

An incredible journey into the Life, Physical and Earth Sciences that powerfully shows the beauty, power, intelligence and the love of the God who created all things.

Quick Start Info CrossWired Science Core 3

Welcome to CrossWired Science Core Year 3!

We are happy to take you on a thrilling journey to learn about God's handiwork as we study Life, Earth and Physical Science together. Our prayer is that you will come to know the power, love intelligence and beauty of the Lord more than you ever thought possible through the things you learn in this course!

PLEASE READ THIS BEFORE BEGINNING.

1. Be sure to be logged in when you are using the downloadable Student Notebook Printable Modules. The printable Student Modules will schedule and navigate every lesson of the year. (The online calendars are for those using CWS as a supplement). These printable Student Modules are the ONLY way to effectively access the online lessons and videos. All blue print is hyperlinked.

2. There are 24 Student Notebook Modules for Year 3. They may be printed module by module.

CrossWired Science Core Year 3a 12 MODULES Global Topics Aiming & Microwaves

CrossWired Science Core Year 3b 12 MODULES Global Topics Pressure & Ultraviolet

3. Integrating CrossWired Science Core and our High School Program, BCP, There are 24 "Student Notebook Modules each year for both **Biology/Chemistry/Physics** (High School) & **CrossWired Science Core** (K-9th Grade).

Modules in BCP 301 & 302 correspond to the Module Lessons in the CWS Year 3 Core Curriculum

 Some lessons each week overlap for all students, Kindergarten through High School, including: Experiments/Video Links/Core Videos/Specific Videos/Gold Digs/Memory Verses/Devotions/Concept Drawings/ and Scientists (K-8th grade). Each age has its own level of work in each of these content areas..

4. There are references to First Year Students and Second Year Students in many Modules.

These refer to existing students and students entering into a group studying CWS materials. If you were a member of a CWS group last year and a friend wants to join it this year, you would be the second year student and he would be the first year student. Your assignments are sometimes slightly different because he does not have the same background you have. We did this so new students can join an existing group.

5. You do not need to print the Student Modules. You can save money and use them electronically and simply use a regular notebook to record your student's work. You can also use an editing tool to type in these electronically. If you print them, we highly recommend the EPSON ECOTANK COLOR PRINTER 3760 SE (Costco/Sam's club). Printing costs to print the first 12 modules for CWS in color is about \$5 TOTAL. This printer is a homeschooler's dream come true. The ink lasts forever and refills are VERY inexpensive.

6. CWS is organized by Global Topics. These bring out God's wonders in different subject areas. If you are a student using CWS for a Full Year's curriculum, you will use the **Student Modules** to access ALL lesson components. You can download them from any Global Topic. Click CWS: Core 1 or CWS: Core 2. or CWS: Core 3. Download the Student Module PDF. The Student Module provides step-by-step instructions with the blue, hyperlinked text designed to access the lesson content directly.

Quick Start Info (cont.)

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7. Hyperlinked General Links and Unit Links. "General Links 1", "General Links 2" and "Unit Links" are not accessible on the Lesson Page by clicking (hyperlinked), unless you are in the Parent or Admin Account. (If parents are logged on in in their user, you can see General Links and Unit Links when you click on the Parent Tab in the top menu. These General and Unit Links are immediately accessed when an image is clicked. To get to the links in the student user, you must copy and paste the Link in the URL bar at the top of every link. We realize this is inconvenient. We do this to add a tiny amount of internet protection.

8. Interestables and Clipped Sentences. We will often ask students to find "Interestables". These are interesting–even fascinating– facts and concepts. We want Note Taking about them to be as easy and pleasant as possible. We encourage using "Clipped Sentences" for note taking, which are shortened notes like those taken in a college class. An example of a clipped sentence for, "The iris is the colored part of the eye. It grows and shrinks to let different amounts of light into your eye." Clipped: "Iris colored. Grows shrinks. Adjusts light."

9. Review is an essential component to a CrossWired approach. Review is VERY important for detailed long-term memory! *You will see materials brought back to your students at regular intervals.* The material in Core Videos and some in Gold Digs and Digging Deepers will need to be mastered over the course of 3-4 years in Biology/Chemistry/Physics (BCP).

When you watch a Core Video of each Global Topic the first time, 3-5 notes are taken on it or an easy First Timer Quiz is taken. The third time there is a little more difficult Mastery Quiz. BUT, even after these 3 sessions with every Core Video you are not done with the material.

There is a very novel Mastery System we will be introducing. It will take all the material of all the Core Videos/Gold Digs and Digging Deepers and assess by Computerized Super-Reviews what a child knows and doesn't know. The students will be helped to get 100% in every Review by in-built video-based animated sessions. The more the student masters the material in their three interactions with the material before the Super-Review, the more enjoyable "Super-Mastery" will be. Super Mastery is mastering ALL CWS Core material.

10. Go at your OWN pace! We encourage you to choose what sections fit your students' needs and spread out the lessons over as much time as needed. The goal is to create a LOVE for learning about God's handiwork, NOT to create head-smart but heart-ignorant young people!

11. Stay Connected - Join our <u>CrossWired Science Community Facebook Group</u> and join our email list at contact@crosswiredscience.com if you do not receive our weekly devotional emails.

1. Core Video 1 (20 minutes)

CWS CORE 3: Module 1

Fluid Dynamics Video: V1: Fluid Dynamics and Bernoulli Review

First Year Students: Do NOT do quiz. Find 3-5 interestables from these Core Videos and star the best one of each. Mark the second best one with the phrase "2nd". Younger students may want to draw a picture from the video. Your teacher will decide which to do.



Second Year Students Review: (Note: You have 8 review Global Topics this year and 4 new ones.) You have already interacted with this video three times. This quick review needs you to find 3 more "compound interestables". These interestables will have 3 or more facts tied together into one concept. For instance, in this video you could write: Hydrodynamics is a branch of Fluid Dynamics. Example: The sharks dorsal fin helps its hydrodynamics by its dermal fibers which stiffen it for high-speed swimming."

