Science in the Scientific Revolution

Lab and Review Book

LEVEL 1

Property of:
Section 1: The Revolution Begins

Lesson 1

1. Heliocentric means __________-centered

2. Geocentric means __________-centered.

3. Copernicus put the planet __________ closest to the sun.

Nicolaus Copernicus

Draw Copernicus’s view of how the sun, planets, and stars are arranged

How is that different from what most believed?

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Section 1: The Revolution Begins
Lesson 2

1. Mars is ______________ when it appears in the eastern sky right after sunset.

2. What do we call it when a planet appears to be moving one direction in the night sky, then changes direction, and then later on changes direction again?

Make the four drawings explained in the book:

Geocentric System

Heliocentric System
(These are what we observe.)
What word is used for the situation shown in the diagram on the right?

In this lesson, you learned two arguments that natural philosophers used against the heliocentric system. Summarize them in the box below:

1. ____________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________

2. ____________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
   ____________________________________________________________________________
Explain in your own words why the Bible doesn’t teach that the earth is stationary in space.

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Explain in your own words why the center of the universe probably isn’t important to God.

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______________________________________________________
1. Order the following bones in terms of length in the human body, starting with the shortest: femur, humerus, tibia

_________________, ___________________, ___________________

2. Men and women have the same number of ribs.  
   TRUE or FALSE

3. How did Vesalius correct Galen on the length of the humerus and the number of bones in the sternum?

_________________________________________________________________
_________________________________________________________________
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4. Why did Galen get those facts wrong, and why did Vesalius get them right?

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In the drawings below, point out where you would find elastic cartilage, hyaline cartilage, and fibrocartilage.

Cartilage can be turned into bone. What is that process called?
Section 1: The Revolution Begins

Lesson 7

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
Make a drawing like the one on page 24, labelling the muscles, tendon, and ligament.

List the functions of:

Skeletal muscles_____________________________________________________

_________________________________________________________________

Tendons __________________________________________________________

_________________________________________________________________

Ligaments _________________________________________________________

_________________________________________________________________
1. Which blood vessels “pulse” (you can feel the blood pumping through them)?

_______________________________________________________

2. Which is usually found more superficial (closer to the surface) in the body: arteries or veins?

_______________________________________________________

Using the diagram on the right, point out where you felt your pulse and name the blood vessels you were feeling.

Why couldn’t you see those blood vessels pulsing?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Why can you see some of your veins?

________________________________________________________________________

________________________________________________________________________

Why don’t you see your veins pulsing?

________________________________________________________________________

________________________________________________________________________
1. Motor nerves are nerves that control ________________.

2. Sensory nerves are nerves that allow us to ________________ things around us—like temperature, smell, light, etc.

Attach a picture of your brain model or draw a picture of it, labelling the cerebrum and the cerebellum.
The Digestive System

Glue the organs onto this body outline, as discussed in the activity. After you are done with the lesson, label the organs. Indicate which are part of the digestive tract and which are accessory organs.
1. The parts of the body that the food moves through is called the __________________________  __________________.

2. The digestive organs that the food DOES NOT pass through are called ________________________  ________________.

3. Which is longer:

   the small intestine

   OR

   the large intestine
Lesson 12

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
1. What do the kidneys produce?

2. Fill in the blanks to describe how a filter works:

A filter (whether it’s a kidney, coffee filter, or air filter in your house) has lots of tiny ____________. The molecules that make up the water or air are ____________ than the holes, so they can pass through the holes. Things like dirt or coffee grounds are ____________ than the holes and can’t fall through. Those things get stuck on the filter.

3. How did the natural philosophers of the day think the kidney worked, and how did Vesalius show they were wrong?

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________________________________________________________________________
1. When you breathe air into your lungs, the temperature of the air

Heats up or Cools down

2. There is one less lobe on the left lung as compared to the right lung because it has to make room for the ____________________.

3. Label the heart, lungs and trachea in the diagram below.
Lesson 15

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
In your experiment the noodles were like _______________ and the vanilla extract was like ________________.

Write a short story about a particle that wants to make people sick. Have it plan the three different ways it can spread the disease, just as Fracastoro thought.
1. Conrad Gesner was fascinated by the natural world. He is an example of a _____________________.

   Draw a pencil, pointing out the pencil lead

   Why is that part of the pencil called the “lead?”

