TEACHER GUIDE

3rd–8th Grade

Includes Student Worksheets

Science

- Weekly Lesson Schedule
- Student Worksheets
- Quizzes
- Answer Key

GOD'S DESIGN®

Physical World

Machines & Motion

Heat & Energy

Inventions & Technology

MASTERBOOKS CURRICULUM

Debbie & Richard Lawrence

TEACHER GUIDE

3rd–8th Grade

Includes Student Worksheets

Science

- Weekly Lesson Schedule
- Student Worksheets
- Quizzes & Final Exam
- Answer Key

God's Design: Physical World

MASTER BOOKS CURRICULUM

First printing: July 2018

For information write:

Master Books®, P.O. Box 726, Green Forest, AR 72638

Master Books® is a division of the New Leaf Publishing Group, Inc.

ISBN: 978-1-68344-132-8

ISBN: 978-1-61458-656-2 (digital)

Unless otherwise noted, Scripture quotations are from the New King James Version of the Bible.

Printed in the United States of America

Please visit our website for other great titles:
www.masterbooks.com

For information regarding author interviews,
please contact the publicity department at (870) 438-5288.

100% GUARANTEE Faith Grower 100% GUARANTEE

Your reputation as a publisher is stellar. It is a blessing knowing anything I purchase from you is going to be worth every penny!

—Cheri ★★★★★

Last year we found Master Books and it has made a HUGE difference.

—Melanie ★★★★★

We love Master Books and the way it's set up for easy planning!

—Melissa ★★★★★

You have done a great job. MASTER BOOKS ROCKS!

—Stephanie ★★★★★

Physically high-quality, Biblically faithful, and well-written.

—Danika ★★★★★

Best books ever. Their illustrations are captivating and content amazing!

—Kathy ★★★★★

Affordable
Flexible
Faith Building

MASTERBOOKS
CURRICULUM

Table of Contents

Welcome to GOD'S DESIGN®

PHYSICAL WORLD

God's Design for the Physical World is a course that has been designed for use in teaching physical science to elementary and middle school students. It is divided into three sections: *Heat and Energy*, *Machines and Motion*, and *Inventions and Technology*. Each section has 35 lessons including a final project that ties all of the lessons together.

In addition to the lessons, special features in each book include biographical information on interesting people as well as fun facts to make the subject more fun.

Although this is a complete curriculum, the information included here is just a beginning, so please feel free to add to each lesson as you see fit. A resource guide is included in the appendices to help you find additional information and resources. A list of supplies needed is included at the beginning of each lesson, while a master list of all supplies needed for the entire series can be found in the appendices.

Answer keys for all review questions, worksheets, quizzes, and the final exam are included here. A helpful daily schedule starts on page 15. If you wish to cover the material in more depth, you may add additional information and take a longer period of time to cover all the material or you could choose to do only one or two of the books in the series as a unit study.

Why Teach Physical Science?

Maybe you hate science or you just hate teaching it. Maybe you love science but don't quite know how to teach it to your children. Maybe science just doesn't seem as important as some of those other subjects you need to teach. Maybe you need a little motivation. If any of these descriptions fits you, then please consider the following.

It is not uncommon to question the need to teach your kids hands-on science in elementary school. We could argue that the knowledge gained in science will be needed later in life in order for your children to be more productive and well-rounded adults. We could argue that teaching your children science also teaches them logical and inductive thinking and reasoning skills, which are tools they will need to be more successful. We could argue that science is a necessity in this technological world in which we live. While all of these arguments are true, not one of them is the real reason that we should teach our children science. The most important reason to teach science in elementary school is to give your children an understanding that God is our Creator, and the Bible can be trusted. Teaching science from a creation perspective is one of the best ways to reinforce your

children's faith in God and to help them counter the evolutionary propaganda they face every day.

God is the Master Creator of everything. His handiwork is all around us. Our Great Creator put in place all of the laws of physics, biology, and chemistry. These laws were put here for us to see His wisdom and power. In science, we see the hand of God at work more than in any other subject. Romans 1:20 says, "For since the creation of the world His invisible attributes are clearly seen, being understood by the things that are made, even His eternal power and Godhead, so that they [men] are without excuse." We need to help our children see God as Creator of the world around them so they will be able to recognize God and follow Him.

The study of physical science helps us to understand and appreciate the amazing way everything God created works together. The study of energy helps us understand that God set up the universe with enough energy to sustain life and that He created the sun to replenish the energy used up each day. The study of friction and movement helps us appreciate the laws of motion and helps us understand how simple machines can be used to do big things. And finally, studying inventions and technology will not only help us understand the technological world in which we live, but will help us realize that God created man to be creative just like Him.

It's fun to teach physics. It's interesting too. Energy and motion are all around us. We use technology and inventions every day. Finally, teaching physics is easy. You won't have to try to find strange materials for experiments or do dangerous things to learn about physics. Physics is as close as your child's toy box or the telephone—it's the rainbow in the sky and it's the light bulb in the lamp. So enjoy your study of the physical world.

How Do I Teach Science?

In order to teach any subject you need to understand how people learn. People learn in different ways. Most people, and children in particular, have a dominant or preferred learning style in which they absorb and retain information more easily.

If a student's dominant style is:
Auditory He needs not only to hear the information but he needs to hear himself say it. This child needs oral presentation as well as oral drill and repetition.
Visual She needs things she can see. This child responds well to flashcards, pictures, charts, models, etc.
Kinesthetic He needs active participation. This child remembers best through games, hands-on activities, experiments, and field trips.

Also, some people are more relational while others are more analytical. The relational student needs to know why this subject is important, and how it will affect him personally. The analytical student, however, wants just the facts.

If you are trying to teach more than one student, you will probably have to deal with more than one learning style. Therefore, you need to present your lessons in several different ways so that each student can grasp and retain the information.

Grades 3–8

The first part of each lesson should be completed by all upper elementary and junior high students. This is the main part of the lesson containing a reading section, a hands-on activity that reinforces the ideas in the reading section (blue box), and a review section that provides review questions and application questions.

Grades 6–8

In addition, for middle school/junior high age students, we provide a "Challenge" section that contains more challenging material as well as additional activities and projects for older students (green box).

If questions are included, space is provided on the worksheet pages, but these are typically more reflective answers that do not appear in the answer key.

We suggest a threefold approach to each lesson:

Introduce the topic

We give a brief description of the facts. Frequently you will want to add more information than the essentials given in this book. In addition to reading this section aloud (or having older children read it on their own), you may wish to do one or more of the following:

- Read a related book with your students.
- Write things down to help your visual learners.
- Give some history of the subject. We provide some historical sketches to help you, but you may want to add more.
- Ask questions to get your students thinking about the subject.

Make observations and do experiments

- Hands-on projects are suggested for each lesson. This part of each lesson may require help from the teacher.
- Have your students perform the activity by themselves whenever possible.

Review

- The "What did we learn?" section has review questions.
- The "Taking it further" section encourages students to
  - Draw conclusions
  - Make applications of what was learned
  - Add extended information to what was covered in the lesson
- The "FUN FACT" section adds fun or interesting information.

By teaching all three parts of the lesson, you will be presenting the material in a way that children with any learning style can both relate to and remember.

Also, this approach relates directly to the scientific method and will help your students think more scientifically. The *scientific method* is just a way to examine a subject logically and learn from it. Briefly, the steps of the scientific method are:

1. Learn about a topic.
2. Ask a question.
3. Make a hypothesis (a good guess).
4. Design an experiment to test your hypothesis.
5. Observe the experiment and collect data.
6. Draw conclusions. (Does the data support your hypothesis?)

Note: It's okay to have a "wrong hypothesis." That's how we learn. Be sure to help your students understand why they sometimes get a different result than expected.

Our lessons will help your students begin to approach problems in a logical, scientific way.

How Do I Teach Creation vs. Evolution?

We are constantly bombarded by evolutionary ideas about the earth in books, movies, museums, and even commercials. These raise many questions: Do physical processes support evolutionary theories? Do physical laws support an old earth? Do changes in the magnetic field support an old earth? The Bible answers these questions, and this book accepts the historical accuracy of the Bible as written. We believe this is the only way we can teach our children to trust that everything God says is true.

