

The handout for my roundtable on the implications of the AP Physics Redesign were taken from the presentation: Science and History Course and Exam Review Overview & Status

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AP Forum

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AP Science & History Review

Where can improvements be made?

A National Research Council Report (2002) identified several opportunities to improve math and science education in the US. These recommendations are equally applicable to all AP course subjects.

- Courses should emphasize deep understanding rather than comprehensive coverage.
- Programs should reflect current understanding of learning in the discipline.
- Programs should reflect current research directions within the disciplines.
- Courses should include a deep emphasis on inquiry and reasoning

AP Science Review

Goals

The Redesign Project will produce a more inclusive and more engaging program of study for each discipline. To achieve this we identify:

Science

- The essential concepts that are to be studied in depth
- The essential reasoning and inquiry skills that are to be supported by instruction and measured on the exams
- Teaching practices that are most successful at developing understanding
- The minimum resources required to support these practices
- Cutting-edge areas of research that can best capture essential concepts within the discipline and reveal the unity of scientific ways of knowing.

AP Science & History Review

Goals

This information will be used to create an overall course experience to:

- Engage students in the college-level knowledge, skills and abilities within the discipline
- Support teachers with professional development opportunities and tools
- Ensure the receipt of college credit for qualifying student exam performance

AP Review

Process Design

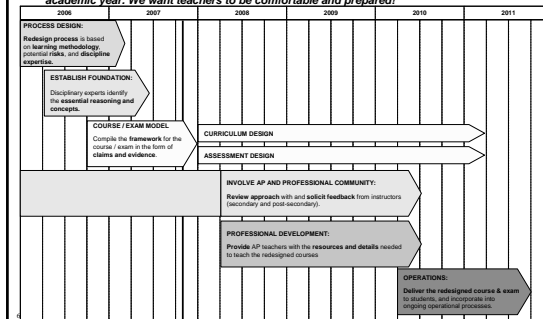
PROCESS DESIGN:
Redesign process is based on learning methodology, potential risks, and discipline expertise.

The process of AP review has been informed by:

- College Curriculum Study
- National & select state standards
- Established learning science approaches to curriculum and assessment design
 - *Learning and Understanding* (National Research Council, 2002)
 - *Understanding by Design* (Wiggins and McTighe, 2005)
 - *Evidence-centered Design* (Steinberg, Mislevy, & Almond, 2003)

AP Science & History Review

How will we get there? With PD considerations, AP Physics might slip to 2011-2012 academic year. We want teachers to be comfortable and prepared!



AP Review

How will we get there?

PROCESS DESIGN:
Redesign process is based on learning methodology, potential risks, and discipline expertise.

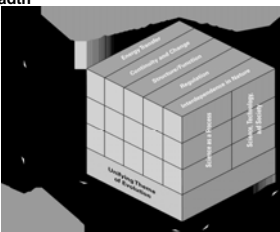
- The AP Science Redesign is supported in its initial phases by a grant from the **National Science Foundation**. Principal Investigators on that grant provide expertise in learning science, science education, and assessment design.
- Discipline-specific expertise is provided by **Redesign Commissions** whose membership includes secondary and post-secondary educators and practicing scientists and historians.
- The role of the AP staff is to develop resources to support and facilitate the work of these teams.

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AP Science & History Review

Phase I Bio Recommendations

- Establish a conceptual framework that will increase depth and reduce breadth
- Emphasize inquiry-based teaching and learning and integrate reasoning
- Define prior knowledge
- Increase Access
- Assume a leadership role in professional development
- Develop formative assessments



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AP Review

How will we get there?

PROCESS DESIGN:
Redesign process is based on learning methodology, potential risks, and discipline expertise.

Commissions were assembled to provide subject matter expertise and direction for the review

- Professional organizations, the National Science Foundation, and College Board members identified by consensus the Commission members
- Each Commission is comprised of leaders in Higher and Secondary Education with subject-specific expertise
- The Commission provides input and guidance on:
 - Essential course content and skills
 - Instructional practices

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AP Review

Establish Foundation

ESTABLISH FOUNDATION:
Disciplinary experts identify the essential reasoning and concepts.

Each Science Commission was charged to focus the redesigned AP course on the following goals:

- Draw upon current research on learning, instruction, and assessment
- Reduce the breadth of content coverage
- Increase depth of understanding of essential concepts
- Develop capacity to use inquiry and critical thinking skills
- Organize curriculum, instruction, and assessment using unifying themes
- Create learning programs accessible to students from a broad range of backgrounds
- Prepare students for success in subsequent college-level courses

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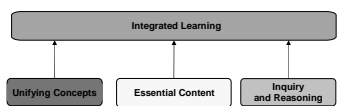
AP Review

Establish Foundations

ESTABLISH FOUNDATION:
Disciplinary experts identify the essential reasoning and concepts.

