

BIOLOGY II: WORMS, BEANS, GERMS, AND GENES!

INSTRUCTOR'S GUIDE

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What does 'noeo' mean?

noeo | (no!eh!o) | verb

1. To perceive with the mind, to understand, to have understanding.
2. To think upon, heed, ponder, consider.
(Source: The New Testament Greek Lexicon)
3. Train the brain.
(Source: our 8 year-old son)

Romans 1:20

For since the creation of the world His invisible attributes, His eternal power and divine nature, have been clearly seen, being **understood** through what has been made, so that they are without excuse.

noeo

Scripture taken from the NEW AMERICAN STANDARD BIBLE®,
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Welcome

Welcome to Noeo Science! Thank you for trusting us to provide you with quality materials for teaching science at home. We understand that many homeschooling parents do not have a science background and may feel a bit intimidated about teaching science...especially when it comes to the experiments! Our books and experiment kits have been carefully selected to be of the highest quality available, yet simple enough for even the most science-phobic teachers and students. We intensely searched through library catalogs, websites, and hundreds of books before deciding on what we believe are the 'best-of-the-best'. We hope that you will agree and we're always open to your comments and suggestions.

Our Instructor's Guides provide a logical, focused progression through the books and experiments. Multiple sources of information are used to teach each science topic. However, you won't need to spend your time searching for books or cross-checking indexes to make the curriculum 'flow'. That work has been done for you!

Our Philosophy

The essence of science is simply observing and describing God's creation. When scientists make a new discovery, they are seeing another part of creation revealed. Romans 1:20 tells us that His attributes, power, and divine nature are clearly seen in what has been made.

While some scientists deny that their discoveries are evidence of God's creation, there are many that do recognize His attributes in all of creation. Our children should not be protected from science because of some scientific theories that deny God. They should instead be immersed in the sciences so that 'His invisible attributes, His eternal power and divine nature' will be clearly seen.

Understanding the Noeo Science Curriculum

You will find that the Noeo Homeschool Science curriculum is different from any other that is available. Each year of science will fill your child with wonder and excitement as they build a strong foundational knowledge of science. They'll be having so much fun that the learning will come naturally for them...and painlessly for you.

Noeo Homeschool Science is variety-filled, with a structure that is best described as a balance between the classical method and the Charlotte Mason approach.

We emphasize narration and summarization, vocabulary development, observation, and the scientific method. We do not promote rote memorization or the worksheet and test methodology, as we think that this approach is less valuable for long-term retention. The following table illustrates these characteristics:

<u>Teaching Method</u>	<u>Corresponding Noeo Science Curriculum Qualities:</u>
Classical	<ul style="list-style-type: none"> • Emphasizes vocabulary development, especially in the younger years. • Develops critical thinking skills and logic through the use of the scientific method. • Incorporates the classical stages of learning, i.e. the “Trivium” (grammar, logic, and rhetoric).
Charlotte Mason	<ul style="list-style-type: none"> • Provides the best books available (including “living books”). • Utilizes a child’s natural curiosity to acquire knowledge. "Studies serve for delight". • Uses narration and notebooks rather than worksheets, tests, or repetitive drills to evaluate learning .

We feel it is important to learn science from a variety of sources, using a variety of teaching techniques. Our curriculum does not use the traditional, single textbook approach to science education. We think variety will encourage more interest in science, particularly with younger students. All of the books are carefully selected to allow children to discover the beauty, complexity, orderliness, and wonder of God's design. While some written work is expected, many hands-on activities are included within the bright, colorful, and well-written books. Living book biographies of many important scientists are included to provide a practical perspective. Optional internet references are also provided throughout the curriculum.

Occasionally, a book may introduce a particularly secular viewpoint. We view these times as an opportunity for discussions and encourage you not to skip over or 'cover up' this information. We do not provide 'canned' answers for these discussions, but encourage instructor's to study the issues for themselves and to pray for guidance and understanding in providing answers to each student's unique questions.

