2020

Erie Rise Leadership
Academy Charter School

Parent Lesson Plan

[PARENT LESSON PLAN]

~~8th~~ 7th Grade, Week of 4/27

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INTRODUCTION

Hello Parents!

Included in this packet is a week's worth of printed ELA, Mathematics, and Science/Social Studies work for your students while they are at home. Each day is separated into the 3 content areas for the printed material. If you have access to the digital curriculum, a pacing guide is also provided outlining the digital component assigned for each specific day. If you need technology, please contact the school and we can make it available to you. Also remember, USATestPrep is always an option!

We know some of this material maybe be challenging, but try your best to complete it! Hopefully we will see you back in the classroom soon and will be able to go over all the information.

Printed materials may be turned into to the distribution centers once completed, but it is not a requirement.

Mrs. Will will be available on Youtube Live every day from 10AM-11AM to assist with curriculum questions and/or any resource questions for parents or students.

Stay safe and healthy everyone!

Missing seeing everyone's smiling face! Remember to wash your hands!

Educationally Yours ,
Mrs. Veronica Will

Distribution Sites/Information

Food/Curriculum distribution will take place at:

Erie Rise Leadership Academy Charter School
1006 West 10th Street
Erie, PA 16502

Monday and Wednesday from 9AM until 12PM

Leadership Team

Mrs. Veronica Will, Principal: 814 873-5158
Mr. Aubrey Favors, HR: 814 812-3026
Mr. Kirk Paskell, Transportation: 814 566-0002
Mr. Homer Smith, PR: 814 392-3413
Mrs. Pearl Jeffries, Social Services: 814 722-5056

DIGITAL LESSON PACING GUIDE

ConnectED Instructions

Please see attached instructions for accessing the digital curriculum.

USATestPrep Instructions

Please see attached instructions for accessing this test-prep site.

If you have access to high speed internet, below are the assignments the teachers have assigned for the various content areas:

Digital Pacing Guide

	Monday	Tuesday	Wednesday	Thursday	Friday
ELA/Writing 7th grade	Connect Ed./Study Sync Skill- Connecting Words Complete assignments and Access sheet 1	Connect Ed./Study Sync Skill- Synonyms and Antonyms Complete assignments and Access sheet 1	Connect Ed./Study Sync 1st Read- "Deep Water" Complete assignments and Access sheet 1	Connect Ed./Study Sync Re-Read 1- "Deep Water" Complete assignments and Access sheet 1	Connect Ed./Study Sync Re-Read 2 "Deep Water" Complete assignments and Access sheet 1
Math	USA Test Prep	USA Test Prep	USA Test Prep	USA Test Prep	USA Test Prep
Science	Khan Academy- Preparing to study biology	Khan Academy- General Science Skills	Khan Academy- What is Life?	Khan Academy- Reproduction	Khan Academy- Separating Living and Non-Living things
Social Studies	Khan Academy- The Achaemenid Empire	Khan Academy- State Building: The Persian Empire	Khan Academy- Zoroastrianism	Khan Academy- Cyrus the Great and the Achaemenid Empire	Khan Academy- The Rise of Persia

ELA PRINT MATERIAL

Complete the activity "Make TV Time Thinking Time"
This can be done using just one television show or you can split it up and complete the sections using different television shows. This is the full week's work. I hope it is of high interest for the scholars!

MATH PRINT MATERIALS

GRAYSON-WAYNE
Math

3 Printed Material - USATest Prep worksheets

- **3 worksheets**

Chapter 6 Packets

- **1-2 lessons per day**

Coach PSSA Packets on Probability and Statistics

- **1-2 lessons per day**

8148449220 Texts only please

Daily Class Dojo Check-Ins

- **please provide contact information if you haven't already.**

*****Please complete atleast 2 lessons per day and work on USATest Prep daily. Contact me for questions**

SCIENCE/SOCIAL STUDIES PRINT MATERIAL

Social Studies-Alimahmoodi:

Chapter 32: New Challenges
Chapter 19: Medieval Europe

Day 1 (Monday 4/27)

1. Complete Chapter 32 Document Based Test
2. Redefine Chapter 32 Vocabulary

Day 2 (Tuesday 4/28)

1. Read the graphic novel "September Morning"
2. Write a 10-sentence reflection on the graphic novel

Day 3 (Wednesday 4/29)

1. Complete Chapter 32 Test
    a. Use all previous materials to complete this test.

Day 4 (Thursday 4/30)

1. Read Chapter 19 Lesson 1
2. Answer the attached review questions
3. Define Chapter 19 Vocabulary words using the provided text

Day 5 (Friday 5/1)

1. Complete Chapter 19 Lesson 1 Guided Reading

Monday-Preparing to study Biology-Watch the Video https://www.khanacademy.org/

Tuesday- General Science Skills

Wednesday-What is Life?

Thursday-Reproduction

Friday-Separating Living from non-living things

Daily Class Dojo Check-Ins

please provide contact information if you have not already.

ADDITIONAL RESOURCES (EDUCATIONAL)

Included are a list of hand selected resources for students with internet to use at home.

Print

Medieval European governments, religions, languages, and culture still influence the modern world.

Geography of Europe

How did geography shape life in Europe after the fall of Rome?

During the 400s, Germanic groups invaded the Western Roman Empire. In A.D. 476, these groups overthrew the last emperor in Rome and brought the Empire to an end. Europe then entered a new era called the Middle Ages, or medieval times. This was a 1,000-year period between ancient and modern times. During the Middle Ages, Western Europe was divided into many kingdoms, and Catholic Christianity strongly influenced society.

Physical geography shaped Europe's development. The continent of Europe is a huge peninsula, with many smaller peninsulas branching out from it. As a result, most land in Europe lies within 300 miles (483 km) of a seacoast. This encouraged trade and helped the European economy to grow.

Rivers and Seas

Rivers also played an important **role** in Europe's growth. Major rivers, such as the Rhine, Danube, Seine, and Po, flow from inland mountains into the oceans and seas surrounding the continent. These rivers are navigable, or wide and deep enough for ships to use. People and goods can sail easily from inland areas to the open sea and, from there, to other parts of the world.

Europe's seas and rivers provided protection as well as possibilities for trade. The English Channel, for example, separated the islands of Britain and Ireland from the rest of Europe. As a result, these people were far enough away to be largely safe from the many wars fought on Europe's mainland. They were able to develop their own governments and societies. In mainland Europe, wide rivers like the Rhine also kept groups of people separated. Because of this separation and isolation, many different cultures developed.

Europe also has many mountain ranges. In the southwest, the Pyrenees isolated what is now Spain and Portugal from the rest of Europe. In the middle of the continent, the Alps separated Italy from central Europe. The Carpathians cut off what is now Ukraine and Russia from southeast Europe. The mountains, like the rivers, made it difficult for one group to control all of Europe and encouraged the growth of independent territories.

Explaining Why were rivers important to the peoples of Europe?

Kingdoms in Western Europe

How did Germanic groups build kingdoms in Western Europe?

By A.D. 500, Western Europe had divided into many Germanic kingdoms. Germanic people in Italy and Spain adopted many Roman ways. People farther from Rome held on to more of their Germanic traditions.

Roman influence was even weaker in Britain. After Roman armies abandoned the area that is today England, Germanic groups known as Angles and Saxons settled there. In time, they became the Anglo-Saxons.

The Anglo-Saxons pushed aside earlier settlers known as the Celts (KEHLTS). Some Celts fled north and west, while others crossed the sea to Ireland. The Scottish, Welsh, and Irish peoples today are largely descended from the Celts.

The Franks in Europe

The Franks were the strongest Germanic group. They settled what is now France and western Germany. In 481, Clovis (KLOH • vuhs) became king of the Franks. Fifteen years later, he became the first Germanic ruler to accept Catholic Christianity. Before long, nearly all of the Franks became Catholic.

After Clovis died, Frankish kings lost much of their power. By 700, power had passed from kings to government officials known as mayors of the palace.

In 714, Charles Martel (mahr • TEHL), or "Charles the Hammer," became mayor of the palace. The pope, who was the head of the Catholic Church, gave Martel his support. Martel and the pope wanted to restore order and strengthen Catholic Christianity in the lands of the old Western Roman Empire.

Martel's first move was to halt the spread of Islam into Europe. By the early 700s, Muslims from North Africa had conquered Spain and entered France. In 732, Charles Martel defeated the Muslims at the Battle of Tours. This battle stopped the advance of Islam into Western Europe. It also ensured that Christianity would remain Western Europe's major religion.

After Charles Martel died, his son Pepin (PEH • puhn) became mayor of the palace. With the support and blessing of the pope, Pepin became king of the Franks. In return, Pepin was expected to help the pope. In 754, Pepin forced a Germanic group called the

Lombards to leave Rome. He then gave the pope a large strip of Lombard land in Italy. These lands became known as the Papal States.

The Emperor Charlemagne

After Pepin died in 768, his son Charles became king of the Franks. In the years that followed, Charles sent his armies into neighboring lands. He nearly doubled the size of his kingdom to include what is today Germany, France, northern Spain, and most of Italy.

By 800, Charles's kingdom had grown into an empire. For the first time since the fall of Rome, most Western Europeans were ruled by one government. His conquests won Charles the name of Charlemagne (SHAHR • luh • MAYN), or Charles the Great. A monk named Einhard described Charlemagne this way:

"Charles was large and strong, and of lofty stature [height] . . . [his] nose a little long, hair fair, and face laughing and merry. . . . He used to wear the . . . Frankish dress—next [to] his skin a linen shirt and linen breeches [pants], and above these a tunic fringed with silk. . . . Over all he flung a blue cloak, and he always had a sword girt [fastened] about him."

—from *The Life of Charlemagne*, by Einhard

In 800, Charlemagne came to Rome and defended the pope against unruly Roman nobles. On Christmas day, Charlemagne was worshipping at the church of St. Peter in Rome. After the service, the pope placed a crown on Charlemagne's head and declared him the new Roman emperor. Charlemagne was pleased but also concerned. He did not want people to think the pope had the power to choose who was emperor.

Despite this concern, Charlemagne accepted his duties as emperor and worked to strengthen the empire. The central government, located in the capital of Aachen (AH • kuhn), was small. As a result, Charlemagne relied on local officials called counts to help him govern. The counts ran local affairs and raised armies for Charlemagne. Royal messengers went on inspections and told the emperor how the counts were doing.

Charlemagne wanted to advance learning in his kingdom. He had tried late in life to learn to write and wanted his people to be educated too. He established a school for the children of government officials. Students at the school studied religion, Latin, music, literature, and arithmetic.

Waves of Invaders

More than anything else, Charlemagne's forceful personality held the empire together. After Charlemagne died in 814, his empire did not last long. It was soon divided into three kingdoms.

These Frankish kingdoms were prey to outside attacks. In the 800s and 900s, waves of invaders swept across Europe. Muslims from North Africa raided France and Italy. Fierce nomads called Magyars from Hungary invaded eastern parts of France and Italy. Vikings launched raids from their homeland in Scandinavia (SKAN • duh • NAY • vee • uh).

Scandinavia is in northern Europe. Norway, Sweden, and Denmark are all part of modern Scandinavia. Much of Scandinavia has a long, jagged coastline. It has many fjords (fee • AWRDS), or narrow inlets of the sea. The fjords, surrounded by steep cliffs or slopes, were carved by glaciers long ago. The Viking people, known as Norsemen or "north men," lived in villages near the fjords.

Scandinavia has little farmland, so the Vikings had to depend on the sea for food and trade. They became skilled sailors and traveled in sturdy longboats. These boats could survive the rough Atlantic and also navigate shallow rivers.