There are five common views of the origins of life and the age of the earth:

Historical biblical account	Progressive creation	Gap theory	Theistic evolution	Naturalistic evolution
Each day of creation in Genesis is a normal day of about 24 hours in length, in which God created everything that exists. The earth is only thousands of years old, as determined by the genealogies in the Bible.	The idea that God created various creatures to replace other creatures that died out over millions of years. Each of the days in Genesis represents a long period of time (day-age view) and the earth is billions of years old.	The idea that there was a long, long time between what happened in Genesis 1:1 and what happened in Genesis 1:2. During this time, the "fossil record" was supposed to have formed, and millions of years of earth history supposedly passed.	The idea that God used the process of evolution over millions of years (involving struggle and death) to bring about what we see today.	The view that there is no God and evolution of all life forms happened by purely naturalistic processes over billions of years.

Any theory that tries to combine the evolutionary time frame with creation presupposes that death entered the world before Adam sinned, which contradicts what God has said in His Word. The view that the earth (and its "fossil record") is hundreds of millions of years old damages the gospel message. God's completed creation was "very good" at the end of the sixth day (Genesis 1:31). Death entered this perfect paradise *after* Adam disobeyed God's command. It was the punishment for Adam's sin (Genesis 2:16–17; 3:19; Romans 5:12–19). Thorns appeared when God cursed the ground because of Adam's sin (Genesis 3:18).

The first animal death occurred when God killed at least one animal, shedding its blood, to make clothes for Adam and Eve (Genesis 3:21). If the earth's "fossil record" (filled with death, disease, and thorns) formed over millions of years before Adam appeared (and before he sinned), then death no longer would be the penalty for sin. Death, the "last enemy" (1 Corinthians 15:26), diseases (such as cancer), and thorns would instead be part of the original creation that God labeled "very good." No, it is clear that the "fossil record" formed sometime *after* Adam sinned—not many millions of years before. Most fossils were formed as a result of the worldwide Genesis Flood.

When viewed from a biblical perspective, the scientific evidence clearly supports a recent creation by God, and not naturalistic evolution and millions of years. The volume of evidence supporting the biblical creation account is substantial and cannot be adequately covered in this book. If you would like more information on this topic, please see the resource guide in the appendices. To help get you started, just a few examples of evidence supporting biblical creation are given on the following pages.

Evolutionary Myth: Physical processes support evolution.

The Truth: Much of what scientists observe directly contradicts the ideas of evolution. Certain physical properties have been observed and tested to the point that they have been declared to be physical laws. The first law of thermodynamics states that matter and energy cannot be created or destroyed; they can only change form. There is no mechanism in nature for creating either energy or matter. Therefore, evolutionists cannot explain how all of the matter and energy in the universe came to be. This is a topic most evolutionists tend to ignore. The Bible tells us that God created it all and set it in motion.

The second law of thermodynamics states that all systems move toward a state of maximum entropy. This means that everything moves toward total disorganization and equilibrium. Heat moves from an area of higher temperature to an area of lower temperature, and organized systems become disorganized. For example, an organized system of cells that makes up a living creature quickly becomes disorganized when that creature dies. A house left to itself will eventually crumble into dust. Everything around us says that without intervention, chaos and disorganization result. Evolutionists, however, believe that by accident, simple molecules and simple organisms combined to form more complex molecules and organisms. This flies in the face of the second law of thermodynamics and everything that is observed to happen naturally. The changes required for the formation of the universe, the planet earth and life, all from disorder, run counter to the physical laws we see at work today. There is no known mechanism to harness the raw energy of the universe and generate the specified complexity we see all around us.[1]

A third physical property that contradicts evolution is the small amount of helium in the atmosphere. Helium is naturally generated by the radioactive decay of elements in the earth's crust. Because helium is so light, it quickly moves up through the rocks and into the atmosphere. Helium is entering the atmosphere at about 13 million atoms per square inch per second (67 grams/second). Some helium atoms are also escaping the atmosphere into space, but the amount of helium escaping into space is only about 1/40th the amount entering the atmosphere. So, the overall amount of helium in the atmosphere is continually increasing. If you assume that helium cannot enter the atmosphere any other way, which is a reasonable assumption, then the amount of helium in the atmosphere indicates that the earth could be no more than two million years old, which is much less than the billions of years needed for evolution. This is a maximum age—the actual age could be much less since this calculation assumes that the original atmosphere had no helium whatsoever. Also, helium could have been released at a much greater rate during the time after the Genesis Flood. Therefore, the amount of helium in the atmosphere indicates a much younger earth than evolutionists claim.[2]

[1] John D. Morris, *The Young Earth* (Colorado Springs: Creation Life Publishers, 1994), p. 43. See also www.answersingenesis.org/go/thermodynamics.

[2] Ibid., pp. 83–85.

Evolutionary Myth: Changes in the earth's magnetic field indicate an earth that is billions of years old.

The Truth: Most scientists agree on some fundamental facts concerning the earth's magnetic field. The earth is a giant electromagnet. The earth is surrounded by a magnetic field that is believed to be generated by current flowing through the interior of the earth. And there is evidence that the magnetic field of the earth has reversed several times. Also, nearly everyone agrees that the magnetic field is decreasing. The disagreement between evolutionists and creationists concerns how long it takes for the earth's magnetic field to change and what caused or causes the changes. Evolutionists believe that the magnetic field slowly decreases over time, reverses, and then slowly increases again. There are some serious problems with this idea. First, when the magnetic field is very low the earth would have no protection from very harmful radiation from the sun. This would be detrimental to life on earth. Second, at the current rate of decay, the magnetic field of the earth would lose half its energy about every 1,460 years. If the rate of decay is constant, the magnetic field would have been so strong only 20,000 years ago that it would have caused massive heating in the earth's crust and would have killed all life on earth. This supports the idea of an earth that is only about 6,000 years old, as taught in the Bible.

Creationists believe that the magnetic field reversals happened very quickly, and that the decay rate is fairly constant. One study of a lava flow indicated that reversals occurred in only 15 days. Thus, the reversals likely happened as a result of the Genesis Flood when the tectonic plates were moving and the earth's crust was in upheaval.[3]

[3] Ibid., pp. 74–83.

Despite the claims of many scientists, if you examine the evidence objectively, it is obvious that evolution and millions of years have not been proven. You can be confident that if you teach what the Bible says is true, you won't go wrong. Instill in your student a confidence in the truth of the Bible in all areas. If scientific thought seems to contradict the Bible, realize that scientists often make mistakes, but God does not lie. At one time scientists believed that the earth was the center of the universe, that living things could spring from non-living things, and that blood-letting was good for the body. All of these were believed to be scientific facts but have since been disproved, but the Word of God remains true. If we use modern "science" to interpret the Bible, what will happen to our faith in God's Word when scientists change their theories yet again?

Integrating the Seven C's

The Seven C's is a framework in which all of history, and the future to come, can be placed. As we go through our daily routines we may not understand how the details of life connect with the truth that we find in the Bible. This is also the case for students. When discussing the importance of the Bible you may find yourself telling students that the Bible is relevant in everyday activities. But how do we help the younger generation see that? The Seven C's are intended to help.

The Seven C's can be used to develop a biblical worldview in students, young or old. Much more than entertaining stories and religious teachings, the Bible has real connections to our everyday life. It may be hard, at first, to see how many connections there are, but with practice, the daily relevance of God's Word will come alive. Let's look at the Seven C's of History and how each can be connected to what the students are learning.

Creation

God perfectly created the heavens, the earth, and all that is in them in six normal-length days around 6,000 years ago.

This teaching is foundational to a biblical worldview and can be put into the context of any subject. In science, the amazing design that we see in nature—whether in the veins of a leaf or the complexity of your hand—is all the handiwork of God. Virtually all of the lessons in *God's Design for Science* can be related to God's creation of the heavens and earth.

Other contexts include:

Natural laws—any discussion of a law of nature naturally leads to God's creative power.

DNA and information—the information in every living thing was created by God's supreme intelligence.

Mathematics—the laws of mathematics reflect the order of the Creator.

Biological diversity—the distinct kinds of animals that we see were created during the Creation Week, not as products of evolution.

Art—the creativity of man is demonstrated through various art forms.

History—all time scales can be compared to the biblical time scale extending back about 6,000 years.

Ecology—God has called mankind to act as stewards over His creation.

Corruption

After God completed His perfect creation, Adam disobeyed God by eating the forbidden fruit. As a result, sin and death entered the world, and the world has been in decay since that time. This point is evident throughout the world that we live in. The struggle for survival in animals, the death of loved ones, and the violence all around us are all examples of the corrupting influence of sin.

Other contexts include:

Genetics—the mutations that lead to diseases, cancer, and variation within populations are the result of corruption.

Biological relationships—predators and parasites result from corruption.

History—wars and struggles between mankind, exemplified in the account of Cain and Abel, are a result of sin.

