

Science in the Ancient World

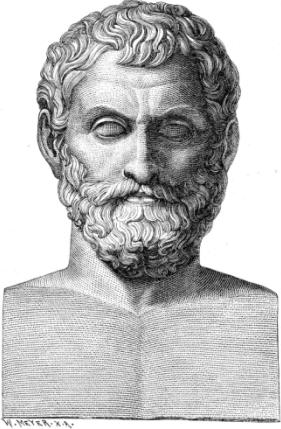
*Lab and Review
Book*

*LEVEL 2
(oldest students)*

Property of:

Lesson 1

Who is Thales and why did he go to Egypt?



Experiment Information

DATA:

Length of the ruler's shadow: _____

Length of the ruler: _____

Length of my shadow: _____

My height: _____

Length of tree's shadow: _____

Factor= length of ruler/length of shadow= _____

My calculated height=length of my shadow x Factor= _____

My actual height: _____ Are these numbers close? _____

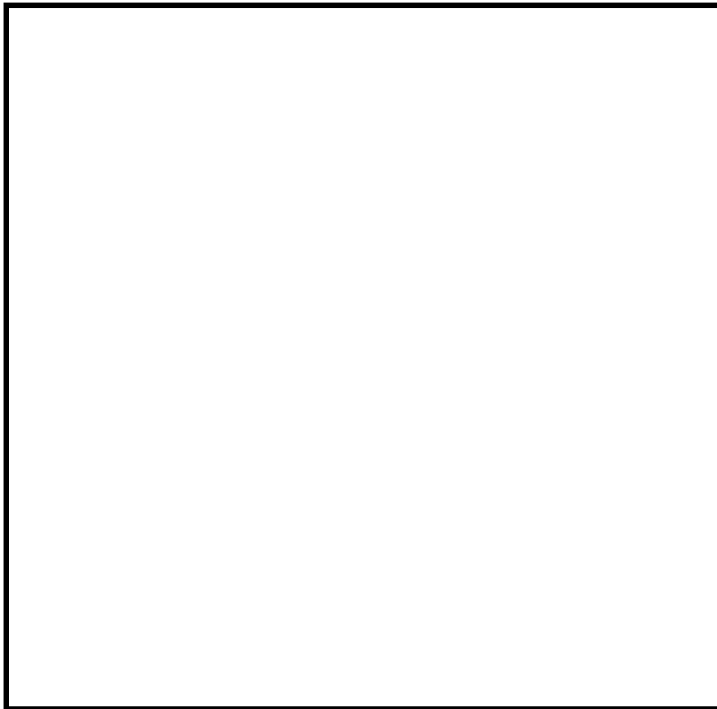
Tree's calculated height=length of tree's shadow x factor= _____

Lesson 2

In lesson 1, we measured the height of a tree. What did Thales measure?

What is one of the chemicals made when wax is burned?

Draw a picture of the experiment you did



Explain what happened in the experiment:

What other chemical (besides water) is made when wax is burned? Why didn't you see it in the experiment?

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Level 2

Lesson 3



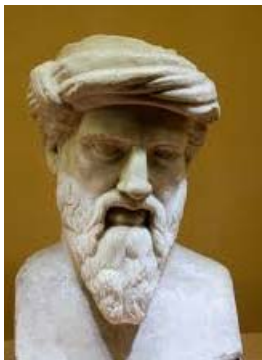
What does the word pitch mean when it comes to music?

Write (in order of their pitch) the seven letters that are used to identify the basic musical notes

MUSICAL NOTES: _____

What is an octave?

Explain what happened in the experiment:



What did Pythagoras figure out about the length of a musical string and the octave?

Pythagoras

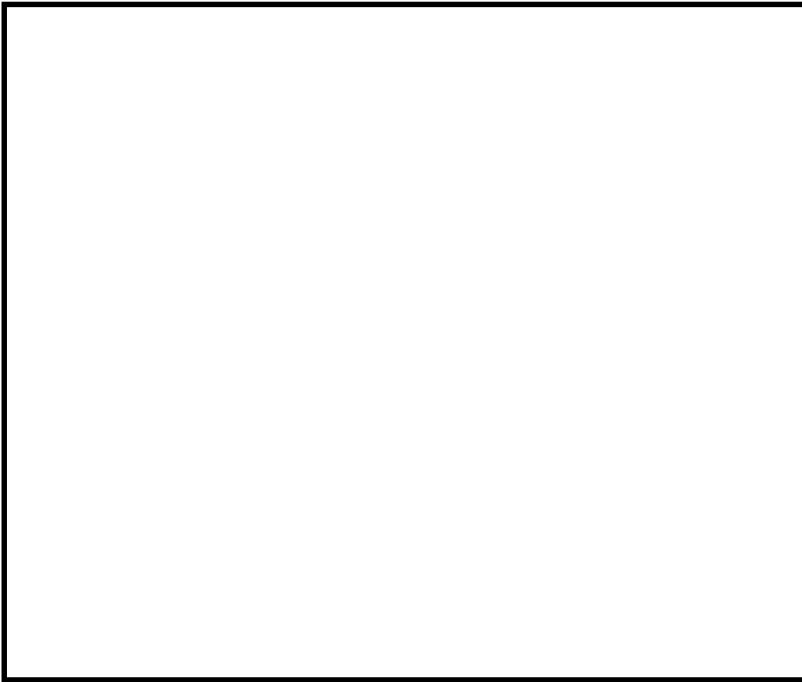
Section 1: Science Before Christ, Part 1

Level 2

Lesson 4

Fill in the blanks: The clumps of air in a sound wave are called _____, and the areas of spread-out air are called _____.

Draw a picture of a sound wave, labelling the crests and troughs



What is frequency?

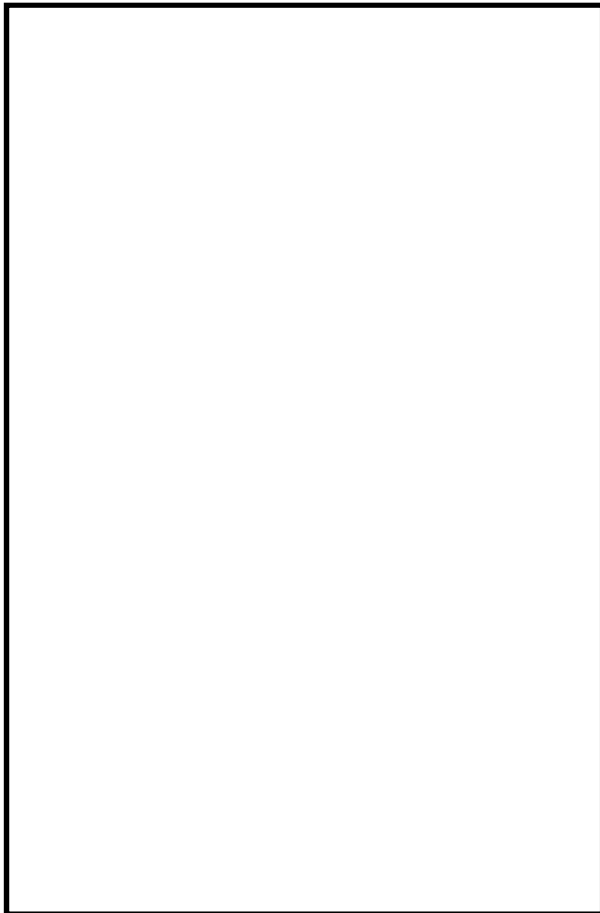
How does frequency relate to pitch?

How does the amount of air in the crests relate to volume?

Why do you take a deep breath before shouting really loudly?

Lesson 5

Draw a picture like the one on page 14



How does a vibrating string make a sound wave?

Fill in the blanks: The faster the string vibrates, the _____ the pitch. The longer the distance over which it vibrates, the _____ the volume.

On Your Own: If you can, peek inside a piano. What do you see? What happens on the inside when you press a key?

A piano is a _____ instrument.



What is another property of a string that affects how quickly it vibrates? (Hint: Think about how a stringed instrument is tuned.)

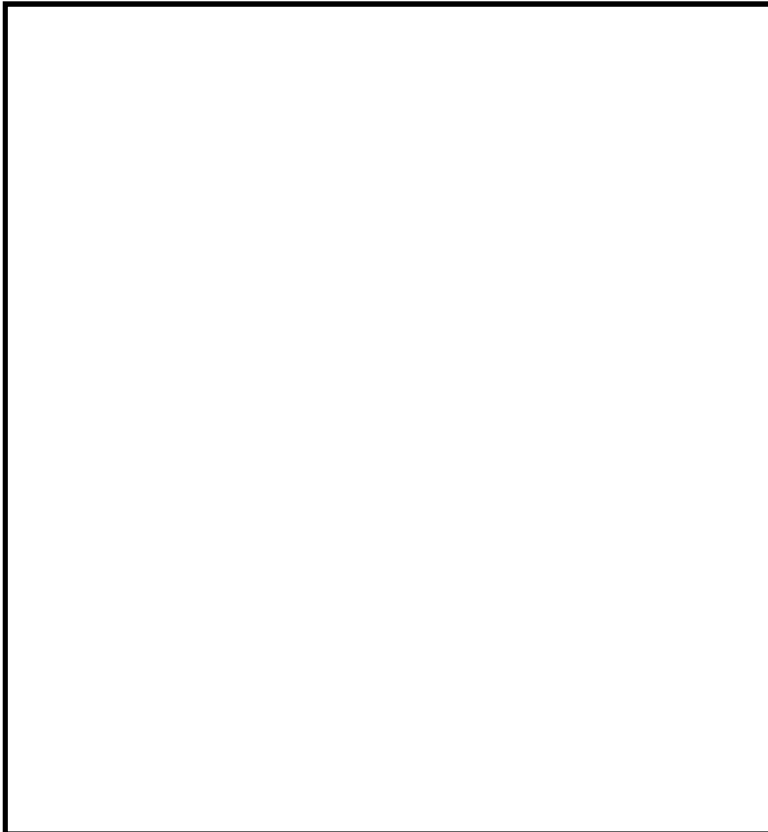
Section 1: Science Before Christ, Part 1

Level 2

Lesson 6

Why do scientists think that atoms are real, even though we can't see them?

Make a pointillist drawing or paste one here



How does a pointillist drawing illustrate the concept of atoms?

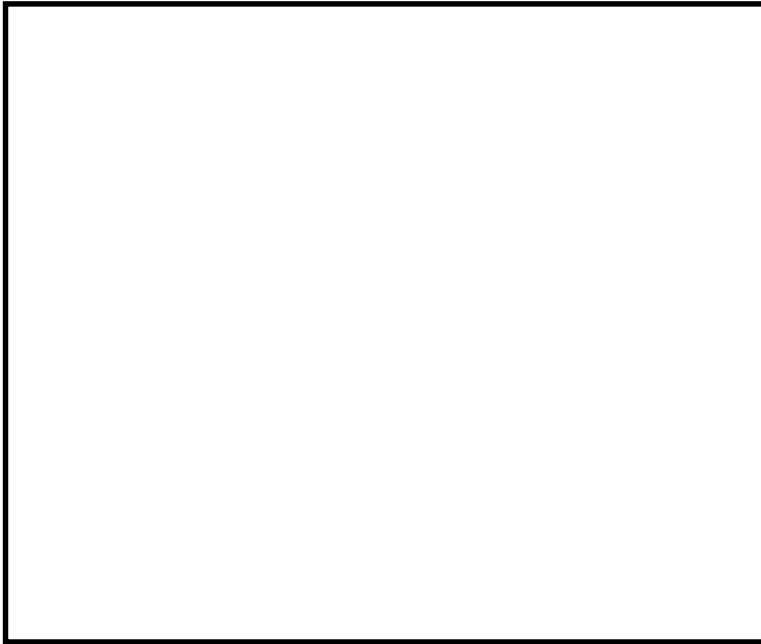
If a printer makes a picture using 300 dots per inch, what is the widest each dot can be?

Section 1: Science Before Christ, Part 1

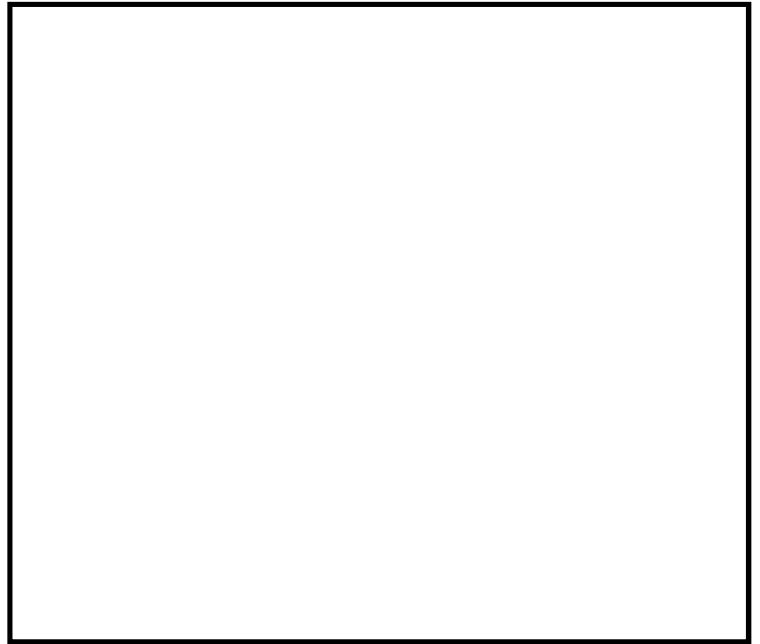
Level 2

Lesson 7

First Experiment Drawing



Second Experiment Drawing



What made the foam in the experiment?

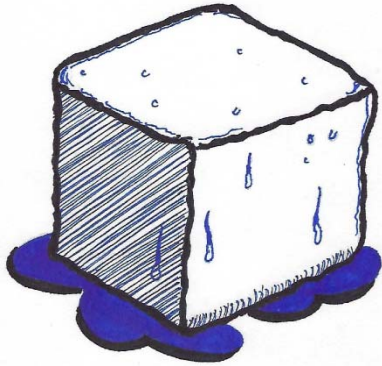
Explain the difference between atoms and molecules.