Just as creation is orderly and well organized, we think a good science curriculum should follow an orderly design. Each year of the curriculum will focus on biology, chemistry, or physics. Each of these 3 foundational sciences is studied independently for an entire year rather than jumping randomly from one subject to another without reason. The study of biology, chemistry, and physics is then repeated at a higher level and in more detail upon the completion of each three-year course of study (e.g. biology in 1st and 4th grade, chemistry in 2nd and 5th grade, etc.). Subjects that overlap multiple science disciplines, such as geology, weather, and astronomy, are included at logical points within the 3 major science studies. For example, astronomy is studied in parallel with the study of gravity within the physics curriculum.

	Approximate Ages	Grade Equivalent	Classical Trivium Stage
Chemistry I Physics I Biology I	5-8	1-3	Early Grammar
Chemistry II Physics II Biology II	9-12	4-6	Late Grammar or Early Logic

Our curriculum is designed on a 4-day per week schedule. If you would prefer to do science twice weekly, then simply complete the first two days of scheduled readings and assignments on your first day, and the last two days of reading and assignments on your second day. Alternatively, you may wish to do all of the reading on the first day and the assignments and experiments on the second day. The key is to understand what works best for you and your children and to adjust the schedule as necessary.

The daily time necessary to complete the assignments will vary with individual student ability and based on the content being studied. We provide the following table as a guideline of the approximate time that you can expect to spend on

daily assignments:

	4-Day Schedule	2-Day Schedule
Grades 1-3	15-20 minutes	30-40 minutes
Grades 4-6	20-30 minutes	40-60 minutes

The Science and Lab Notebooks

We provide reproducible sheets for creating science and lab notebooks for use with the Noeo Science curriculum. The notebooks are an integral part of the curriculum. Feel free to modify these sheets and to tailor your expectations for each child.

Your student will be asked to describe, sketch or summarize what they learn from the reading assignments, or to complete a lab sheet for their experiments. This method will encourage concentration and attention to detail. In addition, the lab sheets are designed to help your student to apply the scientific method in all of their experiments.

Younger students may need to 'narrate' their descriptions and observations to you or an older sibling. You will need to determine the length and amount of detail that your student is capable of. We encourage you to increase this expectation over the course of time.

Science Experiments

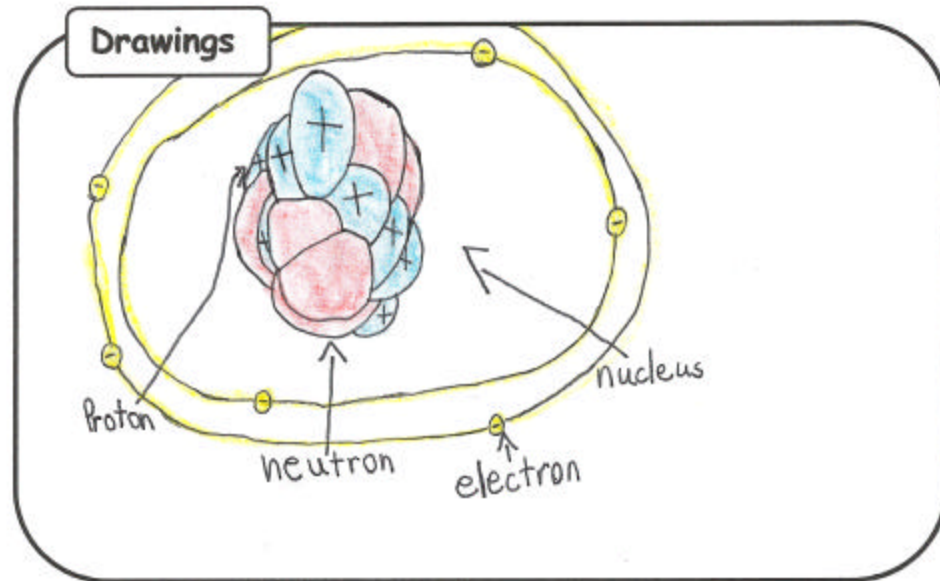
Science is not a spectator sport. The best way for your child to learn and truly comprehend science is by doing hands-on experiments and activities. We understand that this is probably the most difficult part of science for many homeschool families. That is why we were determined to find sources of high quality, yet simple, experiments.

We are pleased to say that the experiments in our curriculum will provide a strong science foundation without wreaking havoc on your daily schedule. For example, many of our experiments are provided through a unique arrangement with *The Young Scientists Club*. These experiment kits come complete with all of the items that are normally difficult to find. They have won multiple awards for their high quality and have become increasingly popular among homeschoolers in recent years. We think you will be pleasantly surprised as your child

progresses through these well organized, fully explained experiment kits while actually having fun learning science.