Catastrophe

God was grieved by the wickedness of mankind and judged this wickedness with a global Flood. The Flood covered the entire surface of the earth and killed all air-breathing creatures that were not aboard the Ark. The eight people and the animals aboard the Ark replenished the earth after God delivered them from the catastrophe.

The catastrophe described in the Bible would naturally leave behind much evidence. The studies of geology and of the biological diversity of animals on the planet are two of the most obvious applications of this event. Much of scientific understanding is based on how a scientist views the events of the Genesis Flood.

Other contexts include:

Biological diversity—all of the birds, mammals, and other air-breathing animals have populated the earth from the original kinds which left the Ark.

Geology—the layers of sedimentary rock seen in roadcuts, canyons, and other geologic features are testaments to the global Flood.

Geography—features like mountains, valleys, and plains were formed as the floodwaters receded.

Physics—rainbows are a perennial sign of God's faithfulness and His pledge to never flood the entire earth again.

Fossils—Most fossils are a result of the Flood rapidly burying plants and animals.

Plate tectonics—the rapid movement of the earth's plates likely accompanied the Flood.

Global warming/Ice Age—both of these items are likely a result of the activity of the Flood. The warming we are experiencing today has been present since the peak of the Ice Age (with variations over time).

Confusion

God commanded Noah and his descendants to spread across the earth. The refusal to obey this command and the building of the tower at Babel caused God to judge this sin. The common language of the people was confused and they spread across the globe as groups with a common language. All people are truly of "one blood" as descendants of Noah and, originally, Adam.

The confusion of the languages led people to scatter across the globe. As people settled in new areas, the traits they carried with them became concentrated in those populations. Traits like dark skin were beneficial in the tropics while other traits benefited populations in northern climates, and distinct people groups, not races, developed.

Other contexts include:

Genetics—the study of human DNA has shown that there is little difference in the genetic makeup of the so-called "races."

Languages—there are about seventy language groups from which all modern languages have developed.

Archaeology—the presence of common building structures, like pyramids, around the world confirms the biblical account.

Literature—recorded and oral records tell of similar events relating to the Flood and the dispersion at Babel.

Christ

God did not leave mankind without a way to be redeemed from its sinful state. The Law was given to Moses to show how far away man is from God's standard of perfection. Rather than the sacrifices, which only covered sins, people needed a Savior to take away their sin. This was accomplished when Jesus Christ came to earth to live a perfect life and, by that obedience, was able to be the sacrifice to satisfy God's wrath for all who believe.

The deity of Christ and the amazing plan that was set forth before the foundation of the earth is the core of Christian doctrine. The earthly life of Jesus was the fulfillment of many prophecies and confirms the truthfulness of the Bible. His miracles and presence in human form demonstrate that God is both intimately concerned with His creation and able to control it in an absolute way.

Other contexts include:

Psychology—popular secular psychology teaches of the inherent goodness of man, but Christ has lived the only perfect life. Mankind needs a Savior to redeem it from its unrighteousness.

Biology—Christ's virgin birth demonstrates God's sovereignty over nature.

Physics—turning the water into wine and the feeding of the five thousand demonstrate Christ's deity and His sovereignty over nature.

History—time is marked (in the western world) based on the birth of Christ despite current efforts to change the meaning.

Art—much art is based on the life of Christ and many of the masters are known for these depictions, whether on canvas or in music.

Cross

Because God is perfectly just and holy, He must punish sin. The sinless life of Jesus Christ was offered as a substitutionary sacrifice for all of those who will repent and put their faith in the Savior. After His death on the Cross, He defeated death by rising on the third day and is now seated at the right hand of God.

The events surrounding the crucifixion and resurrection have a most significant place in the life of Christians. Though there is no way to scientifically prove the resurrection, there is likewise no way to prove the stories of evolutionary history. These are matters of faith founded in the truth of God's Word and His character. The eyewitness testimony of over 500 people and the written Word of God provide the basis for our belief.

Other contexts include:

Biology—the biological details of the crucifixion can be studied alongside the anatomy of the human body.

History—the use of crucifixion as a method of punishment was short-lived in historical terms and not known at the time it was prophesied.

Art—the crucifixion and resurrection have inspired many wonderful works of art.

Consummation

God, in His great mercy, has promised that He will restore the earth to its original state—a world without death, suffering, war, and disease. The corruption introduced by Adam's sin will be removed. Those who have repented and put their trust in the completed work of Christ on the Cross will experience life in this new heaven and earth. We will be able to enjoy and worship God forever in a perfect place.

This future event is a little more difficult to connect with academic subjects. However, the hope of a life in God's presence and in the absence of sin can be inserted in discussions of human conflict, disease, suffering, and sin in general.

Other contexts include:

History—in discussions of war or human conflict the coming age offers hope.

Biology—the violent struggle for life seen in the predator-prey relationships will no longer taint the earth.

Medicine—while we struggle to find cures for diseases and alleviate the suffering of those enduring the effects of the Curse, we ultimately place our hope in the healing that will come in the eternal state.

The preceding examples are given to provide ideas for integrating the Seven C's of History into a broad range of curriculum activities. Even if you use other curricula, you can still incorporate the Seven C's teaching into those. Using this approach will help students make firm connections between biblical events and every aspect of the world around them, and they will begin to develop a truly biblical worldview and not just add pieces of the Bible to what they learn in "the real world."

First Semester Suggested Daily Schedule

Date	Day	Assignment	Due Date	✓	Grade
First Semester-First Quarter					
Week 1	Day 1	Machines & Motion Unit 1: Mechanical Forces Read Lesson 1: Introduction to Mechanical Energy Pages 14-15 • *God's Design: Physical World* • (GDPW) Complete Worksheet • Pages 25-26 • *Teacher Guide* • (TG)			
	Day 2	Read Lesson 2: Potential & Kinetic Energy • Pages 16-18 • (GDPW) Complete Worksheet • Pages 27-28 • (TG)			
	Day 3	Read Lesson 3: Conservation of Energy • Pages 19-21 • (GDPW) Complete Worksheet • Pages 29-30 • (TG)			
	Day 4	Read Lesson 4: Conservation of Momentum Pages 22-24 • (GDPW) Complete Worksheet • Pages 31-32 • (TG)			
	Day 5				
Week 2	Day 6	Read Special Feature: Perpetual Motion • Pages 25-26 • (GDPW)			
	Day 7	Read Lesson 5: Force • Pages 27-29 • (GDPW) Complete Worksheets • Pages 33-35 • (TG)			
	Day 8	Read Lesson 6: Friction • Pages 30-31 • (GDPW) Complete Worksheet • Pages 37-38 • (TG)			
	Day 9	Read Lesson 7: Work • Pages 32-34 • (GDPW) Complete Worksheet • Pages 39-40 • (TG)			
	Day 10				
Week 3	Day 11	Read Lesson 8: Power • Pages 35-36 • (GDPW) Complete Worksheet • Pages 41-43 • (TG)			
	Day 12	Complete **Machines & Motion Quiz 1** (Lessons 1-8) Pages 295-296 • (TG)			
	Day 13	Machines & Motion Unit 2: Simple Machines Read Lesson 9: Simple Machines • Pages 38-39 • (GDPW) Complete Worksheet • Pages 45-46 • (TG)			
	Day 14	Read Special Feature: Archimedes • Pages 40-41 • (GDPW)			
	Day 15				
Week 4	Day 16				
	Day 17	Read Lesson 10: Inclined Planes • Pages 42-43 • (GDPW) Complete Worksheet • Pages 47-48 • (TG)			
	Day 18	Read Lesson 11: Wedges & Screws • Pages 44-46 • (GDPW) Complete Worksheet • Pages 49-51 • (TG)			
	Day 19	Read Lesson 12: Levers • Pages 47-49 • (GDPW) Complete Worksheet • Pages 53-54 • (TG)			
	Day 20				