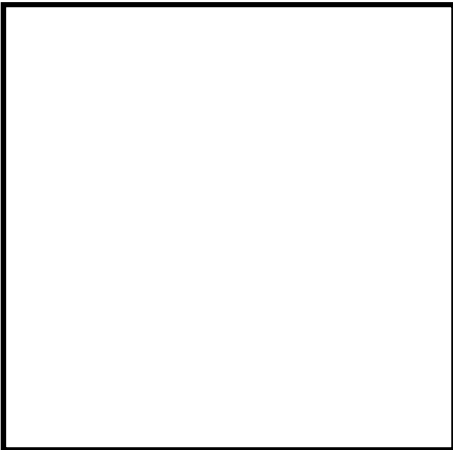
What does “indivisible” mean? Are atoms indivisible?

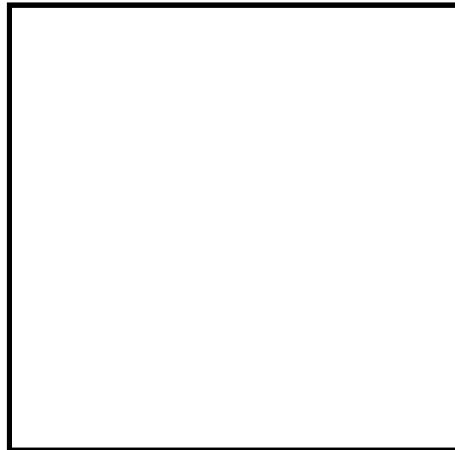
A thought to remember from your book: *Scientists believed a wrong idea about atoms for nearly 2000 years. Even incorrect ideas can eventually lead scientist to correct ideas!*

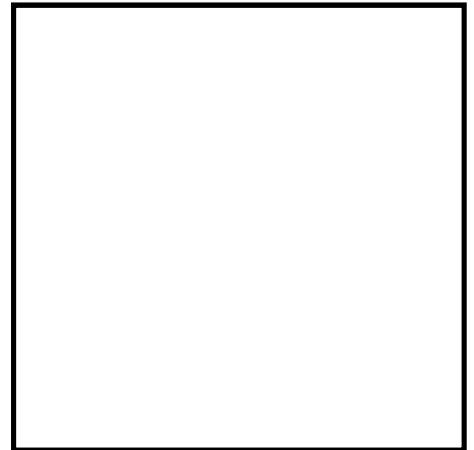
Lesson 8

The drawings below show water in its three phases. Below each drawing, write the name of the phase, and then below that, draw a picture that illustrates what its molecules look like, as shown on page 24.









Why does increasing the temperature of something change it from solid to liquid to gas?

Section 1: Science Before Christ, Part 1

Level 2

Lesson 9

Draw the atoms indicated below, and below the drawing, write down the number of protons, neutrons, and electrons in each.

Hydrogen

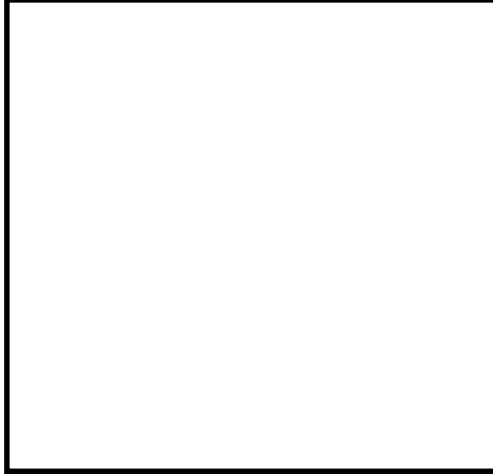


protons _____

neutrons _____

electrons _____

Helium

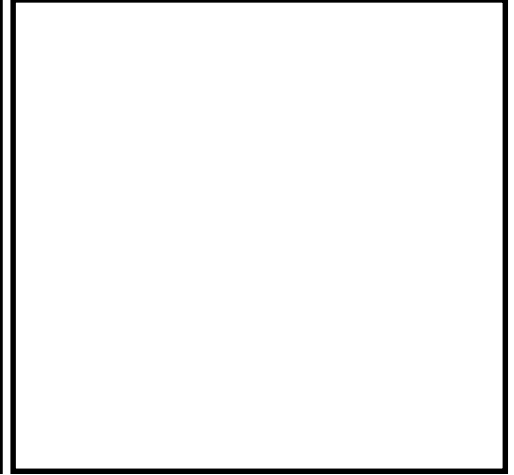


protons _____

neutrons _____

electrons _____

Carbon



protons _____

neutrons _____

electrons _____

Why can't all six electrons in the carbon atom fit in the first circle?

Draw the two carbon ions you made, indicating the charge of each.

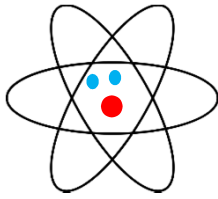


Section 1: Science Before Christ, Part 1

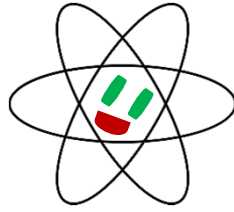
Level 2

Lesson 10

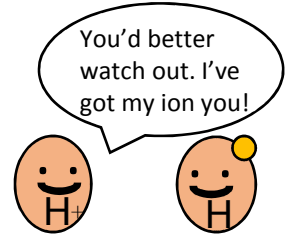
You've lost an electron! Are you okay?



©Lisa Van Weelden, 2016



I'm Positive!



©Lisa Van Weelden, 2016

Why did the pennies in the experiment get shiny?

Why did the part of the nail that soaked in solution look like copper?

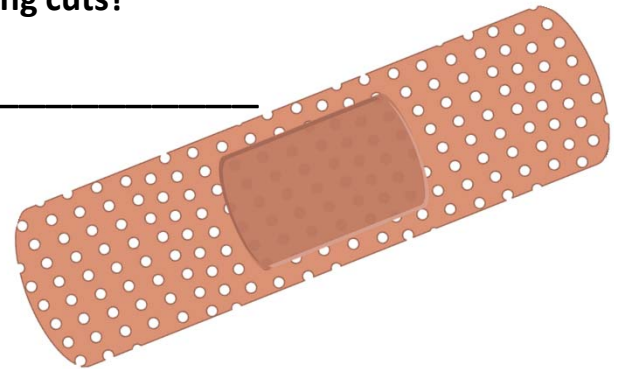
Suppose you have negative ions in a solution of water. What would you need to do to make them come out of the solution as atoms?

What is the Hippocratic oath?

Who is thought to have written it?

Why does rest help a sick person get better?

Why can bandages sprinkled with alcohol be good for healing cuts?



Find the Hippocratic Oath and read it. What are your thoughts on what it means?

Section 1: Science Before Christ, Part 1

Level 2

Lesson 12

What vessels carry blood away from the heart? _____

What vessels carry blood towards the heart? _____



Write a story about a drop of blood traveling through the body:

5. **Why do arteries get smaller the farther they are from the heart?**

Section 1: Science Before Christ, Part 1

Level 2

Lesson 13

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 1: Science Before Christ, Part 1

Level 2

Lesson 14

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 1: Science Before Christ, Part 1

Level 2

Lesson 15

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 16

Do this Math Exercise with your parent (it's okay if your mom or dad needs to use a calculator):

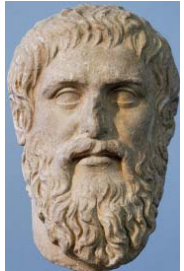
Starting with any number, the answer is 5!

- I. Choose any number (not 0). It can be small if you want the math to be easy or it can be large if you want to test how well this works. My number is _____.
- II. Multiply that number by itself. The answer is _____.
- III. Add the number you chose (step 1) to the result of step 2. The result is _____.
- IV. Divide the result of step 3 by the number you chose (step 1). The result is _____.
- V. Add 24 to the result of step 4. The result is _____.
- VI. Subtract the number you chose from the result of step 5. The result is _____.
- VII. Now divide by 5. The result is _____. I told you!!

Is this a trick or is it always true? _____

Did Plato think that mathematics was discovered (something that existed and man figured out) or invented (made like a lego creation or a blanket fort)? _____

How does Plato's idea about mathematics fit with a Christian point of view?



Can you understand the explanation of why this works? If so, try to explain it yourself.

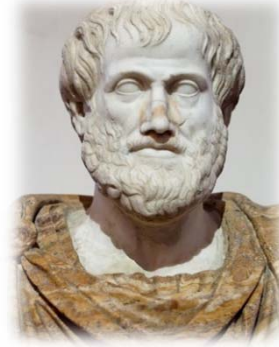
Section 2: Science Before Christ, Part 2

Level 2

Lesson 17

In the spaces below, write down the five elements Aristotle thought existed in nature and where they each belong.

Element 1: _____ Where it belongs: _____
Element 2: _____ Where it belongs: _____
Element 3: _____ Where it belongs: _____
Element 4: _____ Where it belongs: _____
Element 3: _____ Where it belongs: _____



*"We are what we repeatedly do; excellence then, is not an act but a habit."
~Aristotle*

How did Aristotle use the things you wrote above to explain motion?

How does your experiment show that Aristotle wasn't correct?



Check to see if your home has a fire extinguisher. Read the label and see what is in it. Is it a carbon dioxide fire extinguisher? Read what kinds of fires it can be used on. Do not play with it! Fire extinguishers can be dangerous if you don't use them correctly!

Why does a feather fall more slowly than a rock?

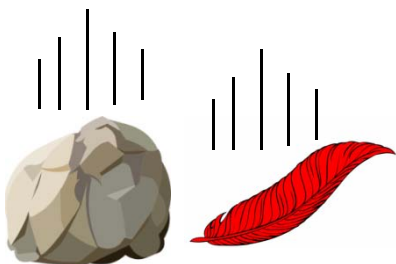


The next time you're in the bathtub, move your hand through the water with your palm facing the bottom of the tub. Then rotate your hand so that your palm is facing the side of the tub. Which one was easier to move through the water? That's because of water resistance—which is a lot like air resistance.

How did Aristotle think the weight of an object affects the speed at which it falls?

How does your experiment show that Aristotle wasn't correct.

If you dropped a rock and a feather in a tall container that had no air, would the rock hit the bottom of the container first?

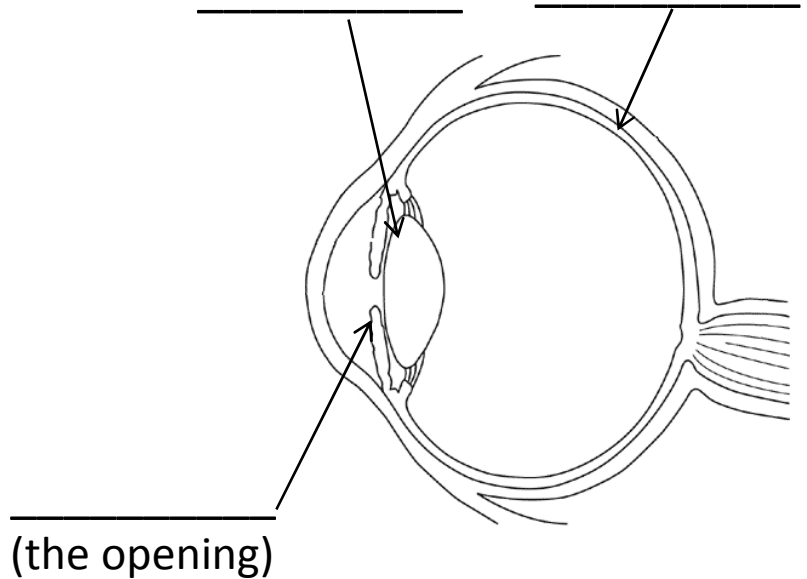


Section 2: Science Before Christ, Part 2

Level 2

Lesson 19

In the sketch below, draw two lines that represent light. One should come from the top of the tree and pass through the pupil to hit the retina. The other should come from the bottom of the tree and pass through the pupil to hit the retina. See page 57 for guidance.



Even though things appear on your retina upside down, you don't see the world upside down. Why?

How important would the towel in your experiment be on a sunny day?

How important would the towel in your experiment be on a cloudy day?

My Classification of Animals

List the two groups you decided to use in the activity, and below each group, list the specific animals you put there:

Group 1:

Group 2:

What do we call it when scientists put living things into different groups?

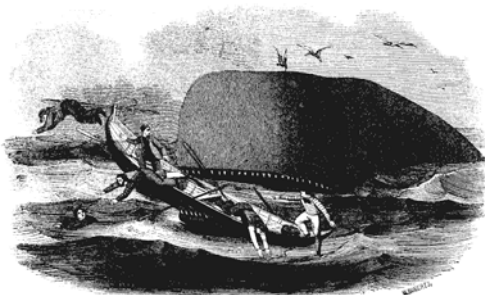
The two basic groups that Aristotle split animals into were:

_____ and _____

What is right and what is wrong about Aristotle's groups?