In the 700s and 800s, the Vikings left their crowded homeland and carried out raids along Europe's coasts. The word *viking* comes from their word for raiding. The Vikings attacked villages and churches, seizing grain, animals, and other valuable items. They burned whatever they could not steal.

The Vikings were more than just raiders. They were also explorers and settlers. They sailed across the Atlantic, settled the islands of Greenland and Iceland, and even landed in North America. For a short time, Viking groups also lived in England. They founded the territory of Normandy in northwestern France and settled in parts of what are now Russia and Ukraine.

Formation of the Holy Roman Empire

Muslim, Magyar, and Viking invaders brought much suffering to Europe's people. Their attacks also weakened the Frankish kingdoms. By the 900s, the eastern Frankish kingdom, known as Germany, became a collection of small territories ruled by nobles. In 911, a group of these nobles sought to unite Germany by electing a king.

In 936, Duke Otto of Saxony was elected king of Germany. Otto became a powerful ruler. Germanic forces defeated the Magyars and freed the pope from the control of Roman nobles. To reward Otto, the pope crowned him emperor of the Romans in 962. Otto's territory became known as the Holy Roman Empire. It included most of present-day Germany and northern Italy.

After Otto, two important emperors, Frederick I and Frederick II, tried to bring Germany and Italy under a strong central government during the 1100s and 1200s. The popes did not want the emperor to control them. They joined with Italy's cities to resist the emperor's forces. Ongoing conflict kept Germany and Italy from becoming united countries until the 1800s.

Explaining What impact did the Battle of Tours have on European history?

The Church and Its Influence

How did the Catholic Church influence life in early medieval Europe?

The Roman Catholic Church played an important role in the growth of a new civilization in medieval Western Europe.

Christianity in Europe

At the time of Rome's fall, large areas of northwestern Europe practiced a variety of non-Christian religions. Ireland was different. In the 400s, a Christian priest named Patrick traveled to Ireland. There, Patrick spread Christianity and founded churches and monasteries, or religious houses.

Patrick inspired Pope Gregory I, or Gregory the Great, to spread Christianity. Gregory asked monks to become missionaries (MIH • shuh • NEHR • eez)—people who are sent out to teach their religion. In 597, Gregory sent 40 monks to Britain to teach Christianity. Other monks spread Christianity, so that by 1050, most Western Europeans had become Catholic Christians.

The Contributions of Monks and Nuns

Monks and monasteries provided schools and hospitals. They taught carpentry and weaving, and they developed improvements in farming. Many monks copied Christian writings as well as Roman and Greek works. They also made illuminations, which are manuscripts decorated with beautiful lettering and miniature religious paintings. These monks helped preserve knowledge of the classical and early Christian worlds.

Monks lived in communities headed by abbots (A • buhtz). Women called nuns lived in their own monasteries called convents. Convents were headed by abbesses (A • buhs • ihs).

Church Authority

Many monasteries became wealthy. As their influence increased, abbots became active in political affairs. This caused disagreements. Kings wanted Church leaders to obey them. Popes, however, believed kings should obey the Church.

Elected pope in 1073, Gregory VII declared that only the pope had the power to appoint high-ranking Church officials. Pope Gregory's order angered Henry IV, the Holy Roman emperor. For many years, the Holy Roman emperor had chosen bishops in Germany. Henry insisted on naming his own bishops. Gregory then declared that Henry was no longer emperor and excommunicated him. This meant that he no longer had the rights of church membership and could not go to heaven.

When the German nobles supported the pope, Henry changed his mind. He traveled to Italy and begged the pope for forgiveness. Gregory forgave Henry, but the German nobles chose a new emperor. When Gregory accepted the new emperor, Henry seized Rome and named a new pope.

The struggle continued until 1122, when a new German king and a new pope agreed that only the pope could choose bishops, but only the king or emperor could give them government posts. This agreement, called the *Concordat of Worms,* was signed in the German city of Worms. A concordat (kuhn • KAWR • DAT) is an agreement between the pope and the ruler of a country.

Describing What major issue did kings and popes disagree on?

LESSON 1 REVIEW

Review Vocabulary

1. What is a *missionary* meant to do?

2. What natural process created the *fjords*?

Answer the Guiding Questions

3. ***Summarizing*** How did mountains and rivers make it difficult for one group to control all of Europe?

4. ***Explaining*** What happened in Britain after Roman armies abandoned the area during the 400s?

5. ***Identifying*** In what modern countries did the Franks settle?

6. ***Analyzing*** What did Charlemagne do to advance education?

7. ***Analyzing*** What role did monasteries play in medieval Europe?

8. INFORMATIVE/EXPLANATORY Henry IV begged for the pope's forgiveness. If you were going to interview King Henry about this incident, what three questions would you ask him? Write your answer in a paragraph.

Chapter 19 Lesson 1 Vocabulary

Ms. Alimahmoodi

Directions: Define the following words

1. Fjord

2. Missionaries

3. Concordat

4. Role

5. Establish

Directions:
Use the five vocabulary words in a sentence:

1.

2.

3.

4.

5.

NAME_____ DATE _____ CLASS _____

Chapter 32 Test, Document-Based Questions

networks

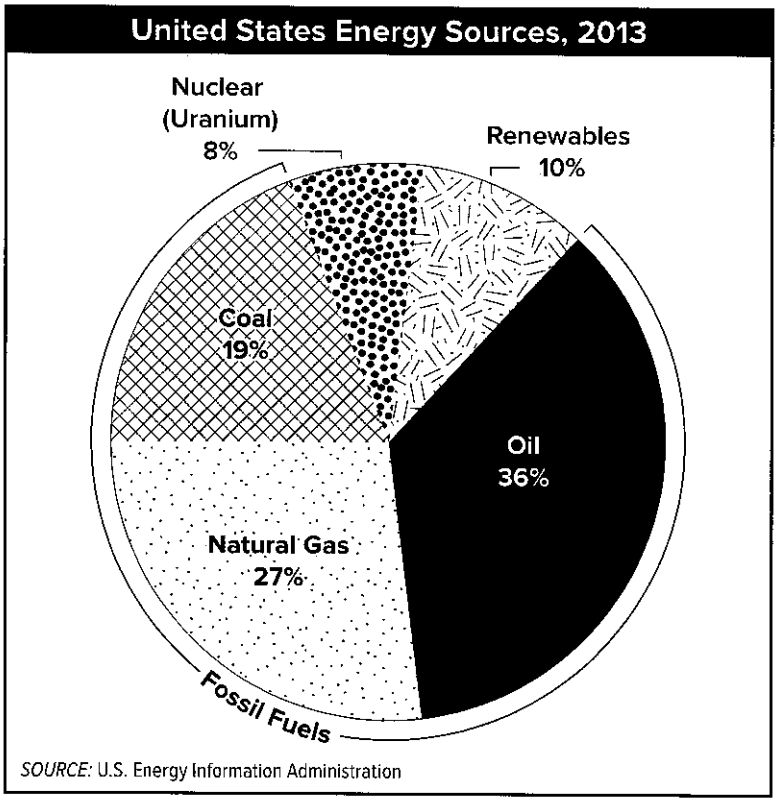
New Challenges

DIRECTIONS: Short Answer Answer each of the following question on a separate piece of paper.

> "A great people has been moved to defend a great nation. Terrorist attacks can shake the foundations of our biggest buildings, but they cannot touch the foundation of America. These acts shattered steel, but they cannot dent the steel of American resolve. America was targeted for attack because we're the brightest beacon for freedom and opportunity in the world. And no one will keep that light from shining."
>
> —George W. Bush, September 11, 2001, address to the nation on the terrorist attacks

1. What does President Bush mean by "the steel of American resolve"?

2. What technique does President Bush use in this excerpt to inspire and incite those listening to his address?



3. Based on the circle graph, which percentage of energy in the United States came from renewables, nuclear, and natural gas in 2013?

4. Which two sources of non-fossil fuel are shown in this graph?

NAME_____ DATE _____ CLASS _____

Chapter 32 Test, Document-Based Questions *cont.*

networks

New Challenges

Gasoline Consumption and Prices		
Year	**Consumption (billions of gallons)**	**Cost per Gallon**
2004	140.0	$ 1.85
2005	140.4	$ 2.27
2006	141.8	$ 2.58
2007	142.3	$ 2.81
2008	138.2	$ 3.26
2009	138.0	$ 2.35
2010	137.9	$ 2.78
2011	134.2	$ 3.53

5. Based on the table, how much did the price of a gallon of regular gas change from 2004 to 2011?

6. Based on the table, in which year was the United States consumption of gasoline at its highest?

DIRECTIONS: Essay Answer the following question on a separate piece of paper.

7. Renewable energy is naturally derived and includes solar and wind power, geothermal energy, and hydropower. Discuss how the production of renewable energy sources can affect both our environment and our economy.

NAME _____ DATE _____ CLASS _____

Guided Reading

networks

Medieval Europe

Lesson 1 *The Early Middle Ages*

ESSENTIAL QUESTION

Why does conflict develop?

Geography of Europe

1. **Determining Cause and Effect** What major world event caused Europe to enter a new era called the Middle Ages?

_____

_____

2. **Identifying** As you read the lesson, fill in facts you learn about how Europe's physical geography shaped the continent's development during the Middle Ages.

Physical Geography	Effect on Europe
Seas	
Rivers	
Mountains	

NAME _____ DATE _____ CLASS _____

Guided Reading *Cont.*

networks

Medieval Europe

Kingdoms in Western Europe

3. Listing As you read the lesson, write down important facts about each of the leaders in the chart below.

King Clovis	Charles Martel	Charlemagne

4. Explaining Who were the Vikings and why were they important in the development of Europe in the Middle Ages?

_____

_____

_____

5. Describing How was the Holy Roman Empire formed? Who was Otto?

_____

_____

_____

NAME _____ DATE _____ CLASS _____

Guided Reading *Cont.*

networks

Medieval Europe

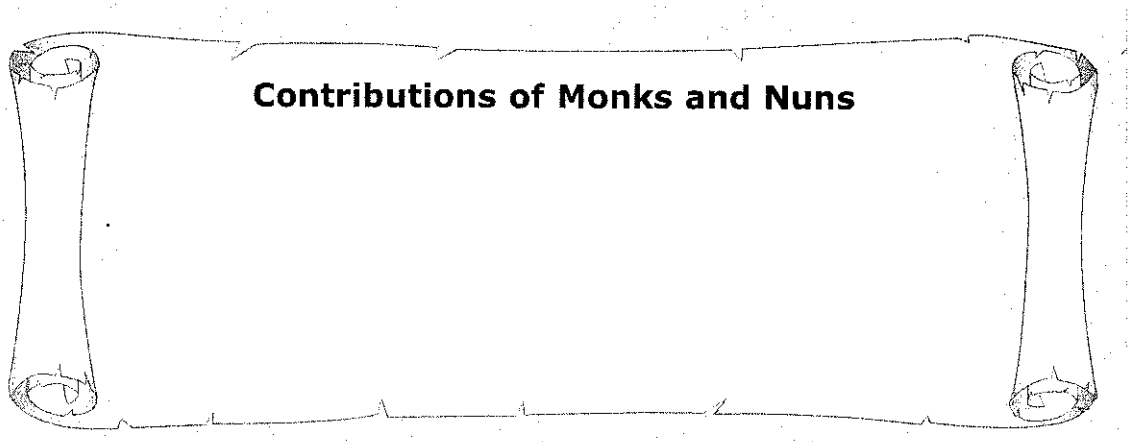
The Church and Its Influence

1. **Determining Effects** What were two effects of the spread of Christianity in Ireland?

_____

_____

2. **Identifying** On the scrolls below, identify at least three contributions made by Catholic monks and nuns in Europe during the Middle Ages.