1.		
2.		
3.		
4.		
5.		

Eye Video V1 LIVING CORNEA Review

All Students: This quick review needs you to find 5 "compound interestables". These interestables will have 3 or more facts tied together into one concept. For instance, in

instance, in s.

this video you could write: Hydrodynamics is a branch of Fluid Dynamics. Example:The sharks dorsal fin helps its hydrodynamics by its dermal fibers which stiffen it for high-speed swimming."

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1.		
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2. Verse Explanation (10 minutes)

Explain what the verses below mean and apply them to your life in some way.

Colossians 1:15-17

Mom's Corner

Make Life-Changing Memories

I had a realization as I was angrily (yes...I mean like mad) cleaning my kitchen grout (yes... I can be like that sometimes) that the memories my children were making were of me being angry while cleaning, and not

the sweet memories I dreamed of. You know... the memories we make up of all the children sitting quietly around our rocking chair, hanging on our every word as we read aloud quality classic literature and train their hearts for eternity. Nope... my kids were running for cover as I furiously threw the toys out of the "toy closet" and had emotional breakdowns over the dirt in our grouted tile counters. What do we want our children to remember years from now? I remember long ago hearing a speaker tell us we should "begin with the end in mind".



So, I made an intentional vow to try harder, do better and make sweeter memories for them to carry into their adulthood. I failed. Over and over. BUT, I kept trying! Let me encourage you - don't give up on this quest, just keep getting back up and trying again.



Today, four of my children have flown the nest, and 4-6 more are still in it, depending on the day, eating everything in sight (yes, they do tend to come back). And, I've learned a few lessons along the way.

One big lesson that keeps coming back is that the *memories* of the ordinary daily moments we share matter more than we realize. Here's a challenge that helped me: Put away the cleaning supplies and let go of some of those perfectionist ideals. Instead, just plop down on the couch together (ignore the mess), pull out your Bibles and teach them all the cool tools a Study Bible has to offer and

actually have them take turns reading it aloud. It changes the atmosphere of your home... really. While you're at it, pick a fun book to read aloud together, and add some snacks from exotic locations (go shop in the back aisles of your grocery store, or order a subscription snack box) and just be present with them in the moment.

Mom's Corner

Make Life-Changing Memories (continued)

The Gift Of Being Necessary

There's more; Give your children the gift of being necessary.

We all need to be needed. Instead of doing everything for them, hand them the responsibility of becoming a necessary part of making your family run smoothly. Go beyond the low expectations of the usual chores of taking care of just themselves. Let them participate in the privilege of taking care of everyone.



One way we do this is by rotating who plans and makes dinner every night and having real, meaningful responsibilities to keep our household running smoothly. It's a wonderful way to end the day, with your family around the table eating food made by their siblings. (And yes, I mean actually sit down and eat off real plates!) An unexpected bonus; you get some more free time in your schedule too! Come prepared with questions or comments to get discussion going. It's as easy as "What was a high/low of your day?" or "What did you like about..." You'll be surprised by what comes out when you slow down a little.

Go Big In Celebrating Them Everyone needs it!

When it comes to celebrating each other, I'm not talking about cheering them on in every activity you can sign them up for...and drive them to...and pay for. That leads to exhaustion. I'm talking about making family celebrations into memories they can carry with them.

For instance, long ago, I got frustrated with the endless purchases of impersonal greeting cards. They never say what I want them to, and they cost a fortune – only to be thrown away. So, the "Birthday Journal" was born. Each member of our family has a journal, and on their birthday - we celebrate them by writing to them in it and reading aloud to them what we wrote. These journals are a precious memory–and a record of their lives, and how much they are loved. The birthday journals would be the first thing I would grab if we had a house fire!





Life-Style Lessons

Currently, our "book-style" lessons are secondary to our "lifestyle" lessons. We are learning new ways of connecting and loving the people around us-together. We are learning new skills as we complete a family building project. We are learning new business strategies as we expand our family businesses and add a short-term rental to our repertoire (anyone want to

visit sunny SoCal... I know a place 😁). We have intentionally

included everyone in our endeavors-and believe me, there are memories being made that will serve them well into their futures!

Mom's Corner

Make Life-Changing Memories (continued)

Quests For Adventure Out with boring living!

Don't miss the chance to do something out-of-your-ordinary! Field trips are my favorite - when was the last time you took one? (They are not for just for the littles, either!) Nothing beats ditching the lesson plan for the day, and heading to the zoo with your high schoolers to marvel at the creativity of our God. How about a hike? Make it even more adventurous by jumping in the stream (bonus points if you are fully clothed!) Can't afford a trip?...make up an adventure. Just getting outside is almost an immediate adventure.

Create a challenge for them– it can be as simple as finding new flowers or leaves, or as thrilling as finding a new trail or building a make-shift raft to float down a river. Pack a lunch, a blanket and eat your picnic together: Memories are being made!





Stick Together

It seems like our society pushes us to be independent, the sooner the better. But, is that really what works best? Is that what we should be striving for? We have discovered the great joy of being together, all ages. I encourage you to really think this one through... What is the end you have in mind?

There has been a supreme delight in providing a safe place for our post-high school young adult children to stretch their wings, before they fly the nest. Don't be afraid to swim against the stream in this and encourage your children to stick

around longer. Trust me, they have many more lessons to learn before they go, and you have many more memories to make together!

I guess all of this can be summed up by –**Be intentional**! Be willing to get off the well-worn, familiar path. You are divinely assigned this task of passing on your faith and heritage to your children, so they will pass it on to future generations. It's an ongoing, ever-rewarding privilege that the Lord promises to give you the strength and wisdom to complete. You are building a bridge from one generation to the next.

Never give up. Make all the life-changing memories God has for you!