The two basic groups that modern scientists recognize are:

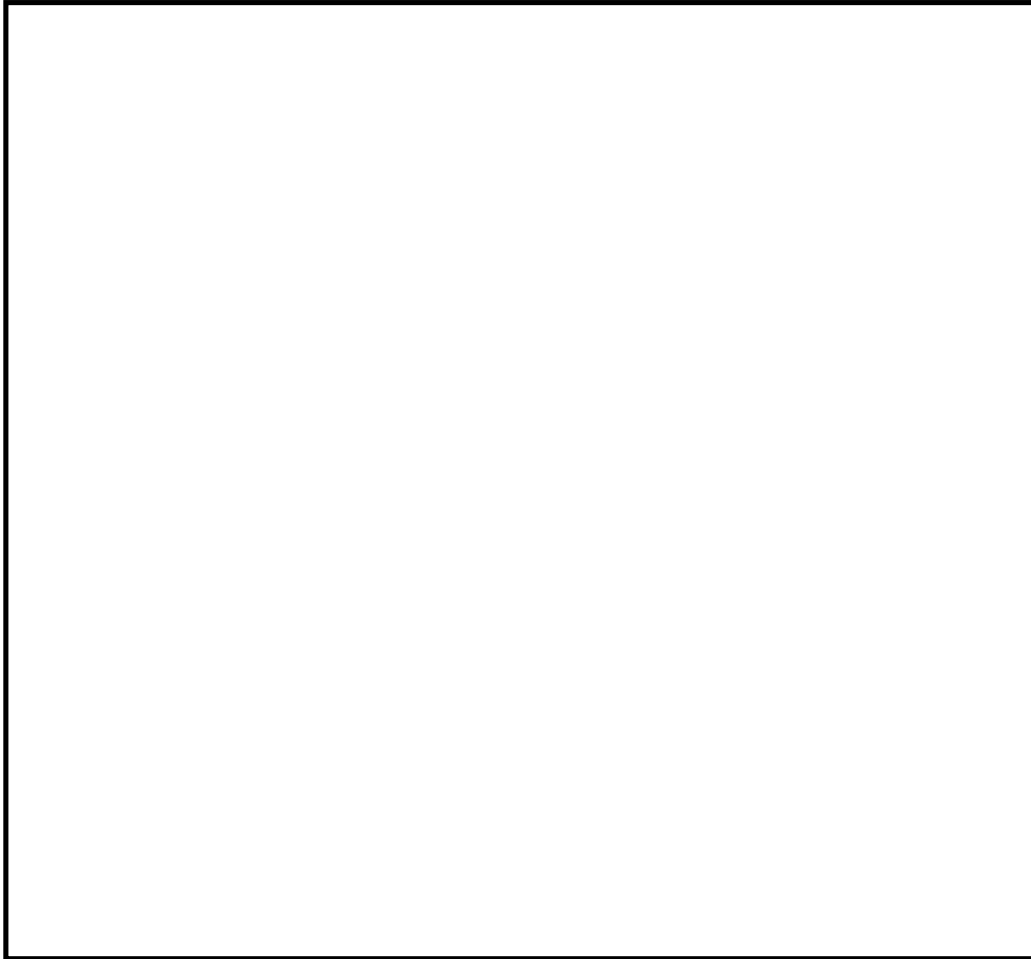
_____ and _____



Moby Dick was a _____ whale

Lesson 21

Draw Aristotle's View of the Universe



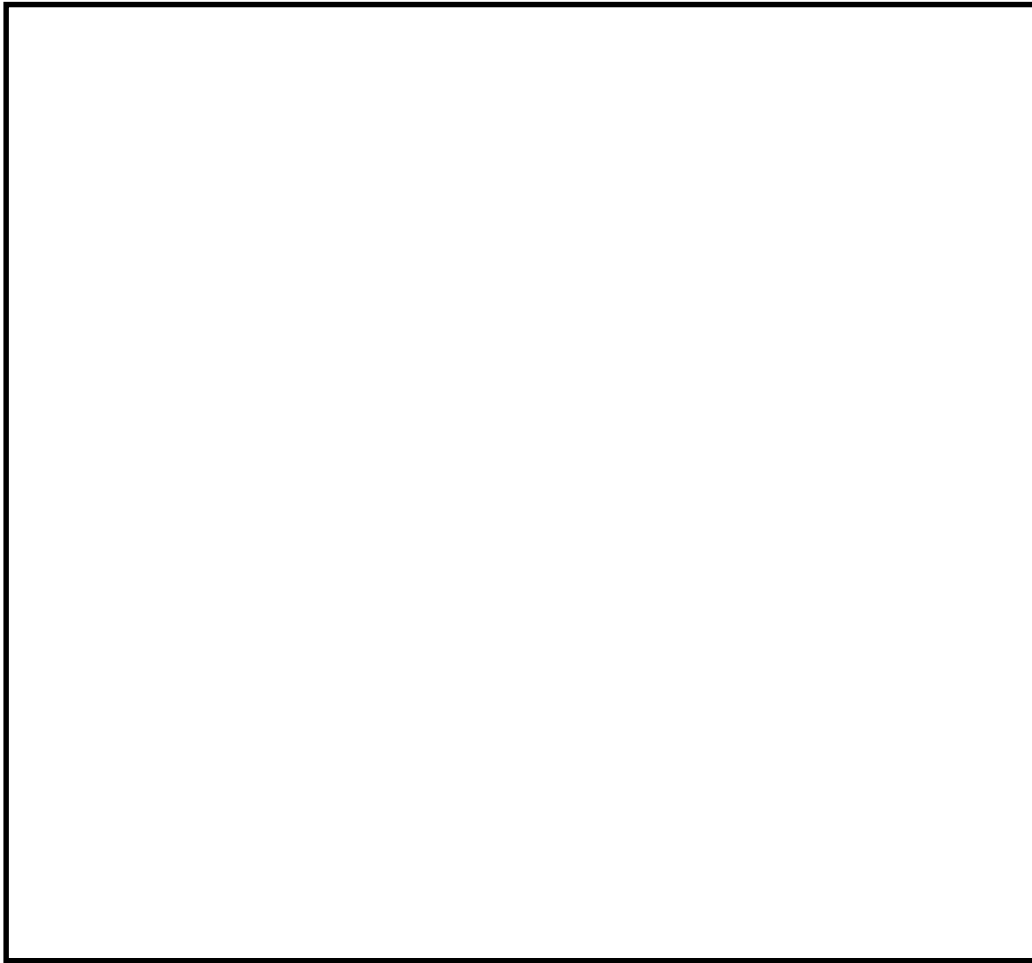
Why is it called a geocentric view?

Why did the spheres in Aristotle's universe spin?

If two different planets attached to two different spheres returned to their original position in the same amount of time, do their spheres spin at the same speed?

1. "Helios" means _____.
2. So, "Heliocentric" means _____.

Draw Aristarchus's View of the Universe



3. Why is this called a heliocentric view?

4. Which is correct – geocentric or heliocentric? _____

5. What is still wrong with the drawing above?

Lesson 23

Write the Law of Reflection:

The bar on the left is the mirror in your experiment. Draw a line coming from the flashlight, hitting the mirror, and reflecting. Use curves to represent angles (see page 68), and indicate what angles are equal.



If a beam of light hits a mirror at an angle of 35 degrees , what will be the angle of reflection?

A sheet of paper is bumpy and rough under a microscope. Will the Law of Reflection work when light reflects off paper? Why or why not?

Archimedes's Principle says:



Alrindi 1999
https://commons.wikimedia.org/wiki/File:Eureka_arkimedi.jpg

How much water does an object displace when it goes under?

First Experiment Drawing

Second Experiment Drawing

How does Archimedes's Principle explain the experiment?

A 150-pound object is underwater. It displaces 145 pounds of water. If you lift it, how much will it feel like it weighs?

Section 2: Science Before Christ, Part 2

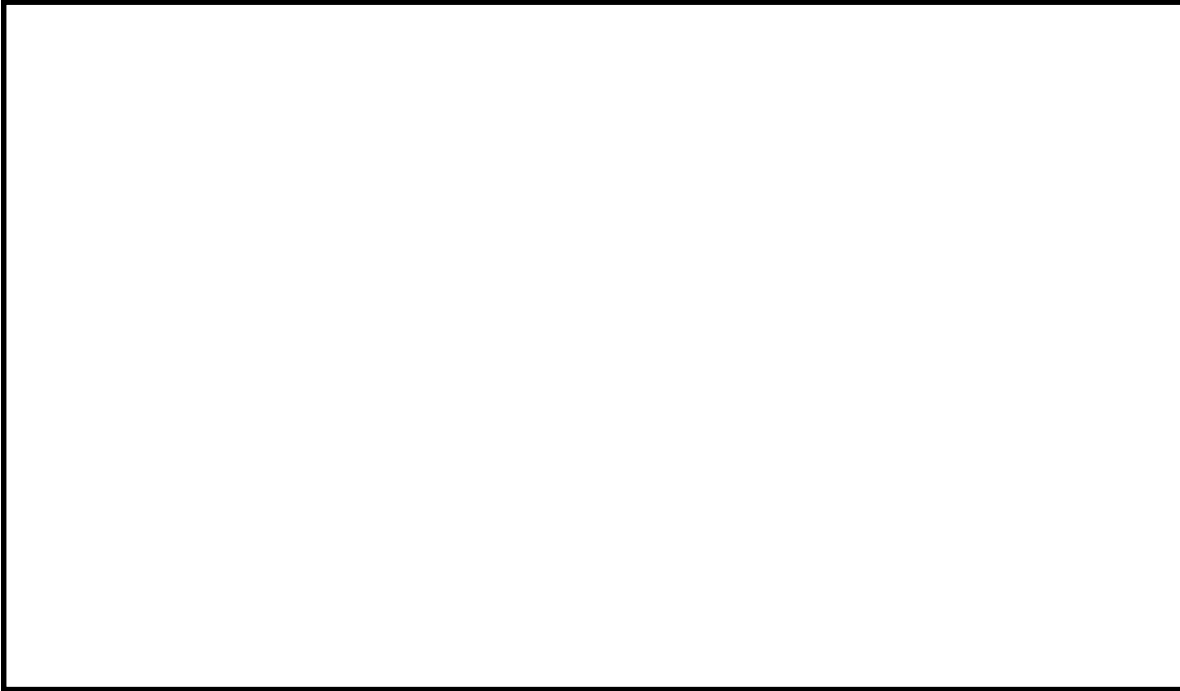
Level 2

Lesson 25

In order to make a lever, you need a _____ and a _____.

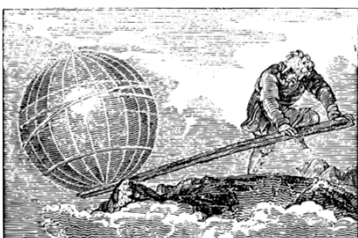
If you want to lift something heavy, should the fulcrum be close to what you are trying to lift or far away? _____

Draw A Lever and Label Its Two Parts



When using a lever to lift a heavy object, what is the relationship between the distance you need to push the lever and the distance the object moves?

Compare the energy needed to move an object with your hand and with a lever.



Archimedes said, "Give me a lever and a place to stand and I will move the earth". Sometimes we can solve the most difficult problems with simple solutions. Think about how this principle might work in your life.

Section 2: Science Before Christ, Part 2

Level 2

Lesson 26

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Section 2: Science Before Christ, Part 2

Level 2

Lesson 27

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 28

What is the proper scientific and mathematical term for a ball?

What is the circumference of a sphere?

Tell Your Own Story About How Eratosthenes Measured the Circumference of the Earth

There are many who think that ancient people believed the earth is flat. That's just not true. The ancients understood it is a sphere, which is why Eratosthenes wanted to measure its circumference. If you were taught that people opposed Columbus because they thought the earth is flat, that's wrong, too!

How was your device a way of measuring the size of a distance object?

How did Hipparchus show that the moon doesn't change in the sky very much.

Draw the moon's orbit and compare it to a circle



Define the following terms:

Apogee - _____

Perigee - _____



G.Gillet/ESO
https://commons.wikimedia.org/wiki/File:Moonsset_over_ESO%27s_Very_Large_Telescope.jpg

Section 2: Science Before Christ, Part 2

Level 2

Lesson 30

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 31

Construct a timeline according to the activity's directions:



Once you have read the lesson, fix your labels if they aren't correct.

What does AD stand for?

In our calendar, what year comes right after 1 BC?

Suppose Christ was born in 4 BC, as most historians suggest. Luke 3:23 says that He was about 30 years old when he was baptized. Assume he was exactly 30 years old and his birthday had already passed. In what year AD was he baptized?

Section 3: Science Soon After Christ

Level 2

Lesson 32

Why did Dioscorides test everything he used instead of accepting the word of someone else?

What did you do in your experiment?

Which glass had an interesting result?

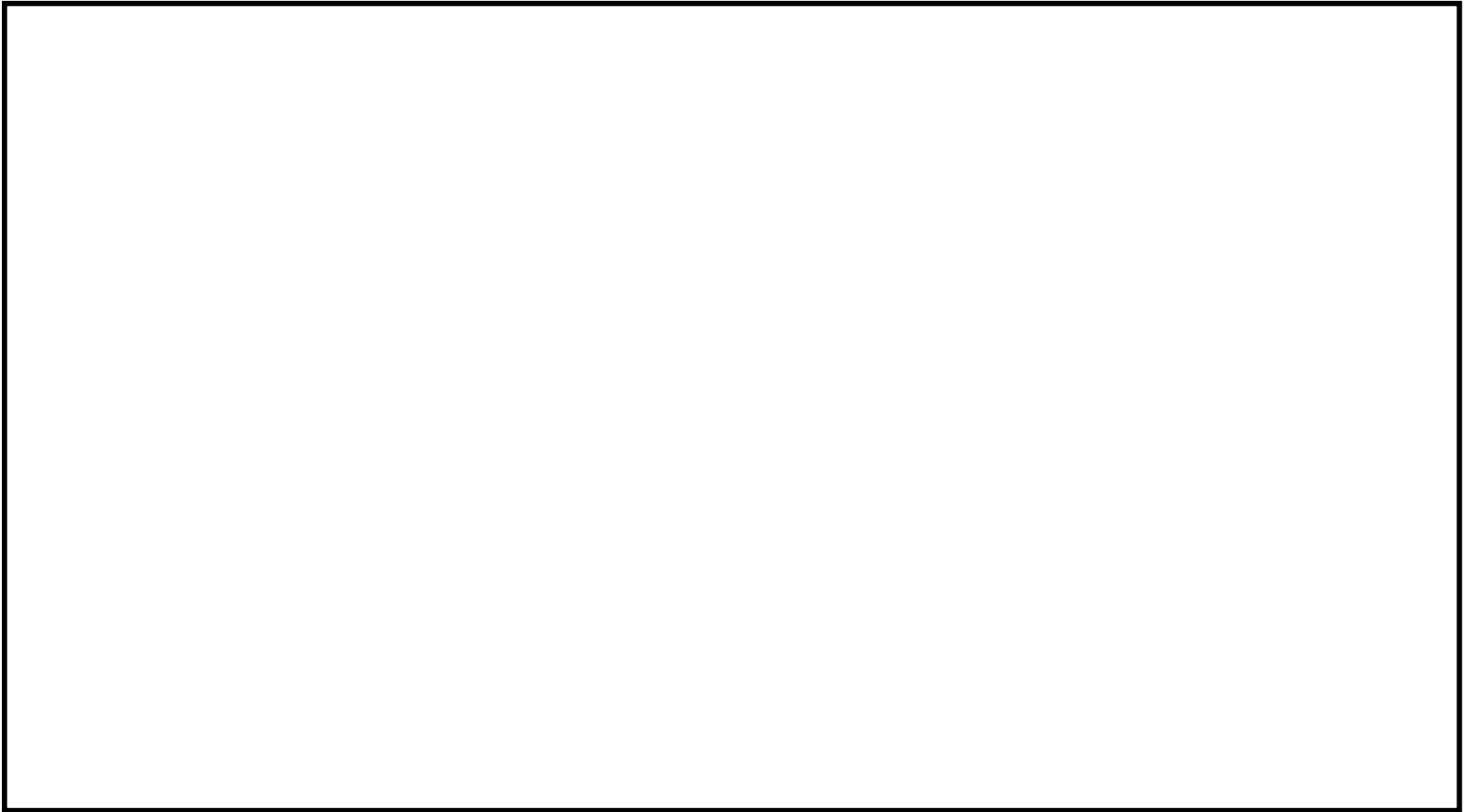
Why?