Date	Day	Assignment	Due Date	✓	Grade
Week 5	Day 21	Read Lesson 13: First-, Second-, & Third-Class Levers Pages 50-51 • (GDPW) Complete Worksheet • Pages 55-57 • (TG)			
	Day 22	Read Lesson 14: Wheels & Axles • Pages 52-54 • (GDPW) Complete Worksheet • Pages 59-60 • (TG)			
	Day 23	Read Lesson 15: Gears • Pages 55-57 • (GDPW) Complete Worksheet • Pages 61-63 • (TG)			
	Day 24	Read Lesson 16: Pulleys • Pages 58-60 • (GDPW) Complete Worksheet • Pages 65-66 • (TG)			
	Day 25				
Week 6	Day 26	Complete **Machines & Motion Quiz 2** (Lessons 9-16) Pages 297-298 • (TG)			
	Day 27	Machines & Motion Unit 3: Kinematics Read Lesson 17: Kinematics • Pages 62-63 • (GDPW) Complete Worksheet • Pages 67-68 • (TG)			
	Day 28	Read Lesson 18: Speed & Velocity • Pages 64-66 • (GDPW) Complete Worksheet • Pages 69-70 • (TG)			
	Day 29	Read Lesson 19: Acceleration • Pages 67-69 • (GDPW) Complete Worksheet • Pages 71-72 • (TG)			
	Day 30				
Week 7	Day 31	Read Lesson 20: Theory of Relativity • Pages 70-72 • (GDPW) Complete Worksheet • Page 73 • (TG)			
	Day 32	Read Special Feature: Albert Einstein • Pages 73-74 • (GDPW)			
	Day 33	Complete **Machines & Motion Quiz 3** (Lessons 17-20) Pages 299-300 • (TG)			
	Day 34	Machines & Motion Unit 4: Dynamics Read Lesson 21: First Law of Motion • Pages 76-78 • (GDPW) Complete Worksheet • Pages 75-76 • (TG)			
	Day 35				
Week 8	Day 36	Read Lesson 22: Second Law of Motion • Pages 79-81 • (GDPW) Complete Worksheet • Pages 77-79 • (TG)			
	Day 37	Read Lesson 23: Third Law of Motion • Pages 82-83 • (GDPW) Complete Worksheet • Page 81 • (TG)			
	Day 38	Read Lesson 24: Gravity • Pages 84-86 • (GDPW) Complete Worksheet • Pages 83-85 • (TG)			
	Day 39	Read Lesson 25: Falling Bodies • Pages 87-89 • (GDPW) Complete Worksheet • Pages 87-88 • (TG)			
	Day 40				
Week 9	Day 41	Read Lesson 26: Center of Mass • Pages 90-92 • (GDPW) Complete Worksheet • Pages 89-90 • (TG)			
	Day 42	Complete **Machines & Motion Quiz 4** (Lessons 21-26) Pages 301-302 • (TG)			
	Day 43	Machines & Motion Unit 5: Circular & Periodic Motion Read Lesson 27: Circular Motion • Pages 94-96 • (GDPW) Complete Worksheet • Pages 91-92 • (TG)			
	Day 44	Read Lesson 28: Motion of the Planets • Pages 95-99 • (GDPW) Complete Worksheet • Pages 93-94 • (TG)			
	Day 45				

Date	Day	Assignment	Due Date	✓	Grade
First Semester-Second Quarter					
Week 1	Day 46	Read Special Feature: Johannes Kepler • Pages 100-101 • (GDPW)			
	Day 47	Read Lesson 29: Periodic Motion • Pages 102-104 • (GDPW) Complete Worksheet • Page 95 • (TG)			
	Day 48	Read Lesson 30: Pendulums • Pages 105-106 • (GDPW) Complete Worksheet • Pages 97-98 • (TG)			
	Day 49	Read Special Feature: Christian Huygens • Page 107 • (GDPW)			
	Day 50				
Week 2	Day 51	Complete **Machines & Motion Quiz 5** (Lessons 27-30) Pages 303-304 • (TG)			
	Day 52	Machines & Motion Unit 6: Use of Machines Read Lesson 31: Machines in History • Pages 109-111 • (GDPW) Complete Worksheet • Pages 99-100 • (TG)			
	Day 53	Read Lesson 32: Machines in Nature • Pages 112-114 • (GDPW) Complete Worksheet • Pages 101-104 • (TG)			
	Day 54	Read Lesson 33: Modern Machines • Pages 115-117 • (GDPW) Complete Worksheet • Pages 105-106 • (TG)			
	Day 55				
Week 3	Day 56	Read Lesson 34: Using Simple Machines—Final Project Pages 118-119 • (GDPW) Complete Worksheet • Pages 107-108 • (TG)			
	Day 57	Complete **Machines & Motion Quiz 6** (Lessons 31-34) Pages 305-306 • (TG)			
	Day 58	Read Lesson 35: Conclusion • Page 120 • (GDPW) Complete Worksheet • Page 109 • (TG)			
	Day 59	Complete **Machines & Motion Final Exam** (Lessons 1-34) Pages 307-309 • (TG)			
	Day 60				
Week 4	Day 61	Heat & Energy Unit 1: Forms of Energy Read Lesson 1: Forms of Energy • Pages 126-128 • (GDPW) Complete Worksheet • Pages 113-116 • (TG)			
	Day 62	Read Lesson 2: Mechanical Energy • Pages 129-132 • (GDPW) Complete Worksheet • Pages 117-120 • (TG)			
	Day 63	Read Lesson 3: Chemical Energy • Pages 133-134 • (GDPW) Complete Worksheet • Pages 121-123 • (TG)			
	Day 64	Read Lesson 4: Nuclear Energy • Pages 135-137 • (GDPW) Complete Worksheet • Pages 125-126 • (TG)			
	Day 65				
Week 5	Day 66	Read Lesson 5: Nuclear Weapons • Pages 138-140 • (GDPW) Complete Worksheet • Pages 127-128 • (TG)			
	Day 67	Read Special Feature: The Manhattan Project Pages 141-142 • (GDPW)			
	Day 68	Complete **Heat & Energy Quiz 1** (Lessons 1-5) Pages 313-314 • (TG)			
	Day 69	Heat & Energy Unit 2: Thermal Energy Read Lesson 6: Thermal Energy • Pages 144-146 • (GDPW) Complete Worksheet • Pages 129-132 • (TG)			
	Day 70				

Date	Day	Assignment	Due Date	✓	Grade
Week 6	Day 71	Read Special Feature: Fahrenheit & Celsius • Pages 147-148 • (GDPW)			
	Day 72	Read Lesson 7: Conduction • Pages 149-151 • (GDPW) Complete Worksheet • Pages 133-136 • (TG)			
	Day 73	Read Lesson 8: Convection • Pages 152-154 • (GDPW) Complete Worksheet • Pages 137-138 • (TG)			
	Day 74	Read Lesson 9: Radiation • Pages 155-157 • (GDPW) Complete Worksheet • Pages 139-142 • (TG)			
	Day 75				
Week 7	Day 76	Read Lesson 10: Solar & Geothermal Energy Pages 158-160 • (GDPW) Complete Worksheet • Pages 143-144 • (TG)			
	Day 77	Complete **Heat & Energy Quiz 2** (Lessons 6-10) Pages 315-316 • (TG)			
	Day 78	Heat & Energy Unit 3: Electricity Read Lesson 11: Electricity • Pages 162-164 • (GDPW) Complete Worksheet • Page 145 • (TG)			
	Day 79	Read Lesson 12: Conducting & Detecting Charge Pages 165-167 • (GDPW) Complete Worksheet • Pages 147-149 • (TG)			
	Day 80				
Week 8	Day 81	Read Lesson 13: Lightning • Pages 168-170 • (GDPW) Complete Worksheet • Pages 151-152 • (TG)			
	Day 82	Read Lesson 14: Current • Pages 171-173 • (GDPW) Complete Worksheet • Pages 153-154 • (TG)			
	Day 83	Read Special Feature: Michael Faraday • Page 174 • (GDPW)			
	Day 84	Read Lesson 15: Voltage & Power • Pages 175-177 • (GDPW) Complete Worksheet • Pages 155-156 • (TG)			
	Day 85				
Week 9	Day 86	Read Lesson 16: Series & Parallel Circuits • Pages 178-180 • (GDPW) Complete Worksheet • Pages 157-158 • (TG)			
	Day 87	Complete **Heat & Energy Quiz 3** (Lessons 11-16) Pages 317-318 • (TG)			
	Day 88	Heat & Energy Unit 4: Magnetism Read Lesson 17: Magnetic Fields • Pages 182-184 • (GDPW) Complete Worksheets • Pages 159-160 • (TG)			
	Day 89	Read Lesson 18: Magnetic Materials • Pages 185-186 • (GDPW) Complete Worksheet • Pages 161-162 • (TG)			
	Day 90				
		Mid-Term Grade			