   ________________________________________________________
   ________________________________________________________
   ________________________________________________________
   ________________________________________________________
   ________________________________________________________
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   ________________________________________________________
   ________________________________________________________

   What is that part of the pencil really made out of?

   ________________________________________________________
   ________________________________________________________
Section 2: The Revolution from the Mid-1500s to the Early 1600s

Lesson 18

Draw Flower #1

Number of petals: _________

Stalk-like structures? ________

Draw Flower #2

Number of petals: _________

Stalk-like structures? ________

A list of the differences between the two flowers:

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

Sketch the whole AND halved peanut.

Sketch the whole AND halved bean

Sketch the whole AND cracked sunflower seed.
A list of the differences between the peanut, bean and sunflower seed:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

1. What do scientists call a peanut’s shell? _____________________

2. Every seed has a pod. **True OR False**

Why it makes sense to classify plants based on flowers and seeds:

________________________________________________________________________
________________________________________________________________________
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________________________________________________________________________
________________________________________________________________________
Section 2: The Revolution from the Mid-1500s to the Early 1600s
Lesson 19

Animal: __________________________

Write as many words as you can that describe the animal.

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______________________________________________________
______________________________________________________
______________________________________________________
______________________________________________________

1. Conrad Gesner was the first in history to try and describe all the ______________ that were known in his time. Because of this he is known as the “Father of Modern ______________.”

2. Because Gesner relied on information from ______________, he could write about a lot of animals. However, because he couldn’t verify the information, there were many ______________ in his book.

3. Most science books (even ones written today) have ___________. The only book that doesn’t have any is the ______________.
Section 2: The Revolution from the Mid-1500s to the Early 1600s
Lesson 20

1. Comparative anatomy examines very different living things and looks for their ________ and ________.

2. Why is it important in science? ______________________________________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

3. If you see a bluegill (a type of fish) and a bass (another type of fish) swimming in a pond, would you call them “fish” or “fishes”?

<table>
<thead>
<tr>
<th>Similarities between the human and cat skeletons:</th>
<th>Differences between the human and cat skeletons:</th>
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1. Comparative anatomy examines very different living things and looks for their ________ and ________.

2. Why is it important in science? ______________________________________________________
   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

3. If you see a bluegill (a type of fish) and a bass (another type of fish) swimming in a pond, would you call them “fish” or “fishes”?
Draw a picture like the one on page 64

Explain what the picture is illustrating:

____________________________________________________________________________
____________________________________________________________________________
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Why was Michael Servetus so interested in blood?

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____________________________________________________________________________
____________________________________________________________________________
What did Tycho Brahe see and how did he show that it was related to the stars and not the moon or earth?

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How did that show the heavens are not immutable?

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____________________________________________________________________________________
1. Astronomers sometimes call comets _____________________ ____________________________.

2. In your experiment the hunk of frozen flour/water represented a ___________ and the hair dryer represented the __________.

3. The tails of comets always face ___________ from the sun.

4. Tycho Brahe used his observations of the comet to destroy Aristotle’s idea that the universe was made of ________________, each of which held a planet.

5. Look at the picture of the comet below. Point out its tail. Draw the sun where you think it would be.
A pendulum is a _________ that hangs from a fixed point and ____________ back and forth.

Write your prediction about the difference between the times it takes the two washers to swing back and forth.

_______________________________________________________________________

_______________________________________________________________________

What did Galileo show about the period of a pendulum?

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________

What did Galileo show about the period of a pendulum?

_______________________________________________________________________

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What did Galileo show about the period of a pendulum?
Draw a picture of your experiment

What happened to the ball when you let it roll down a trough?

______________________________________________________
______________________________________________________
______________________________________________________
______________________________________________________

What is friction?

______________________________________________________
______________________________________________________
______________________________________________________
______________________________________________________

Why did the ball eventually come to a stop in your experiment?

______________________________________________________
______________________________________________________
______________________________________________________
1. Another name for a ramp is an ______________  ____________.

2. Acceleration happens when an object’s speed ________________.

Describe your experiment

____________________________________________________________________________________

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What were the results?

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What do the results show about falling objects?