3. **Explaining** What powers could a pope use to make kings obey his orders?

_____

_____

_____

4. **Describing** What conflict erupted between the Holy Roman Emperor and the leaders of the Catholic Church?

_____

_____

_____

NAME_____ DATE _____ CLASS _____

Chapter 32 Test, Traditional

networks

New Challenges

DIRECTIONS: True/False Indicate whether the statement is true or false.

_____ **1.** President Obama took office during the best economic times in many decades.

_____ **2.** Osama bin Laden's terrorist organization is known as al-Qaeda.

_____ **3.** The Office of Homeland Security was created by President Bush to help protect the United States from further terrorist attacks.

_____ **4.** Acid rain's effect on the environment is minimal.

_____ **5.** During President Obama's second term in office, ISIS took credit for deadly terrorist attacks in Paris and Brussels.

DIRECTIONS: Matching Match each item with the correct statement shown.

_____ **6.** thought by some to weaken traditional Muslim values

_____ **7.** controlled Afghanistan's government in the 1990s

_____ **8.** process used to extract gas and oil from shale rock underground

_____ **9.** protested against reforms of President Obama

_____ **10.** the shared currency of the European Union

A. fracking

B. the Tea Party

C. Western culture

D. the euro

E. the Taliban

DIRECTIONS: Multiple Choice Indicate the answer choice that best completes the statement or answers the question.

_____ **11.** The September 11, 2001, terrorist attacks included damage to which building?

A. the Capitol

B. the Lincoln Memorial

C. the Pentagon

D. the White House

_____ **12.** Which of these statements about the Taliban is true?

A. The Taliban turned over Osama bin Laden to President Bush.

B. The Taliban was a Muslim fundamentalist group supportive of bin Laden.

C. The Taliban is another name for the terrorist organization al-Qaeda.

D. The Taliban claimed responsibility for the terrorist attacks on September 11, 2001.

NAME_____ DATE _____ CLASS _____

Chapter 32 Test, Traditional *cont.*

networks

New Challenges

_____ **13.** What was behind the controversy surrounding the Patriot Act?

A. It protected the rights of terrorists to appeal to a court.

B. It allowed terrorists imprisoned at Guantanamo Bay to receive visitors.

C. Some thought it violated Fourth Amendment protections from unreasonable searches and seizures.

D. It was thought to be too restrictive and useless in the war on terror.

_____ **14.** How did President Bush's appointments to the Supreme Court affect its character?

A. The Supreme Court moved in a conservative direction.

B. The Supreme Court became decidedly more liberal.

C. Women achieved a more prominent voice.

D. The Supreme Court's credibility became questionable.

_____ **15.** What problem did the Affordable Care Act of 2010 address?

A. the financial distress of companies and homeowners

B. lack of health insurance for many Americans

C. homelessness of Iraqi refugees

D. increasing unemployment

> "We know that nations that open their economies to the benefits of trade are more successful at climbing out of poverty. . . . We also know that free trade encourages the habits of liberty that sustain freedom."
>
> —President George W. Bush

_____ **16.** Which of the following best summarizes this quote from President George W. Bush?

A. Free trade encourages good habits in workers.

B. Free trade combats poverty and encourages democracy.

C. Free trade causes poverty but sustains freedom.

D. Free trade is the answer to all economic problems.

Chapter 32 Test, Traditional *cont.*

networks

New Challenges

_____ **17.** What has resulted from ISIS's attempt to create an Islamic state in the Middle East?

A. the overthrow of several dictators in countries such as Tunisia, Egypt, and Libya

B. an alliance with the pro-Russian sympathizers in Crimea

C. a large movement of refugees intent on finding safety

D. support from peace-loving Muslims from around the world

_____ **18.** What is the focus of NAFTA?

A. outsourcing

B. free trade

C. deficit reduction

D. educational reform

DIRECTIONS: Short Answer Answer each of the following questions.

19. What does it mean to say "nations are interdependent"?

_____

_____

_____

20. Who is the target of stricter gun control laws?

_____

_____

_____

Chapter 32 Test, Traditional *cont.*

networks

New Challenges

> "This is the meaning of our liberty and our creed—why men and women and children of every race and every faith can join in celebration across this magnificent mall, and why a man whose father less than sixty years ago might not have been served at a local restaurant can now stand before you and take the most sacred oath."
>
> —First Inaugural Address, President Barack Obama, January 20, 2009

21. How does President Obama contrast himself with his father in the quote?

_____

_____

22. Based on the quote, what is President Obama's sacred oath?

_____

_____

DIRECTIONS: Essay Answer the following question on a separate piece of paper.

