

**GREAT PLAINS TECHNOLOGY CENTER
COURSE OF STUDY**

Career Cluster: Science, Technology, Engineering and Mathematics (SC)

Career Pathway: Science and Mathematics

Local Program: PLTW Biomedical Science and Medicine (SC0040007)

Program Hours: Secondary Students: 720 Hours

<u>Instructors:</u>	Name	Office	E-Mail
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Credits: Secondary Students: 3 high school credits per year - *OK Promise Credit

Prerequisites: Enrollment in the Biomedical Science and Medicine program is with the home school recommendation. Biology I or concurrently enrolled.

Program Description:

Students in this program will study biomedical science through the exciting Project Lead the Way curriculum that will provide students hands-on projects and experiences. Topics will include bioinformatics, human medicine, and an in-depth study of the human body. Students will also study advanced math courses that may include Adv. Algebra II, Adv. Trigonometry/Pre-Calculus, and an AP math course as well as advanced science courses that may include Anatomy and Physiology, Microbiology, Adv. Chemistry and AP Biology. Alternatively, for their science requirement, students may participate in concurrent enrollment for Human Biology and Medical Terminology through Cameron University. Students who complete this program will have been exposed to a diverse curriculum that will better equip them to choose a major at the college/university level. Students will also have the strong math and science foundation needed to be prepared to enter a college/university program in a science related field.

This is a two-year academy that will emphasize biomedical knowledge and projects as well as academics. The academics will prepare the students to transition into the medical field of study in post-secondary. Upon completion of the AP courses, the student will be able to test for college credit in those subjects.

Program Goals:

This program challenges students to use mathematical, scientific and technological principals in solving real-world problems.

Upon achieving the goals of this program, students will:

- work as a contributing member of a team
- lead a team
- use appropriate written and/or visual mediums to communicate with a wide variety of audiences
- practice public speaking
- listen to the needs and ideas of others
- understand the potential impact their ideas and products may have on society

- think creatively
- problem solve
- manage time, resources and projects
- research
- go beyond the classroom for answers
- collect and analyze data
- prepare for two-and four-year college programs

Career Opportunity Examples:

- A career in biochemistry
- A career in biomedical engineering
- A career in dentistry
- A career in forensics
- A career in microbiology
- A career in immunology
- A career in pharmacology
- A career in physiology
- A career in radiological sciences

Program Objectives:

After successful completion of this program, the student will be able to:

- Understand how the skills they are learning in the classroom can be applied in everyday life.
- Increase cooperative learning and higher-order thinking skills.
- Develop strategies to direct their own learning.
- Make connections to problems in context and see the value in what they learn.
- Synthesize and construct knowledge to grapple with the complexities of problems.

DESCRIPTION OF COURSES

Biomedical Science and Medicine is a two-year program. Each year a student will choose two Project Lead the Way (PLTW) courses and one academic math or science course. Students will complete a total of four PLTW courses and two academic math or science courses.

<u>Course #</u>	<u>Course Name</u>	<u>HST</u>	<u>HSL</u>	<u>Total</u>
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ST00003	Principles of Biomedical Sciences (8706*) – PLTW Course	72	48	120
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This course provides an introduction to the biomedical sciences through exciting “hands-on” projects and problems. Student work involves the study of human medicine, research processes and an introduction to bioinformatics. Students investigate the human body systems and various health conditions including heart disease, diabetes, sickle-cell disease, hypercholesterolemia, and infectious diseases. A theme through the course is to determine the factors that led to the death of a fictional person. After determining the factors responsible for the death, the students investigate lifestyle choices and medical treatments that might have prolonged the person’s life. Key biological concepts including: homeostasis, metabolism, inheritance of traits, feedback systems, and defense against disease are embedded in the curriculum. Engineering principles including: the design process, feedback loops, fluid dynamics, and the relationship of structure to function are incorporated in the curriculum where appropriate. The course is designed to provide an overview of all the courses in the Biomedical Sciences program and to lay the scientific foundation necessary for student success in the subsequent courses.