Blessings, Renita

> "We will not hide these truths from our children; we will tell the next generation about the glorious deeds of the Lord, about His power and His mighty wonders." Psalm 78:4

Lesson 1 Page 5

3. SPECIFIC VIDEOS: Watch each video. Write 5 "Interestables" for each one.
Remember make it easy and use clipped dance sentences! Use the back, too!
There is a video series you might enjoy called John 10:10. You may substitute in the video below for the amount of minutes it is for that amount of time for any of those below. (For instance, it the John 10 video is 5 minutes, you could watch 5 minute less of the Veritasium video below. Record the interestables in the box on the next page called "Extra Video".
Mark which video you took the time off by writing, for example, "-5 minutes".
This Mod's John 10:10 video is It's a Wonderful Telescope JN10 5 min



Younger: <u>PEREGRINE FALCON SPEED</u> BW 4m <u>WEIRD ANIMAL TEETH</u> SSK 4m Older: Entomology <u>How Different Species of Fireflies Blink</u> SED 10 min

Review: BIOLOGY : Chameleons Change Color Ver 6 min



Younger: SNAPPING TURTLE: BIGGEST! BW 6m Check Out the Gr

Check Out the Great Barrier Reef! SSK 7m

Older: Robot Piano Catches Fire Playing Rush E (World's Hardest Song) MR 11 min

4. <u>SOUND 5: Sound Makers</u> (45+ minutes)



Lesson 1 Page 6

Sections A-E

Older students:

- Read This Digging Deeper for 5 sections.
- Write 3 exciting facts or draw & label 2 pictures of the most interesting concepts found in the 7 letters for this Gold Dig in the boxes below.

You may take the quiz for the parts you do, but the quiz will erase itself when you close it. You must finish the entire quiz in one sitting. An alternative to doing Gold Dig lessons is to watch "Absolute Genius" Videos found in Fluid Dynamics <u>General Links</u>. These are only accessed by copy/ pasting the given URL

For clickable access Be logged into Parent User and use this link: *General Links 1 Hyperlinks*.

Title:

Title:

1. Core Video (15+minutes)

Lesson 2 Page1

DO NOT DO THE QUIZ. Find 5 interestables from these Core Videos and star the best one of each. Mark the second best one with the phrase "2nd". **Complete on the back.**

Aim Video

V1 HORNED LIZARDS



1.		
2.		
3.		
4.		
5.		

2. Devotion: (10+ minutes)

Teen Devotion: <u>Envelopes And Oranges</u> Science Devotion: <u>The Sun In Its Might</u> Bible Devotion: <u>YAKES AND OAKES</u>

Read the devotion in Teen Devotions link above. Write the main take home point and 2 personal applications below. Next Pick either the Science or the Bible Bible and do the same . Use the back for more room. For younger children, we suggest using the book "Indescribable" or "How Great Thou Art" by Louie Giglio.

Lesson 2 Pg.2

3. Concept Drawing (20 min)

Draw this diagram. Label it.



Draw this and this.



Write 5 interestables about this on the back.



Above: The top of each ommatidium makes a hexagon which makes the compound eye look a bit like a honeycomb!



Amazing Insect Vision!

Compound eyes and Ommatidia

If all we ever saw was one insect eye, that ought to be enough to convince us that evolution is impossible. They are amazing! If you look closely at the eye of an insect, you will see the hexagon lenses of

the ommatidia (singular=ommatidium). Light goes in the crystal and is focused down the black tubes called the rhabdom. As it travels down the rhabdom, it is detected by the light-detecting cells.

The pigment cells act like curtains to make certain no light goes outside the one rhabdom to the one next to it, The helps the insect to see more clearly. The more ommatidia the insect has, the better it sees. The dragonfly has wrap-around eyes with 25,000 ommatidia to help it see insects it is hunting flying as fast as cars travel through towns.. An ordinary beetle might have only 2000 ommatidia and a bee has 5000. Each ommatidium has its own glass-like crystal to help in focusing the light.

Bug eyes are quite a marvel of God's light-detecting engineering which the bugs DNA makes out of the plants and other things it it eats!



Bug eyes come in all kinds of shapes and sizes, all designed by God!



Horsefly eyes!



Dragonfly wrap-around -the-head super-eyes!

4. FD: General Links 1-Lesson #1 (45-60 minutes)

Lesson 2 Pg.3

Today is a"General Links 1" Lesson where YOU pick what Links to watch.

Year 1 Students: Watch 45-60 minutes of Links you chose from this group. Write 2 great facts from 3 of your favorite Links. **Year 1 Students: Review:** Extra Credit—also do above, recording different interestables than last year. Finish work on the back of this sheet.

These links are a review of Core 1. Record your rewatched links on the new link page below.

PARENTS: Watch this **VERY IMPORTANT** video which explains <u>How To Do Links</u>. Click the button "Quick Looks" in the upper right hand corner of the page. **Record your Link Views.** Every link has a number. Record the date viewed in small print in the appropriate box in the Viewing Record sheets below. This is explained in <u>How To Do Links</u>.

IMPORTANT: The General Links 1 link above is not to activated links. In the student user, Links can only be accessed by copying the URL. For clickable links you must be logged into the Parent User and access the links from the Parent/Teacher tab. Watch 45-60 minutes of Links you chose from this group.

 Link 1:
 Link 2,3:
 (Put notes on back)

 5. Scientist (20 minutes)
 Vr. 1 students: List some general information about this scientist's life.

 Raymond Damadian
 Vr. 1 students: List some general information about this scientist's life.