23. What are two sides of the argument regarding free trade?

Chapter 32 Vocabulary

Ms. Alimahmoodi

1. Terrorism

2. Insurgent

3. Levee

4. Prior

5. Definite

6. Bailout

7. Interdependent

8. Globalization

9. Trade Deficit

10. Free Trade

11. Outsourcing

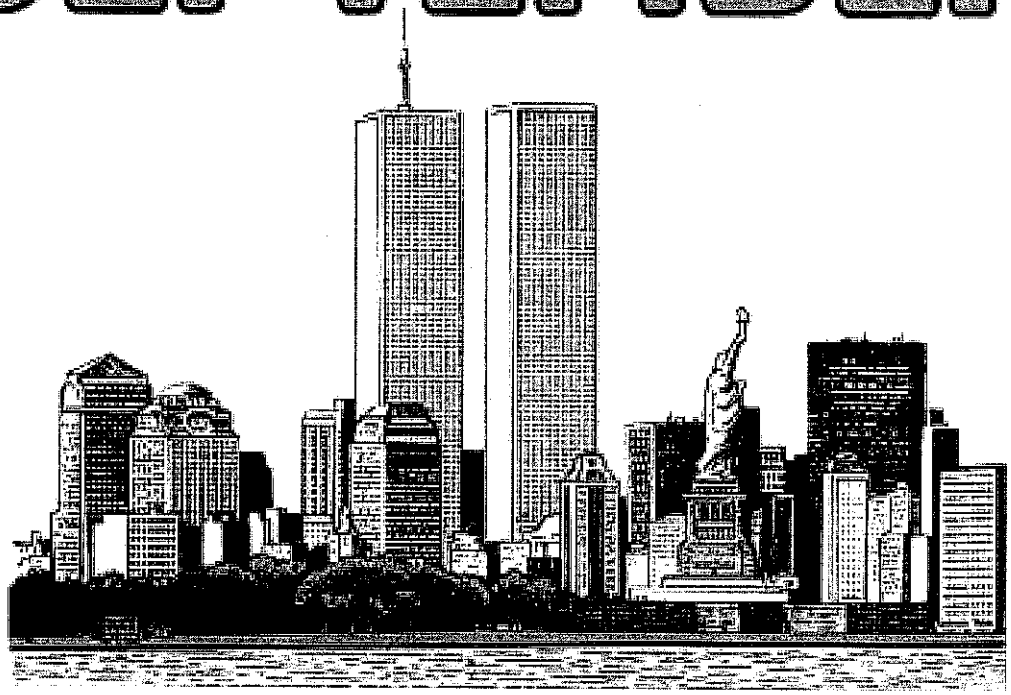
12. Acid Rain

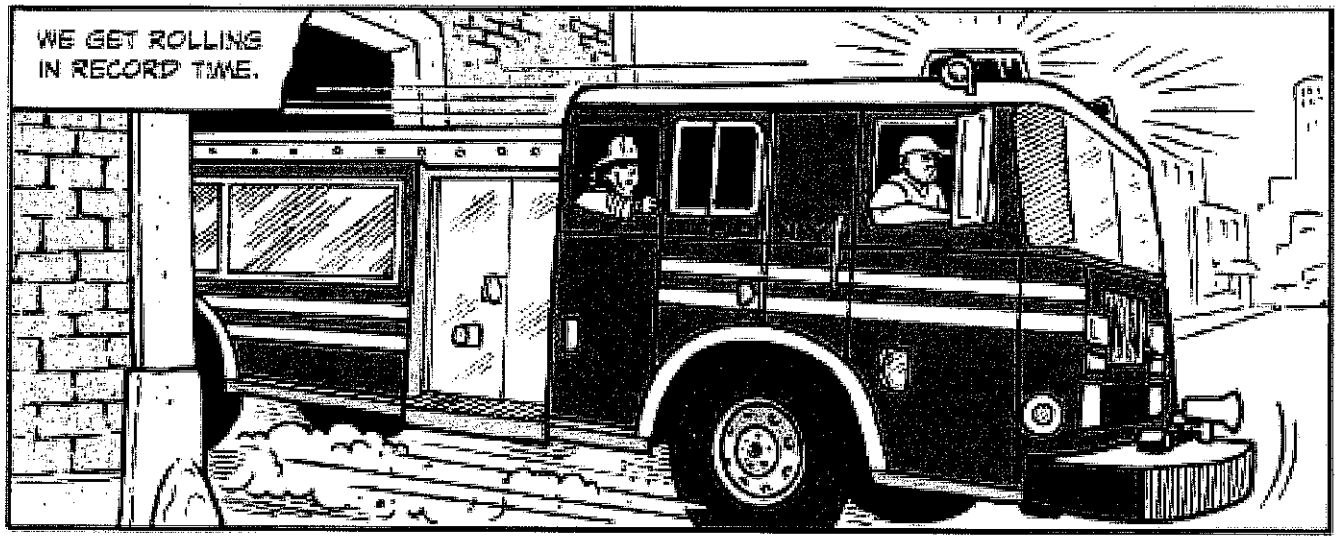
13. Decade

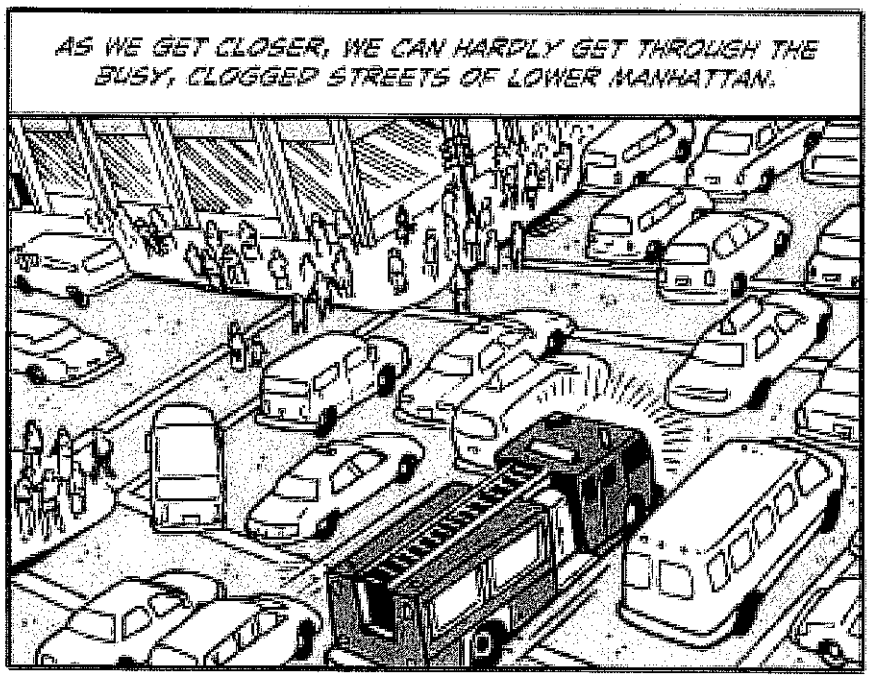
14. Aware

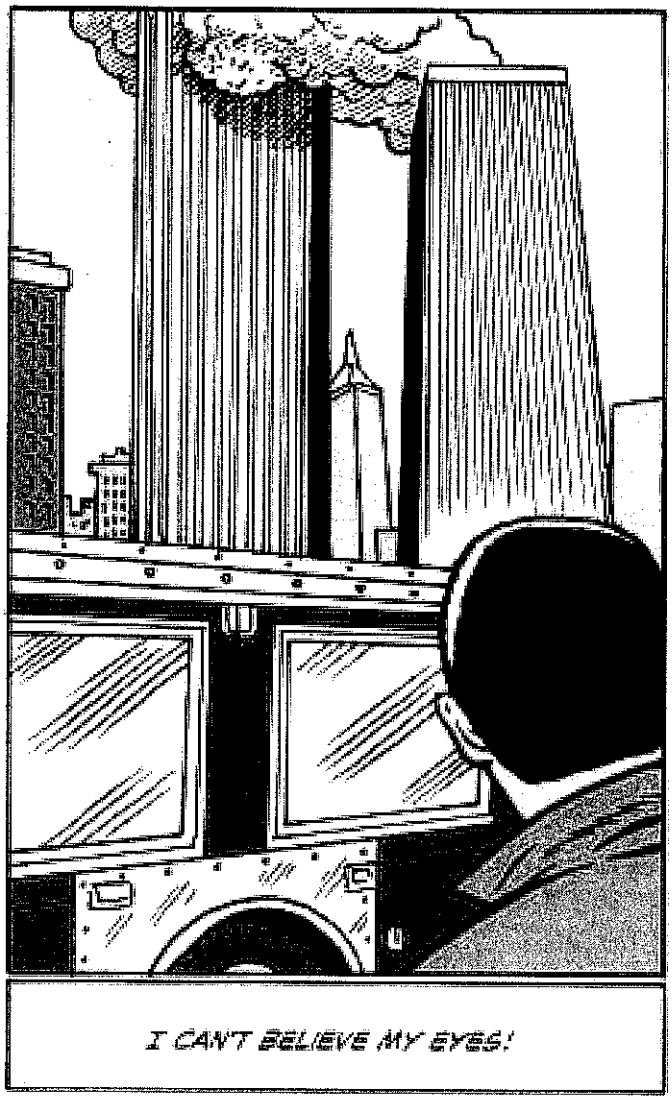
GRAPHIC NOVEL

SEPTEMBER MORNING





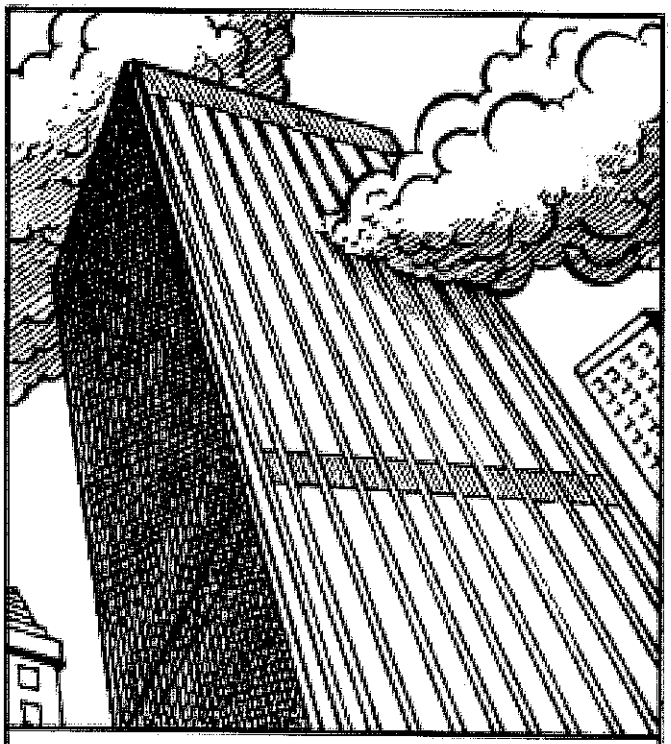




I CAN'T BELIEVE MY EYES!

WASTING NO TIME, WE GRAB OUR MED KITS AND A COUPLE OF TANKS OF "O".

SUDDENLY THERE IS A DEAFENING ROAR ABOVE US...



THE SOUTH TOWER HAS BEEN HIT!

FLYING DEBRIS COMES RAINING DOWN. I HOPE THAT NOTHING BIG HITS US!

Distributive Property

Name: **Class:**
Teacher: **Date:**

Directions: Complete the guided notes to explore the Distributive Property

---

Distributive Property: _____

Note: Distributive sounds like _____. When someone distributes something they divide it up evenly.

The distributive property helps us to rewrite an expression without parenthesis.

a(b + c)= _____ **a(b - c)= _____**

The distributive property works when _____ and _____ expressions are within parenthesis! When the order of operations cannot be used to simplify an expression with unlike terms, this property can help to re-write an equivalent expression.

Be Careful!!

Sometimes the number that is distributed (coefficient) will be after the parenthesis, just move it to the front and distribute normally. Remember the commutative property says we can move the numbers when multiplying and the answer is the same.

(b + c)a → a(b + c) = _____ **(b - c)a → a(b - c) = _____**

Guided Examples:

a) $2(x + 5) = 2x + 2 * 5 =$

b) $-3(x + 4) = -3x + -3 * 4 = -3x + -12 =$

c) $(x - 4)x = x(x - 4) = x * x - 4 * x =$

d) $(1 - 2x)8 = 8(1 - 2x) =$

e) $y(1 - y) = y * 1 - y * y =$

Independent Practice: Use the distributive property to rewrite each expression.

1. $7(8 + z)$ a. _____
2. $5(r + 10)$ b. _____
3. $-3(12 - w)$ c. _____
4. $9(8 + 3e)$ d. _____
5. $x(x - 2)$ e. _____

Name _____ Date _____

Distributive Property of Multiplication

Example: 7 (2 + 6)

(7 x 2) + (7 x 6)

14 + 42

56

Use the distributive property to find the product.

1. 5 (4 + 3)

2. 9 (6 + 8)

3. 2 (3 + 7)

4. 8 (6 + 7)

5. 6 (9 + 9)

6. 7 (8 + 5)

7. 10 (2 + 5)

8. 4 (4 + 9)

Fill in the blanks!

9. 9(8 + 4) = 9 x _____

10. 21 = 7 (_____ + 1)

Monday-Preparing to study biology-Watch the Video

https://www.khanacademy.org/

What should I know before starting biology?

If you are curious about biology or plan to study it in the future, you may be wondering what "prerequisites" it has – that is, what other knowledge will give you a solid foundation to learn biology. If so, big kudos for thinking ahead!

In my opinion, the only strict preparation for biology are curiosity, an open mind, and a willingness to think critically about the natural world. If you have those, you can start learning biology without other background, if you're willing to pick up bits of chemistry, physics, statistics, and math along the way.

That said, you may find your journey through biology smoother and more satisfying if you already have some familiarity with topics in other areas, particularly chemistry. Below are some foundational topics that will help you get the most out of Khan Academy's biology materials (or any biology class).

Tuesday-General Science Skills

- The scientific method. Are you rusty on what a hypothesis is or how it gets tested? How about experiments? These basic concepts will help you not only in biology, but also in any other area of science.

Chemistry

- Introduction to chemistry. A big picture view of chemistry and why it is important to math and other sciences, like biology.
- General chemistry. Get a feel for atoms, molecules, and how they interact with each other. After all, that's what you (and all life) are made up of.
- Acid-base chemistry. A lot of the chemistry in your body is acid-base chemistry that takes place in watery solutions. Knowing what acids and bases are will get you a long way with biochemistry.

Physics

- Laws of thermodynamics. Get a feeling for what energy is and what rules govern its transfer. Energy is constantly flowing through ecosystems, organisms, and cells, and is essential to keep these systems running.

Statistics

- Basics of probability. Probability is a key concept in biology. You don't need to know tons of details or formulas, but if you understand the basic concepts, that will help you a lot with genetics and population genetics.
- Statistics. Remind yourself about the basic ways we can describe sets of data, such as mean, median, and mode. If you go even deeper and learn about hypothesis testing, you'll definitely be ahead of the curve!

Math

- Basic algebra and graphing. Most intro bio classes are not that math-intensive, but having an understanding of basic algebra and graphs (e.g., the meaning of slope) will help you understand figures and data in biology.

Do I *have* to know all these before starting?

Not necessarily. As I mentioned, you can also learn as you go. You just need to be willing to work on these topics in parallel with your learning of biology. So, don't be deterred from biology if you haven't yet mastered all of these topics.

Wednesday-What is Life?

Introduction- In the intro to biology video, we defined biology as the branch of science concerned with the study of living things, or organisms.

That definition is pretty straightforward. However, it opens the door to more difficult—and more interesting—questions: What is life? What does it mean to be alive?

You are alive, and so am I. The dog I can hear barking is alive, and so is the tree outside my window. However, snow falling from the clouds is not alive. The computer you're using to read this article is not alive, and neither is a chair or table. The parts of a chair that are made of wood were once alive, but they aren't any longer. If you were to burn the wood in a fire, the fire would not be alive either.

What is it that defines life? How can we tell that one thing is alive and another is not? Most people have an intuitive understanding of what it means for something to be alive. However, it's surprisingly hard to come up with a precise definition of life. Because of this, many definitions of life are operational definitions—they allow us to separate living things from nonliving ones, but they don't actually pin down what life is. To make this separation, we must come up with a list of properties that are, as a group, uniquely characteristic of living organisms.

Properties of life

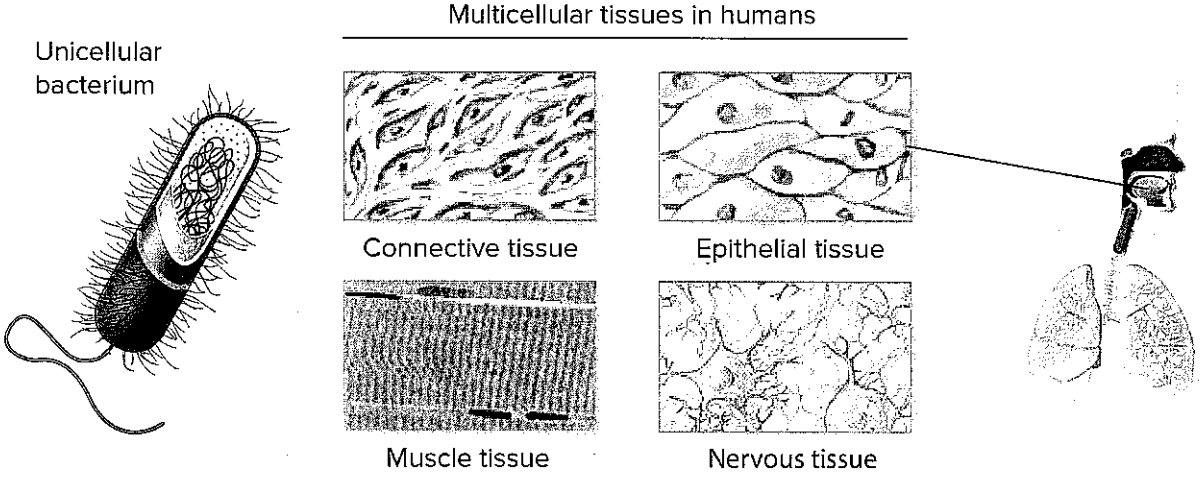
Biologists have identified various traits common to all the living organisms we know of. Although nonliving things may show some of these characteristic traits, only living things show *all* of them.

1. Organization

Living things are highly organized, meaning they contain specialized, coordinated parts. All living organisms are made up of one or more **cells**, which are considered the fundamental units of life.

