



**BOARD MEETING DATE:**  
March 12, 2012

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## **NEW HIGH SCHOOL SCIENCE SEQUENCE**

### **POLICY ISSUE/SITUATION:**

In the fall of 2012, a new common science sequence will be taught district-wide. Incoming 9<sup>th</sup> graders will enroll in Physics and follow a course pathway that will build content knowledge and critical thinking skills preparing them for entry into any college, technical school, or career-training program.

### **BACKGROUND INFORMATION:**

In August of 2008, The Beaverton School District Board charged the Science Project Team with the task of evaluating and making specific programmatic recommendations for the District. In May of 2011 the Board received and accepted the Science Project Teams final report. Contained within the Specific Program Recommendations of the report: *“For all students, clearly delineated core high school science sequences that allow for increasingly rigorous content knowledge and process skills will be developed, so that upon graduation, students are career and college ready in science. A STEM science sequence will be identified for students who want to go into Science, Technology, Engineering and Mathematics careers.”*

### **RECOMMENDATION:**

It is recommended that the School Board review and receive the new High School Science Sequence.

Physics

Chemistry

Biology

In the fall of 2012, a new common science sequence will be taught districtwide. Incoming 9th graders will enroll in Physics and follow a course pathway that will build content knowledge and critical thinking skills preparing them for entry into any college, technical school, or career-training program.

## Key Features

- Develops science and math literacy for all students
- Teaches students problem solving, innovation, design, and critical thinking
- Responds to the local and national demand for graduates prepared for 21st century careers
- Sequence meets ODE content standards
- Follows the new national framework for science standards
- Lab-based and STEM (Science Technology Engineering Mathematics) focused
- Students engage in regular scientific inquiry and engineering design
- Earth Science standards are woven into all courses

Physics

- Hands-on course that is highly engaging to students
- Emphasis on data collection, analysis and communication that lays the foundation for future science courses
- Scientific inquiry and engineering design used to recognize and apply patterns
- Math abilities, performance in problem solving, and technical communication skills are enhanced
- Topics include motion, forces, momentum, energy, waves, and electromagnetism

Chemistry

- Students build on skills and knowledge learned in physics to increase their depth of understanding of chemistry topics
- Builds foundation for understanding chemistry of life
- Lab-based course provides authentic experiences in scientific inquiry and engineering design
- Increased opportunities for critical thinking and reasoning
- Topics include the structure of atoms and compounds, the Periodic Table of Elements, chemical reactions, physical changes, gases, solutions, acids and bases, chemical quantities, kinetic theory, and thermodynamics

Biology

- Connect scientific themes and principles from physics and chemistry to the living world, including learning about complex biological molecules, energy, energy transformation, and energy flow
- Scientific inquiry and engineering design used to explore advanced problems
- Emphasize higher order thinking, communication, and reasoning skills that are essential to college and career readiness by addressing the technological, historical, and environmental aspects of biology
- Topics include the study of biochemistry, cellular processes, genetics, evolution, and ecology

**Physics****Chemistry****Biology****What prompted the change?**

District data show that fewer students are career and college ready in science, and student gains in science were smaller than in any other core subject.

**How will a common science sequence for BSD high school students better prepare them for college or career?**

National and District data show that students who take a full year of physics, chemistry, and biology have higher scores SAT and ACT scores; tests that are used to indicate college readiness. A common science sequence allows each course to build on a student's prior knowledge, allowing a greater number of our students to take advanced science courses that will prepare them for college and career.

**What is the new sequence of science courses for high school students?**

For most students, physics will be taken in the freshman year, chemistry in the sophomore year, and biology, the junior year. Seniors may choose an Advanced Placement (AP) or International Baccalaureate (IB) course or other science electives.

**Why physics first?**

Physics can be an active and engaging class, suitable for freshman. Students who take physics first will have a solid foundation for future courses. Physics explains the laws of nature, universal scale, and energy storage and transfer that are foundational for chemistry and biology. Engineering will be directly taught and real-world connections to mathematics will be made. Scientific inquiry will provide hands-on experiences with data collection, analysis, and pattern recognition.

**What benefits have been seen in school districts that have moved to a physics first model?**

Increased enrollment in upper level AP and IB science courses, increased number of female students in upper level physics courses, increased student achievement, and more positive student attitudes toward science have been documented. (<http://www.bscs.org/news/pages/capstonepdf.html>)

**How will the whole sequence be affected?**

We will have a single sequence that will prepare students for college and career. Courses will be taught so that a solid learning progression in science is achieved. The sequence will be taught as a whole rather than three separate and unconnected courses.

**What is different about this class than a normal physics class?**

The focus will be on the application of physics to solve problems and finding patterns in data and in the physical world. There will be a greater emphasis on conceptual understanding of physics concepts, inquiry and engineering, without sacrificing mathematical rigor and error analysis. There will be less reliance on a textbook - although one will be used.

**Will students be prepared for the mathematics required for the freshman physics course?**

The mathematics of the 9th grade physics class will focus on modeling patterns of nature. The course has been designed to work with students' intuitive ideas of physics in the natural world through labs that challenge their misconceptions with data that they have collected. Specific science and mathematics targets have been aligned within the 9th grade curriculum to help provide applications and connections between the content areas. One advantage of this sequence is an increased opportunity for students to use mathematical reasoning skills that may help enhance student math skills and abilities.

## IB SCHOOLS SCIENCE SEQUENCE PATHWAYS

Grade Level	General Pathways		Biology / Pre-Med	Environmental Focus	Physics, Chemistry & Engineering	
	Core Sequence Diploma Credit	Core Sequence Diploma Credit	Core Sequence Diploma Credit	Core Sequence Diploma Credit	Core Sequence Diploma Credit	
9	Physics I/ STEM Physics		STEM Physics	STEM Physics	STEM Chemistry	
10	Chemistry I	STEM Chemistry	STEM Chemistry	STEM Chemistry	Biology I	
11	Biology I	HL Biology I	HL Biology I	HL Biology I	HL Physics I	
Recommended Enhanced Science Pathway						
12*	SL Physics, HL Physics I, SL Chemistry, SL Environmental Systems, HL Biology I, HL Biology II, Human Anatomy, Astronomy, elective science courses		HL Biology II	SL Chemistry and/or Human Anatomy	HL Biology II and/or SL Environmental Systems	HL Physics II



## AP SCHOOLS SCIENCE SEQUENCE PATHWAYS

Grade Level	General Science Pathways		Biology / Pre-Med	Environmental Focus	Physics, Chemistry & Engineering
	Core Sequence Diploma Credit	Core Sequence Diploma Credit	Core Sequence Diploma Credit	Core Sequence Diploma Credit	Core Sequence Diploma Credit
9	Physics I/ STEM Physics		STEM Physics	STEM Physics	STEM Chemistry
10	Chemistry I	STEM Chemistry	STEM Chemistry	STEM Chemistry	AP Biology
11	Biology I	AP Biology	AP Biology	AP Biology	AP Physics
Recommended Enhanced Science Pathway					
12*	AP Physics, AP Chemistry, AP Environmental Science, AP Biology, Human Anatomy, elective science courses		AP Chemistry and/or Human Anatomy, AP Physics	AP Environ. Science and/or AP Chemistry	AP Chemistry

\*Some students may be ready to start taking upper level courses earlier than 12<sup>th</sup> grade and should talk to their counselor and parents about this possibility.