Based on their color and what you have learned in this lesson, do grapes contain acid or base?

Lesson 33

Draw a Picture of a Siphon



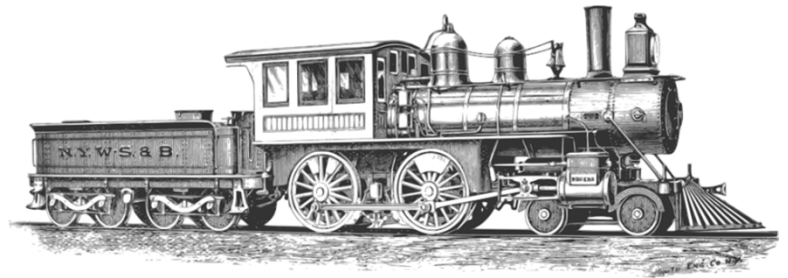
How does a siphon work?

Why does poking a hole in it make it stop working?

In our experiment, what made the pinwheel spin?

A steam engine converts _____ energy into _____ energy.

What was the power source for the first trains?



These days, we use a lot of steam to generate _____.

If you didn't keep adding fuel to the fire under Hero's aeolipile, what would you see after a long time? Why?

Section 3: Science Soon After Christ

Level 2

Lesson 35

If I put an object 12 cm in front of a flat mirror, its image will appear to be _____ cm _____ the mirror.

What Law did Hero use to demonstrate where an object's image is in a flat mirror?

Explain your experiment and how it showed that an object's image in a flat mirror appears to be the same distance behind the mirror as the object is in front of the mirror

Section 3: Science Soon After Christ

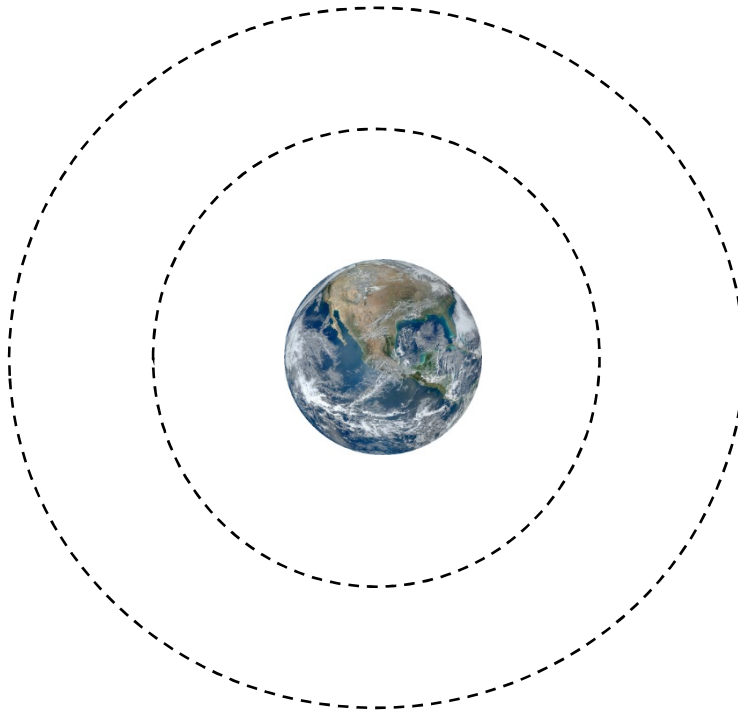
Level 2

Lesson 36

Retrograde motion happens when planets are seen moving one direction in the night sky, but would then appear to stop and _____ direction.

What did Ptolemy add to the geocentric model to account for retrograde motion?

The drawing below shows the earth in Ptolemy's system. The circles are the orbits of two planets. Draw each planet in an epicycle, as is done on p. 110:

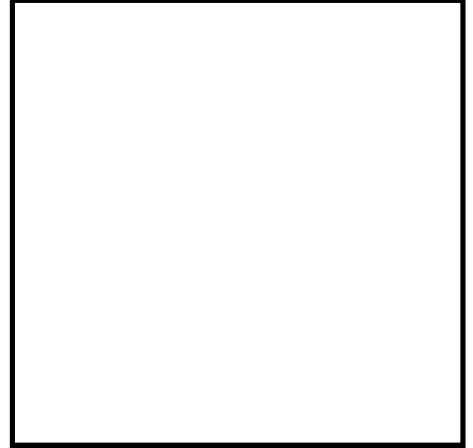
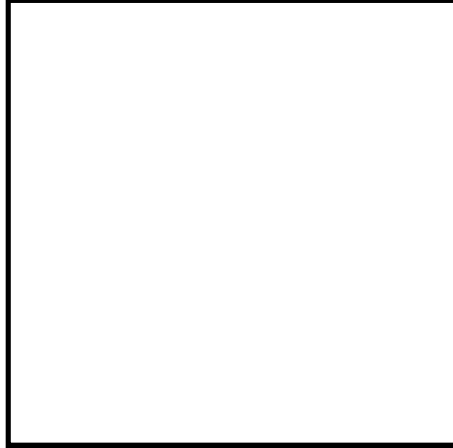
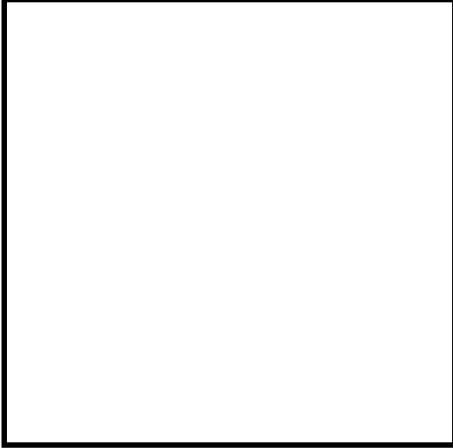


Which is faster in Ptolemy's system – the motion of the planet around the earth or the motion of the planet in its epicycle?

Lesson 37

Refraction is the process by which _____ bends when it starts traveling through a different substance.

Draw the three different results in your experiment.



Why were the results different?

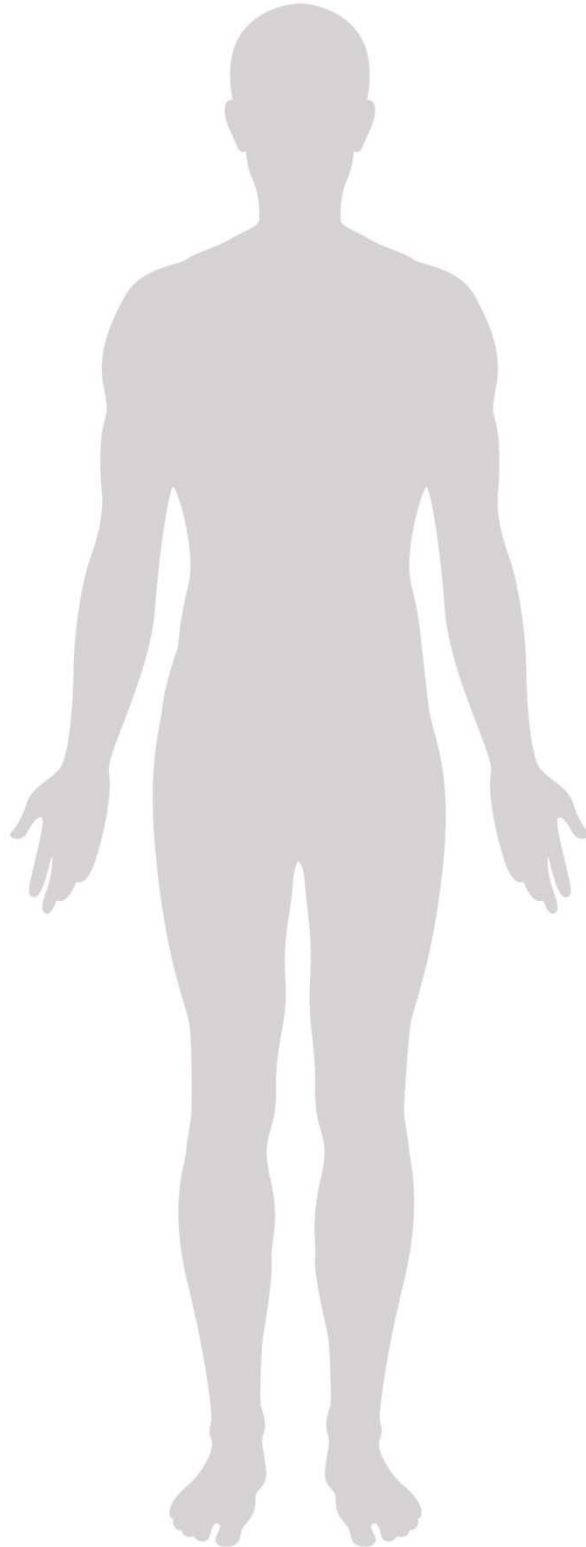
Does light travel faster in water or in vegetable oil?

The next time you have a glass of water with a straw or play in the pool, check out the refraction that happens. The pencil in this picture tells you what you might see. Can you explain why this is caused by refraction?



Lesson 38

Use the outline below for the activity, and once you have glued the organs in place, label them.



Section 3: Science Soon After Christ

Level 2

Lesson 38 (Cont.)

Why did Galen's dissection of apes help him learn about human anatomy but ended up causing him to be wrong when it came to some things?

Lesson 39

Lab Data: Your Pulse

Your resting 30-sec pulse count: _____

Multiply the number by 2 to get your resting pulse rate: _____

Your 30-sec pulse count after exercise: _____

Multiply the number by 2 to get your after-exercise pulse rate: _____

Adult resting 30-sec pulse count: _____

Multiply the number by 2 to get adult's resting pulse rate: _____

Adult 30-sec pulse count after exercise: _____

Multiply the number by 2 to get adult's after-exercise pulse rate: _____

Pulse rate measures a how much your body is using what is in your _____. It gets _____ the more vigorous your exercise.

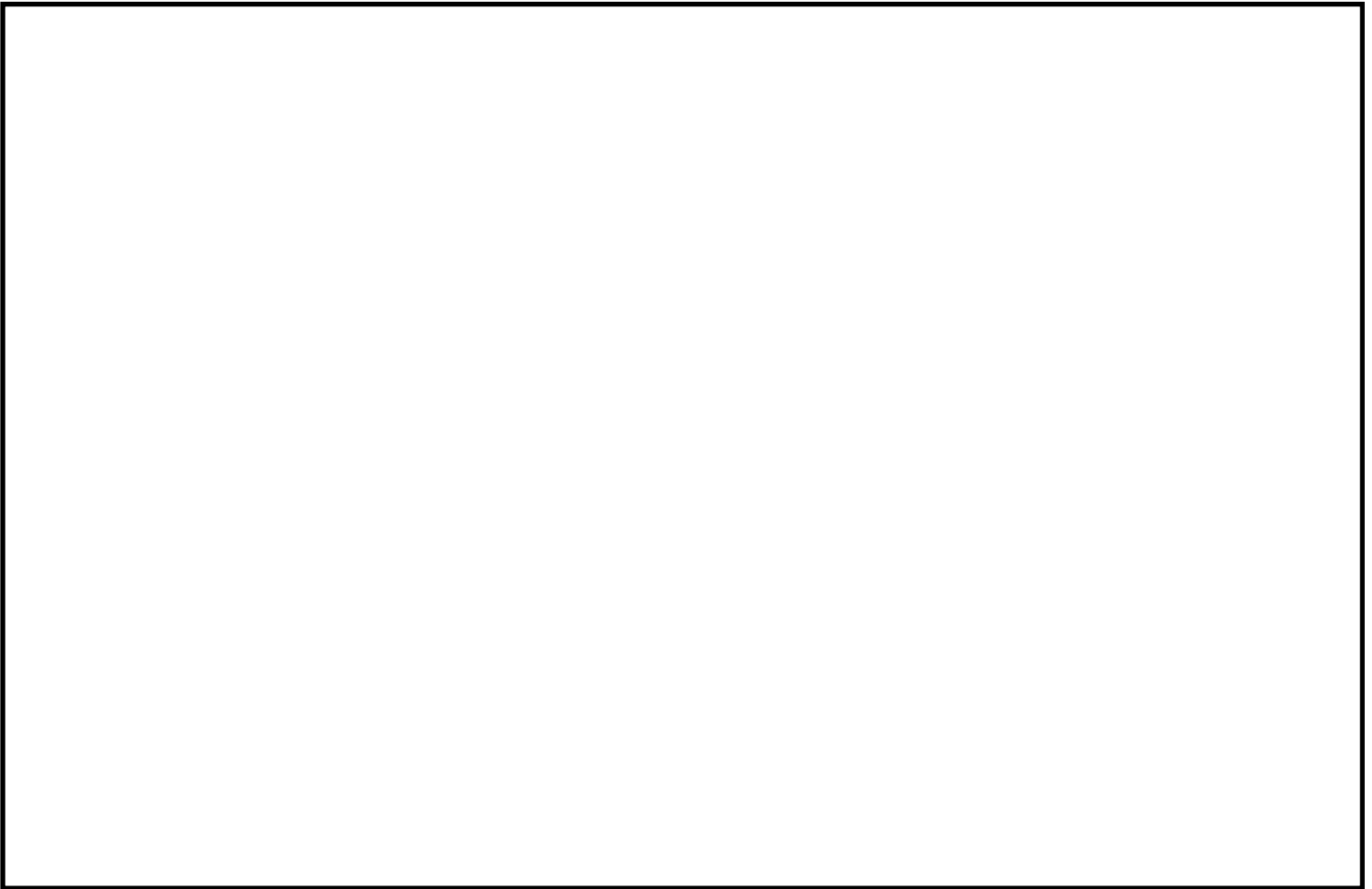
On this photograph of a person's hand, mark where you would find the pulse.



How does your pulse rate change over the course of your life?

In order to bend your arm at the elbow, your biceps brachii _____ and your triceps brachii _____.

**Draw Two Pictures Like the Ones on Page 122.
Point out the tendons, and indicate for each muscle if it is
contracted or relaxed**



What does “biceps” mean? _____

What does “triceps” mean? _____

What does “brachii” mean? _____

Lesson 41

Explain how your brain, spinal cord, and spinal nerves work together so you can move your legs the way you want to move them.