Our other experiments and activities are also carefully selected to provide relevant and interesting examples of the topics being studied. We provide a supply list for each week of the year, along with a 'Master Supply List' at the beginning of the Instructor's Guide. You'll notice that most, if not all, of the items on this list can already be found in your home (honest!).

The following three pages are samples copied from a science notebook of a nine-year-old that is using our Chemistry II course. Younger students would orally “narrate” their summaries to an older sibling or adult. Older children should be expected to provide more detailed narrations (summarizations). It is not necessary to complete an experiment sheet for every experiment, especially with younger students. However, it is good to complete them often in order to establish a strong understanding of the scientific method.



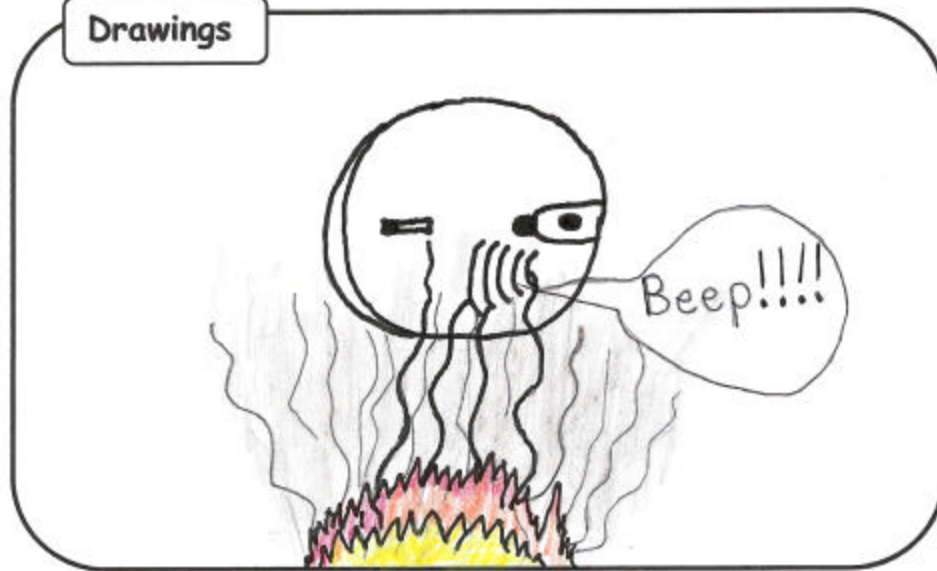
Reading Notes

Atoms are made up of: electrons, neutrons, and protons.
Atoms are tiny particles of what everything is made.

Definitions

nucleus- The core section of an atom that contains protons and neutrons.
neutron- a subatomic particle with no electrical charge in the nucleus of an atom.
Proton- a positively charged subatomic particle in the nucleus of an atom.
electron shells- an energy level around the nucleus.

Drawings



Reading Notes

Today we read about Americium.

Americium is named after America. Americium is found in smoke detectors. It is what makes smoke detectors work.

Definitions

Date 2/2/06

Experiment Name A feast for Yeast

What have you learned about this subject?
(observation/research)

That yeast is alive!

What question are you trying to answer?
(question)

What happens when you
feed sugar to yeast?

What things do you need?
(materials)

1. a bottle
2. yeast
3. sugar
4. warm water
5. a balloon
6. _____
7. _____
8. _____

What will you do to answer the question? (experiment/test)

put yeast in a bottle, put in sugar and put
a balloon over it.

What do you think will happen? (hypothesis/prediction)

the balloon will blow up with CO₂ that the
yeast makes

What happened? (results)

the balloon inflated.

Why do you think this happened? (conclusion)

The balloon catches the CO₂.