Even **unicellular** organisms are complex! Inside each cell, atoms make up molecules, which make up cell organelles and structures. In multicellular organisms, similar cells form tissues. Tissues, in turn, collaborate to create organs (body structures with a distinct function). Organs work together to form organ systems.

Multicellular organisms—such as humans—are made up of many cells. The cells in multicellular organisms may be specialized to do different jobs and are organized into **tissues**, such as connective tissue, epithelial tissue, muscle, and nervous tissue. Tissues make up **organs**, such as the heart or lungs, which carry out specific functions needed by the organism as a whole.



Left: unicellular bacterium, with the exterior of the cell cut away to show the multiple layers of the cell and the DNA in its interior. Center: multicellular tissues in humans. Small drawings of connective tissue, epithelial tissue, muscle tissue, and nervous tissue. Right: diagram of a human upper body, showing one location where epithelial tissue like that shown in the center panel could be found—the lining of the mouth.

2. Metabolism

Life depends on an enormous number of interlocking chemical reactions. These reactions make it possible for organisms to do work—such as moving around or catching prey—as well as growing, reproducing, and maintaining the structure of their bodies. Living things must use energy and consume nutrients to carry out the chemical reactions that sustain life. The sum total of the biochemical reactions occurring in an organism is called its **metabolism**.

Metabolism can be subdivided into anabolism and catabolism. In **anabolism**, organisms make complex molecules from simpler ones, while in **catabolism**, they do the reverse. Anabolic processes typically consume energy, whereas catabolic processes can make stored energy available.

3. Homeostasis

Living organisms regulate their internal environment to maintain the relatively narrow range of conditions needed for cell function. For instance, your body temperature needs to be kept relatively close to 98.6^\circ degreesF (37^\circ degreesC). This maintenance of a

stable internal environment, even in the face of a changing external environment, is known as **homeostasis**.

[Show example of how homeostasis is maintained.]

Image of a jackrabbit in the desert, showing the rabbit's very thin—almost see-through—heavily veined ears, which are used for heat dissipation.

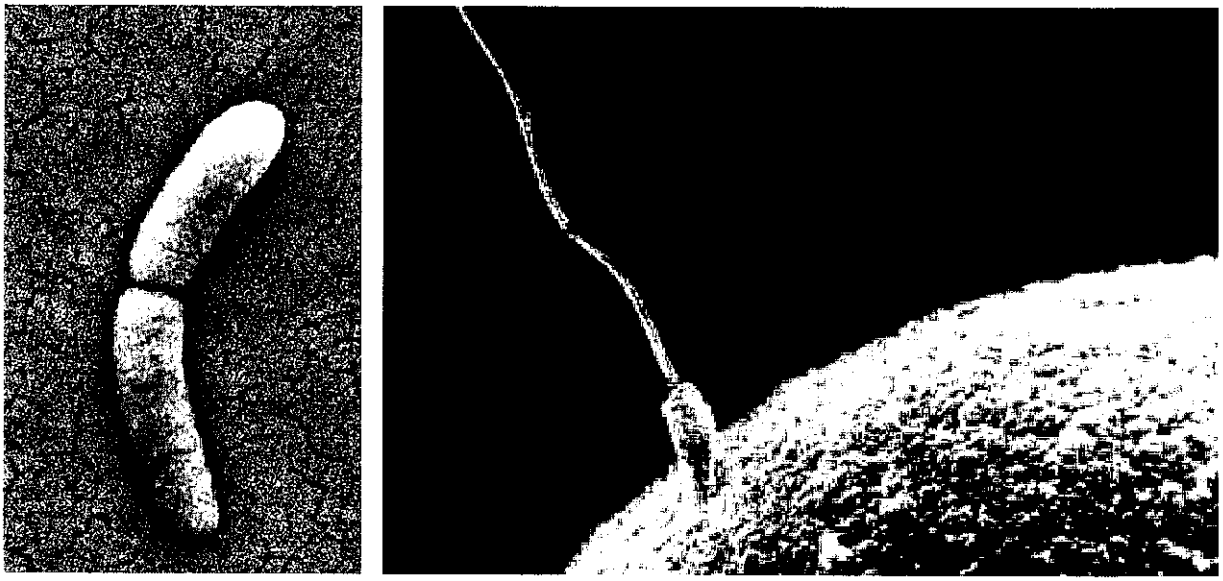
4. Growth

Living organisms undergo regulated growth. Individual cells become larger in size, and multicellular organisms accumulate many cells through cell division. You yourself started out as a single cell and now have tens of trillions of cells in your body^1 1start superscript, 1, end superscript! Growth depends on anabolic pathways that build large, complex molecules such as proteins and DNA, the genetic material

Thursday-Reproduction

5. Reproduction

Living organisms can reproduce themselves to create new organisms. Reproduction can be either **asexual**, involving a single parent organism, or **sexual**, requiring two parents. Single-celled organisms, like the dividing bacterium shown in the left panel of the image at right, can reproduce themselves simply by splitting in two!



Left: image of a Salmonella bacterium dividing into two bacteria. Right: image of a sperm and egg meeting in fertilization.

In sexual reproduction, two parent organisms produce sperm and egg cells containing half of their genetic information, and these cells fuse to form a new individual with a full genetic set. This process, called fertilization, is illustrated in the image at far right.

6. Response

Living organisms show "irritability," meaning that they respond to stimuli or changes in their environment. For instance, people pull their hand away—fast!—from a flame; many plants turn toward the sun; and unicellular organisms may migrate toward a source of nutrients or away from a noxious chemical.

[See a plant respond to touch.]

Short movie (GIF) of a *Mimosa pudica* plant responding to touch. When the tip of a branch is touched, the leaves on that branch rapidly fold inwards in series, starting with those closest to the touched point.

7. Evolution

Populations of living organisms can undergo **evolution**, meaning that the genetic makeup of a population may change over time. In some cases, evolution involves **natural selection**, in which a heritable trait, such as darker fur color or narrower beak shape, lets organisms survive and reproduce better in a particular environment. Over generations, a heritable trait that provides a fitness advantage may become more and more common in a population, making the population better suited to its environment. This process is called **adaptation**.

Is this the definitive list?

Living organisms have many different properties related to being alive, and it can be hard to decide on the exact set that best defines life. Thus, different thinkers have developed different lists of the properties

of life. For instance, some lists might include movement as a defining characteristic, while others might specify that living things carry their genetic information in the form of DNA. Still others might emphasize that life is carbon-based.

Image of a mule on a farm. The mule looks similar to a donkey and is clearly a living animal, despite the fact that it cannot reproduce.

It's also true that the list above is not foolproof. For instance, a mule, the offspring of a female horse and a male donkey, is unable to reproduce. However, most biologists (along with everyone else) would consider a mule, pictured above, to be alive. A similar point is illustrated in this amusing story: a group of scientists had, after much debate, decided that ability to reproduce was the key property of life. To their disappointment, someone pointed out that a lone rabbit did not meet this bar^2_2squared.

Nonetheless, the list above provides a reasonable set of properties to help us distinguish between things that are alive and those that are not.

Friday-Separating living and non-living things

How well do the properties above allow us to determine whether something is alive? Let's revisit the living and nonliving things we saw in the introduction as a test.

The living things we saw in the introduction—humans, dogs, and trees—easily fulfill all seven criteria of life. We, along with our canine friends and the plants in our yards, are made of cells, metabolize, maintain homeostasis, grow, and respond. Humans, dogs, and trees are also capable of reproducing, and their populations undergo biological evolution.

Nonliving things may show some, but not all, properties of life. For instance, crystals of snow are organized—though they don't have cells—and can grow but don't meet the other criteria of life. Similarly, a fire can grow, reproduce by creating new fires, and respond to stimuli and can arguably even be said to "metabolize." However, fire is not organized, does not maintain homeostasis, and lacks the genetic information required for evolution.

Living things may keep some properties of life when they become nonliving, but lose others. For instance, if you looked at the wood in a chair under a microscope, you might see traces of the cells that used to make up the living tree. However, the wood is no longer alive, and, having been made into a chair, can no longer grow, metabolize, maintain homeostasis, respond, or reproduce.

[Can a robot be considered alive?]

What counts as life is still being defined.

The question of what it means to be alive remains unresolved. For instance, viruses—tiny protein and nucleic acid structures that can only reproduce inside host cells—have many of the properties of life. However, they do not have a cellular structure, nor can they reproduce without a host. Similarly, it's not clear that they maintain homeostasis, and they don't carry out their own metabolism.

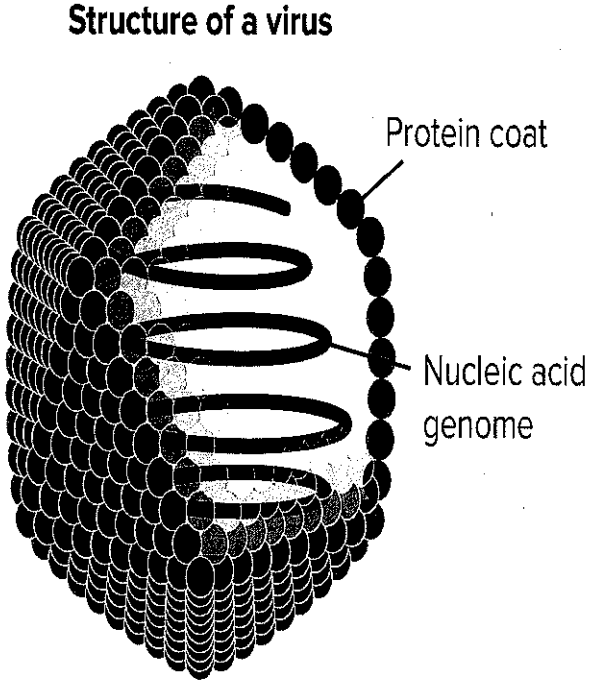


Diagram of a virus. The virus consists of a nucleic acid genome inside an external protein coat.

For these reasons, viruses are not generally considered to be alive. However, not everyone agrees with this conclusion, and whether they count as life remains a topic of debate. Some even simpler molecules, such as self-replicating proteins—like the "prions" that cause mad cow disease—and self-replicating RNA enzymes, also have some, but not all, of the properties of life.

Moreover, all of the properties of life we have discussed are characteristic of life on earth. If extraterrestrial life exists, it may or

may not share the same characteristics. Indeed, NASA's working definition that "life is a self-sustaining system capable of Darwinian evolution" opens the door to many more possibilities than the criteria defined above^33cubed. However, this definition also makes it hard to quickly decide whether something is alive!

As more types of biological entities are discovered, on Earth or beyond, they may demand that we re-think what it means for something to be alive. Future discoveries may call for revisions and extensions of the definition of life.

What do *you* think?

How would you define life? Would you add something to the list of properties above, subtract something, or use an entirely different definition? Can you think of exceptions or special cases that aren't covered by the list? Share your ideas in the comments section below!

Monday-7th Grade Science Homework

Write 5 things that you leaned from watching Overview Biology.

1.

2.

3.

4.

5.

Tuesday -7th Grade Science Homework

Preparing to study biology-Word Definitions

1.The scientific methods-

2. Chemistry-

3. General Chemistry

4. Acid-Base Chemistry

5. Physics

6. Statistics

7. Math

Wednesday -7th Grade Science Homework

Answer the Questions?

1.What is life? Give 3 examples.

2.What does it mean to be alive? Give 3 examples.

3. What is it that defines life? Give 3 examples.

4. How can we tell that one thing is alive and another is not? Give 3 examples.

5. Name some traits of life?

Thursday -7th Grade Science Homework

Word Definitions

1.Cells

2. Unicells

3.multicells

4.tissue

5.organs

6.metabolism

7.anabolism

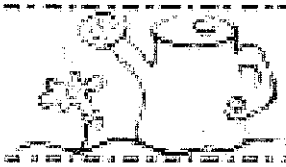
8.catabolism

9.homeostasis

10.growth

Friday -7th Grade Science /Quiz.