How was the motion you experienced in the experiment different?

Was it voluntary or involuntary motion?

Would a person whose spinal cord is broken near the shoulder be able to control his legs?

Would that person have a reflex like you experienced in the experiment?

Did you know there are scientists who are studying how to repair nerve damage so that those with spinal cord injuries can walk again? Is that something you think would be a neat job? There's all kinds of careers that use science!

Section 3: Science Soon After Christ

Level 2

Lesson 42

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 3: Science Soon After Christ

Level 2

Lesson 43

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 3: Science Soon After Christ

Level 2

Lesson 44

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Lesson 45

If your friend blows a whistle right next to you and then moves across the room and blows it again, the sound will be:

louder or softer or the same

How does Boethius's view of sound explain your answer above?

If your friend blows a whistle right next to you and then moves across the room and blows it again, the pitch will be:

Higher or lower or the same

How does Boethius's view of sound explain your answer above?



Section 4: Science in the Early Middle Ages

Level 2

Lesson 46

Is the earth eternal?

Yes or No

What argument did John Philoponus use to support that idea?

Why did Philoponus actually believe the earth is not eternal?

Why didn't Philoponus use that reason when arguing with natural philosophers?

Section 4: Science in the Early Middle Ages

Level 2

Lesson 47

How did Aristotle think a projectile travels through the air?

Describe your experiment and explain how it shows that Aristotle was wrong.

Airplanes often fly very high on long trips, because there is less air the higher you are. Why is that important for an airplane?

Section 4: Science in the Early Middle Ages

Level 2

Lesson 48

What is the name of the man (pictured on the right) who is considered to be the father of the method used in modern science?



Describe your experiment and explain how it shows that the sun heats the earth with its light, not its heat.

Explain why it isn't surprising that someone who was a very important person in the Christian church is considered by some to be the person who came up with the method by which modern science is done?

Section 4: Science in the Early Middle Ages

Level 2

Lesson 49

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 4: Science in the Early Middle Ages

Level 2

Lesson 50

Draw the different setups that you used for the candle in your experiment in the boxes below:

--	--	--

Why did the candle go out when you covered it?

Which candle burned longest and why?

Rewrite Bacon's quote on the top of page 151 in your own words.

Why does pouring water on a fire usually put it out?

Section 4: Science in the Early Middle Ages

Level 2

Lesson 51

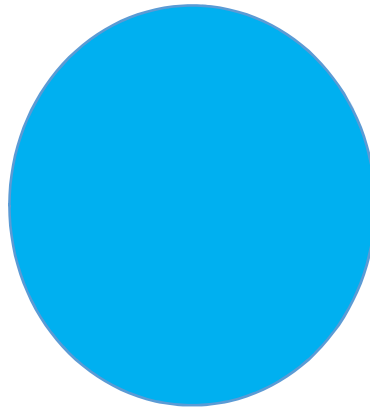
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 4: Science in the Early Middle Ages

Level 2

Lesson 52

Draw arrows that represent beams of light traveling from left to right through both pieces of glass below. For the one that has focused light beams, label the focal point:



Is the glass in a magnifying glass flat or curved?

Why?



Section 4: Science in the Early Middle Ages

Level 2

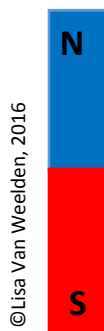
Lesson 53

Write the Basic Law of Magnetism and use it to explain why the magnets were first attracted to each other in the experiment but were later repelled by each other.



How does a magnet attract a piece of metal that is not a magnet?

Draw a magnet next to the one below so that the magnets will be attracted to one another:



Suppose you have a very strong magnet and a very weak one. You put them together so that their like poles are closest to each other, and you hold them in place for a very long time. What will eventually happen?

Section 4: Science in the Early Middle Ages

Level 2

Lesson 54

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 4: Science in the Early Middle Ages

Level 2

Lesson 55

Explain why $\frac{1}{2}$ cup of water plus $\frac{1}{2}$ cup of alcohol did not result in 1 full cup of alcohol/water solution in the experiment



When you add ice to a drink it can help you remember this idea. Just like our experiment, the beverage you're drinking (representing smaller molecules) slips in between the gaps of the ice (representing larger molecules).

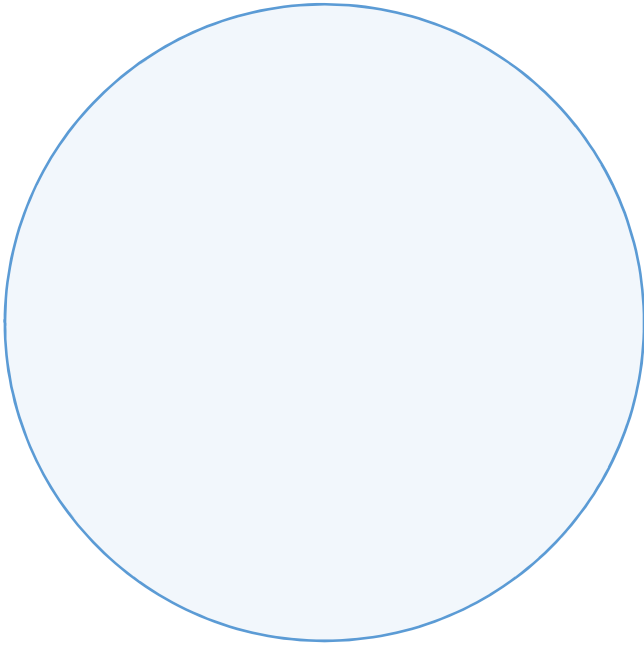
If you add 1 cup of one liquid to 1 cup of another liquid, can you get a solution that has a volume of more than 2 cups? Assume the molecules of the liquids don't change when the 2 liquids are mixed.

Section 4: Science in the Early Middle Ages

Level 1

Lesson 56

Draw how a rainbow forms in a drop of water. Use the drawing on p. 170 as a guide.



Why are the colors in a primary rainbow always the same, with red on top and violet on bottom?

Bradwardine taught that different causes of motion can lead to the same _____.

Bradwardine and the other Oxford Calculators thought that _____ was very important in the study of science.

What is the difference between kinematics and dynamics?

Do some research and find the name of another member of the Oxford Calculators. Some sources call them the “Merton Calculators.”



Understanding motion and how things move can help you be very good at some games!

Section 4: Science in the Early Middle Ages

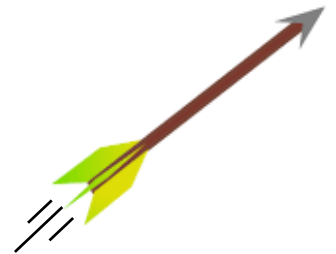
Level 2

Lesson 58

Use your own words to explain what impetus is.

What determines impetus?

Use your own words to define the range of a projectile, like the arrow shown on the right.



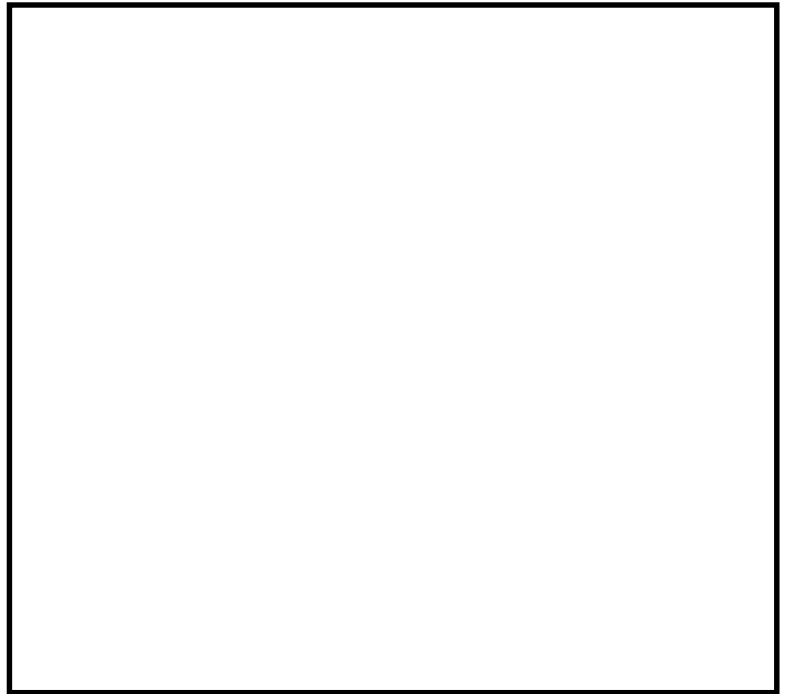
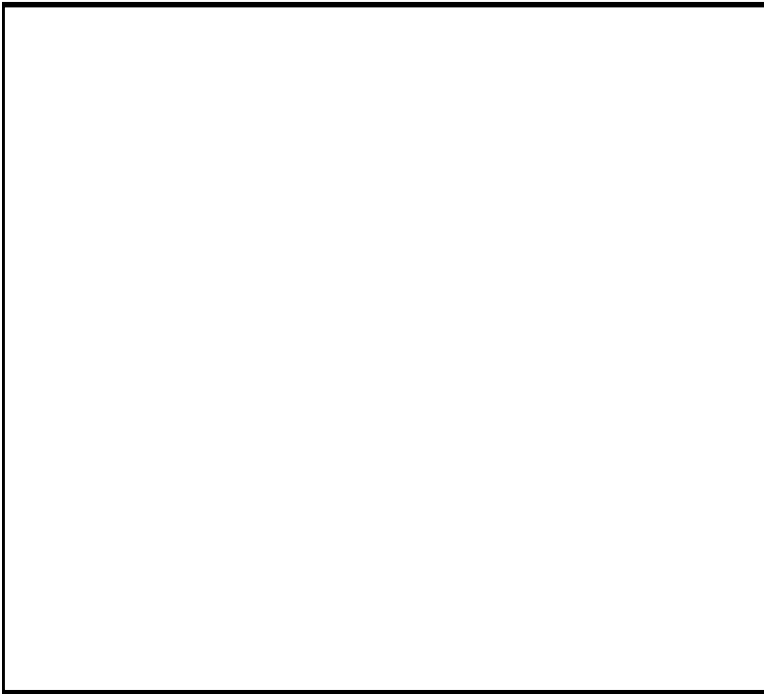
Why does pulling back harder on a bow make the arrow fly farther When the bow is released?

Section 4: Science in the Early Middle Ages

Level 2

Lesson 59

Draw pictures like the ones on p. 179 to show why the can in the experiment could tilt once some water was added to it. Point out the center of gravity in each picture.



Why was the can able to tilt once some water was added to it?

If you stood the can straight up in a freezer and let the water freeze, would the can be able to tilt?

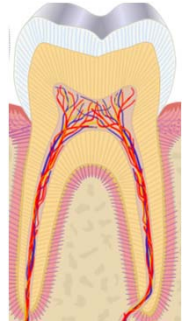
If you are able, put the can in a freezer overnight and then do the experiment to see if you were right!



A tightrope walker uses a long pole to adjust his or her center of gravity so it is always above the rope. It's the same reason why when you are walking on a curb or along a beam or any higher and/or narrower place that you stick your arms out.

Why did Guy de Chauliac have better anatomy knowledge than Galen?

Why did Guy de Chauliac say you shouldn't eat or drink something hot and then follow it with something cold? (Use the concepts of expansion and contraction.)



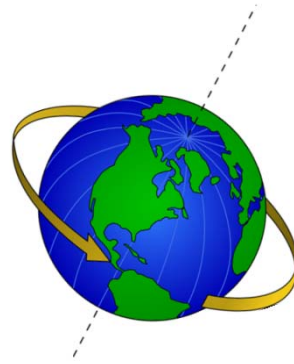
Can you think of any common household items that might break if the temperature is changed too quickly? List them below.

Section 5: Science in the Late Middle Ages

Level 2

Lesson 61

The earth rotates while it orbits the sun. The rotation is what turns day into night.



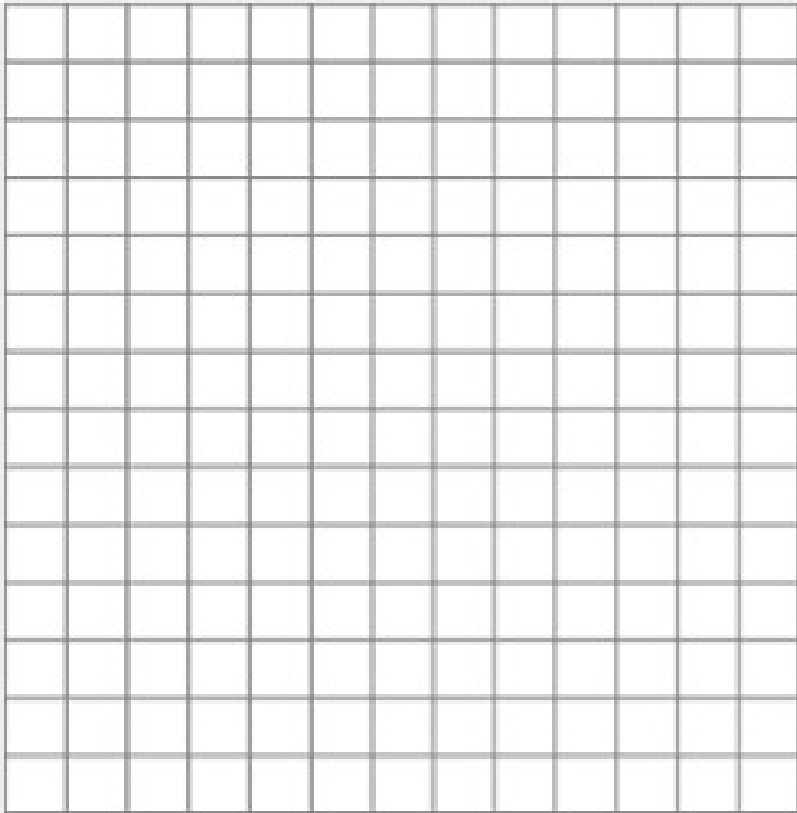
Even though the above statement is true, an arrow shot straight up in the sky will land where it was fired. Why?

What is the difference between astrology and astronomy?

Can you find a Bible verse (or two) that says we shouldn't study astrology?