The science courses and exams will produce *Integrated Learning of science* by embedding the "Essential Content" within:

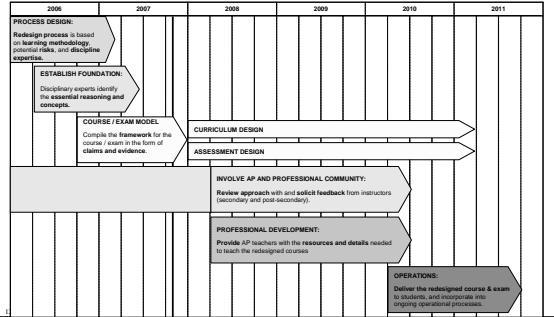
- "Unifying Concepts" that deepen learning by increasing coherence
- "Inquiry and Reasoning" skills that deepen learning by involving students in knowledge construction



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AP Review

How will we get there? See last one for note on possible date!



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AP Review

Course / Exam Model

COURSE / EXAM MODEL:
Complete the framework for the course / exam in the form of claims and evidence.

CURRICULUM DESIGN

ASSESSMENT DESIGN

The new AP courses and exams will be based on well-defined learning objectives and descriptions of student work that achieves these objectives.

Assessment Design

- The assessment model will support deep learning by emphasizing reasoning and inquiry
- Each of the scores within the 5-4-3-2-1 scoring model will be tied to clear and specific standards for student achievement

Curriculum Design

- Course descriptions will clearly define the scope of the learning objectives.
- Embedded formative assessments will support progress toward success on the AP Exam.
- Curricular resources will be provided to support AP students and teachers.

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AP Review

Involve AP & Professional Communities

INVOLVE PROFESSIONAL AND AP COMMUNITY:
Review approach with and solicit feedback from instructors (secondary and post-secondary).

Guiding principles of the Review process are to:

- Rely upon the expertise of the leading educators and scholars from both higher and secondary education.
- Solicit feedback and input from those most involved with the courses and exams.

After the 2008 release of the draft Course / Exam model:

- Review and comment by professional communities
- Solicit input from a representative sample of AP teachers
- Involve and consult with higher education communities
- Present the model at professional conferences
- Provide Redesign updates on AP Central

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AP Review

Professional Development

PROFESSIONAL DEVELOPMENT:
Provide AP teachers with the tools and details needed to teach the redesigned course.

The Professional Development program will identify and provide resources, such as:

- Complete practice exams for each redesigned course prior to the launch of all redesigned exams
- An appropriate sustained professional development experience for AP teachers, to be launched 2 full years before the launch of the redesigned course
- Teacher tools, including curriculum modules, formative assessments and lesson plans, including sharing tools used by existing AP teachers
- Student tools (print and web-based) for individual and classroom use

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AP Review

Operations

OPERATIONS:
Deliver the redesigned course & exam to students, and incorporate into original operational processes.

The new approach will leverage potential opportunities to improve the operational delivery of AP exams such as:

- Develop more flexible administration schedule in response to teacher feedback
- Provide score reports that include descriptions of student performance with regard to the measured learning objectives

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AP Review

What does this mean for AP teachers?

There are still many details to be finalized for the Redesign. At this point, the following impacts are known:

- The amount of change differs by exam. Subject-specific details will be provided as available.
- Through the AP Course Audit network and AP Central, the College Board will continue to provide purposeful, direct and regular updates on any significant course redesign changes
- The criteria used in the Course Audit will reflect the redesign.
- The AP Redesign effort provides a renewed opportunity to involve higher education faculty with the goal of ensuring ever-increasing credit policies across institutions

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AP Review

What does this mean for me?

- AP instructors and students will have a well-defined set of learning objectives that support deeper understanding.
- The AP Exams will be congruent with these learning objectives.
- AP instructors will have tools and professional development opportunities that support learning and success on the AP Exam
- The post-secondary community and professional societies will have a better understanding of, and confidence in, the value of AP courses.

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AP Science Review

Challenges

Each Redesign Commission identified considerations that needed to be addressed in defining the "Essential Content."

ESTABLISH FOUNDATION:
Disciplinary experts identify the essential reasoning and concepts.

Commission	Consideration
Biological Science	<ul style="list-style-type: none"> Express coherence across molecular, cellular, organism, and population levels. Reduce breadth by distinguishing essential concepts from examples of these concepts.
Environmental Science	<ul style="list-style-type: none"> Environmental issues must use basic science as the foundation. Increase the role of mathematical reasoning.
Chemistry	<ul style="list-style-type: none"> Traditional emphasis on calculation and description shifts to an emphasis on the underlying concepts and the reasoning from which they emerge. Traditional emphasis on teacher-directed procedures is an early scaffold that supports subsequent experiences involving experimental design.
Physics	<ul style="list-style-type: none"> AP Physics B is too often a first high school course in physics. Mechanics is foundational and emphasized in the introductory algebra-based physics at the university.

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AP Science Redesign

Curriculum Model: Physics

ESTABLISH FOUNDATION:
Disciplinary experts identify the essential reasoning and concepts.