ST00001 Human Body Systems (8707*) – PLTW Course 72 48 120

The human body is a complex system requiring care and maintenance. This course will engage students in the study of basic human physiology, especially in relationship to human health. Students will use a variety of monitors to examine body systems (respiratory, circulatory, and nervous) at rest and under stress, and observe the interactions between the various body systems. Students will use Logger Pro software to design and build systems to monitor body functions.

ST00004 Medical Interventions (8708*) – PLTW Course 72 48 120

Medical practice includes interventions to support humans in treating disease and maintaining health. Student projects will investigate various medical interventions that extend and improve quality of life, including gene therapy, pharmacology, surgery, prosthetics, rehabilitation, and supportive care. Students will study the design and development of various medical interventions including vascular stents, cochlear implants, and prosthetic limbs. They will review the history of organ transplants and gene therapy, and read current scientific literature to be aware of cutting edge developments. Using 3-D imaging software and current scientific research students will design and build a model of a therapeutic protein.

ST00005 Biomedical Innovation (8719*) – PLTW Course 72 48 120

This capstone course gives student teams the opportunity to work with a mentor, identify a science research topic, conduct research, write a scientific paper, and defend team conclusions and recommendations to a panel of outside reviewers. Each team will have one or more mentors from the scientific and/or medical community guiding their scientific research. Additionally, students may train and test for a phlebotomy certification. This course may be combined with the capstone course from the pre-engineering pathway, allowing students from both pathways to work together to engineer a product that could impact healthcare.

ST00027 STEM Capstone (8705) 72 48 120

In the Capstone, students identify a real-world challenge and then research, design, and test a solution, ultimately presenting their unique solutions to a panel of professionals. PLTW Capstone does not focus specifically on producing a marketable process or product, but rather centers on using, documenting, and working through the design process to address a problem.

ST00278 Crime Scene Investigation (8720) 72 48 120

This course incorporates the diverse fields of physical and biological sciences to recreate events that surround a crime and phenomenon that are associated with these scenes. Students in this course will continue to strengthen their scientific knowledge by applying concepts that have been previously learned and utilizing the science and engineering practices to apply that knowledge to each type of evidence that is presented. This course lends itself to diverse hands-on lab activities that applies the theory that is being learned so that students get a well-rounded STEM course.

ST00015 Microbiology (5336) 72 48 120

This course is a survey of the principles and techniques of microbiology with emphasis on disease prevention and health maintenance. Topics include the various groups of microorganisms, their structure, physiology, genetics, microbial pathogenicity, infectious diseases, immunology, and selected practical applications. Course work will include hands-on labs, computer-simulated lab experiments, student investigation into the physiology of several microorganisms, cooperative teamwork, special projects, and biotechnology education. Microbiology is beneficial class for all students interested in biomedical or other scientific careers.

ST00301 Medical Terminology (8559) 72 48 120

Medical Terminology is designed to develop a working knowledge of the language of medicine. Knowledge of medical terminology enhances students' ability to successfully secure employment or pursue advanced education in healthcare.

During this course, the student will learn to:

1. Understand the tools of word analysis that will make the comprehension of complex medical terminology easier (case history reports on patients will be reviewed with analysis of medical terms in each.)
2. Correlate an understanding of word elements with the basic anatomy, physiology, and disease process of the human body.

HL00046 Anatomy & Physiology (5333) 72 48 120

Anatomy is the study of the structure and shape of the body and their relationships to one another. This course includes both gross anatomy (anatomy of the large body structures), as well as microscopic anatomy (anatomy of body structures too small to be seen with the naked eye).

Human physiology, a branch of general physiology, is concerned with how the human body works. This course will approach the study through an organ-system approach. Organ-systems are collections of cells, tissues, and organs which have dedicated functions in the body.