6. Craft & Fun Supplements	Optional Lesson 2 Page 4
Possible Subject Areas: Fluid Dynamics Wright Brothers Bernoulli Foils	ULE 1 Build a Wright Brothers'
Eyes Cornea of eyes Lasers Lizards Dragonfly Hummingbird Fly Butterfly Birds	Plane #1 Plane Make: Iolilipop stick aeroplane
Grassnoppers Shark Birds and Insects Flying Patterns	#2 Plane
5 Hummingbird Feeders	Wright Flyer Paper mode #3 Plane #3 Plane Many More Models
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Lizard Color Pages 1 Lizard Color Pages 2	

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1. Core Video (15+minutes)

Lesson 3 Page1



1. 2. 3. 4. 5. Aim Video V2 <u>LEAFHOPPER LEAPS</u>

All Students: DO NOT DO THE QUIZ. Find 5 interestables from these Core Videos and star the best one of each. Mark the second best one with the phrase "2nd". Complete on the back.

1.		
2.		
3.		
4.		
5.	 	

Aim Video V3 BOLAS SPIDER

All Students: Follow directions above.



2. Verse Memory (15 minutes)

Write or illustrate the verses & memorize.

Colossians 1:15-17

3a. <u>Aiming</u> 1 Experiment Block (3+ Hours/3 Weeks)

The CWS website has many experiments you can do with this Global Topic. Go to the link above and chose 3 hours worth of experiments to do over the next 3 weeks. Record your experiments and findings below and on the next page.

NOTE: This is the official Connected Experiment Block of CWS. All students in CWS have the

same experiments to access.

Experiments: Aiming 1



Mods 1-3

This experiment is for advanced CORE students. We recommend completing the WONDERS Track and WONDERS PAK before doing this experiment.

STRUCTURAL COLOR & Thin Films

"The precious possession of a man -and woman- is diligence." -Proverbs 12:27

NOTE:

This introduction has nothing to do with the experiment we will do with Polarized light. However, it does involve "creating " color that is not there in an object. We wanted to give you an introduction to thin films which cause interference of light which gives different colors and then get into Polarizing filters which also create colors.

Bubbles and Puddles

Bubbles and oil coated puddles that you see on a road after a rain have colors that are not in the bubbles or the oil films. Instead there are nano-sized layers that alter the incoming white light in ways to reflect colored light.

Hooke and Newton and Feathers

Robert Hooke and Isaac Newton were the first ones to grasp that the peacock feather didn't have any color in it. Instead the color was in the light, not in the feather. They thought the feather was doing something to the light to change it. This was such a radical idea that few people could comprehend it; but Hooke and Newton were spot on.

All the color in this incredible feather is made by layered, clear nano-thin mirrors! There are 1 million mirrors in one feather!





Hummingbirds use thin films in some feathers, also.

Peacock Feathers'n Thin Layers!

The peacock feather uses what we call "thin films to cause "interference" to create color.

There are one million micro-miniaturized flat, super-thin multilayered mirrors that give one peacock feather its beautiful colors. The mirrors are like a layeredsandwich in that they have precise layers (See above). These mirrors are made mostly of keratin, the same protein that makes up our fingernails, hair, outer skin, rhino horns and animal claws.

The thickness of the tiny "mirrors" has to be extremely exact to give the colors we see. Where the mirrors change the feather from one color to the next in the design of the "eye" of the peacock feather (left), the multi-thickness mirrors have to change thickness at that exact place. WOW!!!

Write 5 interestables on Thin Films on the back of this sheet

NOTE: This is in the

official Experiment

Mod 1-3

POLARIZED LIGHT



INTRO:

Polarized light is different than light reflected from thin films...kinda. You'll see what we mean next week.

Using the Polarizing Filters

In this fascinating experiment you are going to use two pieces of polarizing plastic sheeting. These polarizers are not just ordinary pieces of plastic. Isaac Newton would have been shocked if he had them. If he'd understood what they are doing, he would have unravelled some of the greatest mysteries in the universe, those dealing with light.

Polarizing Light and Fence Slats

Imagine a fence with 10,000 miniature slats all running the same direction imbedded into these pieces of plastic. (See the slats above.) This is a little what these are like. If you had eyes to see this small, you'd see 10,000 lines that look like this running

Exact accuracy

The peacock feather has exactly the correct thicknesses of micro-mirrors to create the colors to make the peacock feather



Photo by Jatin Sindhu

eye. The colors of the feathers are cause by thin films NOT polarized light.



Above: Multiple thin film layers for the colors of a beetle's exoskeleron. This same thing is happening with peacock feathers. This is NOT caused by light being polarized. God is great at adding beauty by sophisticated color!

INTRO cont.

Put simply, these "slats" prevent all light from passing through except the light waves that are aligned correctly to them so the light waves can "slide" between the "slats". When you have one piece of plastic polarizer, it cuts about 90% of the light. All that gets through is light that that can get through are light waves that are aligned correctly (See diagram with slats, top left.)

When you have a second polarizer and turn it and put something like layers of the rock mica between the two, strange things happen.

The second polarizer only lets certain light through and the layers of the mica reflect light certain ways because of their thin layers of mica. This causes different colors to filter out and give you interesting patterns.

We'll have you do this in a very easy experiment. Then we'll have you make a great little thin film device out of clear regular plastic and packing tape. You'll love what it does!

Write 5 interestables on Polarized Light on the back of this sheet

3a. Polarized Light Experiment Block (3+ Hours over 3 Weeks) pg.3

SUPPLIES: If you click on these you will see what they are and where you can buy them. Most are only sold in bulk, but you will be able to see exactly what to get. These will be available in the BCP Experiment Pak #1 in September 2023.

- 2 polarizing plastic sheets about two square inches each
- Plastic sheet to put tape creations on (sheet protectors work)
- <u>Thin mica sheet</u>-any size (optional)
- **Velvet Bag** to hold polarizers (Optional) Bigger than 3x3 is best.
- Packing tape or magic scotch tape (Packing tape works a little better)

Clear plastic fork and plastic plates

Other plastic items (i.e. <u>a plastic case that holds pencil leads</u>, <u>scotch tope plastic holder</u>, etc.)

