Introduction to the UIL Science Contest

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*Physics
Purpose of UIL Exams

- to challenge students in the basic fundamental principles of science
- to promote learning in biology, chemistry, and physics
- to foster a sense of enthusiasm about advanced topics and courses in the sciences
- to help prepare students for the rigor of college level courses
The Science Contest

- Biology, Chemistry & Physics are all combined on one exam, and is both an individual and a team competition.
- The contest helps to promote a broad base of knowledge and better understanding.
- The contest models degree requirements at most Universities.
- Many current areas of research are in interdisciplinary fields.
Contest Structure

- 60 Multiple Choice Questions, which are divided into 20 of each topic Biology, Chemistry & Physics.
- Contestants are given 6 pts. for a correct answer, 0 pts. for unanswered questions, and lose 2 pts. for incorrect answers.
- The best possible answer is the correct answer.
Few Details...

- At the state competition only, there is no limit on the number of answer choices given on a question, e.g. A through J, not just up to five answer options A through E.

- There is no restriction that numeric wrong answers must differ by ±5%.
  - This will allow for more realistic pH problems in chemistry and will better model actual college-level exams.
Academic Meets

- Invitational Meets A & B (practice - not governed by UIL) in January & February
- District Meets 1\textsuperscript{st} week & 2\textsuperscript{nd} week usually during March
- Regional Meet usually during April
- State Meet usually during May
Advancement/Qualification

- Are done by division (1A-5A) and each HS may enter 6 contestants at their district meet, where a minimum of 3 contestants constitutes a team.
- 1\textsuperscript{st}, 2\textsuperscript{nd} & 3\textsuperscript{rd} place overall scorers
- Top score in each subject area
- Top 4 member team by combined score
- Plus one alternate in each category
Things to keep in mind ...

- The contest is **hard**!
- However, the top scores at the State Contest will be nearly perfect in each subject.
- There needs to be a clear cut winner and this will require a selection of hard questions on the contest.
- All schools divisions 1A – 5A compete with the same contest, but the scores are only compared with schools in the same division.
- But there are benefits for all of that effort spent in preparing for the contest...
Some Contest Rules

- Contestants have up to 2 hours, but must remain for at least 30 minutes.
- You may use additional scratch paper provided by the contest director.
- Calculators (not computers) without built in or stored scientific information are allowed, but the memory must be cleared before the beginning of the contest.
Biology Texts

(10th ed not recommended)

Biology, 8th or 9th edition
Campbell, et. al.
Biology Text: Not in C&CR

Principles of Life, 1st edition
by Hillis and Saldava
Recommended Online Biology Resources:

- University of Texas Bio 311C site: http://bio311.biosci.utexas.edu/

- Learn Genetics University of Utah: http://learn.genetics.utah.edu/

- Kimball’s Biology Pages: http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/
Chemistry Texts

Chemistry: The Central Science
by Brown, LeMay & Bursten
Chemistry Texts

General Chemistry
by Whitten, Davis & Peck
Chemistry Text: Not in C&CR

**Chemical Principles, the quest for insight** by Atkins and Jones 4th, 5th, and 6th editions
Chemistry Text: Not in C&CR

◆ *Chemical Principles*
  by Zumdahl (& Decoste) 5th, 6th, and 7th editions
Recommended Online Chemistry Resources:

- University of Texas CH 301 site: [http://ch301.cm.utexas.edu/](http://ch301.cm.utexas.edu/)

- University of Texas CH 302 site: [http://ch302.cm.utexas.edu/](http://ch302.cm.utexas.edu/)

The department of chemistry at UT has developed an online chemistry eBook. This is what they now teach CH301 and CH302 from. For now, it is open and free.
Physics Texts

Physics
by Giancoli
Physics Texts

Conceptual Physics
by Hewitt
Physics Texts

Physics for Scientists and Engineers
by Serway & Jewett
Physics Texts

The Feynman Lectures on Physics by Feynman, Leighton & Sands
Physics Directed Study Text

The Pluto Files
by Neil deGrasse Tyson
Not in C&CR, but is posted on UIL site.
FAQs on Texts

- Do I need to get these exact texts?
  - Does it need to be the same edition?
- Does the text matter?
- What about other texts?

