



Knowledge Skills Behavior Awareness

AP[®]

***Redesigning High-Stakes Assessments
to Measure 21st Century Knowledge and
Skills***

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Traditionally, many college science course outlines have looked like this:

Topic Outline

<i>Topic</i>	<i>Percentage of Course</i>
I. Molecules and Cells	25%
A. Chemistry of Life	7%
Water	
Organic molecules in organisms	
Free energy changes	
Enzymes	
B. Cells	10%
Prokaryotic and eukaryotic cells	
Membranes	
Subcellular organization	
Cell cycle and its regulation	
C. Cellular Energetics	8%
Coupled reactions	
Fermentation and cellular respiration	
Photosynthesis	

College biology students have often been assessed with questions like these:

The creeping horizontal and subterranean stems of ferns are referred to as:

1. Prothalli
2. Fronds
3. Stipes
4. Roots
5. Rhizomes

The energy required to run the Calvin cycle reactions of photosynthesis comes from which two substances produced during the light-dependent reactions?

1. ATP and NADPH
2. ADP and PO₄
3. +H and O₂
4. O₂ and CO₂
5. H₂O and CO₂

David Conley on College Readiness

“What recent research has come to define as “best practices” entry-level college courses [are] quite different from the stereotypical freshman course. These courses require students to **engage significantly** with the course content and topics and to use **key cognitive strategies**. . . .

. . . Several studies have found college faculty members nationwide, regardless of the selectivity of the institution, to be in near-universal agreement that most students arrive unprepared for **the intellectual demands and expectations** of postsecondary faculty.”

David Conley, *College and Career Ready: Helping All Students Succeed Beyond High School*

First step: identifying 21st century skills within the context of a specific discipline

Science Practices: The student can/is able to . . .

Use representations and models to communicate scientific phenomena and solve scientific problems.

Engage in scientific questioning to extend thinking or to guide investigations within the context of the course.

Plan and implement data collection strategies appropriate to a particular scientific question.

Perform data analysis and evaluation of evidence.

Work with scientific explanations and theories.

Connect and relate knowledge across various scales, concepts and representations in and across domains.

Similarly, historians have aligned on 4 key historical thinking skills central to 21st century history studies

Historical Thinking Skills

Crafting Historical Arguments from Historical Evidence

- Historical argumentation
- Appropriate use of relevant historical evidence

Chronological Reasoning

- Historical causation
- Patterns of continuity and change over time
- Periodization

Comparison and Contextualization

- Comparison
- Contextualization

Historical Interpretation and Synthesis

- Interpretation
- Synthesis

Merging of content with 21st century skills creates a set of “learning objectives” that become the focus of assessment

Content

Transmission of information between neurons occurs across synapses.

+

Skill

The student can *create representations and models of natural* phenomena and systems

**Learning
Objective**

The student is able to create a visual representation to describe how nervous systems transmit information.

Now try this college biology question:



The equation above shows a reversible reaction that occurs in blood. An Olympic marathoner training at high altitude in Colorado feels dizzy and begins hyperventilating while taking a run. Her blood pH is elevated, resulting in alkalosis. How will normal blood pH be restored?

1. An increase in O_2 concentration in the plasma will lead to a decrease in H^+ concentration
2. An increase in CO_2 concentration in the plasma will lead to an increase in H^+ concentration
3. A decrease in sweating will lead to an increase in HCO_3 concentration
4. A decrease in respiration will lead to an increase in plasma O_2 concentration

Essay questions are evolving to require students to perform more complex cognitive tasks

By the early twentieth century, the United States had emerged as a world power. Historians have proposed various dates for the beginning of this process, including the three listed below. Choose one of the three dates below or choose one of your own, and write a paragraph explaining why this date best marks the beginning of the United States' emergence as a world power. Write a second paragraph explaining why you did not choose the other dates. Support your argument with appropriate evidence.

1898 (Spanish-American War)

1917 (Entry into the First World War)

1941 (Entry into the Second World War)

Most significantly, the overarching design of assessments seeks to foster and measure 21st century skills

Some examples:

- ▶ NSF-funded AP Engineering design portfolio, AP English writing portfolios
- ▶ Cambridge International Examinations' Global Perspectives and Research programme
- ▶ International Baccalaureate's Theory of Knowledge and project/research components
- ▶ Project Lead the Way: biomedical, technology, and engineering interim assessments