Procedure #1: Plastic silverware, plastic plates, etc and polarized light

Use 1 Polarizer

Stand in front of a white computer screen. (ie use a open text document on your screen), Hold one of the the polarizing sheets flat between you and the screen. Look at the white screen. Turn it clockwise like you would a dial. You should see the screen fade to black as you turn it. (If it does, this means it is giving off polarized light)

Try a Thin Sheet of Mica (if you have some.)

Put your piece of mica between the polarizing sheet and the computer. Turn the sheet.

You should see places where many colors of light are shining off the mica.

Color is caused by the light reflection off different micro-thicknesses of the mica going through the polarizer.

Try Plastic silverware, plastic plates, plastic pencil lead containers, clear plastic tape dispensers, etc. Twist the object.

As you put each object in 6" or so front of a computer screen, twist the object and turn the sheet behind. You should see colors stronger were the object is experiencing the most stress.





Turn your polarizer like this keeping it parallel to the other one but when outside, use two and separate them and put the object you are viewing between them. Look toward light. The polarizer furthest from you polarizes the light. The one closest to you affects the polarized light from the first one.

Take objects outside

You can also do this while outside using just the sun as your source of polarized light. Put the object being viewed in-between the two polarizing sheets. See picture below left but imagine the sun is the light source). Turn the sheet furthest from your eye while holding it parallel to the other sheet as you hold it. (See below if you need further description.)

Procedure #2: Microwaved grapes and orbees

How Microwaving Grapes Makes Plasma Ver 8m Now for some excitement.

Do the experiment shown in this video with with grapes and with the clear orbees. Check it with a polarizer to see if there is only polarized light being given off. (Turn the polarizer and see if it fades to nothing like your computer screen did.)

Mod 1-3



Polarized light art by A. Comaro

3a. Polarized Light Experiment Block (3+ Hours over 3 Weeks) pg.4

Mod 1-3

Procedure #3 Tape Mosaics & Polarizers

This is amazing. This is polarized light art.

Cut off a 3"x3" section of the <u>transparency</u>. (Any clear piece of plastic will work...ie a deli container, sheet protector etc. Cut up the packing tape into little pieces -(1/4") on each side works well.)

Cut the tape into 100 or so pieces and arrange them in all different patterns on the clear square of transparency like papers would be randomly piled onto of each other if 100's of them covered a desk.

View them close to a white computer screen through 1 p-filter. Turn the filter as you view it. You should see an amazing array of colors. (Or put it between 2 filters and view it outside.)



Your polarized filter tape creations could be soupedup to look like this. (This is NOT easy! There is an easier way. More on that later.

"How countless are your works, LORD! In wisdom you have made them all; the earth is full of your creatures." Psalms 104:24 God's infinite intelligence pulled off some pretty great things here on earth!! (Below)

Additional Designs

You can use the rest of the transparency to make additional designs of pieces of layered tape like your name, pine trees, rockets etc.

You can get more plastic transparencies from a stationery store and make



an entire collection of incredible designs. Or try a sheet protector piece as your base.

View these outside in the sun as well, you just need to use both filters with one between the light source and the tape design you made and one pfilter close to your eye. It works well to view these close to a lamp with the lamp shade taken off.

A few other tapes work as well as packing tape. See if you can discover other types of clear tape that work.

Note: The tape is birefringent which means that certain colors of light pass through it at different speeds separating out the colors of light.

Sheet protectors, like those you can buy at Costco work fine for the base of the Tape



All kinds of animals and insects use sunlight that is polarized to navigate and migrate. Cuttlefish even make polarized light from sunlight with their skin to send secret messages to each other! God understands His creation perfectly and knows how to use it in His animals and insects!

Inside/Outside (Review)

You can view objects outside or in front of a white computer screen. Put one polarizing sheets close to your eyes and look through it at objects you are looking at and twisting. (Look at the object and the screen of the computer which is giving off polarized light through the sheet.) The twisting affects the polarized light and gives it color.

You can view objects in sunlight. Put the object between the sheets and turn the polarizer closet to your eyes. Light from the sun will give you the color when seen through the sheets.







3b. Flight Patterns Hunt(1st, 2nd Timers and Bio/Chem/Physics) 3 Months Less

Lesson 3 Page 3

This Hunt was given in Core 1. Find different birds, mammals and insects than you did last year. The purpose of this Hunt is to get you thinking more deeply about aerodynamics and to apply your knowledge to living things. You have the next 3 months to find 20 flying creatures with different flying patterns and analyze the aerodynamics involved in each. You may include flying mammals, and insects and birds. The analysis of their flights may be researched or hypothesized. You must see each one personally. We've listed 6. Write in your analysis of these two and do likewise for your remaining flight patterns. (Put the remaining 5 on the back)

Flight Patterns Hunt

- 1. Dragonfly (See <u>Dragonfly Flight Design</u>)
- 2. Hummingbird (See Hummingbird flight Design 1 and Design 2 and Robotics)
- 3. Butterfly (See Red Admiral Flight, Designer Wings, Photonic Sructures for beauty,)
- 4. Birds 1 (See Swifts, Albatross)
- 5. Grasshopper (See Locusts)
- 6. Fly (See Aces of the Air, How Flies Fly, Fly Development)
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.

14.

15.

1. FD Unit Links Lesson #1 (30+ minutes)

Today is a"Unit Links" Lesson where YOU pick which Links to watch. Watch 20-25 minutes of videos you chose from this group. *Write 2 great facts from the videos you watch.* IMPORTANT: For clickable links you must be logged into the Parent User

and access the links from the Parent/Teacher tab.

Link 1:



2. Sound Unit Links Watch 30 minutes of	LESSON 4 Page 2
Today is a "Unit Links" Lesson where YOU pick what Links to Write 2 great facts from the videos you watch. IMPORTANT: For clickable links you must be logged into the Parent User and access the links from the Parent/Teacher tab. Sound Unit Hyperlinks	o watch.
Link 1:	
Link 2:	Build your <u>Science Field</u> Scroll down the linked page to read about it!
Link 3:	

Lesson 4 Page 2

VIEW RECORD SHEET - Log in to access. Choose 30-45 min of links. Log in to parent/Teacher

account for HYPERLINKS. Record the date watched.