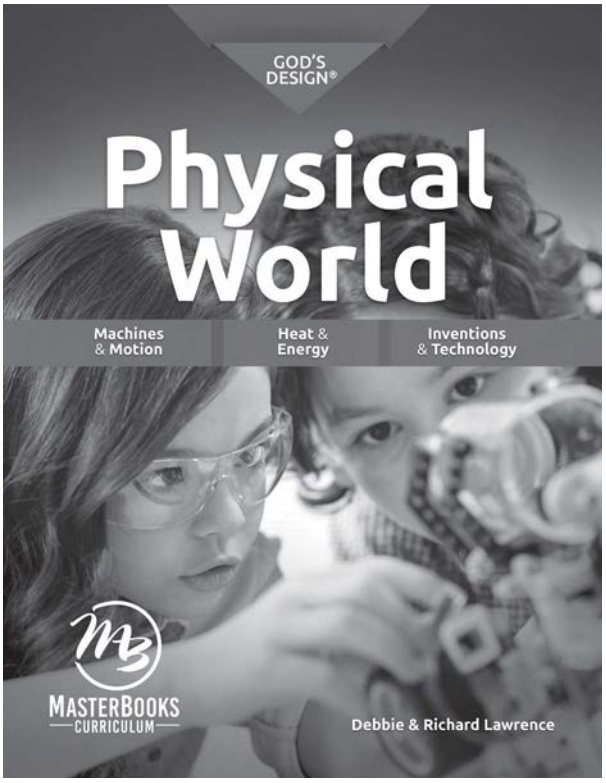
Second Semester Suggested Daily Schedule

Date	Day	Assignment	Due Date	✓	Grade
Second Semester-Third Quarter					
Week 1	Day 91	Read Lesson 19: The Earth's Magnetic Field Pages 187-189 • (GDPW) Complete Worksheet • Pages 163-164 • (TG)			
	Day 92	Read Lesson 20: Electromagnetism • Pages 190-191 • (GDPW) Complete Worksheets • Pages 165-166 • (TG)			
	Day 93	Read Special Feature: Joseph Henry • Page 192 • (GDPW)			
	Day 94	Read Lesson 21: Generators & Motors Pages 193-194 • (GDPW) Complete Worksheets • Pages 167-168 • (TG)			
	Day 95				
Week 2	Day 96	Complete **Heat & Energy Quiz 4** (Lessons 17-21) Pages 319-320 • (TG)			
	Day 97	Heat & Energy Unit 5: Waves & Sound Read Lesson 22: Waves • Pages 196-198 • (GDPW) Complete Worksheets • Pages 169-171 • (TG)			
	Day 98	Read Lesson 23: Electromagnetic Spectrum Pages 199-201 • (GDPW) Complete Worksheets • Pages 173-174 • (TG)			
	Day 99	Read Lesson 24: Sound Waves • Pages 202-204 • (GDPW) Complete Worksheets • Pages 175-177 • (TG)			
	Day 100				
Week 3	Day 101	Read Lesson 25: Characteristics of Sound Pages 205-207 • (GDPW) Complete Worksheets • Pages 179-180 • (TG)			
	Day 102	Read Lesson 26: Behavior of Sound • Pages 208-210 • (GDPW) Complete Worksheets • Pages 181-182 • (TG)			
	Day 103	Read Lesson 27: Musical Instruments • Pages 211-215 • (GDPW) Complete Worksheets • Pages 183-184 • (TG)			
	Day 104	Read Special Feature: Johann Sebastian Bach Pages 216-217 • (GDPW)			
	Day 105				
Week 4	Day 106	Complete **Heat & Energy Quiz 5** (Lessons 22-27) Pages 321-322 • (TG)			
	Day 107	Heat & Energy Unit 6: Light Read Lesson 28: Light • Pages 219-221 • (GDPW) Complete Worksheet • Pages 185-186 • (TG)			
	Day 108	Read Lesson 29: Color • Pages 222-224 • (GDPW) Complete Worksheet • Pages 187-189 • (TG)			
	Day 109	Read Lesson 30: Reflection • Pages 225-227 • (GDPW) Complete Worksheet • Pages 191-192 • (TG)			
	Day 110				

Date	Day	Assignment	Due Date	✓	Grade
Week 5	Day 111	Read Lesson 31: Mirrors • Pages 228-230 • (GDPW) Complete Worksheet • Pages 193-194 • (TG)			
	Day 112	Read Lesson 32: Refraction • Pages 231-233 • (GDPW) Complete Worksheet • Pages 195-196 • (TG)			
	Day 113	Read Lesson 33: Lenses • Pages 234-236 • (GDPW) Complete Worksheet • Pages 197-199 • (TG)			
	Day 114	Read Special Feature: Eyes & Eyeglasses Pages 237-238 • (GDPW)			
	Day 115				
Week 6	Day 116	Read Lesson 34: Using Energy: Final Project Pages 239-240 • (GDPW) Complete Worksheet • Page 201 • (TG)			
	Day 117	Complete **Heat & Energy Quiz 6** (Lessons 28-33) Pages 323-324 • (TG)			
	Day 118	Read Lesson 35: Conclusion • Page 241 • (GDPW) Complete Worksheet • Page 203 • (TG)			
	Day 119	Complete **Heat & Energy Final Exam** (Lessons 1-34) Pages 325-327 • (TG)			
	Day 120				
Week 7	Day 121	Inventions & Technology Unit 1: Communications Read Lesson 1: Printing Press • Pages 248-250 • (GDPW) Complete Worksheet • Pages 207-208 • (TG)			
	Day 122	Read Special Feature: Johann Gutenberg Pages 251-252 • (GDPW)			
	Day 123	Read Lesson 2: Telegraph • Pages 253-255 • (GDPW) Complete Worksheet • Pages 209-210 • (TG)			
	Day 124	Read Special Feature: Samuel Morse • Page 256 (GDPW)			
	Day 125				
Week 8	Day 126	Read Lesson 3: Telephone • Pages 257-260 • (GDPW) Complete Worksheet • Pages 211-212 • (TG)			
	Day 127	Read Lesson 4: Radio • Pages 261-264 • (GDPW) Complete Worksheet • Pages 213-215 • (TG)			
	Day 128	Read Lesson 5: Television • Pages 265-268 • (GDPW) Complete Worksheets • Pages 217-218 • (TG)			
	Day 129	Read Lesson 6: Communication Satellites Pages 269-272 • (GDPW) Complete Worksheet • Pages 219-220 • (TG)			
	Day 130				
Week 9	Day 131	Read Lesson 7: Computer • Pages 273-276 • (GDPW) Complete Worksheet • Pages 221-223 • (TG)			
	Day 132	Read Special Feature: The Internet • Pages 277-278 • (GDPW)			
	Day 133	Complete **Inventions & Technology Quiz 1** (Lessons 1-7) Pages 331-332 • (TG)			
	Day 134	Inventions & Technology Unit 2: Transportation Read Lesson 8: Steam Engine • Pages 280-282 • (GDPW) Complete Worksheet • Pages 225-226 • (TG)			
	Day 135				

Date	Day	Assignment	Due Date	✓	Grade
		Second Semester-Fourth Quarter			
Week 1	Day 136	Read Lesson 9: Train • Pages 283-286 • (GDPW) Complete Worksheet • Pages 227-228 • (TG)			
	Day 137	Read Lesson 10: Internal Combustion Engine Pages 287-289 • (GDPW) Complete Worksheet • Pages 229-232 • (TG)			
	Day 138	Read Lesson 11: Automobile • Pages 290-292 • (GDPW) Complete Worksheet • Pages 233-234 • (TG)			
	Day 139	Read Lesson 12: Jet Engine • Pages 293-295 • (GDPW) Complete Worksheet • Pages 235-237 • (TG)			
	Day 140				
Week 2	Day 141	Read Lesson 13: Airplane • Pages 296-298 • (GDPW) Complete Worksheet • Pages 239-240 • (TG)			
	Day 142	Read Special Feature: The Wright Brothers Pages 299-300 • (GDPW)			
	Day 143	Read Lesson 14: Rocket Engine • Pages 301-304 • (GDPW) Complete Worksheets • Pages 241-242 • (TG)			
	Day 144	Read Lesson 15: Spacecraft • Pages 305-307 • (GDPW) Complete Worksheet • Pages 243-245 • (TG)			
	Day 145				
Week 3	Day 146	Read Lesson 16: Drones • Pages 308-311 • (GDPW) Complete Worksheets • Pages 247-248 • (TG)			
	Day 147	Complete **Inventions & Technology Quiz 2** (Lessons 8-16) Pages 333-334 • (TG)			
	Day 148	Inventions & Technology Unit 3: Military Inventions Read Lesson 17: Historical Military Weapons Pages 313-315 • (GDPW) Complete Worksheets • Pages 249-250 • (TG)			
	Day 149	Read Lesson 18: Gunpowder • Pages 316-318 • (GDPW) Complete Worksheets • Pages 251-252 • (TG)			
	Day 150				
Week 4	Day 151	Read Lesson 19: Tank • Pages 319-322 • (GDPW) Complete Worksheet • Pages 253-254 • (TG)			
	Day 152	Read Lesson 20: Submarine • Pages 323-327 • (GDPW) Complete Worksheets • Pages 255-256 • (TG)			
	Day 153	Read Lesson 21: Radar & Sonar • Pages 328-331 • (GDPW) Complete Worksheets • Pages 257-259 • (TG)			
	Day 154	Complete **Inventions & Technology Quiz 3** (Lessons 17-21) • Pages 335-336 • (TG)			
	Day 155				
Week 5	Day 156	Inventions & Technology Unit 4: Modern Conveniences Read Lesson 22: Electric Light • Pages 333-336 • (GDPW) Complete Worksheets • Pages 261-262 • (TG)			
	Day 157	Read Special Feature: Thomas Edison • Pages 337-338 • (GDPW)			
	Day 158	Read Lesson 23: Refrigeration • Pages 339-342 • (GDPW) Complete Worksheets • Pages 263-264 • (TG)			
	Day 159	Read Special Feature: Frederick McKinley Jones Pages 343-344 • (GDPW)			
	Day 160				

