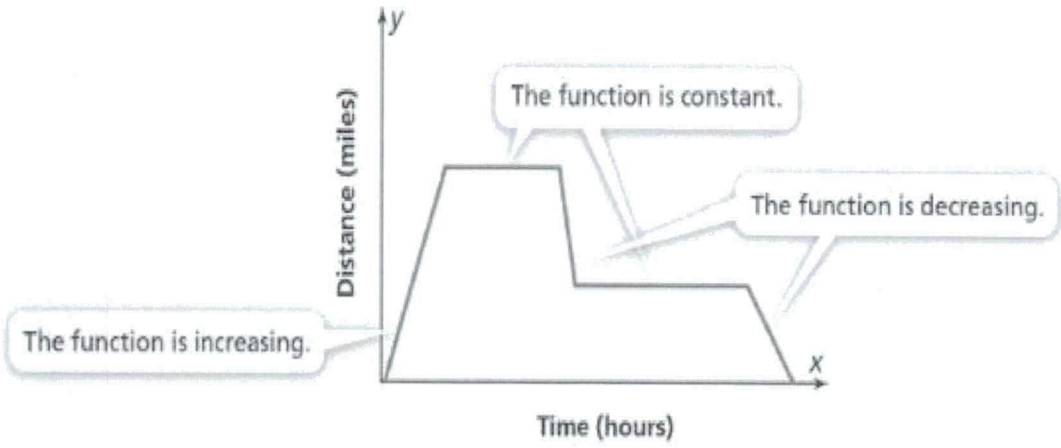
Picture



Words

This graph increases, then stays constant, increases again, and finally decreases sharply.

You can describe the relationship between two quantities by analyzing the behavior of the function relating the quantities in different intervals on a graph.



Practice & Problem Solving

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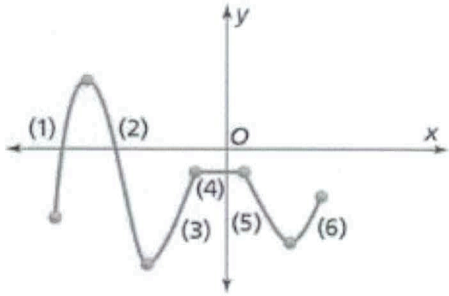
6. Use the graph to complete the statements.

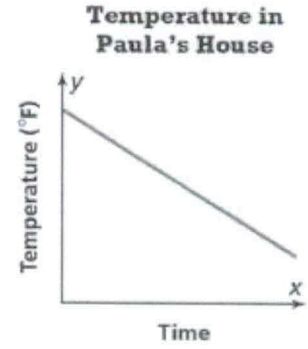


The function is _____ in intervals 1, 3, and 6.

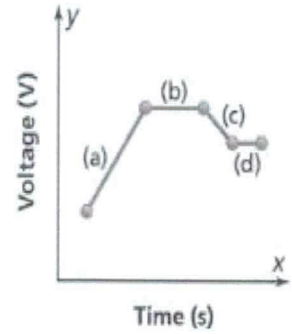
The function is _____ in intervals 2 and 5.

The function is constant in interval _____.

7. The graph below shows the temperature in Paula's house over time after her mother turned on the air conditioner. Describe the relationship between the two quantities.



8. You have a device that monitors the voltage across a lamp over time. The results are shown in the graph. Describe the behavior of the function in each interval.



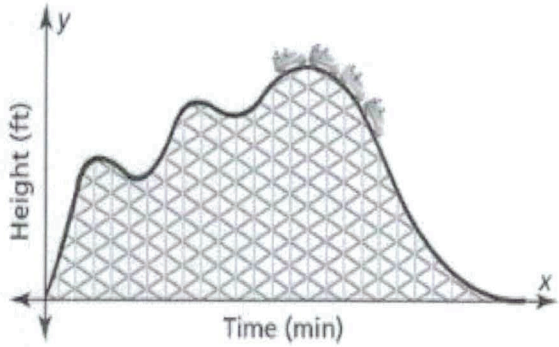
In interval (a), the function is _____.

In interval (b), the function is _____.

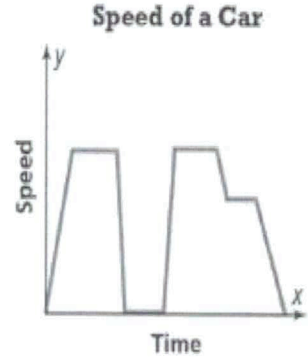
In interval (c), the function is _____.

In interval (d), the function is _____.

9. The graph below shows the height of a roller coaster over time during a single ride. Circle the intervals in which the function is increasing. In which interval is the increase the greatest?