	Level 1						
1a.	1b.	7a.	7b.	13a	13b.		
2a.	2b.	8a.	8b.	 14a	14b.		
За.	3b.	9a. '	9b.	15a	15b.		
4a.	4b.	10a	10b.	16a	16b.		
5a.	5b.	11a -	11b.	17a	17b		
6a.	6b.	12a	12b.	18a	18b		
	Level 2						
1a.	1b.	7a.	7b.	13a	13b.		
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1a.	1b.	7a.	7b.	13a	13b.
2a.	2b.	8a.	8b.	14a	14b.
3a.	3b.	9a.	9b.	15a	15b.
4a.	4b.	10a	10b.	16a	16b.
5a.	5b.	11a	11b.	17a	17b.
6a.	6b.	12a	12b.	18a	18b.

Level 3

1a.	1b.	7a.	7b.	13a	13b.
2a.	2b.	8a.	8b.	14a	14b.
3a.	3b.	9a.	9b.	15a	15b.
4a.	4b.	10a	10b.	16a	16b.
5a.	5b.	11a	11b.	17a	17b.
6a.	6b.	12a	12b.	18a	18b.

Find also at: Curriculum: First Timers: Fluid Dynamics: Lesson Page from your login at www.crosswiredscience.com

3. Article (Extra credit)

Younger Students: Go over this article with Dad and Mom **Older Students:** Annotate this article; underline what is interesting and star the best info.

Write 5 clipped-sentence interestables on this article on the back.

Diabolical ironclad beetles inspire extra-strong joints

by Dr. Jonathan Sarfati 10/21

One type of beetle is so tough that you could run it over and it would still walk away. This is the 'diabolical ironclad beetle' (*Nosoderma diabolicum*, formerly *Phloeodes diabolicus*), found in the southwestern USA.



This beetle is only 2 cm long, or under an inch, but can survive a force of 149 newtons. This is equivalent to the weight of 15

kg, or about 39,000 times the beetle's own weight. It is also 2.5 times as much as the average male university student can exert between thumb and index finger, 1 and about 10 times the bite strength of potential predators. The ironclad beetle is sometimes known as 'pin-bender', because pins will bend rather than penetrate, unless a hole is drilled first.2'

What makes the ironclad beetle so tough?



This beetle's toughness was intriguing, especially with no mineral in its exoskeleton, unlike shells or bones.³ A team led by David Kisailus, a materials scientist and biomimeticist at University of California, Irvine, worked out the intricate fine structure that greatly increased toughness.⁴

The wing-cases (*elytra*, see box) are joined to the underside of the exoskeleton. Over the beetle's vital organs, the join is *interdigitated*, i.e. similar to interlocking fingers. Like columns of a bridge, the 'fingers' resist compression. But resistance can only go so far. Sometimes material must yield or break. This is why tall buildings in earthquake-prone areas are often supported on flexible bearings that allow some

swaying.5 So too with the beetle: in places further from the vital organs, the joints are latched or free-standing, which allows the excellence to viold under pressure



3. Article (Extra credit)

Younger Students: Go over this article with Dad and Mom **Older Students:** Annotate this article; underline what is interesting and star the best info.

Write 5 clipped-sentence interestables on this article on the back.

Diabolical ironclad beetles inspire extra-strong joints

(Continued)

The other feature is the suture joining the two elytra. The suture comprises interlocking halves called *blades*, and they are shaped like jigsaw puzzle pieces. The blades have an elliptical shape, which turns out to be stronger than triangular or semicircular blades found in other beetles.³ Dr Kisailus said, "If you take two pieces of that jigsaw puzzle, and you try to pull them apart, once they're attached, it's a pretty robust interface. And so that is what provides the beetle with strength."²

Another strength enhancer is the layered (laminated) structure. Kisailus explained (emphasis in original), "*That's* what defines the toughness in this organism—it provides a lot of energy dissipation instead of failing brittlely. It just de-laminates."²

Application to aircraft design

Often, joints are the weakest part of any structure. They can fail catastrophically, which can be deadly, e.g. in airplanes. The newest airplanes are often made largely of composite materials that combine lightness and strength. However, it's hard to make strong joints between different types of material, such as carbon-fibre composites to metals. Rivets and glues can fail, as can traditional fasteners.

Kisailus and his team joined carbon-fibre-reinforced composite to



aluminium plates with a traditional fastening pin used in aerospace engineering. Then they made plates with a laminated structure and edges milled to mimic the ironclad beetle's suture

to nclad e

Insect

exoskeletons

have a laminated

structure, so cracks can't

propagate

through the

layers, making

the exoskeleton

hard to break.

Under stress, the traditional fastener failed catastrophically. However, with the beetle mimic,

the delamination took much of the energy, and the separation of layers made the structure expand and grip more tightly. Any fracturing is both more gradual and more predictable, which could lead to easier inspection to detect cracking earlier.³



Read a Science book or magazine for one hour. Choose a way to record something about your reading. Reading aloud as a family is great!

- Short essay // Key words // Mind map or drawing, etc.
- **ANSWERS** magazine is great to use.
- <u>CREATION</u> magazine is another of our favorites..

CWS SUGGESTION: Heroes of History: **Dr. Paul Brand By J. Benge** p.1-35. NOTE: We offer these five great books at \$10 under Amazon with free shipping from YWAM. See <u>PURCHASE BOOKS</u>. Buy "Science Bundle 2"

Title:

Pages read

"Walk in love" –Ephesians 5:2

God shows His love through the beauty of birds like the toucan.

He also shows the beauty of His love through the beauty of His love moving in your heart to bring specific thoughtful blessings to others. Part of "walking in love" each day involves kind encouragements and blessings God wants you to give others.

To "walk in love" also means if someone is being selfish or crabby, to do your best to forgive and love. When you do this, God understands your efforts to be a peacemaker.. He will help you.