Date	Day	Assignment	Due Date	✓	Grade
Week 6	Day 161	Read Lesson 24: Sewing Machine • Pages 345-348 • (GDPW) Complete Worksheets • Pages 265-266 • (TG)			
	Day 162	Read Lesson 25: Modern Appliances • Pages 349-351 • (GDPW) Complete Worksheets • Pages 267-268 • (TG)			
	Day 163	Read Lesson 26: Clocks • Pages 352-355 • (GDPW) Complete Worksheets • Pages 269-271 • (TG)			
	Day 164	Complete **Inventions & Technology Quiz 4** (Lessons 22-26) Pages 337-338 • (TG)			
	Day 165	Inventions & Technology Unit 5: Medical Inventions Read Lesson 27: Microscope • Pages 357-359 • (GDPW) Complete Worksheet • Pages 273-274 • (TG)			
Week 7	Day 166	Read Special Feature: Jonas Salk • Page 360 • (GDPW)			
	Day 167	Read Lesson 28: Medical Imaging—Part 1 Pages 361-364 • (GDPW) Complete Worksheets • Pages 275-276 • (TG)			
	Day 168	Read Lesson 29: Medical Imaging— Part 2 Pages 365-368 • (GDPW) Complete Worksheet • Pages 277-278 • (TG)			
	Day 169	Read Lesson 30: Microsurgery • Pages 369-371 • (GDPW) Complete Worksheet • Pages 279-280 • (TG)			
	Day 170				
Week 8	Day 171	Complete **Inventions & Technology Quiz 5** (Lessons 27-30) Pages 339-340 • (TG)			
	Day 172	Inventions & Technology Unit 6: Entertainment Read Lesson 31: Roller Coasters • Pages 373-376 • (GDPW) Complete Worksheets • Pages 281-282 • (TG)			
	Day 173	Read Lesson 32: Phonograph • Pages 377-380 • (GDPW) Complete Worksheet • Pages 283-284 • (TG)			
	Day 174	Read Lesson 33: Moving Pictures • Pages 381-384 • (GDPW) Complete Worksheet • Pages 285-287 • (TG)			
	Day 175				
Week 9	Day 176	Read Lesson 34: Becoming an Inventor: Final Project Pages 385-386 • (GDPW) Complete Worksheet • Page 289 • (TG)			
	Day 177	Complete **Inventions & Technology Quiz 6** (Lessons 31-34) • Pages 341-342 • (TG)			
	Day 178	Read Lesson 35: Conclusion • Page 387 • (GDPW) Complete Worksheet • Page 291 • (TG)			
	Day 179	Complete **Inventions & Technology Final Exam** (Lessons 1-35) • Pages 343-345 • (TG)			
	Day 180				
		Final Grade			



Machines & Motion Worksheets

for Use with

Machines & Motion

(*God's Design: Physical World*)

1 Introduction to Mechanical Energy

Let's get moving

Supply list – Experimenting with motion

☐ Tennis ball

☐ String

☐ Tennis racquet or baseball bat

☐ Copy of "Types of Motion" Worksheet

Physical laws

Write your observations.

What did we learn?

1. What is mechanics?

2. What is energy?

3. What are some ways that objects move?

Taking it further

1. What force greatly affects motion on earth?

2. List three or more ways that mechanical advantage is being used around you.

   a.

   b.

   c.

Name _____ Date_____

Types of Motion Worksheet

Objects move in three different ways. They move in straight lines, in arcs, and in circles.

For each activity, describe the motion that you observe and what forces you think are causing the motion. Note: These activities should be performed outside in an area with enough room for fast-moving balls.

Activity	Observed motion	Forces affecting movement of ball
1. Roll a tennis ball along the ground.		
2. Hold a tennis ball as high as you can and then drop it.		
3. Hit a tennis ball with a tennis racquet or baseball bat into an open area.		
4. Hit the tennis ball against a wall (with no windows).		
5. Tie a string around the ball and swing it around your head. Be sure that no one is standing near you. After a few rotations, release the string.		

1. Did the ball move faster when you rolled it or when you hit it with a racquet or bat?

_____

2. What happened to the ball on a string when you let go of it?

3. Why didn't it keep spinning?

2 Potential & Kinetic Energy

Ready to move

Supply list – Conversion of energy

☐ Rubber bands

☐ Book

☐ Paper/Cardboard

☐ Drawing compass

☐ Pencil

Supplies for Challenge – Calculating energy

☐ Ruler or yardstick

☐ Copy of "Calculating Energy" Worksheet

What did we learn?

1. What is potential energy?

2. What is kinetic energy?

3. Give several examples of objects with potential energy.

4. Give several examples of objects with kinetic energy.

Taking it further

1. Describe the transfer of energy between kinetic and potential energy that occurs during a roller coaster ride.

2. Explain how a wind-up clock uses potential and mechanical energy.

Name _____ Date_____

Calculating Energy Worksheet

Gravitational Potential Energy

$P.E. = mgh$

$g = 9.8\ m/s^2$

Kinetic Energy

$K.E. = 1/2\ mv^2$

1. A 3 kg rock is perched on an outcropping 20 meters above the ground. How much potential energy does it have?

2. If you lift a 16 kg child from the floor to her bed, which is 1 meter high, how much have you increased her potential energy?

3. How does the potential energy of an airplane change as it takes off and flies?

4. How does the potential energy of the same airplane change as it lands?

5. What is the kinetic energy of a 0.2 kg softball thrown at 5 meters/second?

6. What is the kinetic energy of the same softball thrown at 10 meters/second?

7. A car is traveling at 24 meters/second. If it has a mass of 900 kg, what is its kinetic energy?

8. If the same car is traveling at 12 meters/second what is its kinetic energy?

9. How does the kinetic energy of an airplane change as it takes off?

10. How does the kinetic energy of an airplane change as it lands?

3 Conservation of Energy

Can it be used up?

Supply list – Energy transformations

☐ Copy of "Energy Conservation" Worksheet

☐ Toy car

☐ Piece of wood or cardboard

☐ Books

Joule's experiment

Provide your explanation here.

What did we learn?

1. What is the law of conservation of energy?

2. What is the first law of thermodynamics?

3. What is the law of conservation of mass?

4. What happens to mechanical energy that causes a moving object to slow down and eventually stop?

Taking it further

1. If we lived in a world with no friction, what would happen to a toy car when you pushed it across the floor?

2. What famous equation did Einstein publish that explains how mass and energy are related?

3. Based on your observations, what is the most likely final form of energy?

Name _____ Date_____

Energy Conservation Worksheet

According to the first law of thermodynamics energy cannot be destroyed, so we should be able to identify what happens to an object's energy. Perform the following activities and try to identify what happens to the energy in each one.

Activity 1

Give a toy car or other rolling object a push and let it roll across the floor.

How far does the car move? _____

Why does the car stop? _____

What kind of energy did the car have? _____

Where did that energy come from? _____

What was the energy converted into? _____

Activity 2

Make a ramp out of a piece of wood or cardboard and 2 or 3 books. Place the toy car at the top of the ramp. Let the car go.