Reproducible Pages

Science Notebook Page Lab Notebook Page

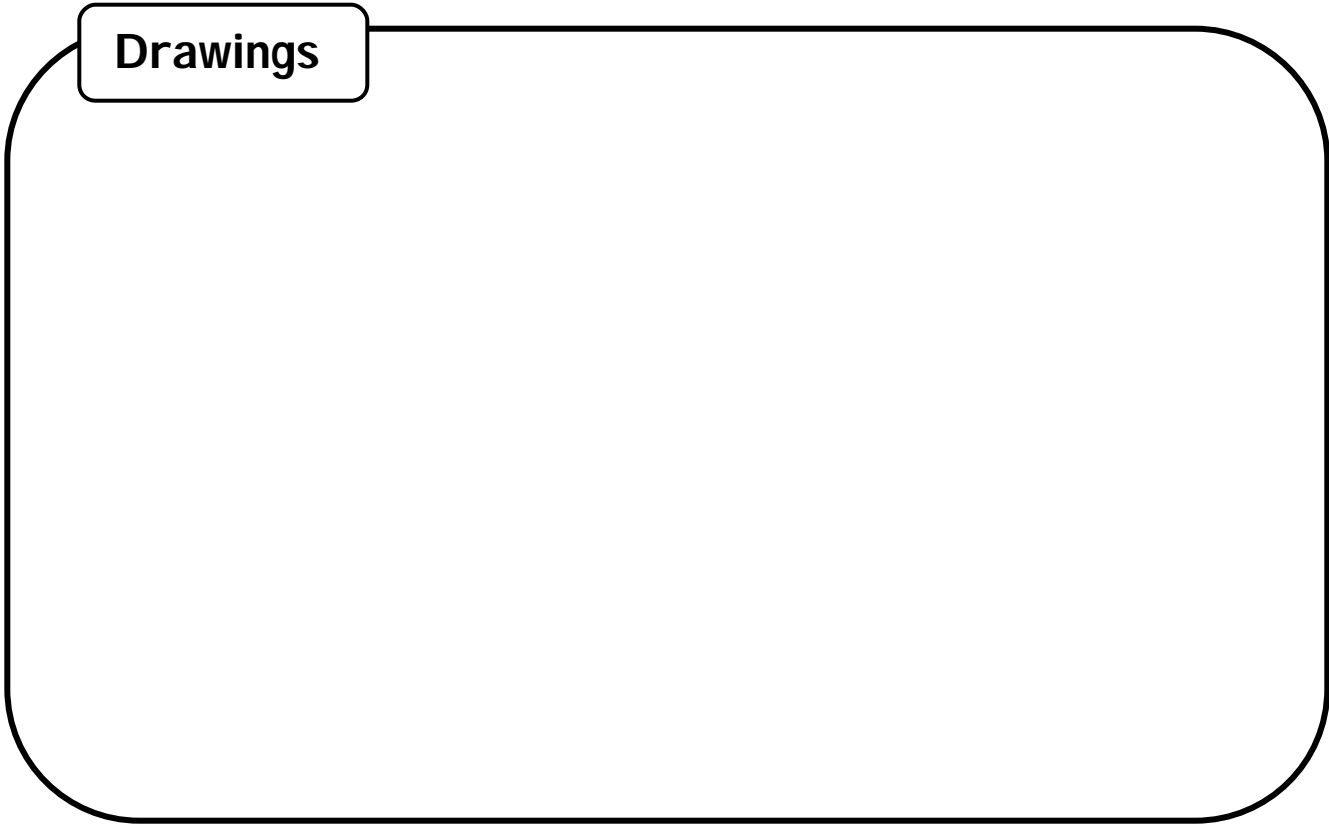
The following pages are provided for your convenience. There are a variety of page styles to be used for notebook creation. Some contain a space for drawing *and* writing, others have space only for drawing *or* writing. Different line spacing options are also provided. Feel free to make as many copies as you need.

Please remember that younger students should begin by orally “telling back” what they have just learned. You may prefer to write their thoughts down in a notebook for them.

As they become better writers, then begin to have them write a sentence or two. Increase your expectations over time until you can find a balance between the student’s love for learning and their need for applied narration.

The lab notebook page (experiment page) is intended to be used as a tool for teaching the scientific method. Again, younger students should not be expected to complete this sheet. Begin by orally asking some of the questions on the sheet after completing an experiment. Progressively increase your expectations for the completion of the experiment sheet. Older students should eventually be able to write a complete lab report without the need for this sheet.

Drawings



Reading Notes

Definitions

Drawings

A large, empty rounded rectangular box with a black outline, intended for drawing. The box is positioned below the 'Drawings' header and occupies most of the page's vertical space.