10. Reasoning The graph shows the speed of a car over time. What might the constant intervals in the function represent?

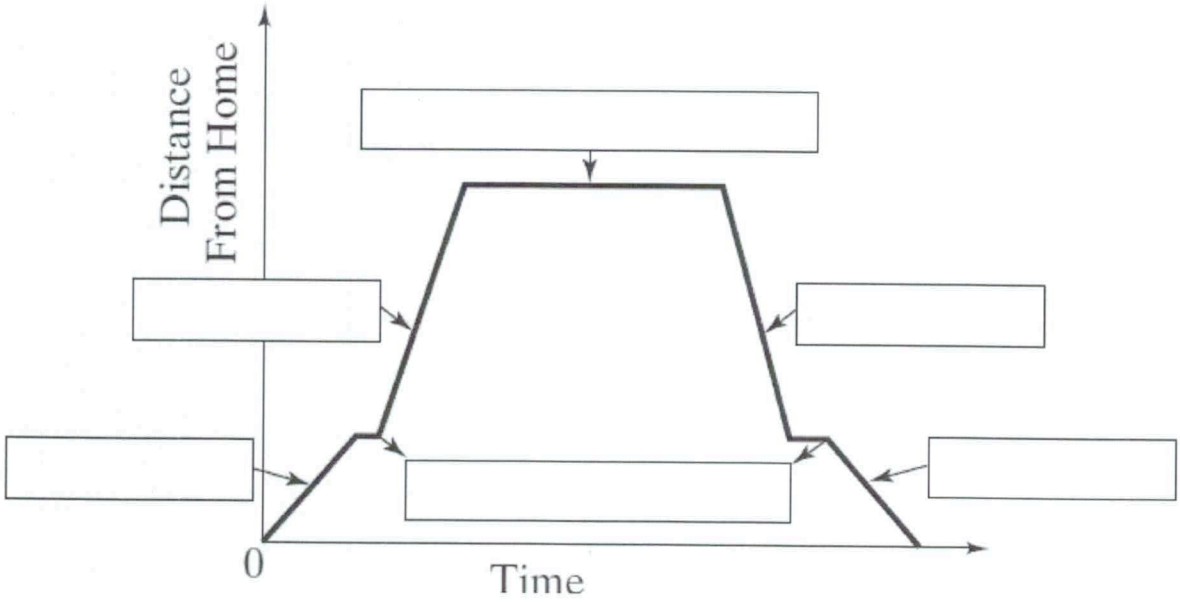


Practice Problems

A. Identify if the following interval is increasing, decreasing, or constant

The graph shows a trip from home to school and back. The trip involves walking and getting a ride from a neighbor. Label each section of the graph.

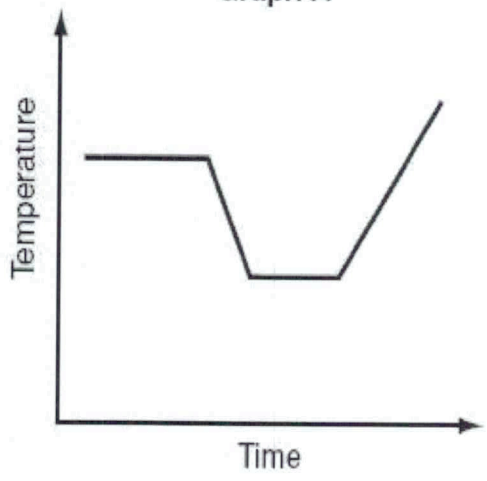
Daily Commute



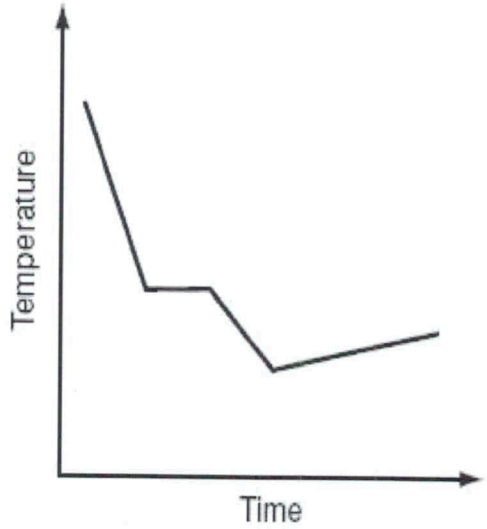
B. Study the following graphs

Divide each graph into sections where the graph changes directions. Then label the sections as *increasing*, *decreasing*, or *same*.