What kind of energy does the car have at the top of the ramp? _____

How did it get that energy? _____

What happened to the car's kinetic energy as it rolled across the floor? _____

_____

Activity 3

Sing a song.

What kinds of energy conversions are involved in singing? _____

_____

What happens to the sound energy that causes the sound to die away? _____

_____

4 Conservation of Momentum

Moving masses

Supply list – Observing momentum

☐ Six marbles

☐ Golf ball

☐ Ping-pong ball

☐ Dominoes

☐ Hardback book

Supplies for Challenge – Calculating momentum

☐ 2 long wooden pencils

☐ Thread

☐ Knife

☐ Ruler

☐ Calculator

☐ 4 cans

☐ 5 small and 5 large glass beads

What did we learn?

1. What is momentum?

2. What two quantities affect an object's momentum?

   a.

   b.

3. What is the law of conservation of momentum?

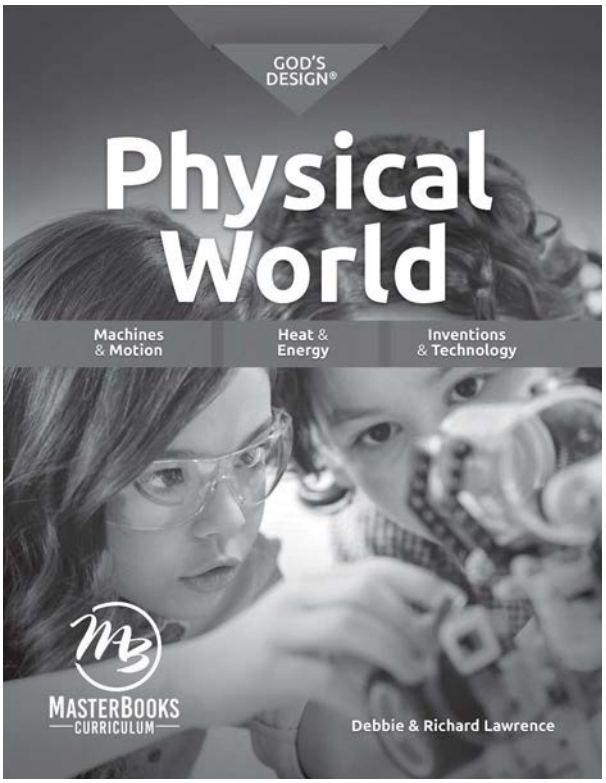
Taking it further

1. If a large football player and a small soccer player are running toward each other, what is likely to happen to the speed and direction of each player when they collide?

2. What will happen if you shoot a penny across a smooth table into a stationary penny?

3. How might a ping pong ball be made to knock over a heavy domino?

4. If a golf ball is rolled very slowly, will it still knock over the dominoes?



Worksheet, Quiz, and Final Exam Answer Keys for Use with *God's Design: Physical World* Series

Machines & Motion Worksheet Answer Keys

1. Introduction to Mechanical Energy

What did we learn?

1. What is mechanics? **The study of motion or moving objects.**
2. What is energy? **The ability to perform work.**
3. What are some ways that objects move? **In straight lines, in arcs, in circles, etc.**

Taking it further

1. What force greatly affects motion on earth? **Gravity.**
2. List three or more ways that mechanical advantage is being used around you. **Door hinges, wheels, engines, nut crackers, scissors, automobiles, etc.**

Types of Motion Worksheet

Activity	Observed motion	Forces affecting movement of ball
1. Roll a tennis ball along the ground.	**Straight line**	**Forward motion from hand, then slowed down by contact with the surface**
2. Hold a tennis ball as high as you can and then drop it.	**Straight down**	**Gravity**
3. Hit a tennis ball with a tennis racquet or baseball bat into an open area.	**Arc**	**Forward motion from racquet, gravity**
4. Hit the tennis ball against a wall (with no windows).	**Arc with a reflection of movement from wall**	**Forward motion from racquet, gravity, push from wall**
5. Tie a string around the ball and swing it around your head. Be sure that no one is standing near you. After a few rotations, release the string.	**Circular, then an arc in a straight line**	**Pull from your arm, gravity**

1. Did the ball move faster when you rolled it or when you hit it with a racquet or bat? **The ball will move faster when hit by the racquet.**
2. What happened to the ball on a string when you let go of it? **The ball on a string went flying in a straight line, but fell in an arc.**
3. Why didn't it keep spinning? **It no longer had a force pulling it toward the center.**

2. Potential & Kinetic Energy

What did we learn?

1. What is potential energy? **Energy that is stored and ready to be used.**
2. What is kinetic energy? **Energy that is being used.**
3. Give several examples of objects with potential energy. **Anything that is above ground level, including a skier at the top of a hill, a bird on a roof, a wound spring, a stretched cord, etc.**
4. Give several examples of objects with kinetic energy. **Anything that is moving, including a dog running, a car driving down the street, a ball sailing through the air, etc.**

Taking it further

1. Describe the transfer of energy between kinetic and potential energy that occurs during a roller coaster ride. **Kinetic energy is used to move the car to the top of a hill where it now has maximum potential energy. As the car moves down the hill this potential energy is converted into kinetic energy. At the bottom of the hill all of the potential energy has been changed and the car has maximum kinetic energy. As the car moves up the next hill, the kinetic energy is again converted into potential energy.**
2. Explain how a wind-up clock uses potential and mechanical energy. **Kinetic energy from your hand is used to wind up or coil a spring inside the clock, thus giving it potential energy. The spring slowly unwinds, converting the potential energy into mechanical energy as the gears inside the clock move the hands of the clock.**

Challenge: Calculating Energy Worksheet

1. A 3 kg rock is perched on an outcropping 20 meters above the ground. How much potential energy does it have? **$U = mgh = 3\ kg \times 9.8\ m/s^2 \times 20\ m = 588\ J.$**

2. If you lift a 16 kg child from the floor to her bed, which is 1 meter high, how much have you increased her potential energy? **U=mgh = 16 kg x 9.8 m/s^2 x 1 m = 156.8 J.**
3. How does the potential energy of an airplane change as it takes off and flies? **As the airplane leaves the ground the potential energy increases as the altitude increases.**
4. How does the potential energy of the same airplane change as it lands? **As the altitude decreases, the potential energy decreases.**
5. What is the kinetic energy of a 0.2 kg softball thrown at 5 meters/second? **K = ½mv^2 = 0.5 x 0.2 kg x 25 m^2/s^2 = 2.5 J.**

3. Conservation of Energy

What did we learn?

1. What is the law of conservation of energy? **Energy cannot be created or destroyed, it can only change forms.**
2. What is the first law of thermodynamics? **In a closed system, energy can neither be created nor destroyed, only transformed or transferred; energy is conserved.**
3. What is the law of conservation of mass? **Matter cannot be created or destroyed in physical and chemical reactions, but only changes form.**
4. What happens to mechanical energy that causes a moving object to slow down and eventually stop? **The mechanical energy is converted into heat energy through friction as well as sound.**

Taking it further

1. If we lived in a world with no friction, what would happen to a toy car when you pushed it across the floor? **It would slide until it collided with something else, then it would bounce back toward you. The wheels would probably not turn because they would not have friction to grip the floor and turn.**
2. What famous equation did Einstein publish that explains how mass and energy are related? **E = mc^2, which shows that mass can be converted into energy.**
3. Based on your observations, what is the most likely final form of energy? **Heat is the end product of most activities.**

Energy Conservation Worksheet

- Activity 1: **The car moves until all of the usable energy is lost. Your push is mechanical energy that is transferred to the car. The mechanical kinetic energy of the car is transformed into heat and sound from the friction between the wheels and the floor, the wheels and the axles, and between the car and the air molecules.**
- Activity 2: **When you lifted the car to the top of the ramp, your mechanical kinetic energy was converted into potential energy from gravity. That potential energy was converted into kinetic energy as the car rolled down the ramp and across the floor. The car's mechanical energy was again converted into heat and sound energy due to friction.**
- Activity 3: **Mechanical energy of pushing air across your vocal cords is converted into sound energy. The sound energy is eventually lost due to friction with air molecules. If you want to take the energy conversions back even further, the mechanical energy in your throat came from the chemical energy in your food and the chemical energy in your food came from the light energy from the sun that was converted into chemical energy by plants.**

4. Conservation of Momentum

What did we learn?

