Lesson Plan Assignment

Please prepare a lesson plan that will allow your students to meet at least two of the California State High School Life Science Standards (see Appendix A). You are encouraged to include computer and wet lab activities appropriate to your school facilities. For molecular biology activities, assume that equipment is available through an industry/university program and that you have a budget of $350 for reagents and supplies.

The lesson plan should be detailed and consist of the following sections:

- Title, Course & Author
- Standards
- Brief Description of Activities
- Calendar
- Background
- Preparation
- Procedures
- Assessment

Title – This should be a general description of the plan. An example might be, "Bioassays – A Hands-on Approach for 9th Grade Life Science." Lesson Plan by Henrik Kibak

Standards – This should be a text box with the standards to be met directly quoted. An example might be:

Investigation and Experimentation

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations. Students will:
    a. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.

    j. Recognize the issues of statistical variability and the need for controlled tests.

Brief Description – Here you will provide a synopsis of the activities so that a peer could understand what your lesson plan covers and whether the activities might be appropriate for their use. Please use third person. An example follows: *Students use digital cameras and software to measure the growth of duckweed under various conditions. They will prepare a standard curve*

of duckweed growth in response to salt concentration. They will use that standard curve to find the salt concentration of an unknown salt solution. Students will display the data they have collected as tables and graphs. When presented with a dose-response curve on an exam, students will be able to correlate a response with a dose in an example unrelated to duckweed.

Calendar – Every teacher develops their own approach to scheduling activities, so use yours here. In the case of the bioassays example I use the following:

Mon	Tue	Wed	Thu	Fri
27	**28** Collect Duckweed Westlake Pond	**29** Prepare Duckweed medium	**30** Introduce Lab Short ppt on bioassays	**1** Students prepare solutions, set up Duckweed Take photos
4	**5**	**6**	**7** Computer Lab Practice Image manipulation	**8** Take second set of photos
11	**12**	**13**	**14** Computer Lab ImageJ Software Compare growth	**15** Set up second run including "unknown"
18	**19**	**20**	**21** Computer Lab ImageJ software Compare growth	**22** Take final set of photos
25	**26** Computer Lab ImageJ software Compare growth	**27**	**28** Exam including bioassay questions.	**29** Lab write-up due

Background – Please write in your own words the basic information that will help you answer student questions and refresh your memory of the subject. One page per standard is a rule of thumb. For the Bioassays example I would provide a paragraph on a scientific control, a standard curve, duckweed biology, and examples such as the pharmaceutical industry, pollution monitoring, or agriculture where bioassays are used every day. If you are going to use software such as ImageJ, a refresher on how to use just the parts you will need for this activity would also be good.

Preparation – In many ways you can consider this an expanded "Materials" section for the lesson plan. First prepare a list of all materials required and where to obtain them. Then describe the preparation and time requirements necessary to carry out the activities you have planned. This can be as varied as "Prepare simple powerpoint on *Lemna* biology – 2 hours," or "Order *Lemna* growth medium from Carolina Biological (800-334-5551) – half hour), or "photocopy 32 copies of Restriction Enzyme Worksheet," but should be very detailed. For example, if you include pipe cleaners in an activity on meiosis, please describe the number and colors of pipe cleaners required and the location/phone number of the store where you will buy them. Or if you are going to show a video, we want the title, date, and publisher of the video, or where to obtain it. If you are taking the students on a field trip, what steps will you have to take?

Procedures - This is normally the bulk of your lesson plan. **For each activity, each period, provide a Heading for the activity followed by a detailed list of exactly what you are going to do during that activity and the estimate of the time it will take.** If you are going to give the students a handout or worksheet, please include a copy in the appendix to your lesson plan. You are encouraged to include "focus questions" in this section. Include your assessment activities such as the time it will take you to check worksheets or grade exams.

Example:

> **Friday, 3/8 - Measuring Lemna growth.**
> Set up the four photography stations during prep – 20 minutes.
> ---------- Student photography – 30 minutes ----------
> At start of class remind students that they will be taking photos of the duckweed they have been growing in micro-titre plates since last Friday. Ask for some predictions of what they think they will observe. Ask them how they could measure the growth of these small circular plants without photographing them?
> Have the students retrieve their microtitre plates from under the growth lights.
> Remind them to take the lids off while carrying the plates.
> Remind them to float the 5mm marker in one of the wells.
> Display an example of a good photograph.
> Remind them to be sure that their plate ID is visible in the photo.
> After taking photograph have students replace evaporated solution with distilled water. Ask why not more solution?
> Ask students who finish first to take photos for students who are absent.
> ---------- ImageJ Presentation – 20 minutes ----------
> When all photos are taken, go through the use of ImageJ software for calculating leaf surface area. This will improve student success during the computer lab next period.

Assessment – Assessment is emphasized in the current political environment and is often important in obtaining administrative support for curriculum. Your lesson plan must provide an exam or equivalent assessment instrument. How will you know that <u>all</u> your students know what you want them to know?

How to write a lesson plan: It is very difficult to write a lesson plan unless you know your students. After you have selected the standards you would like to cover, talk to teachers who have taught this subject/grade level at this school… they can often save you a great deal of time and trouble. Do not proceed linearly through this assignment. After selecting the standards, write the background section, then the assessment. Next start on the procedures, especially the time estimates for the activities. Do you really have enough time? When you have drafted the procedures, return to the assessment. Does it articulate with your activities? If not, modify one or the other. Now prepare the list of materials and the calendar. Again, are your procedures feasible? Now work on the details of the Preparation section. Finally prepare the brief description of activities. Have an experienced peer or department chair review the plan and give you comments.

Your lesson plan will be assessed on the completeness of the lessons, the application to relevant standards, and organization.

Appendix – Applicable Biology/Life Science Standards

1. The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells. As a basis for understanding this concept:

d. *Students know* the central dogma of molecular biology outlines the flow of information from transcription of ribonucleic acid (RNA) in the nucleus to translation of proteins on ribosomes in the cytoplasm.
h. *Students know* most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

3. Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept:

d. Students know how to construct a simple branching diagram to classify living groups of organisms by shared derived characteristics and how to expand the diagram to include fossil organisms.

4. Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:

a. Students know the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.
b. Students know how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.
c. Students know how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein.
d. Students know specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.
e. Students know proteins can differ from one another in the number and sequence of amino acids.
f. Students know why proteins having different amino acid sequences typically have different shapes and chemical properties.

5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept:

a. Students know the general structures and functions of DNA, RNA, and protein.
b. Students know how to apply base-pairing rules to explain precise copying of DNA during semiconservative replication and transcription of information from DNA into mRNA.
c. Students know how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.
d. Students know how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules.
e. Students know how exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of new protein products.

8. Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:

d. *Students know* reproductive or geographic isolation affects speciation.
f.* *Students know* how to use comparative embryology, DNA or protein sequence comparisons, and other independent sources of data to create a branching diagram (cladogram) that shows probable evolutionary relationships.
g.* *Students know* how several independent molecular clocks, calibrated against each other and combined with evidence from the fossil record, can help to estimate how long ago various groups of organisms diverged evolutionarily from one another.

All of the 9th – 12th grade standards on investigation and experimentation apply.

The full description of the standards can be found on-line at:

http://www.cde.ca.gov/cdepress/standards-pdfs/science.pdf