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Section 2: The Revolution from the Mid-1500s to the Early 1600s
Lesson 27

A projectile flies through the air without anything _____________ its motion.
Describe your experiment
______________________________________________________
______________________________________________________
______________________________________________________
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______________________________________________________

Draw a picture like the one on page 81

What force is acting on the ball?
______________________________________________________

Which way does it push?
______________________________________________________

Is there a force pushing the ball away from the table?
______________________________________________________

What do mathematicians call the curve the ball follows?
______________________________________________________
Lesson 28

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
Section 2: The Revolution from the Mid-1500s to the Early 1600s

Lesson 30

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
What did Galileo see with his telescope and how did those observations support heliocentrism?

1. ____________________________________________________
   ______________________________________________________
   ______________________________________________________

2. ____________________________________________________
   ______________________________________________________
   ______________________________________________________

3. ____________________________________________________
   ______________________________________________________
   ______________________________________________________

4. ____________________________________________________
   ______________________________________________________
   ______________________________________________________

This drawing shows the phases of Venus as viewed from the earth. These phases can only be explained if Venus and the earth both orbit the sun.
Draw a picture like the one on page 97

Does the image really appear upside down, as shown in the drawing above?

________________________________________________________________________

Why don’t we see the world upside down?

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________________________________________________________________________
Kepler’s First Law says: All planets orbit the sun in an ________, with the ________ at one focus.

The drawing on the right is a circle. Draw an ellipse on top of it to show the difference between an ellipse and a circle. The eccentricity of the ellipse should be small.

The drawing on the right is a circle. Draw an ellipse on top of it to show the difference between an ellipse and a circle. The eccentricity of the ellipse should be large.

The planet whose orbit has the highest eccentricity is __________

The planet whose orbit has the lowest eccentricity is __________
Draw a picture like the one on the right side of the illustration on page 104, pointing out the high tides and low tides.

Why does each shore on the earth experience two high tides and two low tides a day?

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1. Empiricism is the idea that the only way we can learn anything is through ___________________ or ____________________.

2. Sir Francis Bacon thought that the world behaved in a ______________ way, so the best way to learn about it was through ________________.

3. What things did Bacon think you shouldn’t learn about with experiments?  _______________________________________
   ____________________________________________________
   ____________________________________________________
   ____________________________________________________

4. Sir Francis Bacon believed in heliocentrism:  True OR False
What happened to the vinegar in your experiment?

How is that similar to what happens when the pancreas adds a liquid to what is leaving the stomach?
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
Section 3: The Revolution in the Early 17th Century
Lesson 38

How did Harvey use math to show that blood circulates?

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What other pieces of evidence did Harvey use support that idea?

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1. A list that names people, their children, their children’s children, and so on is called a ___________________________.

2. Did James Ussher use only the Bible in his calculation of when God created the earth? ______________________

3. What else did he use? ________________________________

Explain the basics of what he did:

______________________________________________________________________________________
______________________________________________________________________________________
______________________________________________________________________________________
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______________________________________________________________________________________
______________________________________________________________________________________
______________________________________________________________________________________
______________________________________________________________________________________
______________________________________________________________________________________
______________________________________________________________________________________

Draw two pictures that illustrate the difference between heterogeneous and homogeneous substances.

What is an element? ______________________________________
________________________________________________________
________________________________________________________

What word (homogeneous or heterogeneous) would Jungius apply to elements? ______________________________________

What is a compound? ______________________________________
________________________________________________________
________________________________________________________
________________________________________________________

What word (homogeneous or heterogeneous) would Jungius apply to compounds? ______________________________________
Draw a picture like the one on page 125.

What is this a drawing of, what does it measure, and how does it work?

Which two of Aristotle’s ideas does this show to be wrong?
Do your best to draw the picture that your helper describes to you in the box below.
How does your picture compare to the one your helper described?

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How does your experiment illustrate dualism?

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Make a drawing of your experimental setup.

What happened in the experiment?

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What does that demonstrate?

________________________________________________________________________

________________________________________________________________________
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
Section 3: The Revolution in the Early 17th Century

Lesson 45

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
Section 4: The Revolution in the Mid 17th Century

Lesson 46

1. An anesthetic makes people ___________ _______________ to things like pain.

2. What system in the human body did Thomas Bartholin discover? ________________________________

3. What is the difference between a local anesthetic and a general anesthetic? ________________________________
   ________________________________
   ________________________________
   ________________________________

4. What did Thomas Bartholin use as a local anesthetic? ________________________________
   ________________________________
The drawing below is based on Otto von Guericke’s Magdeburg hemispsheres experiment. Use arrows to represent what the air is doing inside and outside of the two hemispheres:

TRYING TO SEPARATE THE TWO "MAGDEBURG HEMISPHERES"

Why couldn’t the hemispheres be pulled apart?