Options:
- Half-price books / Online book sellers
- Interlibrary loan
Other “Book” Options

Kinetic Books & Thinkwell
UIL Online Resources

http://www.uil.utexas.edu/academics/

- UIL Academics home page
- Academic Contests: Science

Information from the Contest Directors will be posted here.

- The new Physics directed study information is posted here.
Main Topics in Biology

1. Structure Relates to Function
   - Basic Biochemistry
   - Basic Cell Biology
   - Biological Membrane

2. Energy is Stored, Used and Transformed in Living Systems
   - Respiration and Photosynthesis
   - Metabolism
   - Enzyme Kinetics
Main Topics in Biology

3. Gene Expression
   - DNA, RNA, and Proteins
   - Protein synthesis
   - Regulation of gene expression
   - DNA Technology

4. Genetics and Inheritance
   - Mendelian inheritance
   - Molecular inheritance-Chromatin, chromosomes, chromatids
   - Genome Structure/Human Life Cycle
   - Cell Division-Mitosis and Meiosis
Main Topics in Biology

5. Evolution
   Microevolution: Selection, Mutation, Migration and Genetic Drift
   Evidence of Macroevolution
   Speciation and Extinction

6. Origin and Diversity of Life on Earth
   3 Domains of Life
   Animal and Plant Behavior
   Biological Hierarchy
Main Topics in Biology

7. Ecology and the Environment
   Population Biology
   Community Dynamics
   Biogeochemical Cycles
3 levels of questions:

1. Knowledge and Comprehension:  
   Advanced recall and identification of subject matter.

2. Application and Analysis:  
   Demonstration of quantitative reasoning using and generating graphs and data.

3. Synthesis and Evaluation: Using information and prior content knowledge to formulate conclusions and generate hypotheses.
Biology Contest Structure

- Participants should expect questions from all topics on all exams.
- Approximately 75% of the UIL exam will consist of questions from levels 1 and 2 and 25% of the UIL exam will draw from level 3 questions.
- The relative level of difficulty will increase with each contest.
Level 1: Knowledge and Comprehension

The distribution of desert biomes is centered around 30° north and south latitude due to ____________________.

A) The fall of atmospheric convection cells (Hadley cells)
B) Seasonal variation in sunlight intensity.
C) Global circulation of surface water in the oceans.
D) Location on the leeward side of mountain ranges.
E) Location on the windward side of mountain ranges.
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Level 2: Application and Analysis

Assuming Hardy-Weinberg equilibrium, what is the expected frequency of heterozygotes in the F1 generation given the following genotypic frequencies found in the parental (P1) generation?

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<thead>
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<th>Genotype</th>
<th>Frequency</th>
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<tbody>
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<td>AA</td>
<td>0.36</td>
</tr>
<tr>
<td>Aa</td>
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B) 0.41  
C) 0.59  
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Level 3: Synthesis and Evaluation

The products of mitosis are two genetically identical cells because:

A) the mitotic spindle allows for equal segregation of chromosomes
B) it is preceded by DNA replication in the S phase of interphase.
C) maternal and paternal chromatids are unequally distribute to two daughter cells.
D) the distribution of DNA during telophase I occurs before cytokinesis.
E) haploid cells unite during mitosis resulting in identical daughter cells.
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The 20 questions in Physics:

- There will be 4 directed study questions from “The Pluto Files” by Tyson.
- Variety of question types: conceptual, symbolic, and numeric questions
- There is a range of difficulty on each contest and over the contest season.
- AC circuits (with phasor diagrams) are allowed.
- Problems that require vector operations expressed in unit vector notation & calculus will be included on the contests to help better differentiate the scores for the top students.
“The Pluto Files” Directed Study
Questions

- Invitational A – chapters 1 & 2
- Invitational B – chapters 1 & 2
- District 1 – chapters 3 & 4
- District 2 – chapters 3 & 4
- Regional – chapters 5 & 6
- State – chapters 7, 8 & 9
Some Contest Strategies

- Watch units!
- Make diagrams with labels
- Look for order of magnitude answers
- Problem identification...
  Quick/Easy, Moderate or Hard
  - Use these identifiers to work on speed
  - Recognize when to come back later
Coaches/Team Suggestions

- Goal setting for student moral is very, very important!
- Have students solve old contests UIL or TMSCA exams & help out other students.
- Practice contests as posted on UIL invitational meet site or attend TMSCA contests.
- If possible coordinate with other teachers to arrange for help when needed.
- Positive reinforcement & food are good motivators.