1. Graph A



2. Graph B

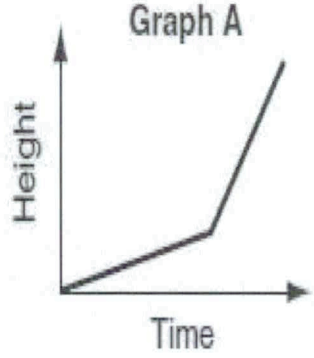


3. Which graph above shows that the air temperature fell steadily, leveled off, fell again, and then increased slightly?

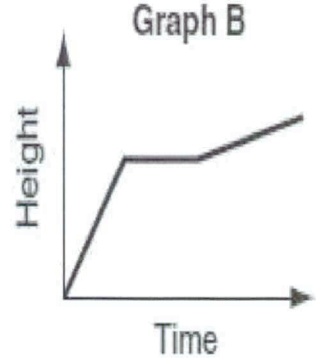
_____

4 **Choose the graph that best represents each situation.**

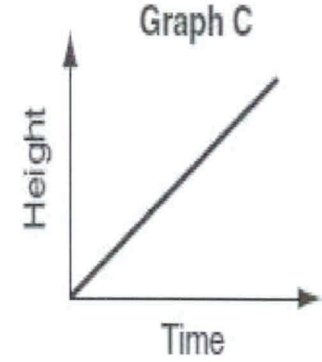
Graph A



Graph B



Graph C



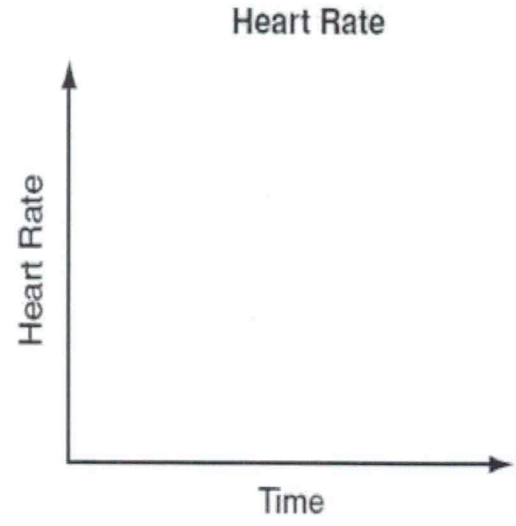
A tomato plant grows taller at a steady pace. _____

A tomato plant grows quickly at first, remains a constant height during a dry spell, then grows at a steady pace. _____

A tomato plant grows at a slow pace, then grows rapidly with more sun and water. _____

5.

The heart rate of someone walking, then running, then resting.



Math Writing Prompt

DIRECTIONS: Select one topic to write about every day. You can write your journal on the space provided or at the back portion of the packets.

1. How do you make use of your time productively while in quarantine?
2. What are your thoughts about how the government respond on the current pandemic?
3. What do you know about social distancing? How important social distancing is?
4. If the stay at home order will be lifted, what's the first thing that you are going to do?
5. How can you make sure that you are safety during this difficult time?

G.F. Grindall 8th grade science

Lesson plan for the week of 5/11 – 5/15

Study Island.

Instruction and assignment-

Go to the following link,
http://www.classzone.com/books/ml_science_comp/page_build.cfm?content=audio_read&state=none

Click on student tools, then audio reader, then click the chapter on cells

Go to Study Island, AZ Programs, 7th grade science. Complete lesson section 5d, then take the quiz.

Go to Khan Academy, join class ARY689R. 50 points for each assignment completed. These points will go toward the calculator give away.

1. Based on the presence of chloroplasts, a cell wall, a large central vacuole, and rigid shape, it can be concluded that the cell is most likely a plant cell. Chloroplasts trap light energy for photosynthesis. The central vacuole controls the amount of water inside of the cell. And cell walls provide strength and support for the cell membrane to prevent cells from bursting if too much water enters or leaves the cells' vacuoles.

2. Bacterial cells, like plants, have cell walls. Animal cells do not have cell walls. Though bacteria and plants both have cell walls, the structures of their cell walls are very different.

3. Prokaryotes include only bacteria and archaea, which are all single-celled organisms. So, the group prokaryotes is entirely unicellular.

4. Unlike bacteria, an animal cell contains a nucleus. Both bacteria and animal cells have cell membranes. Bacteria have cell walls, whereas animals do not. Neither bacteria nor animal cells have chloroplasts.

5. The cell shown is a bacterium. All bacterial cells are prokaryotic cells. Bacteria do not have nuclei. They contain circular DNA and ribosomes, but no organelles.

6. All cells can be classified into one of two groups based on the presence or absence of a nucleus and membrane-bound organelles. Cells containing a nucleus and membrane-bound organelles are classified as eukaryotic. Alternately, cells that lack a nucleus and membrane-bound organelles are prokaryotic.

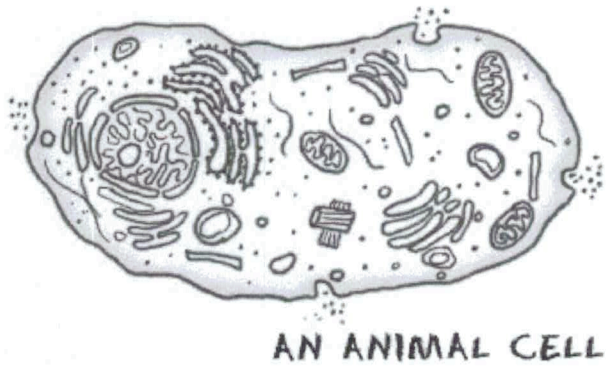
7. Both plant cells and animal cells contain cell membranes, mitochondria, and cytoplasm. Cell walls and chloroplasts are found in plant cells only.