Lesson 62

Graphing Activity

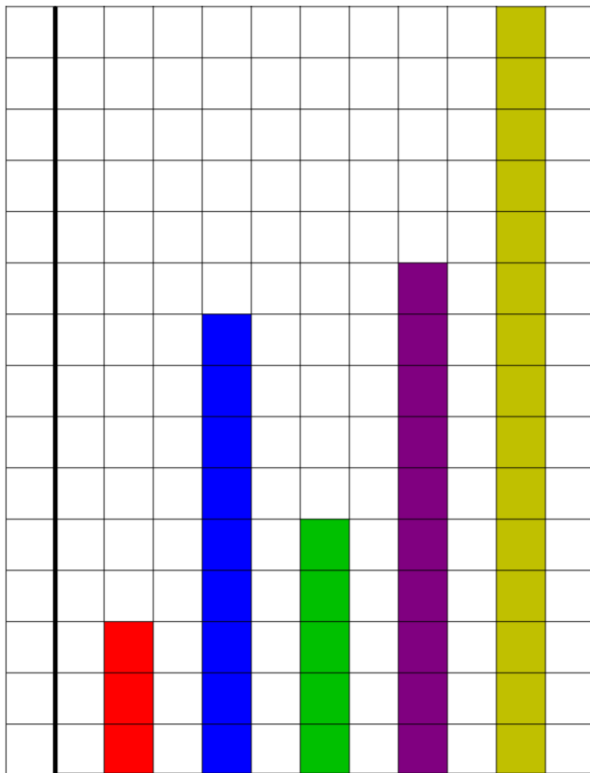


As you count the M & Ms in your package, color in one box for each candy above the appropriate color.

Which color is the most common?

Which color is the least common?

Red Orange Yellow Green Blue Brown



The graph on the left shows the answers students gave to the question “How much do you like science?”

What is on the horizontal axis?

What is on the vertical axis?

What is the most common answer?

What is the least common answer?

How many students answered the question?

Hint: think about what each filled-in square represents

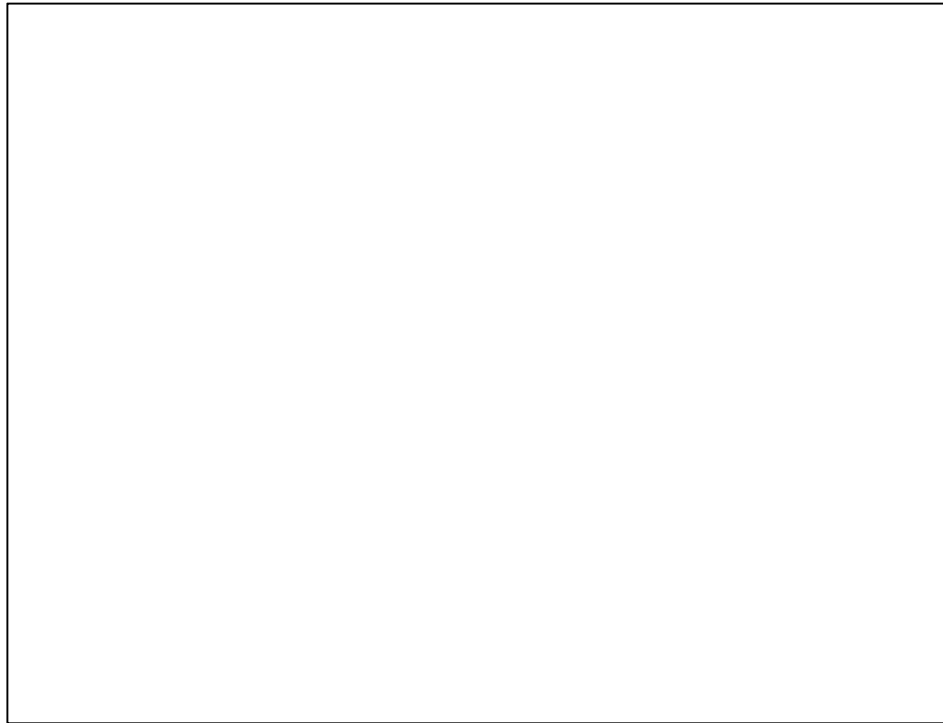
I hate it! I don't like it. It's okay. I like it. I love it!

Section 5: Science in the Late Middle Ages

Level 2

Lesson 63

Draw a picture of the bottle from the experiment and what the water looked like coming from the different holes.



Why did the water come out of the holes differently?

How does this show the way a bathometer measures the depth of water?

Why is it dangerous for an unprotected diver to go deeper than about 300 meters?

What is humidity?

Why do water drops form on the outside of a cold glass?

Nicolas of Cusa invented the first hygrometer. What does it measure?

How does high humidity affect you on a hot day?



How does high humidity affect you on a cold day?

Section 5: Science in the Late Middle Ages

Level 2

Lesson 65

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 5: Science in the Late Middle Ages

Level

Lesson 66

How do we know that plants must absorb something as they grow?

How did your experiment show that plants don't absorb the soil in which they grow?

What do plants absorb as they grow?

What is hydroponics?

In hydroponics, why aren't the roots of a plant submerged in water?

Section 5: Science in the Late Middle Ages

Level 2

Lesson 67

Copy the sentence indicated in your textbook. Your handwriting should be neat. Have a helper time you.

Record the time it took to write the sentence in seconds: _____

Now use the cutout letters to form the same sentence and tape them down. Have a helper time you.

Record the time it took to do that in seconds: _____

If you had to make one copy of the sentence, which way would be faster? _____

Imagine that instead of paper the letters were metal and you could cover them with ink and stamp the phrase. If you had to make 100 copies of that sentence which way would be faster?

What does it mean when someone says that a product has been mass produced?

How did Gutenberg's printing press change the world?



This is a replica of Guttenburg's press. The boy is holding a sample page made on the press.

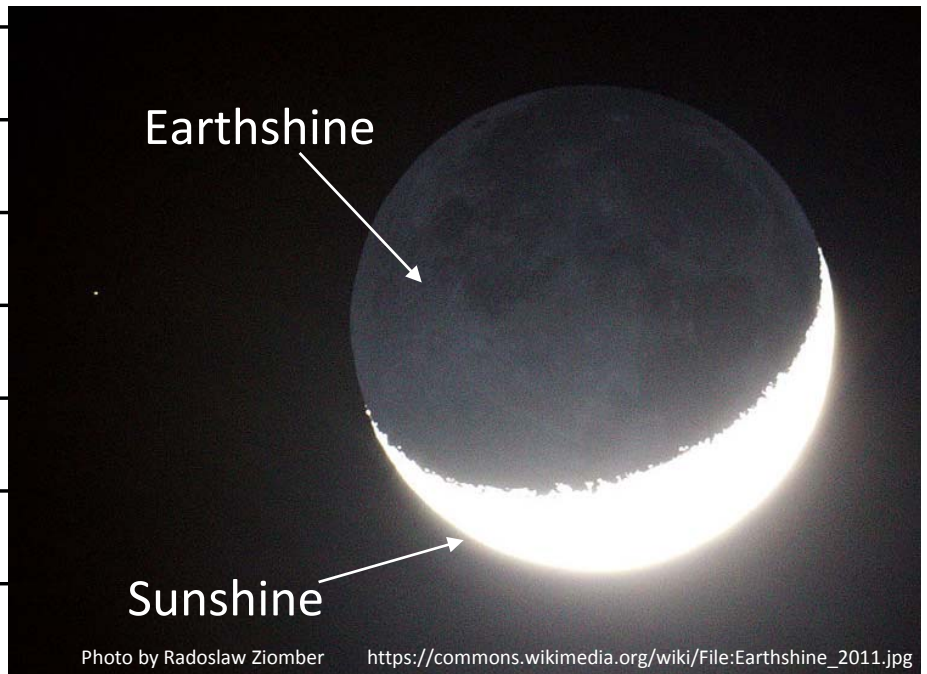
The girl is holding the handle of the press. When making a copy, the person operating the press would walk around to spin the central section and lower the paper onto the plates with the movable type.



Both photos ©Lisa Van Weelden, 2015

How did Leonardo da Vinci's scientific studies help him with his painting?

Use the photo to explain what earthshine is and why it allows us to see the rest of the moon dimly, even when it isn't lit by the sun.



If you watch a crescent moon for many nights, will the brightness of the dimly-lit part change?

Write the phrase "Hello There" in the box. Hold up to a mirror.

Now copy " ɹǝɹɹ ɹllɹH" in the box below. It may be difficult, but you should be able to do it. Hold up to a mirror.

_____ is a way of abbreviating words so that you don't have to write every letter in the word.

_____ writing is when the letters and words are written backwards.

Leonardo da Vinci used both shorthand and mirror writing in his journals. What reasons have people suggested for his use of mirror writing?

1. _____

2. _____

3. _____

Section 5: Science in the Late Middle Ages

Level 2

Lesson 69 (cont.)

1. What is shorthand?

2. What is mirror writing?

3. What well-known philosopher/inventor is known for using mirror writing in his journals?

4. Name 3 possible reasons why that well-known philosopher used mirror writing.

Section 5: Science in the Late Middle Ages

Level 2

Lesson 70

Tape/glue your leaf images here. Use the back of this page if you have more.

How did you make the leaf prints on the previous page?

How did Leonardo da Vinci make the ink that he use for his leaf prints?



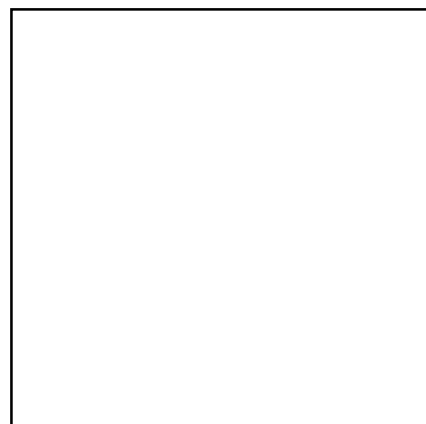
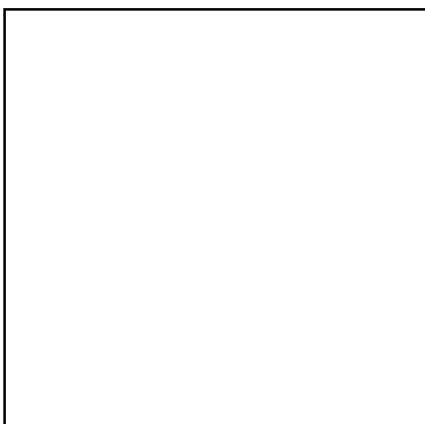
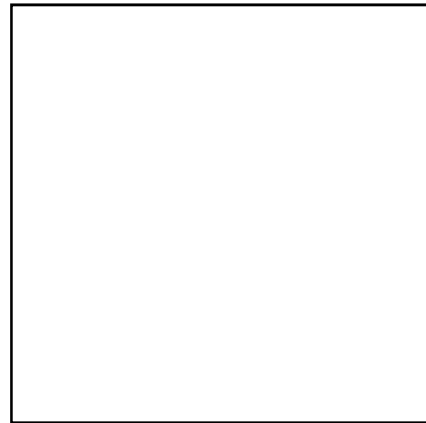
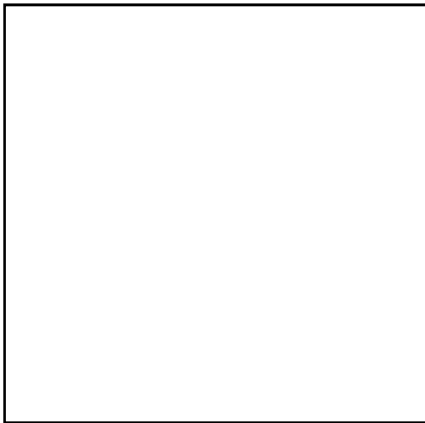
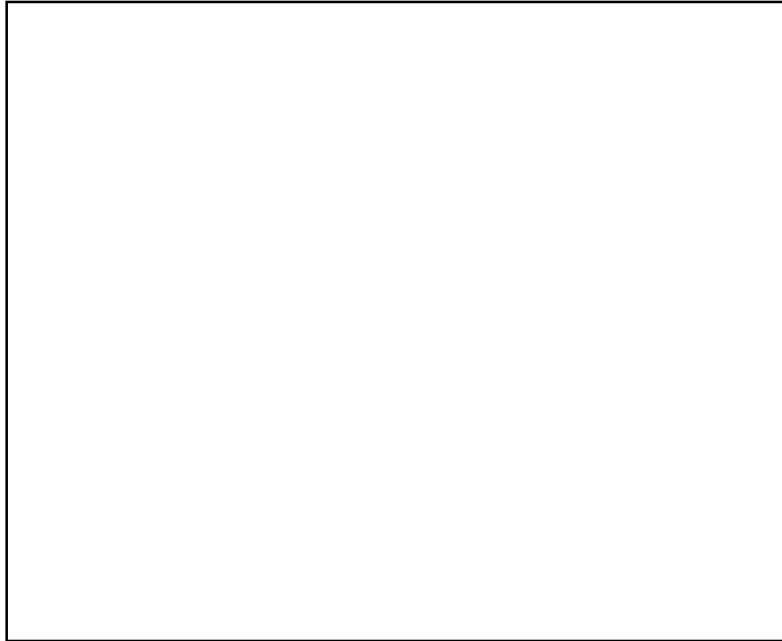
This is an image of the page in Leonardo da Vinci's notebook where he made his leaf print.

Section 5: Science in the Late Middle Ages

Level 2

Lesson 71

Use these boxes to make your drawings for the lesson activity. Use the bigger box for your drawing a thick branch splitting into two and the four smaller boxes for different leaf patterns.