Name _____



Living Things Quiz

1. All living things _____ some walk, some swim, some fly.

2. All living things _____ and get bigger.

3. All living things need and use _____. some use food, some use sunlight, some use soil.

4. All living things can _____. some lay eggs, some have babies, some produce seeds.

5. All living things get rid of _____.

6. All living things react to _____. some escape predators, some blink, some change

7. All living things have a _____. Some living things live longer than others.

8. Living things _____ over time

Word Bank: **energy** **grow** **reproduce** **move** **waste** **change** **lifespan** **change**

Monday-The scientific method (May 4)

Introduction

A biology investigation usually starts with an observation—that is, something that catches the biologist's attention. For instance, a cancer biologist might notice that a certain kind of cancer can't be treated with chemotherapy and wonder why this is the case. A marine ecologist, seeing that the coral reefs of her field sites are bleaching—turning white—might set out to understand why.

How do biologists follow up on these observations? How can *you* follow up on your own observations of the natural world? In

this article, we'll walk through the **scientific method**, a logical problem-solving approach used by biologists and many other scientists.

The scientific method

At the core of biology and other sciences lies a problem-solving approach called the scientific method. The *scientific method* has five basic steps, plus one feedback step:

1. Make an observation.
2. Ask a question.
3. Form a **hypothesis**, or testable explanation.
4. Make a prediction based on the hypothesis.
5. Test the prediction.
6. Iterate: use the results to make new hypotheses or predictions.

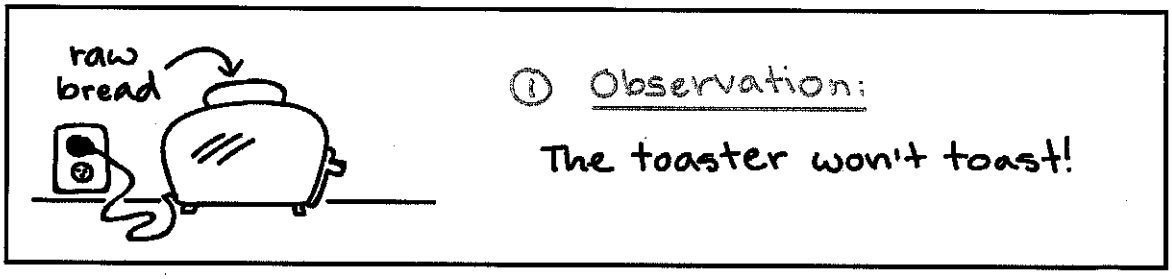
The scientific method is used in all sciences—including chemistry, physics, geology, and psychology. The scientists in these fields ask different questions and perform different tests.

Scientific method example: Failure to toast

Let's build some intuition for the scientific method by applying its steps to a practical problem from everyday life.

1. Make an observation.

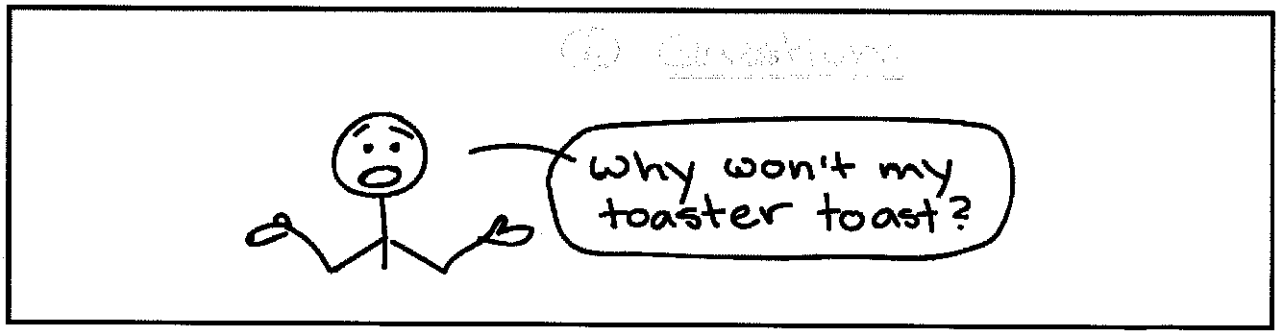
Let's suppose that you get two slices of bread, put them into the toaster, and press the button. However, your bread does not toast.



1. Observation: the toaster won't toast.

2. Ask a question.

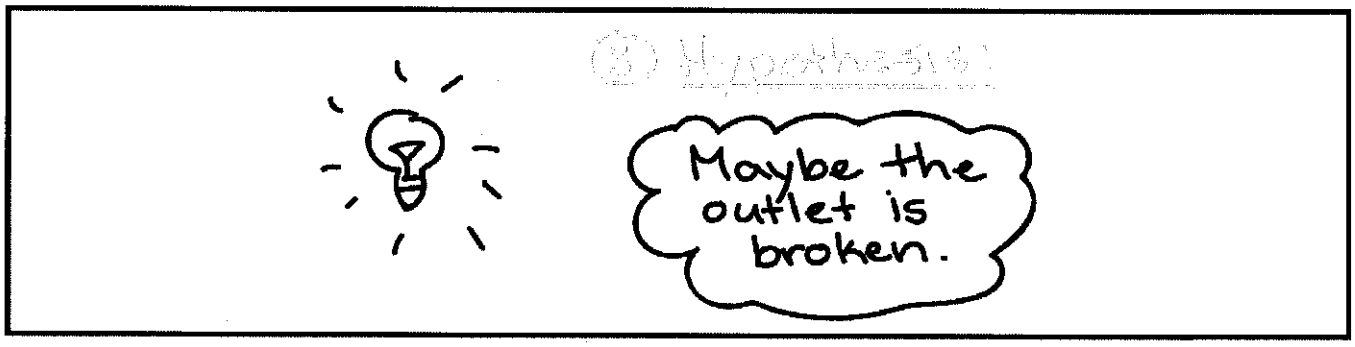
Why didn't my bread get toasted?



2. Question: Why won't my toaster toast?

3. Propose a hypothesis.

A *hypothesis* is a potential answer to the question, one that can somehow be tested. For example, our hypothesis in this case could be that the toast didn't toast because the electrical outlet is broken.



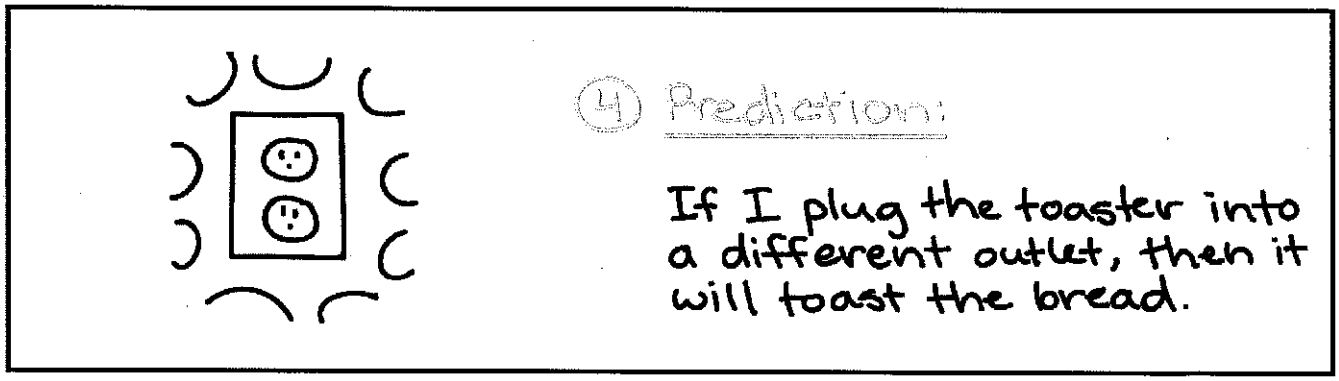
3. Hypothesis: Maybe the outlet is broken.

This hypothesis is not necessarily the right explanation. Instead, it's a possible explanation that we can test to see if it is likely correct, or if we need to make a new hypothesis.

^{1,2}start superscript, 1, comma, 2, end superscript

4. Make predictions.

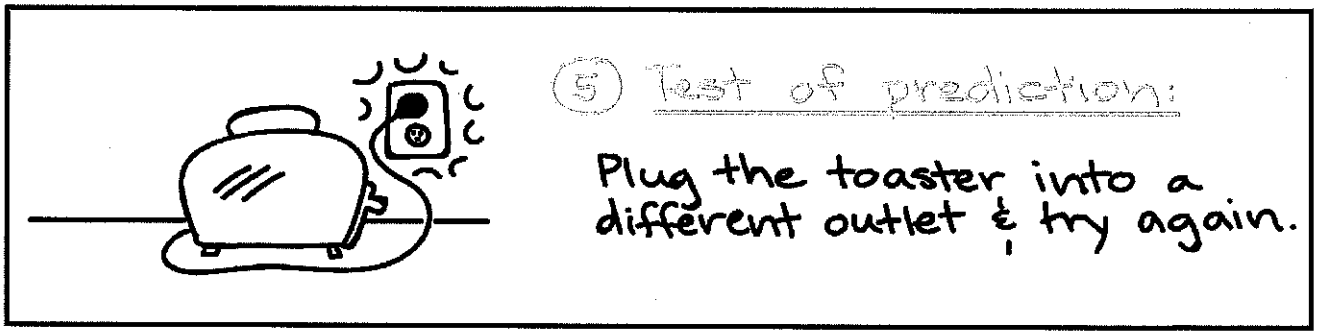
A prediction is an outcome we'd expect to see if the hypothesis is correct. In this case, we might predict that if the electrical outlet is broken, then plugging the toaster into a different outlet should fix the problem.



4. Prediction: If I plug the toaster into a different outlet, then it will toast the bread.

5. Test the predictions.

To test the hypothesis, we need to make an observation or perform an experiment associated with the prediction. For instance, in this case, we would plug the toaster into a different outlet and see if it toasts.