1. What is momentum? **The movement of a mass in a particular direction.**
2. What two quantities affect an object's momentum? **Its mass and velocity.**
3. What is the law of conservation of momentum? **The momentum of a system after a collision must be the same as the momentum before the collision.**

Taking it further

1. If a large football player and a small soccer player are running toward each other, what is likely to happen to the speed and direction of each player when they collide? **The larger player will be slowed down slightly, while the smaller player will be stopped completely and will be moved in the opposite direction.**
2. What will happen if you shoot a penny across a smooth table into a stationary penny? **The first penny will stop and the second penny will accelerate as the momentum of the first penny is transferred to the second penny—try it.**
3. How might a ping pong ball be made to knock over a heavy domino? **If it has more velocity, it will have more momentum, so if you could shoot it at a high enough velocity, it will have enough momentum to overcome the domino's inertia.**

Machines & Motion Master Supply List

The following table lists all the supplies used for *God's Design for the Physical World: Machines & Motion* activities. You will need to look up the individual lessons in the student book to obtain the specific details for the individual activities (such as quantity, color, etc.). The letter *c* denotes that the lesson number refers to the challenge activity. Common supplies such as colored pencils, construction paper, markers, scissors, tape, etc., are not listed.

Supplies needed (see lessons for details)	**Lesson**
☐ Balloons	23
☐ Beads (large and small glass or plastic)	4c
☐ Bible	35
☐ Bicycle	14
☐ Box (small)	7, 12
☐ Broom	16
☐ Bubble gum	32
☐ Bucket	25c
☐ Calculator	4c, 24c
☐ Canning jar rings	26
☐ Cans	4c
☐ Coins (pennies, nickels)	21
☐ Compass (illustration)	2
☐ Compass (navigational)	18
☐ Cup hook	6
☐ Cups (paper or foam)	27
☐ Dominoes	4
☐ Eggs (hard-boiled and raw)	21c, 25
☐ Gallon jug	16
☐ Golf ball	4, 25
☐ Gyroscope (optional)	27
☐ Hammer	22
☐ Marbles	4, 25c, 26
☐ Masking tape	18, 19, 22, 26, 30
☐ Modeling clay	5

Supplies needed (see lessons for details)	**Lesson**
☐ Nuts or washers	30
☐ Ping pong ball	4, 25
☐ Playing card	21
☐ Poster board/cardboard/tagboard	11, 15, 19, 25c, 26c
☐ Pulleys (optional)	16, 34
☐ Rollerskates or inline skates	22, 23
☐ Rolling chair	32
☐ Rope	5, 16
☐ Rubber bands	2, 6, 10, 14c
☐ Sandpaper	6
☐ Scale (bathroom)	5c, 7c
☐ Screwdriver	11c
☐ Screws (with various threads)	11c
☐ Shoebox lid	25c
☐ Sidewalk chalk	18
☐ Slinky® (metal)	29
☐ Spring scale (optional)	6, 10, 14c
☐ Stopwatch	18, 19, 30
☐ Straight pins	15
☐ String	1, 5, 26, 27, 28, 30
☐ Stuffed animal	17
☐ Tack or push pin	26c
☐ Tennis ball	1, 21, 25, 28
☐ Tennis racquet or baseball bat	1
☐ Thread (spools)	4c, 5
☐ Toothpicks	31
☐ Wagon or cart	17, 21
☐ Wood (for making a ramp)	3, 10, 19, 26
☐ Wood (block)	6, 11c, 12, 14, 31
☐ Yard stick/meter stick and ruler	2, 4c, 6, 7c, 11, 12, 18, 19, 26

Heat & Energy Master Supply List

The following table lists all the supplies used for *God's Design for the Physical World: Heat & Energy* activities. You will need to look up the individual lessons in the student book to obtain the specific details for the individual activities (such as quantity, color, etc.). The letter *c* denotes that the lesson number refers to the challenge activity. Common supplies such as colored pencils, construction paper, markers, scissors, tape, etc., are not listed.

Supplies needed (see lessons for details)	**Lesson**
☐ Aluminum foil	10, 12, 14, 18, 30
☐ Balloons	11, 12, 24
☐ Batteries (2 D cells)	14c, 15, 16, 17, 20, 21c
☐ BBs (steel)	18
☐ Bible	35
☐ Box (small)	10c, 27, 33
☐ Calculator	24c
☐ Camera (optional)	34
☐ Candle-making supplies (optional)	28
☐ Cardboard tubes (paper towel rolls)	24, 26, 33
☐ Coins (pennies, nickels)	2, 14, 18
☐ Colander/strainer	10
☐ Colored filters or colored plastic wrap	29c
☐ Comb (plastic)	12
☐ Compass (navigational)	19, 20c
☐ Flashlights	14, 15, 16, 28, 29, 30, 32
☐ Food coloring	8
☐ Funnel	25
☐ Iron filings	17
☐ Jars	12, 27
☐ Lenses	33c
☐ Life Savers candies	13
☐ Magnets	17, 18, 19, 21
☐ Magnifying glass	33
☐ Marbles	2c
☐ Milk	32c
☐ Mirror (hand)	29, 30, 31
☐ Modeling clay	4, 12, 30c
☐ Nails (iron)	18, 20
☐ Needle (sewing)	19
☐ Paint (black)	10c
☐ Paper clips	12, 17, 18, 20
☐ Plastic bottle (2-liter, empty)	25c
☐ Poster board/cardboard/tagboard	2, 14, 19, 27, 30, 31
☐ Prism (optional)	29
☐ Protractor	30c
☐ Radio or CD player	22
☐ Rope	22
☐ Rubber bands	25, 27
☐ Salt	32c
☐ Slinky® (metal)	22c
☐ Sponge	19
☐ Stopwatch	24c
☐ Straight pins	2, 30c
☐ Straws	2, 27
☐ String	26
☐ String instrument (optional)	26
☐ Thermometer	6, 7, 9, 10
☐ Thermos (optional)	9c
☐ Timer (with beep)	24
☐ Tracing paper	22, 33
☐ Tubing (clear plastic)	25
☐ Vegetable oil	6c, 32c
☐ Wire (copper)	14, 15, 16, 17, 20
☐ Wood (block)	2, 18
☐ Yard stick/meter stick and ruler	2, 18, 19, 25, 29, 30

Inventions & Technology Master Supply List

The following table lists all the supplies used for *God's Design for the Physical World: Inventions & Technology* activities. You will need to look up the individual lessons in the student book to obtain the specific details for the individual activities (such as quantity, color, etc.). The letter *c* denotes that the lesson number refers to the challenge activity. Common supplies such as colored pencils, construction paper, markers, scissors, tape, etc., are not listed.

Supplies needed (see lessons for details)	**Lesson**
☐ Aluminum foil	8, 32
☐ Bag (mesh)	25
☐ Bag (plastic)	25
☐ Balloons	14
☐ Battery (6-volt)	4
☐ BBs (steel)	31
☐ Bible	35
☐ Bolts	10c
☐ Bucket	26c
☐ Cloth	24
☐ Coins (pennies, nickels)	9
☐ Colored filters or colored plastic wrap	3c, 5
☐ Compass (navigational)	29
☐ Craft sticks	9, 19
☐ Cups (paper or foam)	3
☐ Diet soda	8c
☐ File (metal)	4
☐ Flashlights	3, 5, 32
☐ Flour	18
☐ Hot plate/heat source	8c
☐ Ink pad	1
☐ Ketchup packets or other condiments packets	20
☐ Magnets	9, 29
☐ Marbles	31
☐ Milk carton (½-gallon)	26c

Supplies needed (see lessons for details)	**Lesson**
☐ Modeling clay	3, 4, 19, 26, 33
☐ Needle (sewing)	24
☐ Notebook	34
☐ Nuts or washers	26
☐ Oranges	28, 30
☐ Oven mitts	8, 10
☐ Paper clips	3
☐ Plastic bottle (2-liter, empty)	20, 26
☐ Popcorn (unpopped)	18
☐ Poster board/cardboard/tagboard	9, 10, 14, 32
☐ Potatoes	1
☐ Radio or CD player	4
☐ Rice (uncooked)	18
☐ Rubber bands	23
☐ Rubber stamps	1
☐ Rubbing alcohol	23
☐ Sewing machine	24
☐ Squirt bottle	8c
☐ Stopwatch	26
☐ Straws	9, 14, 26
☐ String	3, 4, 8, 14, 25, 26
☐ Thread (spools)	19, 24
☐ Train (toy)	9
☐ Tubing (clear plastic)	3, 31
☐ TV remote control (optional)	5
☐ Tweezers	30
☐ Wire (copper)	4
☐ Wood (block)	17
☐ Yard stick/meter stick and ruler	17