ST00006 Adv. Algebra II (4412)– Academic Math Course 72 48 120

This course will enhance and expand the mathematical foundations of Algebra I and Geometry. The course will stress the fundamental extension of previous mathematics and the preparation for future higher-level mathematics courses. It will involve operations with real and complex numbers as well as matrices. The problem-solving processes will use functions and relations. Within the course applications of math, and while satisfying predictions based on a set of data, the use of data analysis, and statistics will be justified. Students who master CareerTech Algebra II will gain experience with quadratic functions, conic sections, logarithmic and exponential functions, linear functions, solution methods for systems of linear functions, and matrix operations.

ST00009 Adv. Geometry (4520) – Academic Math Course 72 48 120

This course will allow students the chance to relate mathematics to real-life situations and careers. It will build logical reasoning capabilities as well as give students an opportunity to justify conclusions in a structured manner. Students will analyze characteristics and properties of two- and three-dimensional geometric shapes. They will use visualization, spatial reasoning, and geometric modeling to solve problems. Throughout the course students connect the algebra skills previously developed to the geometric concepts. The CareerTech Geometry is a rigorous course that prepares students for higher-level mathematics. It was developed by a group of mathematics instructors while correlating it with NCTM Standards (National Council of Teachers of Mathematics) and the Oklahoma PASS Objectives (Priority Academic Student Skills).

ST00223 Adv. Trigonometry (4750) – Academic Math Course 36 24 60

This semester course is designed to be in preparation for AP Calculus and/or AP Physics. The course includes a study of six basic functions of trigonometry, Topics include right triangle relationships, unit circle, sine, cosine, and tangent functions and their applications, inverse trigonometric functions, identities, and trigonometric form of solutions of right and oblique triangles, trigonometric identities, conics, and complex numbers. The student will analyze and graph mathematical functions. Students will use graphing calculators in activities that are appropriate to the topics being studied.

ST00224 Adv. Pre-Calculus (4611*) Academic Math Course 36 24 60

This semester course is designed to be in preparation for AP Calculus and/or AP Physics. The course includes topics in Algebra ranging from polynomial, rational, and exponential functions to conic sections. The course gives a review study of straight lines, conic sections, algebraic curves, transcendental curves, a completed study of straight lines, simplification of equations, and polar coordinates. Students will then begin calculus concepts such as limits, derivatives, and integrals. The student will analyze and graph mathematical functions. Students will use graphing calculators in activities that are appropriate to the topics being studied.

ST00300 AP Precalculus (4614)– Academic Math Course 72 48 120

This year long course is designed to prepare students for AP Calculus and/or obtain college credit. Students acquire and apply mathematical tools in real-world modeling situations in preparation for using these tools in college-level calculus. Modeling, a central instructional theme for the course, helps students come to a deeper understanding of each function type. By examining scenarios, conditions, and data sets, as well as determining and validating an appropriate function model, students develop a greater comprehension of the nature and behavior of the function itself. The formal study of a function type through multiple representations (e.g., graphical, numerical, verbal, analytical), coupled with the application of the function type to a variety of contexts, provides students with a rich study of precalculus.

ST00061 AP Calculus AB (4615) – Academic Math Course 72 48 120

This is a college course taught to high school students that intend to move on to post-secondary. It offers extreme rigor in a specialized field of study. It will enable the student to be successful on the Advanced Placement AP Calculus AB exam and/or in college calculus. An emphasis will be placed on real world applications as they relate to the various engineering fields as well as development of problem-solving skills. **Prerequisites: Algebra I, Algebra II, Geometry, Trigonometry/Pre-Calculus**

ST00062 AP Calculus BC (4616) – Academic Math Course 72 48 120

The AP Calculus BC covers the same differential and integral calculus topics that are included in Calculus AB, plus additional topics in differential and integral calculus, and polynomial approximations and series. This is material that would be included in a two-semester calculus sequence at the college level. Graphing calculator use is an integral part of the course. Students cannot take both the Calculus AB and Calculus BC exams during the same year.