Quotes:(10 minutes)

Write this quote and another quote from this scientist on the back. (A different one than last year.) Also include 3 great interestables about him or her.



"Ninety-nine percent of the failures come from people who have the habit of making excuses."

George Washington Carver

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All rights reserved. No part of this book may be reproduced or transmitted outside of your immediate family in any form or by any means including (but not limited to) photocopying, recording, emailing, screen shots, or by any information storage and retrieval system, without written consent from the author. Written by Don and Renita Miller. **5. CWS Devotionals:** Read the devotional. Write what it means and add a couple personal applications in the space below or on the back–either a need you have or an answer God gave you.

Balancers of the Earth pg.1

Sometimes when I get something in my eyes like a tiny wood chip, I wish our eyeballs were removable.



Think of how convenient that would be If you got something in your eye. You'd jostle your eye around a little and pop it into your hand. Then you could give it a good scrubbing and pop it back in.

That'd be really strange and a bit freaky, but hey, it'd do the job!

Behind that Ole' Eyeball

If you had x-ray vision and you could take your eyeball out, you'd see a bowllike bone your eyeball was sitting in. It's called the orbital bone. That's wild, but what's behind it is even crazier.

There are three tubes behind the orbital bone of each eye. These tubes are slightly smaller than a dime, but they are responsible for ALL of your balance.

If these were accidentally crushed, you'd be so out of whack that you couldn't run, walk, or even sit up! What a gift of God it is that we have those orbital bones...and those semi-circular canals!





All Must Balance!

Every creature must have a way to balance. Scientists found two things that stuck out around the middle of a fly's body. They called them halteres. One day

scientists clipped one haltere off. Guess what happened? The fly flew around like it had lost its mind. It zig-zagged everywhere. It never stopped zig-zagging! **U-Think:** Guess what the scientists learned? The halteres are necessary for fly balance and flight!

A fish had its balance center damaged. **U-Think**: What do you think happened to that fish? Everywhere it swam, it swam sideways!

Surprising Cats

If you drop an adult cat from 2 feet above the ground with its back facing the ground, it will effortlessly flip around and land on its feet. If you tried it with your dog, you'd have one sore dog. That's NOT a good idea with the pooch. Why can a cat flip so easily and a dog, not at all? Try hard to get this one. It's amazing!



Inbuilt Coordination

There is a professor teaching at Cambridge University in England named Dr. Burrows. He is the world's

expert in Insect Kinematics. This means that he knows more than most people about how bugs walk and run and jump and fly. He did a study on Praying Mantis nymphs. A nymph is like a bug teenager.

Dr. Burrows learned that praying mantis nymphs always jump the same way from branch to branch. One of these little bugs might be on a branch one inch from another branch that it wants to jump to. With a mighty little bug leap, it jumps. As it is jumping, it looks like it is in the Olympics doing a gymnastics show when seen with a slow-motion camera. It does 7 different movements every time. It might turn its upper body 1/2 a turn and move its feet up 20°. Then it might tuck its head and twist right a quarter turn. ..and so on.

Using this technique, every time the little bugs would jump, they'd flip, twist and turn in a precise sequence, and they landed perfectly on the branches they were jumping to-even when the branches were different distances apart.





The other really mind-blowing thing he learned was that the little bug would execute each of the seven moves several thousandths of a second slower for every little bit further the branch was that it was jumping to.

Amazing! Perfectly adjusted times for precise body movements to make perfect jumps for little bugs! Praying Mantis Bugs' DNA wires their brain for exactly how to jump, AND their pipsqueak brains know exactly how much to slow each of the 7 movements to make a perfect landing every time. God's infinite mind put that one together!

Learning to Dive and Fly

We have a teenage friend who is a competitive diver. She is one of the best in the United States. She does flips and twists and turns off the diving board and tries to

get it to where she won't overturn or under turn at the end. The goal is to land in the water perfectly. She has spent years training to do this.

Bugs are different. They might only live for a few weeks as a young bug, then go through metamorphosis and go from being a crawling bug like a caterpillar to a flying bug like a butterfly. There aren't years or even



months or weeks for a dragonfly to practice flying amazing flying moves. It's basically: you are a dragonfly; start flying NOW.

U-Think: What did God do to help bugs move in



complicated ways, like how a dragonfly can fly up or down, sideways, backward, and forwards using four different wings?

Here's the amazing answer: God built something like a computer code on the insect's DNA that makes wires grow in its brain that fire its muscles in just the right way.

Some people think insects evolved by accident. The more we learn about insects and how exceedingly complex they are, the more we are convinced this is an exceedingly big mistake to think this way. Only God's infinite brain could figure out the insect DNA codes of the earth! And He did it in one day ...maybe nano-seconds!

This is mind-boggling complex! If there was one praying mantis nymph and one dragonfly in the world, it would be enough to convince us at CrossWired Science that God is real and very powerful, and very smart! Programming movements like this by building a bug brain's wiring correctly is more hi-tech than anything we people have ever built!



Cats Too!

Watch the video below. Destin is a Christian. He's going to show you how a cat flipping from laying on its back is innate. Innate means that the DNA wires its brain for exactly how to do the flip from birth. Monty, our dog, in no way has that wiring.

The other day, we saw the movie, "*That Darn Cat.*" It's a fun older movie where a cat does all kinds of things, including some very gymnastic moves, while a not-so-smart squatty dog just barks and runs all over the place trying to catch him. It's

funny to us how God made dogs and cats, especially pets for people worldwide, and how dogs are big and goofy, tonguelicking and wagging-tailed and always putting on their tough-guy barks to be our ever-protectors. Cats are sooo different.

Cats are elegant and cool. If a dog chases them, they just zip up a wall and are, in a second, walking on a roof while Barky is still on the ground squawking away. We've come to realize that the cool agility of cats is wired into their brains by their DNA, and so is the clumsy chase-barking of dogs. No one trains the cats to be so athletic; they just grow up running around, and their brain effortlessly learns how to do some crazy good athletics.