Date _____

Experiment Name _____

What have you learned about this subject?
(observation/research)

What question are you trying to answer?
(question)

What things do you need?
(materials)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

What will you do to answer the question? (experiment/test)

What do you think will happen? (hypothesis/prediction)

What happened? (results)

Why do you think this happened? (conclusion)

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Weekly
Reading and Assignment
Schedule

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Book List

Usborne Internet-linked Science Encyclopedia
Usborne Internet-linked Complete Book of the Microscope
Usborne Internet-linked Mysteries and Marvels of Nature
The Body Book

Equipment and Experiment Kits

Illumax 100X Slide Microscope and slides

***The Young Scientists Club* kits:**

- **Kit #28 Owls**
- **Kit #29 Eggs**
- **Kit #30 Seeds, Fruits, and Other Plant Parts**

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The following is a complete list of items that will be used for the required experiments over the entire 36-week course. This list includes many items that are common in most homes. The list does not include the items that are provided in *The Young Scientists Club* kits.

Master Supply List	
Item needed:	Week(s) used:
Sugar	2
Paper (paper towel, magazine, colored)	2, 13
Adhesive bandage (e.g. Band-Aid [®])	2
Piece of cardboard	4, 27
Scalpel or sharp knife (adult supervision)	4, 30, 32
Crayons or colored pencils	8, 25, 26, 27, 28, 29
Eggs (at least 2 raw and 2 hard-boiled)	13
Salt	13
Wide-necked bottle (egg-sized opening)	13
Food coloring	13, 32
2 jars with lids	13
Matches (adult supervision required)	13
Baking soda	13
Light source (e.g. desk lamp)	13
Flashlight	13
2-liter plastic bottle with cap	13
Feather	14
Scissors	20, 25, 26, 27, 28, 29
Glue	20, 25, 26, 27, 28, 29
Newspaper	20
Bleach	20
Paper towel	20
2 cups	20
Cotton swabs	24
Tape	25, 26, 27, 28, 29
Plastic wrap	25
Brads	27
Mirror	27
String	28
Empty paper towel tube	28
Onion	30
Celery	32
Variety of leaves	33
Flowers with stems (1 or more types)	34
Variety of fruits and vegetables	35
Garlic clove	35
Large glass jar (e.g. pasta sauce jar)	35
Ruler	35
Mushroom	36
Pond or lake water (optional)	36

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Weekly Schedule	
Week 1	Microscopic World
Week 2	Microscopic World
Week 3	Microscopic World; Classification; Cells
Week 4	Insects
Week 5	Insects
Week 6	Insects
Week 7	Insects; Body Structure
Week 8	Body Protection; Camouflage
Week 9	Body Protection; Fish and Other Water Creatures
Week 10	Fish and Other Water Creatures
Week 11	Fish and Other Water Creatures; Birds and Other Flying Creatures
Week 12	Birds
Week 13	Eggs
Week 14	Birds
Week 15	Land Animals; Reptiles and Amphibians
Week 16	Reptiles and Amphibians
Week 17	Reptiles and Amphibians; Mammals
Week 18	Mammals
Week 19	Mammals; Feeding Methods
Week 20	Feeding Methods; Food and Energy
Week 21	Internal Balance; Communication; Senses
Week 22	Breathing; Reproduction; Life Cycles
Week 23	Ecology; Nature's Balance; Conservation; Evolution
Week 24	Human Body
Week 25	Human Body (Senses)
Week 26	Human Body (Senses; Skeleton)
Week 27	Human Body (Skeleton; Muscles; Teeth; Digestion)
Week 28	Human Body (Nervous System, Respiratory System; Circulatory System)
Week 29	Human Body (Urinary System; Immune System)
Week 30	Plants (Cells and Seeds)
Week 31	Plants (Dispersal; Stems and Roots)
Week 32	Plants (Stems and Roots)
Week 33	Plants (Stems and Roots; Leaves)
Week 34	Plants (Photosynthesis; Flowers)
Week 35	Plants (Pollination; Germination; Propagation)
Week 36	Plants (Water Plants; Fungi)

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Week 1 – Microscopic World				
	Day 1	Day 2	Day 3	Day 4
Usborne Complete Book of the Microscope	Pp. 79-81	Pp. 82-84	Pp. 5-7	Pp. 8-9
Experiment	Optional: Make a Waterscope Pg. 81			
Optional: Internet Links	Microscope Pp. 80-81 ** see note below	Microscope Pp. 83-84	Microscope Pg. 7	Microscope Pp. 8-9

NOTE: See page 4 of *The Usborne Complete Book of the Microscope* for information about the optional Internet links.