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________________________________________________________________________
Describe Otto von Guericke’s machine that developed electrical charge.

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__________________________________________________________________________

What did he use it to do?
__________________________________________________________________________

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How is this similar to your experiment?
__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
### Draw a picture of Saturn

<table>
<thead>
<tr>
<th>Why Did Galileo describe the rings as “ears?”</th>
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### Why could Huygens see that they are rings?

| __________________________________________ |
| __________________________________________ |
| __________________________________________ |
| __________________________________________ |
| __________________________________________ |
| __________________________________________ |

### What are the rings made of?

| __________________________________________ |
| __________________________________________ |
| __________________________________________ |
| __________________________________________ |
| __________________________________________ |
What is momentum?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

An object’s momentum depends on its ________________ and __________________.

State the Law of Momentum Conservation:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

If the two vehicles pictured below are moving with the same speed, do they have the same momentum? If not, which has more?

________________________________________________________________________

________________________________________________________________________
Section 4: The Revolution in the Mid 17th Century
Lesson 51

Why is the time of day different in different parts of the world?
________________________________________________________________________
________________________________________________________________________
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What is the period of a pendulum?
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What does it depend on?
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Write down the prediction you made about what you would see in the first part of your experiment:

__________________________________________________________________________

In the left box, draw what you saw before putting the slotted cardboard in front of the flashlight. In the right box, draw what you saw after putting the slotted cardboard in from of the flashlight. What was the main difference?

__________________________________________________________________________

How did Huygens think light must act in order to explain that?
1. Robert Boyle is considered the father of modern ___________.

2. Chemistry is the study of substances and how they can be ____________________.

3. _____________________ is the pursuit of trying to turn ________________ metals into _________________ metals.

4. Boyle correctly understood that all matter is made up of particles that come in different ________________ and sizes and are in constant _________________.

Draw/color the plates below to show what happened in your experiment.

Right Before Adding Soap   A while after Adding Soap
Why did the nut make noise in the experiment and not the penny?

_____________________________________________________

_____________________________________________________

_____________________________________________________

_____________________________________________________

_____________________________________________________

What was Boyle’s bell experiment?

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_____________________________________________________

_____________________________________________________

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_____________________________________________________

What did it show?

_____________________________________________________

_____________________________________________________

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_____________________________________________________
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
1. What type of blood vessel did Marcello Malpighi discover?

______________________________________________________________________________

2. What similar things did he find in plants?

______________________________________________________________________________

3. How did the blood vessels he discovered relate to William Harvey’s work?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

4. Even though he didn’t discover them, what was Malpighi the first to discuss in the context of human anatomy?

______________________________________________________________________________

5. What do we now know about each person’s fingerprints?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
Examine pictures A, B & C on pg. 173 of your book. Draw each picture in a box below. Write your guesses about what they are in the blanks below.

A: _____________  B: _____________  C: _____________

What did Hooke see when he looked at cork under a microscope?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What did he call them?

________________________________________________________________________

All living organisms are made up of tiny units called _____________.

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
Based on the drawing above, why do planets orbit the sun?

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What did you see in your experiment? (Be sure to use the term “scattered light.”)

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How does that relate to Zodiacal light?

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______________________________________________________
A _______________ is something used to restrict how the blood is flowing when a patient is being treated.

What 2 things did Francesco Redi say should be done to treat a venomous snake bite?

1. ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________

2. ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________

Why is sucking snake venom out of a wound not dangerous to the person doing it?

__________________________________________________________________________
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__________________________________________________________________________
Spontaneous generation is the belief that ___________ things can come from _________________ things.

How did Redi show that maggots don’t come from decaying meat?

What was the control in Redi’s experiment?

What did Redi do to show that maggots are just baby flies?
1. What did Antoni van Leeuwenhoek make that allowed his microscope to magnify things so well?

___________________________________________________
___________________________________________________
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___________________________________________________
___________________________________________________

2. Van Leeuwenhoek discovered all sorts of tiny creatures that he called ________________, or “little animals”.

3. Instead of “little animals”, they are called _________________ and _________________.

Protozoa  Bacteria
Lesson 65

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
Section 5: The Revolution Near the End of the 17th Century

Lesson 66

Draw/color a picture of your flower before the experiment in the box on the left. Write a few words or a short sentence describing its color. Record the same information about the flower in the box on the right AFTER your experiment has gone for at least 12 hours.