Section 5: Science in the Late Middle Ages

Level 1

Lesson 71 (Cont)

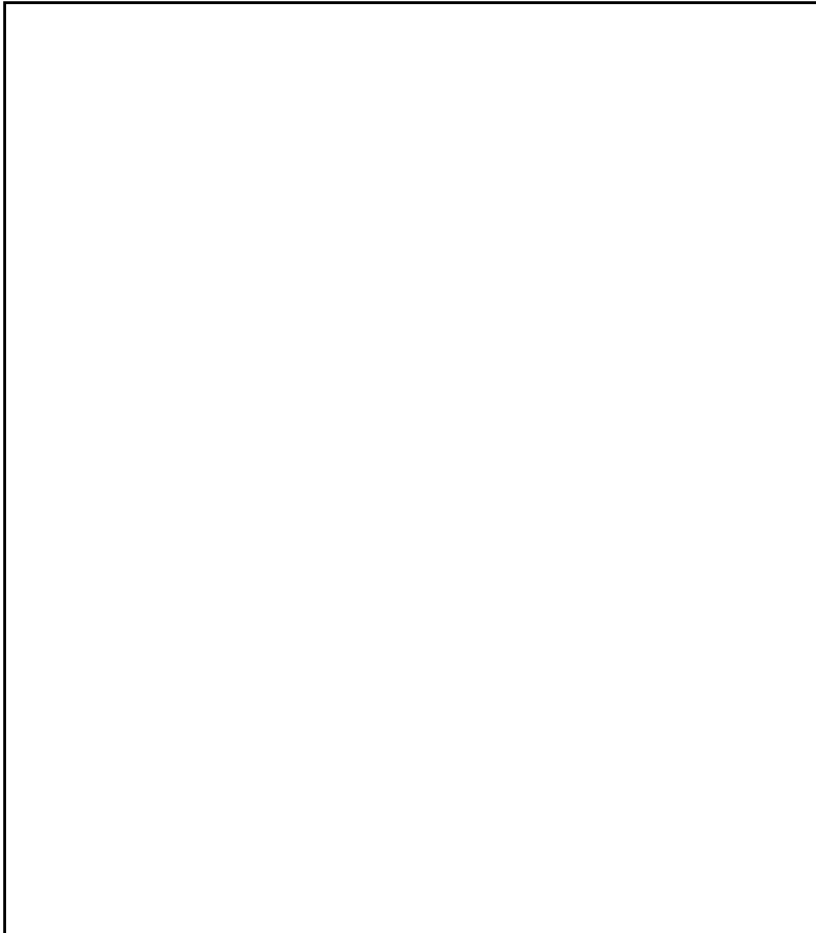
For the leaf patterns you drew on the previous page, label them as “Opposite,” “Alternate,” or “Whorled.”

If you didn’t have one or more of the leaf patterns listed above, draw what they would have looked like.

What is Da Vinci’s rule?

What is a possible reason trees were designed according to Da Vinci’s rule?

Draw a picture of the tree stump/branch you examined below.



Why do trees form rings?

What do the rings tell us about the weather when they formed?

Why is it easier to see the rings on a deciduous tree as opposed to an evergreen tree?

Section 5: Science in the Late Middle Ages

Level 2

Lesson 73

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 5: Science in the Late Middle Ages

Level 2

Lesson 74

Draw a picture (like the one on pg. 225) that shows what happened in the experiment



How did our experiment demonstrate what Leonardo da Vinci figured out? (That air is not an element)

Natural philosophers in Da Vinci's time thought that earth is an element. Why were they wrong?

Section 5: Science in the Late Middle Ages

Level 2

Lesson 75

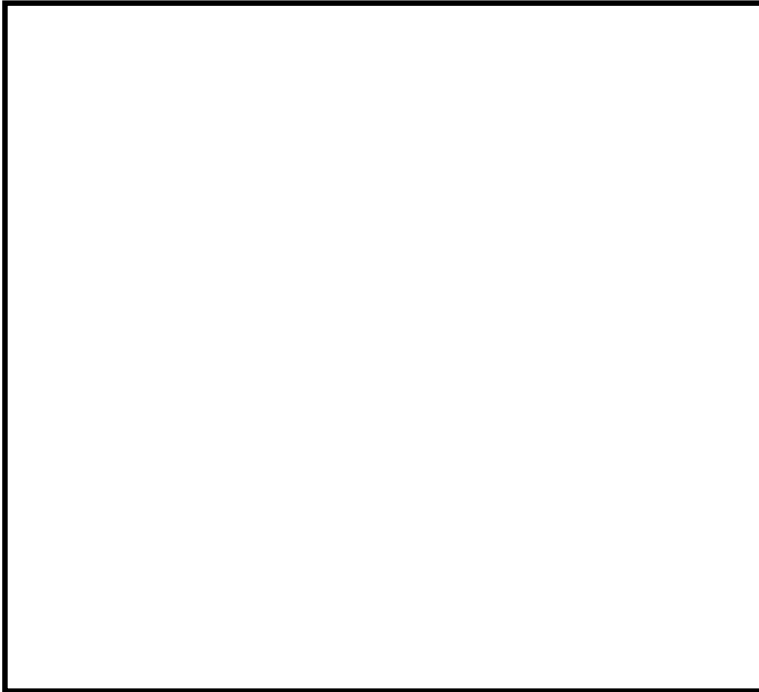
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Section 6: Science in the Early Renaissance

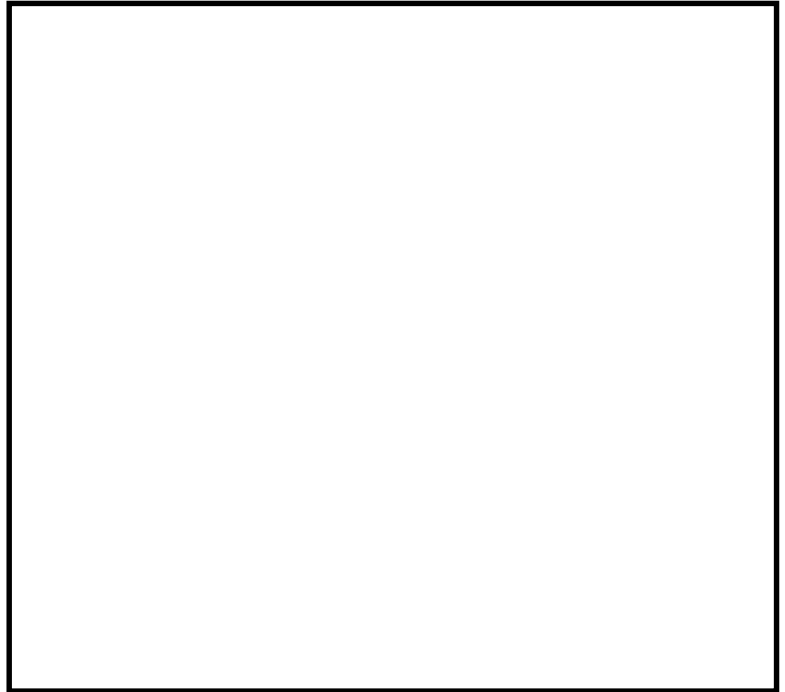
Level 2

Lesson 76

Draw the results of your experiment in the boxes below.



Fresh Water



Salt Water

What explains the difference in the two drawings?

How is the straw/Playdoh thing you made a hydrometer?

Vegetable oil floats on water. Compare how your hydrometer would float in vegetable oil compared to fresh water and salt water.

What is irrigation?

State the Law of Continuity in your own words. Explain why it works.

These are the fountains at the Bellagio in Las Vegas, Nevada. What is one of the ways that you think they get the water to go so high?



Would the Law of Continuity work in the experiment you did in Lesson 63?

Section 6: Science in the Early Renaissance

Lesson 78

Define erosion.

What two things determine how much erosion takes place as water flows over land?

a) _____

b) _____

Two scientists are discussing the Grand Canyon. One says it took millions of years for a river to erode the rock and make the canyon. The other says it formed in just a few months. Explain each scientist's assumption about how water flowed while it was forming the canyon.

The Grand Canyon

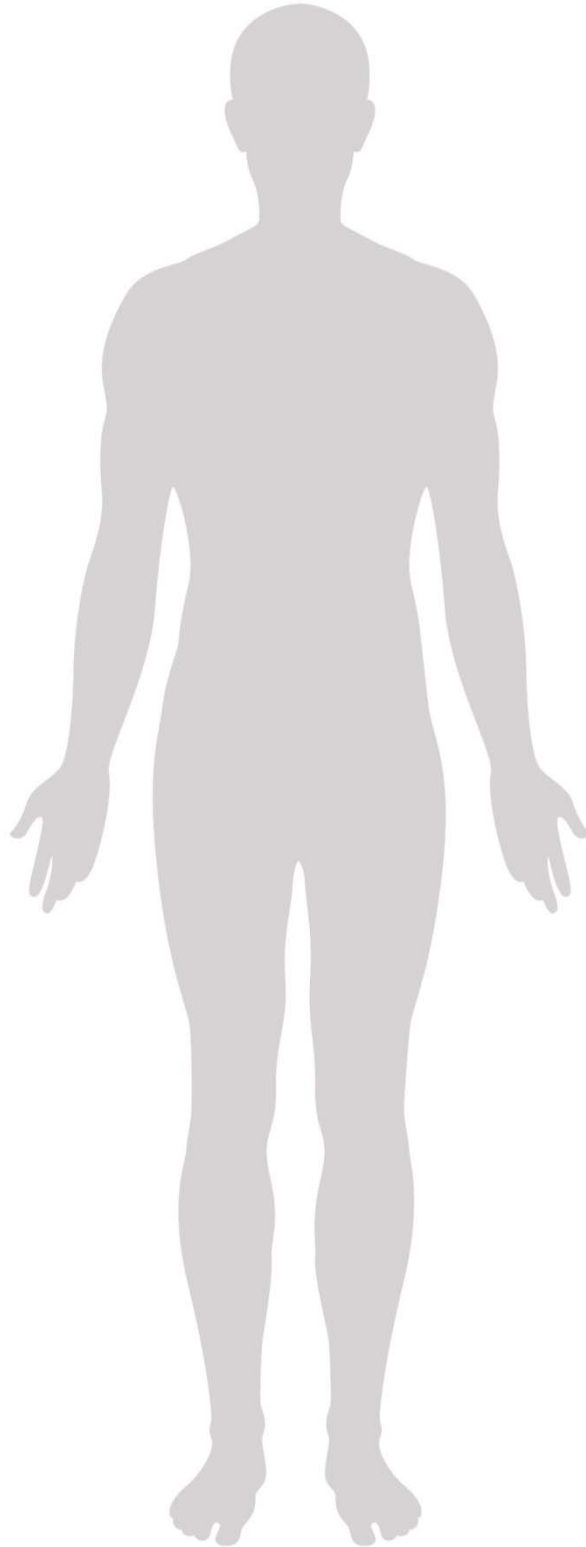


Section 6: Science in the Early Renaissance

Level 2

Lesson 79

Cut out the bones and paste them into the body below. Label them.



Section 6: Science in the Early Renaissance

Level 2

Lesson 79 (Cont)

People who combine their knowledge of science and their artistic abilities (like Leonardo da Vinci) are called _____.

What are the 2 main jobs of the skeleton?

a) _____

b) _____

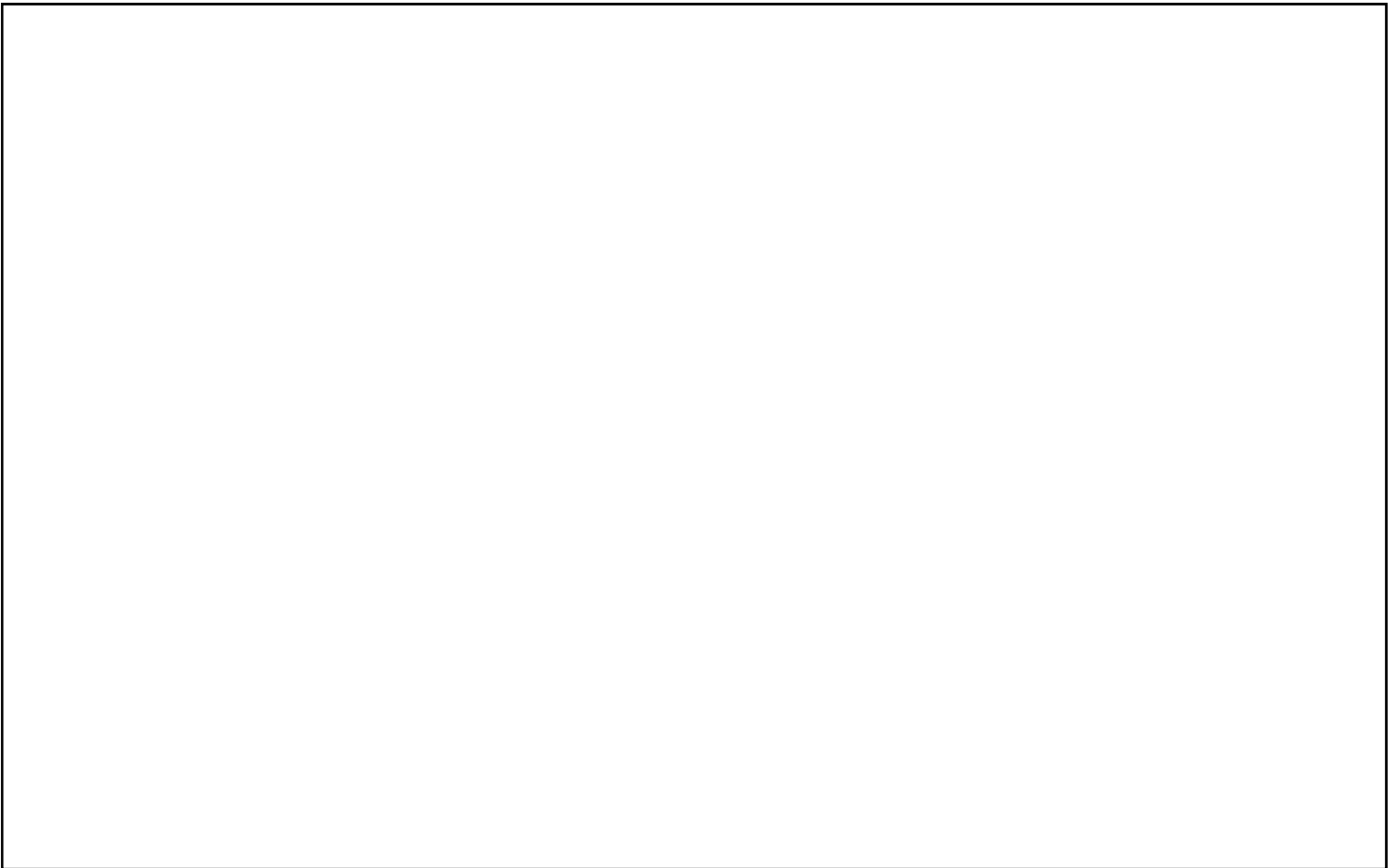
How many bones are in the human skeleton?

Section 6: Science in the Early Renaissance

Level 2

Lesson 80

Draw a picture like the one on pg. 244 (including the labels) that shows how the elbow allows the forearm and arm to move.