8. Plant cells contain a cell wall while animal cells do not have a cell wall. By looking for the presence of a cell wall, students would be able to positively identify a cell as either plant or animal.

9. Unicellular organisms are composed of a single cell. Thus, in unicellular organisms, all metabolic processes must occur within that one cell. Multicellular organisms, however, possess many cells. These cells are often specialized to perform different body functions. So, in multicellular organisms, only some of these processes are typically performed by each cell. Which processes are performed depend on the cell's type.

10. A eukaryote is an organism whose cells contain complex, membrane-bound structures called organelles. Animals, plants, fungi, and protists have eukaryotic cells.

Cells are the Starting Point



AN ANIMAL CELL

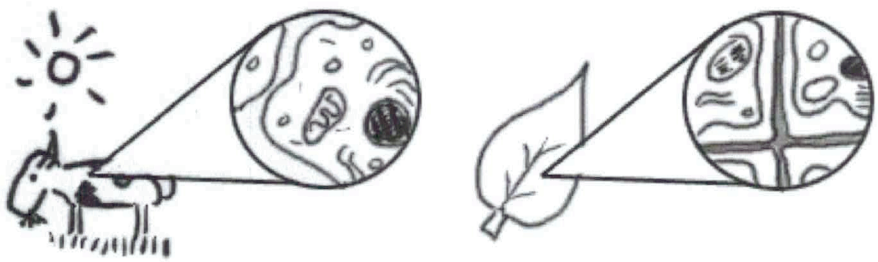
All living organisms on Earth are divided into **cells**. The main concept of **cell theory** is that cells are the basic structural unit for all organisms. Cells are small compartments that hold the biological equipment necessary to keep an organism alive and successful. Living things may be single-celled or they may be very complex such as a human being.

There are smaller pieces that make up cells such as **macromolecules** and **organelles**. A protein is an example of a macromolecule while a mitochondrion is an example of an organelle. Cells can also connect to form larger structures. They might group together to form the **tissues** of the stomach and eventually the entire digestive **system**. However, in the same way that atoms are the basic unit when you study matter, cells are the basic unit for biology and organisms.

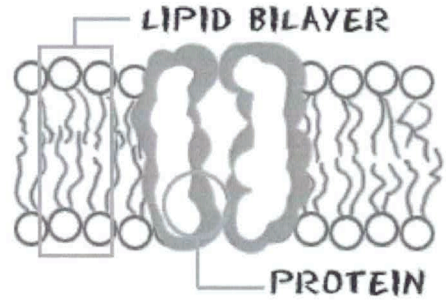
In larger organisms, the main purpose of a cell is to **organize**. Cells hold a variety of pieces and each cell type has a different **purpose**. By dividing responsibilities among different groups of cells, it is easier for an organism to survive and grow.

If you were only made of one cell, you would be very limited. You don't find single cells that are as large as a cow. Cells have problems functioning when they get too big. Also, if you were only one cell you couldn't have a nervous system, no muscles for movement, and using the internet would be out of the question. The trillions of cells in your body make your way of life possible.

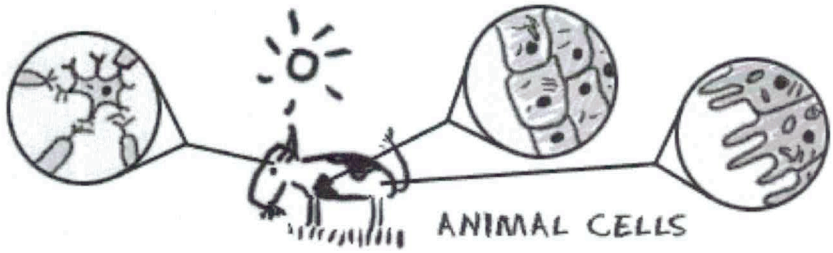
One Name, Many Types



There are many types of cells. In biology class, you will usually work with **plant-like** cells and **animal-like** cells. We say "animal-like" because an animal type of cell could be anything from a tiny microorganism to a nerve cell in your brain. Biology classes often take out a microscope and look at single-celled microbes from pond water. You might see hydra, amoebas, or euglena.



Plant cells are easier to identify because they have a protective structure called a cell wall made of cellulose. Plants have the wall; animals do not. Plants also have organelles such as the green chloroplast or large, water-filled vacuoles. Chloroplasts are the key structure in the process of **photosynthesis**.