Integrated Learning		
Unifying Concepts	Big Ideas of the Essential Content	Scientific Inquiry and Reasoning
<ul style="list-style-type: none"> Models Systems Continuity and Change Scale Structure / Function Science Explains the Real World 	<ul style="list-style-type: none"> Objects and systems have properties such as mass, charge, and internal structure. Fields existing in space can be used to explain interactions. The interactions of an object with other objects is described by forces which can cause a change of motion. Interactions between systems can result in changes in those systems. The interaction of one object or system with another is governed by conservation laws. Some phenomenon can be described as waves. The evolution of a complex systems over time is described by probability. 	<ul style="list-style-type: none"> Strategic skills that support the identification and solution of problems Measurement and interpretation of measurement Construct and interpret visual and graphical representations of relationships Apply mathematical reasoning Draw conclusions based on evidence Experimental design

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AP Science Redesign

Curriculum Model: Biology

ESTABLISH FOUNDATION:
Disciplinary experts identify the essential reasoning and concepts.

Integrated Learning		
Unifying Concepts	Big Ideas of the Essential Content	Scientific Inquiry and Reasoning
<ul style="list-style-type: none"> Models Systems Continuity and Change Scale Structure / Function Science Explains the Real World 	<ul style="list-style-type: none"> The process of evolution explains the diversity and unity of life Cells are a fundamental structural and functional unit of life. Interdependent relationships characterize biological systems, and these interactions give rise to emergent properties. Biological systems maintain homeostasis. Living systems have multiple mechanisms to store, retrieve, and transmit information 	<ul style="list-style-type: none"> Asking testable questions, drawing conclusions based on evidence, and generating useful representations Using symbolic and graphical representations of relationships Experimental design, execution and data analysis Applying the scientific way of knowing through reasoning based on evidence Organizing and communicating ideas Science operates in a social context

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AP Science Redesign

Curriculum Model: Environmental Science

ESTABLISH FOUNDATION:
Disciplinary experts identify the essential reasoning and concepts.

Integrated Learning		
Unifying Concepts	Big Ideas of the Essential Content	Scientific Inquiry and Reasoning
<ul style="list-style-type: none"> Models Systems Continuity and Change Scale Structure / Function Science Explains the Real World 	<ul style="list-style-type: none"> Energy conversions underlie all Earth processes The Earth is composed of interdependent and interacting systems. Matter on Earth is finite and moves through various biogeochemical cycles. Human actions impact the environment. Human beings depend on ecosystem services 	<ul style="list-style-type: none"> The initiation of knowledge creation is usually careful observations that evoke informed questions. Experiments are designed to answer a particular question. The quality of the answer is determined by the thoughtfulness of the design of the experiment and the tenacity of the experimenter Science and technology operate in a social context. Science and technology can serve national interests. But nationalism can impede solutions to transnational problems. The capacity to reason scientifically requires an understanding of cause and effect, the difference between argument and explanation, and the uncertainty that arises from the use of models and measurement. Situations that require the interpretation of graphical, symbolic, and numerical information and the application of judgment in the evaluation of the quality of that information support skill in analysis. Communication is an essential element of the creation of scientific knowledge. Both the individual and the community have a role in the critical evaluation of information or ideas. Skill in the numerical and symbolic representation of information and relationships increases the power of expression and the clarity of thought.

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AP Science Redesign

Curriculum Model: Chemistry

ESTABLISH FOUNDATION:
Disciplinary experts identify the essential reasoning and concepts.

Integrated Learning		
Unifying Concepts	Big Ideas of the Essential Content	Scientific Inquiry and Reasoning
<ul style="list-style-type: none"> Models Systems Continuity and Change Scale Structure / Function Science Explains the Real World 	<ul style="list-style-type: none"> The chemical elements are the fundamental building materials of matter and are best understood by considering them as comprised from atoms that always retain their identity. Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions or molecules and the forces between them Changes in matter involve the rearrangement and/or reorganization of atoms and/or transfer of electrons The laws of thermodynamics explain and predict the direction of changes in matter Rates of chemical reactions are determined by details of the molecular collisions Any bond or intermolecular attraction that can be formed can be broken. These two processes are in a dynamic competition, sensitive to initial conditions and external perturbations. 	<ul style="list-style-type: none"> Asking testable questions, drawing conclusions based on evidence, and generating useful representations Using symbolic and graphical representations of relationships Applying the scientific way of knowing through reasoning based on evidence Organizing and communicating ideas Experimental design, execution and data analysis

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AP Science Redesign

Establish Foundation

ESTABLISH FOUNDATION:
Disciplinary experts identify the essential reasoning and concepts.

The diversity and unity of life can be explained by the process of evolution.

- 1.A The origin of living systems occurred by natural processes, and life continues to evolve within a changing environment.
- 1.B. Organisms can be linked by lines of descent from common ancestry.
- 1.C. Natural selection is a mechanism of evolution that accounts for adaptation.
- 1.D. Human activity can alter the course of evolution.

Cells are a fundamental structural and functional unit of life.

- 2.A. All cells come from preexisting cells.
- 2.B. Cells maintain internal environments that differ from their external environments.
- 2.C. Cell structure defines cell function including metabolism.
- 2.D. Cells communicate with other cells

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