Does the elbow allow for any other type of movement? _____

What kind of joint is the elbow? _____

Name another joint in the body that is the same kind of joint as the elbow.

Section 6: Science in the Early Renaissance

Level 2

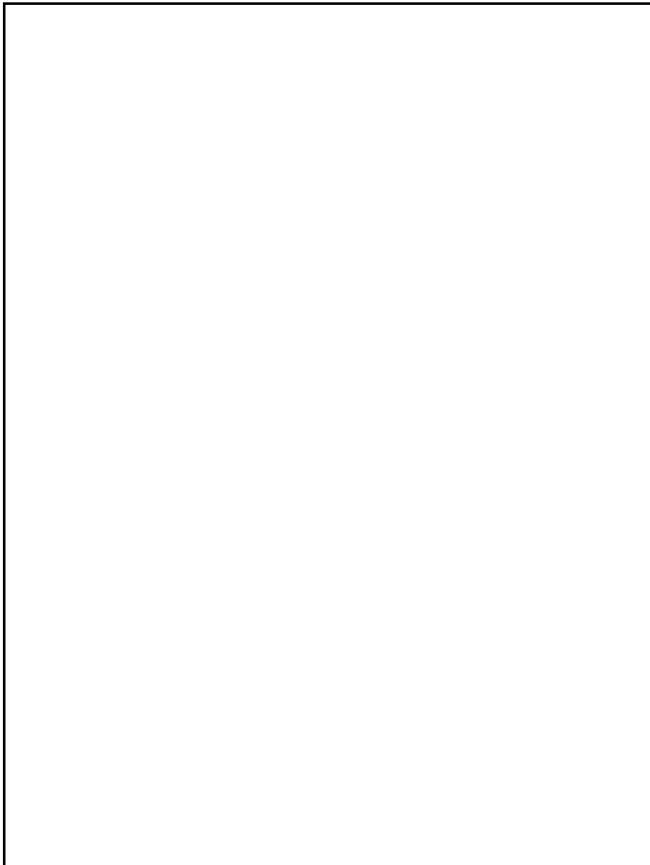
Lesson 81

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

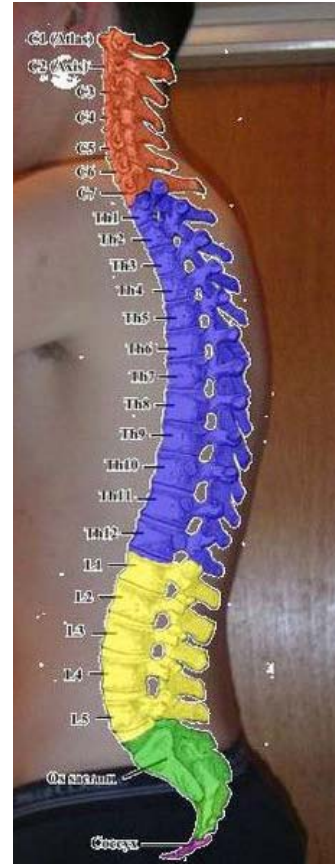
What are the individual bones of the vertebral column called? _____

What does the vertebral column protect? _____

Draw a picture of the contraption you built



A different model of the vertebral column



How is your contraption like the vertebral column?

What's wrong with the shape of your contraption compared to the vertebral column?

Section 6: Science in the Early Renaissance

Level 2

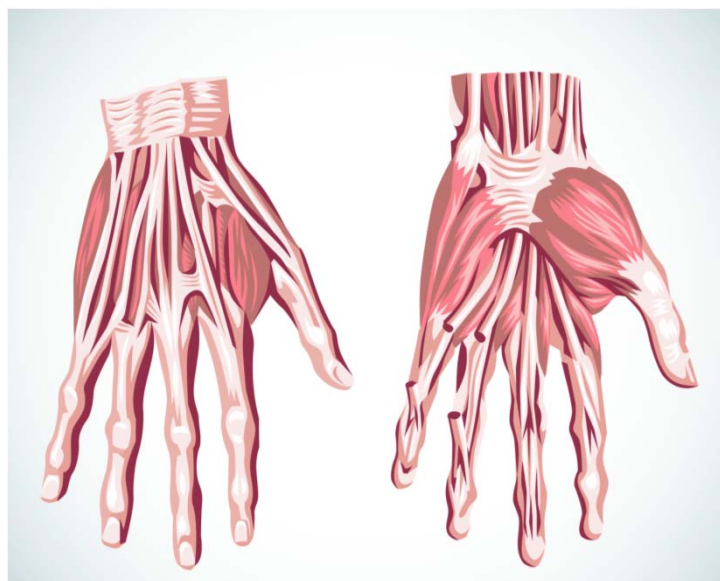
Lesson 83

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Explain your activity and why it is a good model for how you flex and extend your fingers.

Explain the difference between the extrinsic and intrinsic muscles of the hand.

In the illustration below, which side shows the tendons that flex your fingers?



This illustration shows the tendons (white) and intrinsic muscles (red) of the hands. The drawing on the left shows the hand palm down, while the drawing on the right shows it palm up with some of the tendons cut. © URRRRA via shutterstock.com

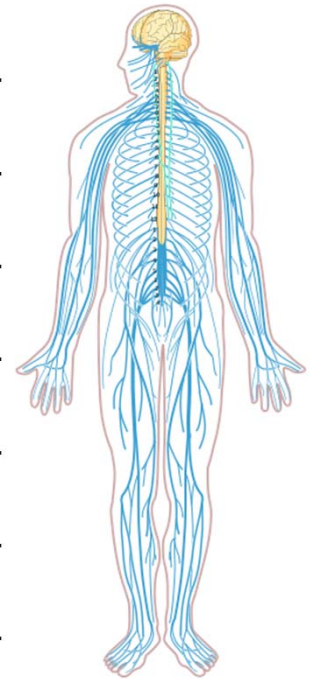
We're still talking about Leonardo da Vinci! Wasn't he amazing?!

Why did Leonardo da Vinci think that the spinal cord was just an extension of the brain?

Was he correct?

How was your experiment a model of the spinal cord?

We have nerves all over our body! This diagram shows the nerves in blue and the brain & spinal cord in yellow.



A person in an accident has his spinal cord cut halfway down. How does that affect the way he moves?

Section 6: Science in the Early Renaissance

Level 2

Lesson 86

Number of Heartbeats counted

Before Jumping Jacks

After Jumping Jacks

Listening _____

Feeling Pulse _____

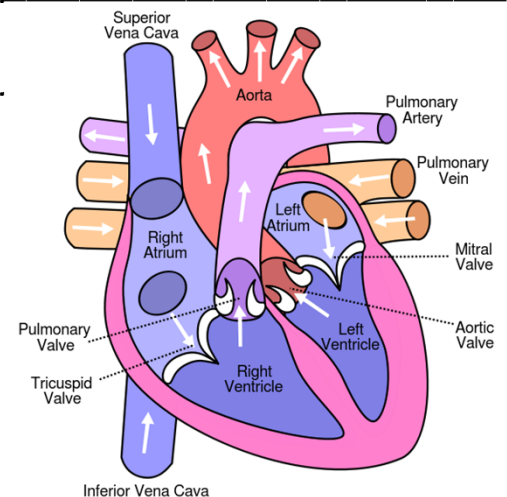
What is the name of the tool that a doctor uses to listen to your heartbeat?

The heart is made of muscle. TRUE or FALSE

What is the purpose of the valves in your heart?

What were you actually listening to in the experiment?

This diagram has a lot of words that may not make sense right now. But it is helpful to look at the white arrows to see how the blood flows through the heart. It's also helpful to look at the white "arch-shaped" parts and know those are the valves. By looking at the shape and placement of them, you can better understand what they do and how they do it.



Section 6: Science in the Early Renaissance

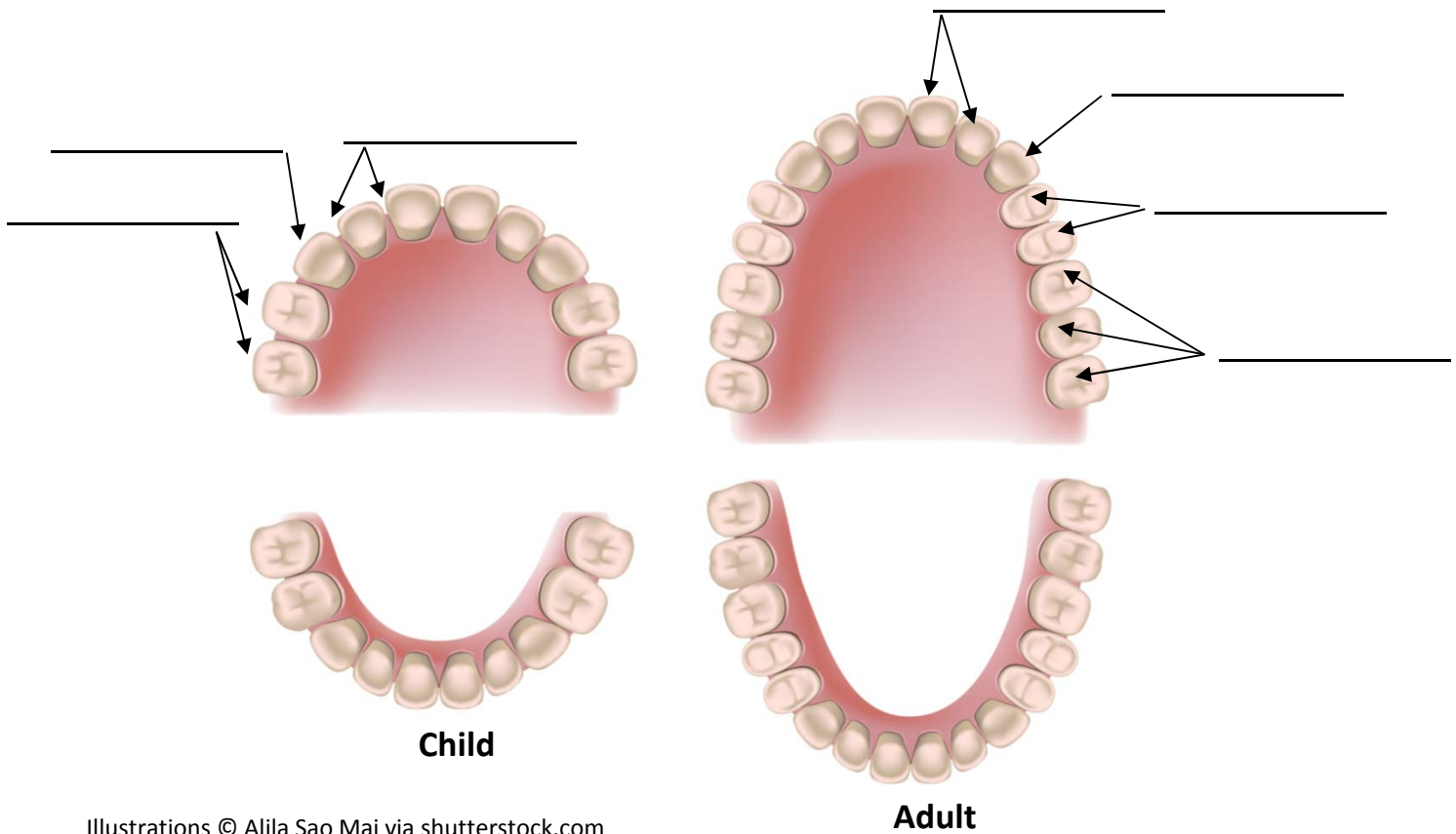
Level 2

Lesson 87

The specific pattern to a person's teeth is called a _____.

A child has _____ teeth, while an adult has _____ teeth.

Label the diagrams below.



Give the function for each type of tooth:

Molar _____

Incisor _____

Canine _____

What are deciduous teeth and why are they called that?

The resistance (rubbing) two surfaces experience when they are moving against one another is called _____.

Draw ball bearings between the two surfaces on the right.



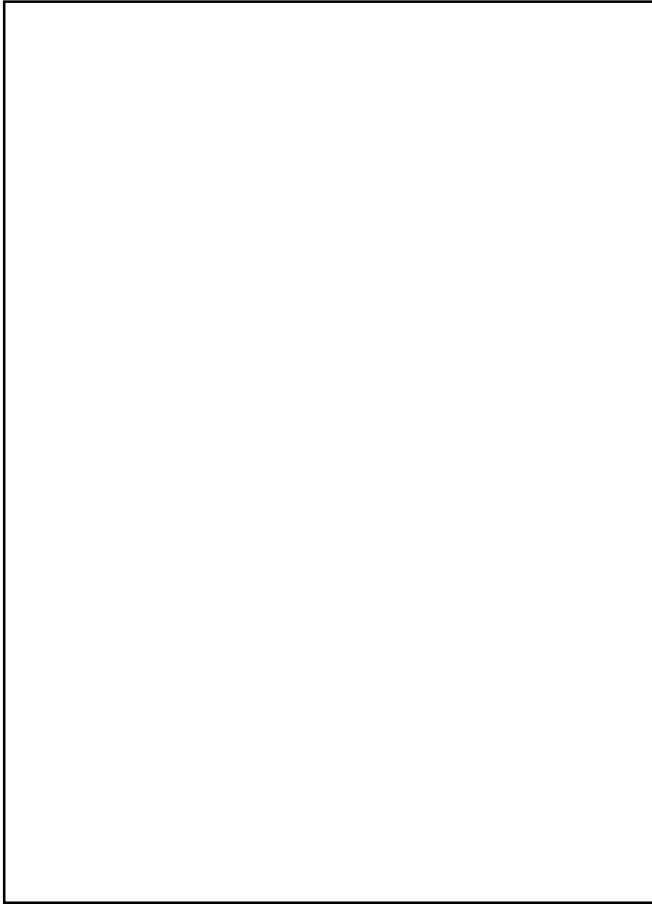
What is the purpose of ball bearings?

Why is there less friction between two surfaces that are already moving against one another as compared to two surfaces that aren't yet moving against one another?

These are deep-groove ball bearings.



Draw a picture of your experiment



When you put 10 pennies on the CD case, it didn't take 10 more pennies to get the case moving again. Why?

Leonardo da Vinci learned the following three things about friction:

1. _____

2. _____

3. _____

Section 6: Science in the Early Renaissance

Level 2

Lesson 90

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!

Created by Lisa Van Weelden