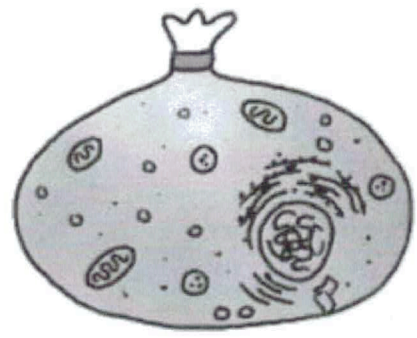


Cells are unique to each type of organism. If you look at very simple organisms, you will discover cells that have no defined nucleus (prokaryotes) and other cells that have hundreds of nuclei (**multinucleated**).

Humans have hundreds of different cell types. You have red blood cells that are used to carry oxygen (O_2) through the body and other cells specific to your heart muscle. Even though cells can be very different, they are basically compartments surrounded by some type of membrane.

Cell Membranes

According to **cell theory**, cells are the main unit of organization in biology. Whether you are a single cell or a blue whale with trillions of cells, you are still made of cells. All cells are contained by a **cell membrane** that keeps the pieces inside. When you think about a membrane, imagine it is like a big plastic bag with some tiny holes. That bag holds all of the cell pieces and fluids inside the cell and keeps any nasty things outside the cell. The holes are there to let some things move in and out of the cell.



Flexible Containers

The cell membrane is not a solid structure. It is made of millions of smaller molecules that create a flexible and porous container. **Proteins** and **phospholipids** make up most of the membrane structure.

The phospholipids make the basic bag. The proteins are found around the holes and help move molecules in and out of the cell. There are also proteins attached to the inner and outer surfaces of the membrane.

Scientists use the fluid mosaic model to describe the organization of phospholipids and proteins. The model shows you that phospholipid molecules are shaped with a head and a tail region. The head section of the molecule likes water (**hydrophilic**) while the tail does not (**hydrophobic**). Because the tails want to avoid water, they tend to stick to each other and let the heads face the watery (**aqueous**) areas inside and outside of the cell. The two surfaces of molecules create the **lipid bilayer**.

Ingrained in the Membrane

What about the membrane proteins? Scientists have shown that many proteins float in the lipid bilayer. Some are permanently attached while others are only attached temporarily. Some are only attached to the inner or outer layer of the membrane while the transmembrane proteins pass through the entire structure. The transmembrane proteins that cross the bilayer are very important in the active transport of ions and small molecules.

Different Membranes of the Cell

As you learn more about cell organelles, you will find that they all have a membrane. Organelle membranes do not have the same chemical makeup as the cell membrane. They have different lipids and proteins that make them unique. The membrane that surrounds a lysosome is different from the membrane around the endoplasmic reticulum.

Some organelles have two membranes. A mitochondrion has an outer and inner membrane. The outer membrane contains the mitochondrion parts. The inner membrane holds digestive enzymes that break down food. While we talk about membranes all the time, you should remember they all use a basic phospholipid bilayer structure, but you will find many variations throughout the cell.

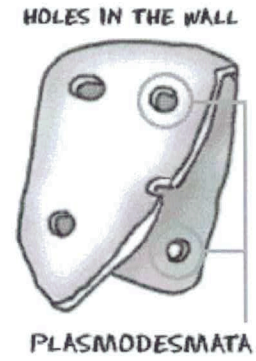
Membrane Proteins - Bumpy Surfaces

We have a page on the basic structure of the cell membrane and other membranes within the cell. They are basic bilayers made of lipids that surround the cell and organelles. The **lipid bilayer** is not smooth because there are a variety of proteins attached to the surface and embedded in the membrane. You will find millions of embedded protein molecules when you look at the cell membrane. Each type of protein has a specific purpose. Examples of membrane proteins include ion channels, receptor proteins, and proteins that allow cells to connect to each other.

A Tale of Two Types

You will learn about two types of membrane proteins: **peripheral** proteins and **integral** proteins. Peripheral proteins have weaker and temporary connections to the membrane. Some just sit on the surface, anchored with a few ionic bonds while others might have small sections that dip into the hydrophobic section of the bilayer. When you look at the entire membrane, there are more peripheral proteins when compared to the number of integral proteins.

As you can guess from the name, integral proteins are permanently connected to the cell membrane. They are hard workers and have large sections embedded in the **hydrophobic** (middle) layer of the membrane.



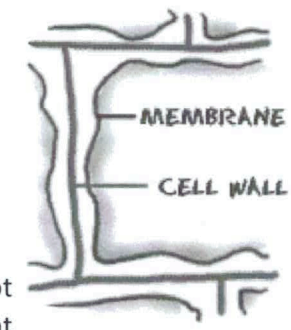
Transmembrane proteins are integral proteins that cross the membrane and can act as pathways for ions and molecules. **Polytopic** transmembrane proteins cross the membrane several times. Some are receptor proteins while others form channels. Ion movement that does not require work is called passive transport while active transport systems use work to move molecules. Active transport is regularly used when membrane proteins pump ions against the concentration gradient.