5. Test of prediction: Plug the toaster into a different outlet and try again.

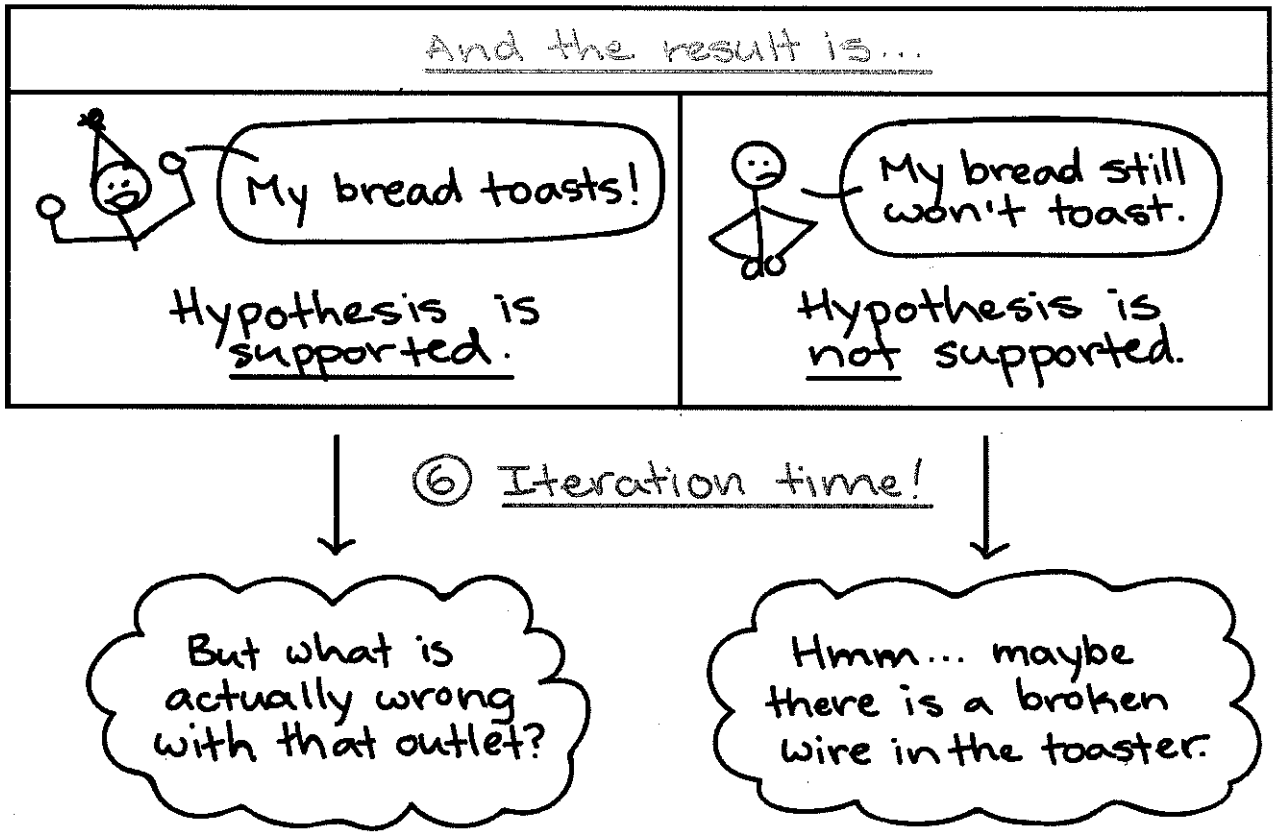
- If the toaster does toast, then the hypothesis is supported—likely correct.
- If the toaster doesn't toast, then the hypothesis is not supported—likely wrong.

The results of a test may either support or contradict—oppose—a hypothesis. Results that support a hypothesis can't conclusively prove that it's correct, but they do mean it's likely to be correct. On the other hand, if results contradict a hypothesis, that hypothesis is probably not correct. Unless there was a flaw in the test—a possibility we should always consider—a contradictory result means that we can discard the hypothesis and look for a new one.

[More about hypotheses, proof, and disproof]

6. Iterate.

The last step of the scientific method is to reflect on our results and use them to guide our next steps.



And the result is:

Left panel: My bread toasts! Hypothesis is supported. Right panel: My bread still won't toast. Hypothesis is not supported.

6. Iteration time!

Left panel (in case of hypothesis being supported): But what is actually wrong with the outlet? Right panel (in case of hypothesis not being supported): Hmm...maybe there is a broken wire in the toaster.

- If the hypothesis was supported, we might do additional tests to confirm it, or revise it to be more specific. For instance, we might investigate why the outlet is broken.

- If the hypothesis was not supported, we would come up with a new hypothesis. For instance, the next hypothesis might be that there's a broken wire in the toaster.

  In most cases, the scientific method is an **iterative** process. In other words, it's a cycle rather than a straight line. The result of one go-round becomes feedback that improves the next round of question asking.

Tuesday-Controlled experiments

How scientists conduct experiments and make observations to test hypotheses.

Introduction

Biologists and other scientists use the scientific method to ask questions about the natural world. The scientific method begins with an observation, which leads the scientist to ask a question. She or he then comes up with a **hypothesis**, a testable explanation that addresses the question.

A hypothesis isn't necessarily right. Instead, it's a "best guess," and the scientist must test it to see if it's actually correct. Scientists test hypotheses by making predictions: if hypothesis \text XXstart text, X, end text is right, then \text YYstart text, Y, end text should be true. Then, they do experiments or make observations to see if the predictions are correct. If they are, the hypothesis is supported. If they aren't, it may be time for a new hypothesis.

How are hypotheses tested?

When possible, scientists test their hypotheses using controlled experiments. A **controlled experiment** is a scientific test done under controlled conditions, meaning that just one (or a few) factors are changed at a time, while all others are kept constant. We'll look closely at controlled experiments in the next section.

In some cases, there is no good way to test a hypothesis using a controlled experiment (for practical or ethical reasons). In that case, a scientist may test a hypothesis by making predictions about patterns that should be seen in nature if the hypothesis is correct. Then, she or he can collect data to see if the pattern is actually there.

Controlled experiments

What are the key ingredients of a controlled experiment? To illustrate, let's consider a simple (even silly) example.

Suppose I decide to grow bean sprouts in my kitchen, near the window. I put bean seeds in a pot with soil, set them on the windowsill, and wait for them to sprout. However, after several weeks, I have no sprouts. Why not? Well...it turns out I forgot to water the seeds. So, I hypothesize that they didn't sprout due to lack of water.

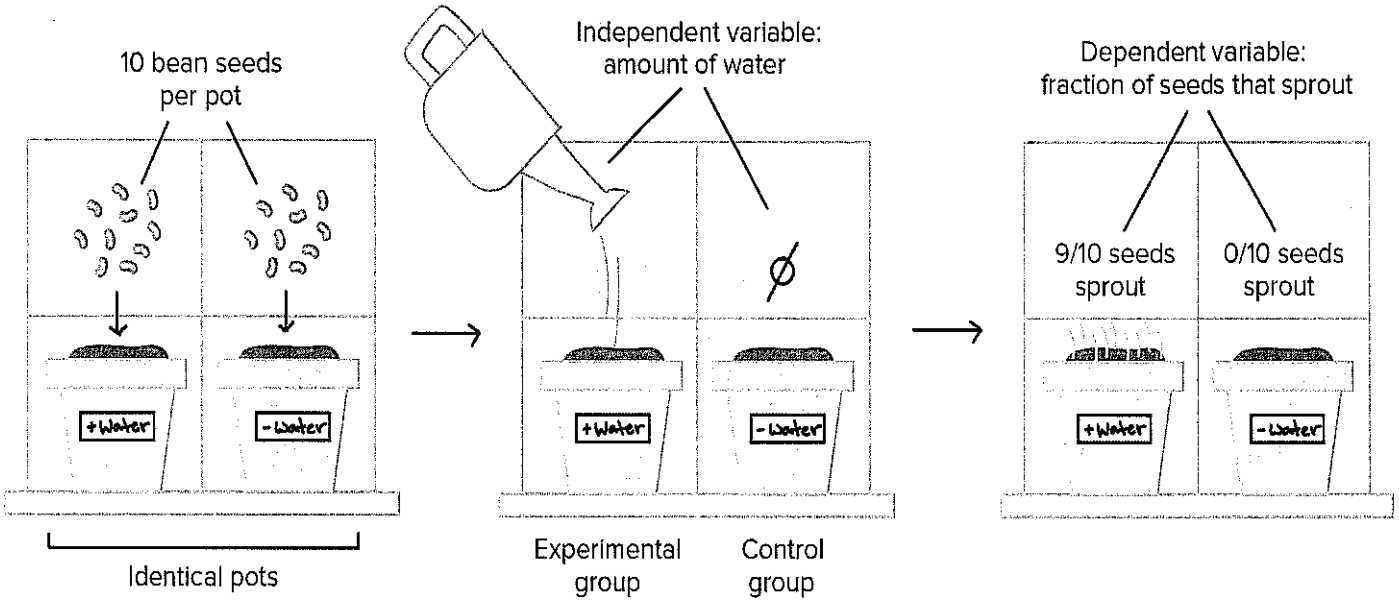
Wednesday-Let's see how this simple example illustrates the parts of a controlled experiment.

To test my hypothesis, I do a controlled experiment. In this experiment, I set up two identical pots. Both contain ten bean seeds planted in the same type of soil, and both are placed in the same window. In fact, there is only one thing that I do differently to the two pots:

- One pot of seeds gets watered every afternoon.
- The other pot of seeds doesn't get any water at all.

After a week, nine out of ten seeds in the watered pot have sprouted, while none of the seeds in the dry pot have sprouted. It looks like the "seeds need water" hypothesis is probably correct!

Let's see how this simple example illustrates the parts of a controlled experiment.



Panel 1: Two identical pots are prepared. 10 bean seeds are added to each pot. The pots are placed near the window.

Panel 2: One pot (experimental group) is watered. The other pot (control group) is not watered. The independent variable is the amount of water given.

Panel 3: In the experimental (watered) pot, 9/10 seed sprout. In the control (unwatered) pot, 0/10 seeds sprout. The fraction of seeds that sprout is the dependent variable.

Control and experimental groups

There are two groups in the experiment, and they are identical except that one receives a treatment (water) while the other does not. The group that receives the treatment in an experiment (here, the watered pot) is called the **experimental group**, while the group that does not receive the treatment (here, the dry pot) is called the **control group**. The control group provides a baseline that lets us see if the treatment has an effect.

Thursday-Independent and dependent variables

The factor that is different between the control and experimental groups (in this case, the amount of water) is known as the **independent variable**. This variable is independent because it does not depend on what happens in the experiment. Instead, it is something that the experimenter applies or chooses him/herself.

[Is there always one independent variable and one dependent variable?]

In contrast, the **dependent variable** in an experiment is the response that's measured to see if the treatment had an effect. In this case, the fraction of bean seeds that sprouted is the dependent variable. The dependent variable (fraction of seeds sprouting) *depends* on the independent variable (the amount of water), and not vice versa.

Experimental **data** (singular: *datum*) are observations made during the experiment. In this case, the data we collected were the number of bean sprouts in each pot after a week.

Variability and repetition

Out of the ten watered bean seeds, only nine came up. What happened to the tenth seed? That seed may have been dead, unhealthy, or just slow to sprout. Especially in biology (which studies complex, living things), there is often variation in the material used for an experiment – here, the bean seeds – that the experimenter cannot see.

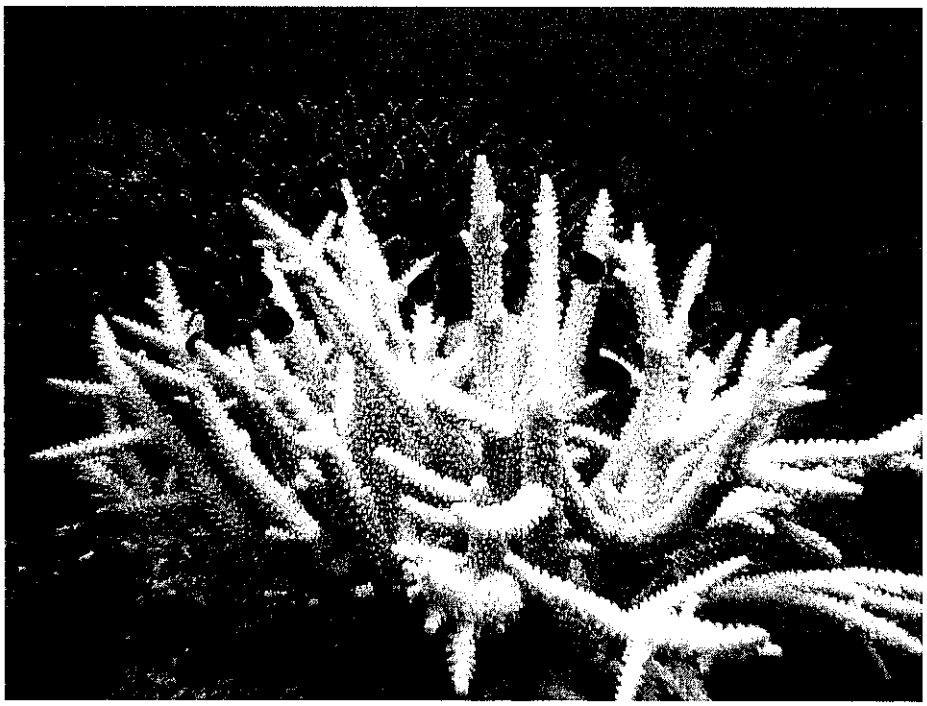
Because of this potential for variation, biology experiments need to have a large sample size and, ideally, be repeated several times. **Sample size** refers to the number of individual items tested in

an experiment – in this case, 101010 bean seeds per group. Having more samples and repeating the experiment more times makes it less likely that we will reach a wrong conclusion because of random variation.