Supply List: none required

Assignments:

Day 1 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Define **cell** using the *Usborne Complete Book of the Microscope* glossary.

Day 2 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Define **germs**, **bacteria**, and **virus** using the *Usborne Complete Book of the Microscope* glossary.

Day 3 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Define **atom** and **pollen** using the *Usborne Complete Book of the Microscope* glossary.

Day 4 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Define **optical microscope** and **electron microscope** using the *Usborne Complete Book of the Microscope* glossary.

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Week 2 – Microscopic World				
	Day 1	Day 2	Day 3	Day 4
Usborne Complete Book of the Microscope	Pp. 10-11	Pp. 12-13	Pp. 14-15	Pp. 16-17
Experiment	Microscope Pg. 11	Microscope Pg. 13		Microscope Pg. 16
Optional: Internet Links	Microscope Pg. 11	Microscope Pg. 12	Microscope Pg. 15	Microscope Pg. 17

Supply List: Illumax 100X Slide Microscope and slides, sugar, various kinds of paper (paper towel, magazine pages, colored paper, etc.), adhesive bandage (e.g. Band-Aid®)

Assignments:

Day 1 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Set up your microscope and view the sugar crystals. Move the focus knob up and down very gently for depth of vision. Sketch what you see. You may also want to look at other small objects with your microscope.

Day 2 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Set up your microscope and view various kinds of paper (NOTE: paper is viewed best along a torn edge). Sketch what you see.

Day 3 – read the assigned pages, summarize and/or sketch what you learned in your science notebook.

Day 4 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Remove the protective netting from above the gauze pad of an adhesive bandage. View the netting with your microscope and sketch what you see.

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Week 3 – Microscopic World; Classification; Cells				
	Day 1	Day 2	Day 3	Day 4
Usborne Complete Book of the Microscope	Pp. 18-20			
Usborne Science Encyclopedia		Pp. 340-341	Pp. 342-343	Pp. 298-299
Optional: Internet Links	Microscope Pp. 18, 20	Science Encyclopedia Pg. 341	Science Encyclopedia Pg. 343	Science Encyclopedia Pg. 299

Supply List: none

Assignments:

Day 1 – read the assigned pages, summarize and/or sketch what you learned in your science notebook.

Day 2 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Complete the “See for yourself” Dichotomous key exercise on page 340 of *The Usborne Science Encyclopedia*.

Day 3 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Define **biological name** and **binomial system** using the *Usborne Encyclopedia* glossary.

Day 4 – read the assigned pages, summarize and/or sketch what you learned in your science notebook. Draw (or trace) an animal cell and label the **organelles** (as shown on page 298 of *The Usborne Science Encyclopedia*).

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Week 4 - Insects				
	Day 1	Day 2	Day 3	Day 4
Usborne Complete Book of the Microscope	Pp. 51-53	Pp. 54-55	Pp. 56-57	Pp. 58-59
Experiment	Microscope Pg. 53	Optional: Microscope Pg. 55	Optional: Microscope Pg. 56	Microscope Pg. 58
Optional: Internet Links	Microscope Pg. 53	Microscope Pg. 55	Microscope Pp. 56-57	Microscope Pg. 58

Supply List: Illumax 100X Slide Microscope and slides, small piece of cardboard, scalpel or craft knife (Caution: an adult will need to help with this experiment!)

Assignments:

Day 1 – use your microscope to observe ants or other insects up close (NOTE: this may be easier if your microscope is removed from the stand). Try to identify some of the structures that you have learned about. Sketch what you see.

Day 2 – Day 3 – read the assigned pages, describe and/or sketch what you learned in your science notebook.

Day 4 - read the assigned pages, describe and/or sketch what you learned in your science notebook. Set up your microscope and view the dust particles. Sketch what you see.