Discovering Structures

This structure of the membrane with embedded proteins and a lipid bilayer was discovered in the early 1970's. Two scientists, Singer and Nicolson, first developed the theory of the "**Fluid Mosaic Model**." They used several different methods, such as the freeze-fracture technique and electron micrographs, to look closely at the cell membrane and its structure. They went on to identify the proteins that sat on the surface, were sunk into the membrane, and the others that crossed the membrane.

Cell Wall - What's it for?

Cell membranes surround every cell you will study. **Cell walls** made of cellulose are only found around plant cells and a few other organisms. **Cellulose** is a specialized sugar that is classified as a structural carbohydrate and not used for energy. If a plant cell is like a water balloon, the cell wall is like a cardboard box that protects the balloon. The balloon is protected from the outside world by a structure that provides protection and support.



While many sugars, such as glucose, can dissolve in water (H_20), cellulose will not dissolve in water and can form long chains to support plants. When you eat plant material, you can't even digest and break down cellulose for energy. Cows and other herbivores have special bacteria in their stomachs to digest the cellulose **polymers**.

While cell walls protect the cells, they also allow plants to grow to great heights. You have a skeleton to hold you up. A 100-foot tall redwood tree does not. It uses the strong cell walls to maintain its shape. For overall support, dense cells in the core of the trunk can let a tree grow very high. Cell walls are slightly **elastic** for smaller plants, leaves, and thin branches. Winds can push them from side to side and they bounce back. Big redwoods need strength in high winds and sway very little (except at the top).

Another Hole in the Wall

A cell wall is not an impenetrable fortress around the delicate plant cell. There are small holes, called **plasmodesmata**, in the cell walls between plant cells. The cell membranes of neighboring cells are able to connect through these holes. The connections allow the transfer of nutrients, waste, and ions (symplastic pathways). Molecules can also pass through the spaces within the cell walls, avoiding the cells completely (apoplastic pathways).

It is great that nutrients can move from cell to cell, but there is also a problem with all the holes. Cells can lose water. Plants lose large amounts of water in the middle of the day or on very hot days. When the air heats up and the water vapor pressure decreases, plants lose water through the process of transpiration. The water escapes through pores on the surface of the plant called stomata. Even when the plant cells lose water, the basic shape is maintained by the cell walls. The plant may droop or wilt, but it can recover when water returns to the system. It will look just the same as when it started.

Cell Walls in Other Species

You may hear about cell walls in other species. Bacteria have a structure called a cell wall. Fungi and some protozoa also have cell walls. They are not the same as the plant cell walls made of cellulose. The other walls might be made from proteins or a substance called chitin. **Chitin** is another structural carbohydrate. They all serve the same purpose of protecting and maintaining structure, but they are very different molecules.

Cell Connections and Communication

All living things communicate in one way or another. When you start looking at the world on a cellular level, you won't find communication in writing or words. Cellular communication is on a **molecular level**. This section talks about cells in a larger organism that are near each other. We don't cover the communication between single-celled organisms. They behave in different ways.

Gap Junctions

Gap junctions are one type of cell connection. When two cells are right next to each other, their cell membranes may actually be touching. A **gap junction is an opening** from one cell to another. It's not a big opening, but it is large enough for cytoplasm to move from one cell to another. The connections are called channels and they act like tunnels for the movement of molecules.

Desmosomes

Desmosomes are a second type of cell connection. They physically connect cells like the gap junction, but no opening is created. Proteins that bond the membrane of one cell to its neighbor create the desmosomes. You will find desmosomes in your skin cells. All of those proteins hold your skin together. The distance between the cells, however small, is about 10 times wider than the gap junction connections.

Tight Junction

The last type of connection we will introduce is the tight junction. Tight junctions happen when two membranes actually bond into one. It makes a very strong barrier between two cells. Cells have some distance with a desmosome. Gap junctions allow molecules to pass. **Tight junctions form solid walls**. These types of connections are often found where one area needs to be protected from the contents of other areas.

Cytoplasm - Filling Fluid

Cytoplasm is the fluid that fills a cell. Scientists used to call the fluid **protoplasm**. Early on, they didn't know about the many different types of fluids in the cell. There is special fluid in

the mitochondria, endoplasmic reticulum, Golgi apparatus, and nucleus. The only two 'plasms' left are **cytoplasm** (the fluid in the cell also called **cytosol**) and **nucleoplasm** (the fluid in the nucleus). Each of those fluids has a very different composition.

The cell organelles are suspended in the cytosol. You will learn that the microfilaments and microtubules set up a "skeleton" of the cell and the cytosol fills the spaces. The cytoplasm has many different molecules **dissolved in solution**. You'll find enzymes, fatty acids, sugars, and amino acids that are used to keep the cell working. Waste products are also dissolved before they are taken in by vacuoles or sent out of the cell.