Biologists and other scientists also use statistical tests to help them distinguish real differences from differences due to random variation (e.g., when comparing experimental and control groups).

Controlled experiment case study: \text{CO}_2CO2start text, C, O, end text, start subscript, 2, end subscript and coral bleaching

As a more realistic example of a controlled experiment, let's examine a recent study on coral bleaching. Corals normally have tiny photosynthetic organisms living inside of them, and bleaching happens when they leave the coral, typically due to environmental stress. The photo below shows a bleached coral in front and a healthy coral in back.



Photograph showing a bleached, white coral in the foreground and a healthy, brownish coral in the background.

Image credit: "Keppelbleaching" (CC BY 3.0).

A lot of research on the cause of bleaching has focused on water temperature^1$_1$start superscript, 1, end superscript. However, a team of Australian researchers hypothesized that other factors might be important too. Specifically, they tested the hypothesis that high \text{CO}_2CO$_2$start text, C, O, end text, start subscript, 2, end subscript levels, which make ocean waters more acidic, might also promote bleaching^2$_2$squared.

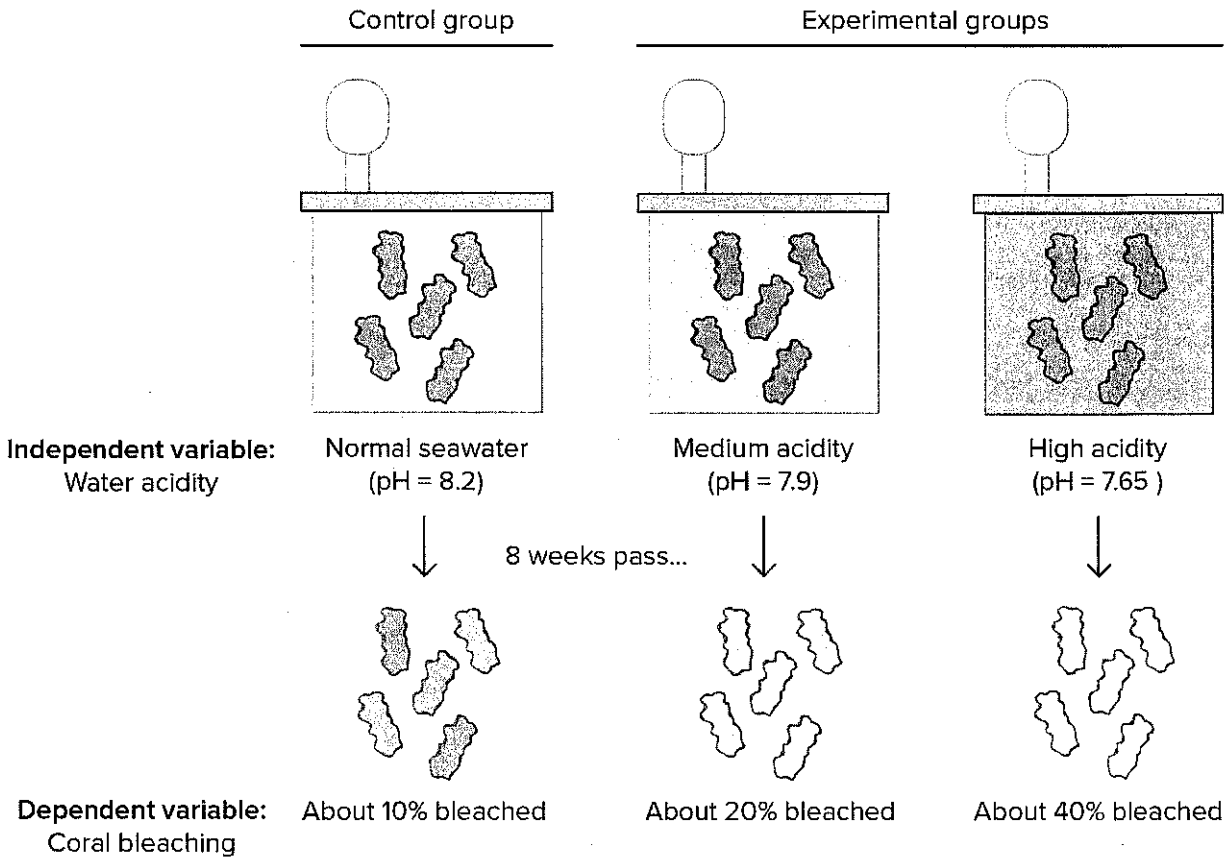
What kind of experiment would *you* do to test this hypothesis? Think about:

- What your control and experimental groups would be
- What your independent and dependent variables would be
- What results you would predict in each group

Have you given it a try?
[See what the Australian scientists did]

\text{pH}start text, p, H, end text

- \text {pH}start text, p, H, end text8.28, point, 2
- \text{CO}_2start text, C, O, end text, start subscript, 2, end subscript\text{pH}start text, p, H, end text7.97, point, 9\text {pH}start text, p, H, end text7.657, point, 65
- \text{pH}start text, p, H, end text
- 5555



Experimental setup to test effects of water acidity on coral bleaching.

Control group: Coral fragments are placed in a tank of normal seawater (pH 8.2).

Experimental group 1: Coral fragments are placed in a tank of slightly acidified seawater (pH 7.9).

Experimental group 2: Coral fragments are placed in a tank of more strongly acidified seawater (pH 7.65).

The water acidity is the independent variable.

8 weeks are allowed to pass for each of the tanks...

Control group: Corals are about 10% bleached on average.

Experimental group 1 (medium acidity): Corals are about 20% bleached on average.

Experimental group 2 (higher acidity): Corals are about 40% bleached on average.

Degree of coral bleaching is the dependent variable.

\text {pH}start text, p, H, end text\text {pH}start text, p, H, end text7.07, point, 0

20\%20, percent40\%40, percent10\%10, percent

Friday-Non-experimental hypothesis tests

Some types of hypotheses can't be tested in controlled experiments for ethical or practical reasons. For example, a hypothesis about viral infection can't be tested by dividing healthy people into two groups and infecting one group: infecting healthy people would not be safe or ethical. Similarly, an ecologist studying the effects of rainfall can't make it rain in one part of a continent, while keeping another part dry as a control.

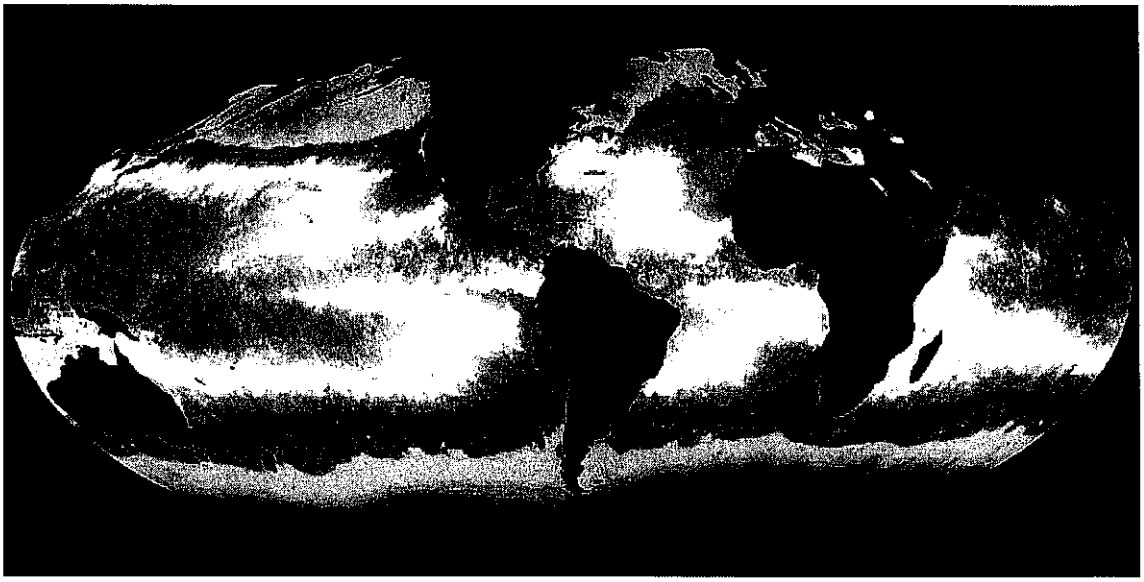
In situations like these, biologists may use non-experimental forms of hypothesis testing. In a non-experimental hypothesis test, a researcher predicts observations or patterns that should be seen in nature if the hypothesis is correct. She or he then collects and analyzes data, seeing whether the patterns are actually present.

Case study: Coral bleaching and temperature

A good example of hypothesis testing based on observation comes from early studies of coral bleaching. As mentioned above, bleaching is when corals lose the photosynthetic microorganisms that live inside of them, which makes them turn white. Researchers suspected that high water temperature might cause bleaching, and they tested this hypothesis experimentally on a small scale (using isolated coral fragments in tanks)^{3,4}_{3,4}start superscript, 3, comma, 4, end superscript.

What ecologists most wanted to know, however, was whether water temperature was causing bleaching for lots of different coral species in

their natural setting. This broader question could not be answered experimentally, as it wouldn't be ethical (or even possible) to artificially change the water temperature surrounding entire coral reefs.



False-colored map representing sea surface temperatures around the globe as different colors. Warmers colors, mostly near the equator, represent hotter temperatures, while cooler colors, mostly near the poles, represent cooler temperatures.

Image credit: "Global sea surface temperature," by NASA (public domain).

Instead, to test the hypothesis that natural bleaching events were caused by increases in water temperature, a team of researchers wrote a computer program to predict bleaching events based on real-time water temperature data. For example, this program would generally predict bleaching for a particular reef when the water temperature in the reef's area exceeded its average monthly maximum by 111 ^\circ \text C Cdegrees, start text, C, end text or more^{1}1start superscript, 1, end superscript.

The computer program was able to predict many bleaching events weeks or even months before they were reported, including a large

bleaching event in the Great Barrier Reef in 1998^{1}_1start superscript, 1, end superscript. The fact that a temperature-based model could predict bleaching events supported the hypothesis that high water temperature causes bleaching in naturally occurring coral reefs.

Make TV Time Thinking Time!

Note to Parents: This is a set of questions based on NWEA skills. You can talk about these questions during the commercial--just mute the sound!

For any story you read or see on TV, here are the questions you can think about.

Think it Through!

- Who is an **important character** in the story?
  What is one of that character's **traits**?
  Why do you think that? How do the character's actions show that trait?

- What is a **choice** that character makes?
  The reason someone does something is called **motive.**
  What was the character's motive--why did that character make that choice?
  What happened because the character made that choice?

- What is something important that happens--an **event** in the story.
  What is an important event in the story?
  What **caused** it?
  What **effects** did it have?

- Every story has a **theme**, a big idea that you can learn by thinking about what happens in the story. What is the theme of the story?
  Why do you think that?

Think More

Plan the sequel—tell what will happen next.