"Teaching" Science At Home
by Dr. Jay L. Wile, Ph.D.

Qualifications

- Helped Develop Indiana's Only Residential High School for Gifted and Talented Students
- NSF-Sponsored Scientist with More Than $200,000 In Research Grants
- Became Interested in Homeschooling Because of Excellent University Students Who Were Homeschooled
- Currently writes homeschooling materials through Berean Builders
- Is an adjunct professor at Memoria College

At all levels, homeschooled students are better at science than publicly-schooled students!

- On the ACT, homeschooled students score 21.9 in science compared to the 21.1 overall average. That's about **10 percentage points higher** using the ACT scale.
- Several large studies in individual states and Canada indicate that homeschooled students **(K-12)** score between 68 to 88 percent on standardized science tests, compared to 50% for publicly-schooled students

MATHEMATICS: A NECESSARY TOOL FOR LEARNING THE SCIENCES

"Diplomacy without arms is like music without instruments"
-Alexander the Great

"Science without math is like music without instruments"
-Jay Wile the Not-So-Great

K-6 Science Education

- Keep it **light**, but not **simple**
- Stress math over science
- Emphasize discovery
- There are **no set topics** to cover. This is a time to gather facts and experience nature.

My experience with students coming out of **elementary school** and into a more rigorous science curriculum has taught me that **enthusiasm for the subject is more important than what the student has covered**.

Two BASIC Approaches to Teaching Science

The Spiral Approach:

Students are taught a little bit about a wide variety of subjects each year. As time goes on, subjects are revisited in a more detailed fashion.

The Immersion Approach:

Students are taught a single subject for a semester or more, allowing them to get a detailed picture. As time goes on, many subjects are covered.

Which Method is Best?

- ✓ High schools and universities use the immersion approach
- ✓ The spiral approach is very repetitive, which many students find boring. However, it does produce high recall.
- ✓ Students tend to think they "know all about" a subject they have already covered and thus do not pay attention when the subject is revisited.

A New and Different Approach

History-Based Science

- Start with Creation as the Beginning of history
- After Creation, introduce science concepts as we learned about them in history.

The complete set is now available!

- 15 lessons per section (3 are optional)
- A hands-on activity for every lesson
- Every lesson has three levels of review to make it truly multigrade
- Free question/answer service

Most Textbooks Written for Schools Use the Spiral Approach

Abeka books offers a different science text for each grade with study questions, tests, and some activities.
http://www.abeka.com/
1-877-223-5226

Bob Jones University Press has similar offerings.
http://www.bjupress.com
1-800-845-5731

"Tried and True" with homeschoolers and private schools.

One problem: very few "hands on" activities can be done at home. Supplements, however, can be used to fix that.

Janice Van Cleave's "_____ for Every Kid."
http://www.amazon.com/Janice-VanCleaves-Biology-Every-Kid/dp/0471503819

Developing Critical Thinking Through Science
http://www.criticalthinking.com

Answers in Genesis offers the "*God's Design For…*" series. It has activities that can be done at home, study questions, and tests.
http://www.answersingenesis.org
1-800-778-3390

Very "homeschool friendly" and uses the immersion approach. However, can be adapted to the spiral approach. Because it uses testing, however, it is not readily adaptable to all ages.

The Young Explorer Series

Mix of a structured curriculum and nature journaling
(Immersion Approach)

- Multigrade, K-6
- Home-friendly experiments
- Very easy to understand
- Course website that gives a lot more advanced information.

How Do You Choose?

- ☞ Think about your children's personalities. Which interest them the most?
- ☞ Think about the time you have available.
- ☞ Think about what is practical in your environment.

- 👍 **The important thing to remember is that they are ALL GOOD CHOICES.**

Movin' On Up…

Once the student is in junior high, it is time to get more deliberate in your science coverage, as the student has been training his or her mind with a lot of math.

A structured curriculum is necessary

Some of the elementary options (like God's Design For…) continue through 8th grade
Others (like Abeka and Apologia) have a specific junior high school series.

The Rainbow - Grades 7 and 8 Immersion

Two courses - one for each year

Discovery oriented with home-friendly experiments.

A kit is included - it has pretty much everything

A bit more understandable than most school books, but not as good as others designed for the home

The number of topics covered is lower than many courses, but the emphasis is on experimentation, so the student trades breadth for experience.

http://www.beginningspublishing.com

Not Surprisingly, I Like My Junior High Courses

In High School, Math Rules

MATH TOOLS NECESSARY FOR LEARNING THE SCIENCES

BIOLOGY: Metric Units

CHEMISTRY: ARITHMETIC and ALGEBRA: (*Algebra 1*, Saxon)

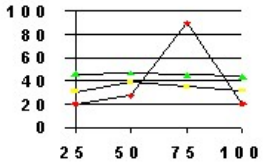
Fraction Manipulation: $\frac{7}{\cancel{64}} \times \frac{\cancel{64}}{13} = \frac{7}{13}$

Positive and Negative Numbers: -122.45 + 567.3 = 454.85

Manipulating exponents: $10^2 \times 10^3 = 10^5$

Algebraic Manipulation: $PV = nRT \Rightarrow n = \frac{PV}{RT}$

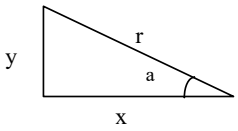
Reading Graphs and Understanding trends:



MATH TOOLS NECESSARY FOR LEARNING THE SCIENCES

PHYSICS : Should have finished Algebra II and be at least starting Trigonometry (*Algebra II*, Saxon)

Using Trig in Triangles:



y = r sina

x = r cosa

y/x = tan a

ADV. CHEMISTRY : Should have finished Algebra II

Logarithms: $\log(x) = 3 \Rightarrow x = 1{,}000$

$\log(xy) = \log(x) + \log(y)$

ADV. PHYSICS: Should have finished Precalculus (*Advanced Math*, Saxon)

High School Science Curricula

As before, there are curricula designed for schools and curricula designed for home. The problem is that for most parents, the curricula designed for schools doesn't work very well :

- **The explanations in most school textbooks are not sufficient for someone who has no teacher to explain them**
- **The labs generally don't work at home**
- **Most parents don't know what parts of the book to cover and what to skip.**

High School Science Curricula for the Home

The "In Your Home" series - http://www.scienceforhighschool.com/

Research Based

Lots of experiments that can be done at home, as long as you get the kits.

Very open-ended

- The average student will not go as deep as most college-prep courses would go, but the interested student will end up going deeper
- Will be exciting for those who like to seek out answers.

The “Discovering Design” series http://www.bereanbuilders.com/

- Lots of experiments that can be done at home, as long as you get the kits. Not all require kits, however.
- Very rigorous – too rigorous for some.
- Not many pictures – The books concentrate on the explanations, making them easy to follow.