Special Fluids in the Nucleus

Nucleoplasm has a little different composition. Nucleoplasm can only be found inside of the **nucleus**. It doesn't have big organelles in suspension. The nucleoplasm is the **suspension fluid** that holds the cell's **chromatin** and **nucleolus**. It is not always present in the nucleus. When the cell divides, the nuclear membrane dissolves and the nucleoplasm is released. After the cell nucleus has reformed, the nucleoplasm fills the space again.

More than Filling

The cytosol in a cell does more than just suspend the organelles. It uses its dissolved **enzymes** to break down all of those larger molecules. The products can then be used by the organelles of the cell. **Glucose** may exist in the cytosol but the mitochondria can't use it for fuel. The cytosol has enzymes that break glucose down into **pyruvate** molecules that are then sent to the mitochondria.

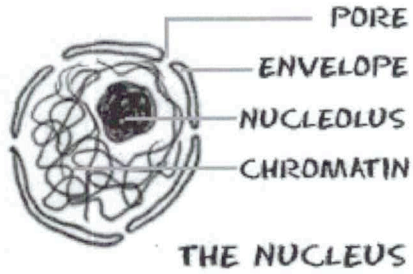
Cell Nucleus - Commanding the Cell

The cell nucleus acts like the brain of the cell. It helps control eating, movement, and reproduction. If it happens in a cell, chances are the **nucleus** knows about it. The nucleus is not always in the center of the cell. It will be a big dark spot somewhere in the middle of all of the cytoplasm (cytosol). You probably won't find it near the edge of a cell because that might be a dangerous place for the nucleus to be. If you don't remember, the cytoplasm is the fluid that fills cells.

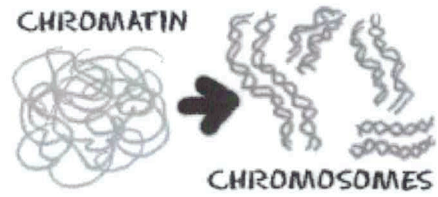
Life Before a Nucleus

Not all cells have a nucleus. Biology breaks cell types into eukaryotic (those with a defined nucleus) and prokaryotic (those with no defined nucleus). You may have heard of chromatin and DNA. You don't need a nucleus to have DNA. If you don't have a defined nucleus, your DNA is probably floating around the cell in a region called the **nucleoid**. A defined nucleus that holds the genetic code is an advanced feature in a cell.

Important Materials in the Envelope



The things that make a eukaryotic cell are a defined nucleus and other organelles. The nuclear envelope surrounds the nucleus and all of its contents. The nuclear envelope is a membrane similar to the cell membrane around the whole cell. There are pores and spaces for RNA and proteins to pass through while the nuclear envelope keeps all of the chromatin and nucleolus inside.



When the cell is in a resting state there is something called chromatin in the nucleus. Chromatin is made of DNA, RNA, and nuclear proteins. **DNA and RNA** are the nucleic acids inside of the cell. When the cell is going to divide, the chromatin becomes very compact. It condenses. When the chromatin comes together, you can see the chromosomes. You will also find the **nucleolus** inside of the nucleus. When you look through a microscope, it looks like a nucleus inside of the nucleus. It is made of RNA and protein. It does not have much DNA at all.

Centrioles - Organizing Chromosomes

Every animal-like cell has two small organelles called **centrioles**. They are there to help the cell when it comes time to divide. They are put to work in both the process of mitosis and the process of meiosis. You will usually find them near the nucleus but they cannot be seen when the cell is not dividing. And what are centrioles made of? Microtubules.

Centriole Structure

A centriole is a small set of microtubules arranged in a specific way. There are **nine groups** of microtubules. When two centrioles are found next to each other, they are usually at right angles. The centrioles are found in pairs and move towards the poles (opposite ends) of the nucleus when it is time for cell division. During division, you may also see groups of threads attached to the centrioles. Those threads are called the **mitotic spindle.**

Relaxing When There's no Work

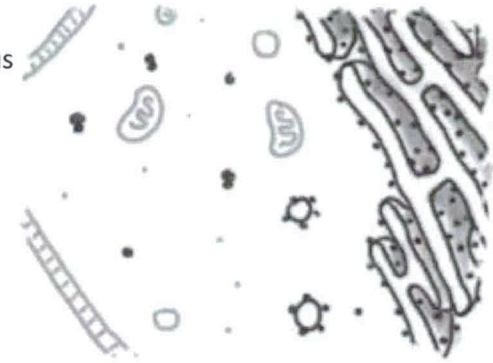
We already mentioned that you would find centrioles near the nucleus. You will not see well-defined centrioles when the cell is not dividing. You will see a condensed and darker area of the cytoplasm called the **centrosome**. When the time comes for cell division, the centrioles will appear and move to opposite ends of the nucleus. During division you will see four centrioles. One pair moves in each direction.