Watch Destin's video now: <u>Slow Motion Flipping Cat Physics</u>

Wasn't this amazing to see? Cats have the DNA-given ability to flip when dropped upside down. Dogs don't.

Zoo Antics

everywhere with their own

Our family visited the San Diego Zoo the other day for the homeschool day. (A GREAT deal!) We saw all kinds of animals doing all kinds of athletic stunts. The aviaries were filled with birds zipping

unique flying styles. Loads of monkeys busied themselves executing their Olympic gymnastics. Polar bears, lions, tigers, giraffes and all the rest had their unique movements and athletics.



Have you ever noticed that all giraffes in the world spread their legs as they drink water? Have you noticed all dogs lift

their heads to bark or howl? Have you noticed that all cats rub themselves against people's legs to get petted? Have you noticed that all birds balance on wires by flipping their tails up and down?

U-Think: Why?

It's because these movements are all prewired and coded for on their DNA. When God created each animal type, He built the codes on their DNA to wire their brains to make different kinds of precise movements.

Learning vs Totally Innate

God made it so most insects don't learn things at all: it's mostly all pre-programmed movements. More advanced animals still have many things programmed by their DNA, like the different gaits of a horse. (**U-Think:** What are the four different gaits of a horse?) But, God also has made it so more advanced animals learn all kinds of things. Puppies can't even walk when they are born. Horse colts can run with their mothers within hours after being born! God put different amounts of pre-wiring into different animals for His own purposes.

Little Boys

U-Think; Have you ever noticed a movement everyone makes when they go about? What is it?

They move their arms in exactly the same way. This is pre-wired by our DNA, just as the sequenced muscle firings for coughing, sneezing, swallowing, and many other things are pre-wired. Why did God give this arm movement to us as we walk? Scientists learned that this helps us avoid injuring our backs when we walk and run.

U-Think: Horses are wired to run an hour after birth. Why is a baby brother person helpless to even turn over for weeks? Running doesn't happen for most little boys for a year. Why did God make it this way? It's so little boys would



grow up with lots of love from mom and dad and not be hyper like a bunch of baby monkeys!

I say that poking fun at little boys because I was always getting into all kinds of things as a little fellow. I can't imagine how crazy the world would be if all baby boys were off and running two hours after being born! Moms around the world would be wildly chasing their newborns everywhere...." Cooooooommmmmmeeee baaaackkkk. Doonnnt ddoooo thatttttt.! What a mess!

But God being all-knowing, knew what was best for little boys—trapped in mom's arms...and little girls too!

God Knows What is Best for Each Stage of Life

There is a lesson here: Trust God that HE knows what is best for every stage of your life. John Bunyan spent some time in the pokey because the jailer wasn't so nice. He realized in time that God wanted him to have some quiet to pray and write. He wrote Pilgrims' Progress from his dull and quiet place. It's been the most printed book of all time, second only to the Bible! God wanted John to help billions of people. He caught God's plan for him!

I think all of us can learn from God's examples of "programming " animals and insects for their stages of life. We need to trust Him with our stages and understand His times and seasons of our lives. (I Chronicles 12:32) And, in the process, we really need to enjoy each stage God has for us, for our sake... and everyone else's!

Evolution: I Don't Think So

It is a BIG mistake to think that complex movements like Dr. Burrow's praying mantis nymphs or dragonfly flight happened because cosmic rays from the sun and other accidents accidentally changed their DNA to give them Olympic jumping abilities and flight abilities beyond any computerized movements we have come up with.







The most highly awarded engineer in Europe, Dr. Andy Macintosh, is a Christian who has studied dragonfly flight. His conclusion is only a God of infinite intelligence could write the DNA codes that build dragonflies and gives them their flight abilities.

He is exactly right. God gave the animals and the insects of the earth their abilities, and He wants us to enjoy the gracefulness of deer, the power of lions, the majesty of eagles, and all the rest. I can hardly wait to see what God has for us in Heaven!

Right Movement on the Right Animals: By Accident? NOPE

Our cat rubs against our legs. When we go to our friend's house, her horse doesn't try

to do the same behavior and squash us against the horse coral fence!

A hummingbird visits our feeder and flaps its wings 80 times a second. An eagle doesn't even try to flap that fast! Can you imagine an eagle flapping its wings 80 times a second???

A hawk jumps off a cliff to catch a rodent for dinner and soars headlong toward the ground. Right at the last moment, it spreads its wings just in time to swoop up



and avoid a big splat on the ground.. I'm glad our Monty dog doesn't have the same DNA brain wiring! He



wouldn't do so well on the upswing. It'd be no more Monty after one leap.

Every animal and every insect has its own "wisdom" and athletic wiring, just like God told Job in Job 38-42 (Read this as a family).

We know someone who went through a very difficult time like Job did. They read these verses in Job and others in Psalms and Isaiah and caught the hope that God was going to do some very beautiful things. God's outcomes were brought even as Job's were. God did miracles, and some very beautiful things happened.

Trust the God of the animals and insects of the earth. He Is worthy of your moment-by-moment trust. He will bring joy in the morning and turn your mourning in any and every area into dancing!

Onto the Activity!

You now have a fun little prop. Everyone loves this balance prop. Go to the experiment section, and we'll explain it to you.

PS. All the athletic abilities of insects and animals involve their brain accessing a constant stream of information coming from their balancing organ. Hence the balance bird is your take home from this activity!

6. <u>U-Choose</u> & <u>Field Trips</u> (30-60+ minutes)



This is a Science-Free-For-All Lesson!

The <u>U-Choose</u> lesson contains truckloads of great ideas. Summarize the projects or <u>Field Trips</u> you choose here. Be sure to add a picture or two (or a dozen).

Go For Whatever U-Want! Field Trips included!





Title





7. WONDERS TRACK **Experiments**!