How does your experiment show that plants shouldn’t be classified by their flowers?

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________________________________________________________________________
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What two ways did Ray classify plants that are still used today?

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Draw a picture of the flower you examined. Label the parts you studied.

What does a flower do for a plant?

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

What do the stamens and carpel do for a plant?

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____________________________________________________________________
____________________________________________________________________
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____________________________________________________________________
The three additive primary colors are ______, ______, and ____.

An object appears green. What color of light does it reflect? What colors does it absorb?

______________________________________________________

______________________________________________________

Draw a picture of Newton’s double prism experiment.

How does this show that a prism separates light into colors rather than adding colors to light?

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This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
What is Newton’s Law of Universal Gravitation?

Draw Your Experiment

Why did the candle rock back and forth?
Draw Your Experiment, Before and After Hitting the Pie Pan

How does Newton’s First Law of Motion explain this?

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Section 5: The Revolution Near the End of the 17th Century

Lesson 72

Draw What You Made in Your Experiment

What happened in the experiment?

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

The more mass an object has, the _____________ its inertia.
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
What is the difference between velocity and speed?

________________________________________________________________________
________________________________________________________________________
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What is acceleration?

________________________________________________________________________
________________________________________________________________________
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Why did the marble in your experiment travel faster the longer it had to drop? Remember to use “gravity” and “acceleration.”

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________________________________________________________________________
Write down Newton’s Second Law:

Describe your experiment and use that law to explain it.
Section 6: The Revolution at the
End of the 17th Century

Lesson 76

Draw Your Experiment,
labeling the forces on the ball

What is a net force?

___________________________
___________________________
___________________________
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___________________________

Use Newton’s Second law to explain your experiment.

_____________________________________________________________________
_____________________________________________________________________
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Why do objects fall with the same acceleration from gravity, even though gravity pulls heavier objects more strongly?

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Circle the two pictures below that represent free fall

Gabriel Christian Brown

John Fowler
Write down Newton’s Third Law of Motion:

________________________________________________________________________
________________________________________________________________________
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Draw a picture of a rocket launching

Use Newton’s Third Law to explain how this works.

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Section 6: The Revolution at the End of the 17th Century

Lesson 79

Level 1

Explain your experiment:

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Which of Newton’s Laws governs each of the following:

a. The fact that the bottom coin slid out of the stack:
________________________________________________________________________

b. The fact that the other coins didn’t move out of the stack:
________________________________________________________________________

c. The fact that the other coins fell down to the counter:
________________________________________________________________________

d. The fact that the shooter coin changed its motion when it hit the stack:
________________________________________________________________________
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
Make “before” and “after” drawings of your experiment.

How does the Law of Momentum Conservation explain this?

What happened when you started with two marbles, and how does the Law of Momentum Conservation explain that?
This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
1. Viscosity is a measure of how a fluid ______________ motion.

2. When most fluids are heated, what happens to their viscosity?

   __________________________________________________________________________
   __________________________________________________________________________

What does motor oil do in an engine?

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_____________________________________________________________________________
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Circle the picture that has the liquid with the highest viscosity.

Water                      milk                       syrup                         coffee
Section 6: The Revolution at the
End of the 17th Century

Lesson 84

Why did some natural philosophers dislike Newton’s Universal Law of Gravitation?

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How did Leibniz see God working in His creation?

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How did Newton see God working in His creation?

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Who was probably more correct?

________________________________________________________________________________________
Section 6: The Revolution at the End of the 17th Century

Lesson 85

Explain what you did in your experiment.

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Why is it easy to slide one page across another but hard to slide all the pages of a book across one another at once?

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What did Amontons think causes friction?

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Section 6: The Revolution at the End of the 17th Century
Lesson 86

Rewrite the statement in the green box on page 263 in your own words:
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How did your experiment demonstrate that to be true?
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How do a car’s wheels use friction to produce the car’s motion?

Why do car tires have treads?
What is mechanical energy? 

Explain your experiment and how it demonstrates the Law of Energy Conservation.
Lesson 89

This is a challenge lesson, so I want to challenge you to make your own notebook page for it!
Why do you often see lightning before you hear the thunder it makes?

Why did most natural philosophers at this time think that light traveled instantly?

What did Rømer do to show that this was wrong?