Interphase is the time when the cell is at rest. When it comes time for a cell to divide, the centrioles duplicate. During prophase, the centrioles move to opposite ends of the nucleus and a mitotic spindle of threads begins to appear. Those threads then connect to the now apparent chromosomes. During anaphase, the chromosomes are split and pulled towards each centriole. Once the entire cell begins to split in telophase, the chromosomes begin to unravel and new nuclear envelopes begin to appear. The centrioles have done their job.

Ribosomes - Protein Construction Teams

Cells need to make **proteins**. Enzymes made of proteins are used to help speed up biological processes. Other proteins support cell functions and are found embedded in membranes. Proteins even make up most of your hair. When a cell needs to make proteins, it looks for ribosomes. **Ribosomes** are the protein builders or the protein **synthesizers** of the cell. They are like construction guys who connect one amino acid at a time and build long chains.

Ribosomes are special because they are found in both prokaryotes and eukaryotes. While a structure such as a nucleus is only found in eukaryotes, every cell needs ribosomes to manufacture proteins. Since there are no membrane-bound organelles in prokaryotes, the ribosomes float free in the cytosol.

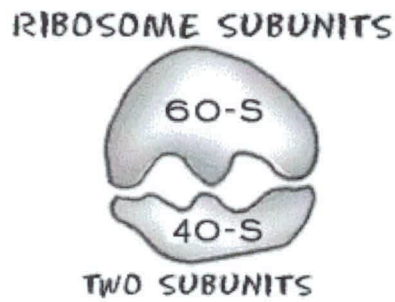


RIBOSOMES CAN BE FOUND FLOATING FREE AND ATTACHED TO THE ER.

Ribosomes are found in many places around a eukaryotic cell. You might find them floating in the cytosol. Those floating ribosomes make proteins that will be used inside of the cell. Other ribosomes are found on the endoplasmic reticulum. Endoplasmic reticulum with attached ribosomes is called rough ER. It looks bumpy under a microscope. The attached ribosomes make proteins that will be used inside the cell and proteins made for export out of the cell. There are also ribosomes attached to the nuclear envelope. Those ribosomes synthesize proteins that are released into the perinuclear space.

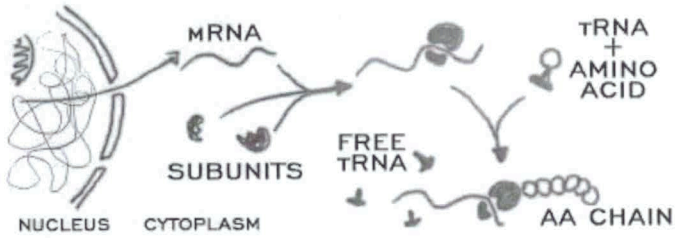
Two Pieces Make the Whole

There are two pieces or subunits to every ribosome. In eukaryotes, scientists have identified the 60-S (large) and 40-S (small) subunits. Even though ribosomes have slightly different structures in different species, their functional areas are all very similar.



For example, prokaryotes have ribosomes that are slightly smaller than eukaryotes. The 60-S/ 40-S model works fine for eukaryotic cells while prokaryotic cells have ribosomes made of 50-S and 30-S subunits. It's a small difference, but one of many you will find in the two different types of cells. Scientists have used this difference in ribosome structure to develop drugs that can kill prokaryotic microorganisms which cause disease. There are even structural differences between ribosomes found in the mitochondria and free ribosomes.

Mixing and Matching Amino Acids



When are ribosomes used in the process of protein synthesis? When the cell needs to make a protein, mRNA is created in the nucleus. The **mRNA** is then sent out of the nucleus and to the ribosomes. When it is time to make the protein, the two subunits come together and combine with the mRNA. The subunits lock onto the mRNA and start the protein synthesis.

The process of making proteins is quite simple. First, you need an amino acid. Another nucleic acid that lives in the cell is **transfer RNA**. tRNA is bonded to the amino acids floating around the cell. With the mRNA offering instructions, the ribosome connects to a tRNA and pulls off one amino acid. The tRNA is then released back into the cell and attaches to another amino acid. The ribosome builds a long amino acid (polypeptide) chain that will eventually be part of a larger protein.

Mitochondria - Turning on the Powerhouse

Mitochondria are known as the powerhouses of the cell. They are **organelles** that act like a digestive system which takes in nutrients, breaks them down, and creates energy rich molecules for the cell. The biochemical processes of the cell are known as **cellular respiration**. Many of the reactions involved in cellular respiration happen in the mitochondria. Mitochondria are the working organelles that keep the cell full of energy.

Mitochondria are small organelles floating free throughout the cell. Some cells have several thousand mitochondria while others have none. Muscle cells need a lot of energy so they have loads of mitochondria. Neurons (cells that transmit nerve impulses) don't need as many. If a cell feels it is not getting enough energy to survive, more mitochondria can be created. Sometimes a mitochondria can grow larger or combine with other mitochondria. It all depends on the needs of the cell.

Mitochondria Structure