ST00206 AP Physics I – algebra based (5213) – Academic Science Course 72 48 120

AP Physics 1 course, together with the AP Physics 2 course, replaces the AP Physics B course as of fall 2014. Through inquiry-based learning, AP Physics 1 students will develop critical thinking and reasoning skills, allowing them to cultivate their understanding of physics and science practices. The AP Physics 1 Exam, which debuts in May 2015, will assess students' achievement of the AP Physics 1 learning objectives.

ST00016 Adv. Chemistry (5051) – Academic Science Course 72 48 120

Adv. Chemistry is designed to prepare students for the complex thinking that will be expected in future science courses. This course will focus on the development of the student as a scientist through the study of chemistry. Being a scientist requires a broad set of tools, including theory, problem solving, written and oral communication, interpreting data and laboratory skills. Areas covered are: Matter, atoms & periodic table, molecules & compounds, chemical reactions & stoichiometry, aqueous solutions & reactions, gases, energy & chemical reactions, atomic & molecular Structure.

ST00007 AP Chemistry (5055) – Academic Science Course 72 48 120

Chemistry is the study of the properties of materials and the changes that materials undergo. A student will see how chemical principles operate in all aspects of our lives, from everyday activities to far-reaching matters like the development of drugs to cure cancer. Students will learn through laboratory and lecture methods using group and individual activities, cooperative learning, presentations, and technology to enhance the learning environment. Students will learn how to design and conduct experiments using a variety of laboratory techniques and technology to investigate a chemical concept. They will apply stoichiometric concepts to chemical reactions and analyze how atomic structure relates to periodicity. The student will analyze how atomic structures relate to chemical bonding and apply chemical concepts to reactions in aqueous solutions. They will learn about gas laws as well as study electrochemistry.

ST00213 PLTW Environmental Sustainability (8854)(Oklahoma’s Promise/ OHLAP)72 48 120

Oklahoma’s Promise/ OHLAP. Students investigate and design solutions in response to real-world challenges related to clean and abundant drinking water, food supply, and renewable energy. (This course is currently not available.)

<u>Course #</u>	<u>Course Name</u>	<u>Lecture</u>	<u>Lab</u>	<u>Credit</u>	<u>CT Hours</u>
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BIOL 1214 – Human Biology (Concurrent Enrollment)		3	0	4	120
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Human Biology is a general education science lab course that introduces the basic concepts of biology, using humans and society as a focus. After establishing the molecular and cellular basis of life, the course describes and investigates the structure and function of the human body with an emphasis on homeostasis. It concludes with an examination of the principles of evolution and ecology, again focusing on human impact on the environment. It is not applicable to the biology major or minor. Lecture 3 hours, laboratory 2 hours. Prerequisites: Student must be eligible to take MATH 1513. Corequisite: BIOL 1214L.

BIOL 1214 – Human Biology (Concurrent Enrollment)		0	2	0	120
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LAB: Human Biology is a general education science lab course that introduces the basic concepts of biology, using humans and society as a focus. After establishing the molecular and cellular basis of life, the course describes and investigates the structure and function of the human body with an emphasis on homeostasis. It concludes with an examination of the principles of evolution and ecology, again focusing on human impact on the environment. It is not applicable to the biology major or minor. Lecture 3 hours, laboratory 2 hours. Prerequisites: Student must be eligible to take MATH 1513. Corequisite: BIOL 1214.

BIOL2013 Medical Terminology (Concurrent Enrollment)		3	0	3	120
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An introduction to the prefixes, roots, and suffixes used to construct medical terms. A systems approach will be used to survey the basic anatomy and physiology of the human body, followed by selected terms defining the pathology, diagnostic procedures, and treatment procedures of each system. Emphasis will be on learning to pronounce, spell, and define all terms. Lecture 3 hours. Will not satisfy General Education science requirements. (Fall, Spring)

Program Total:

- Theory Hours – Dependant on courses taken
- Lab Hours – Dependant on courses taken
- Total Hours Year One – 360
- Total Hours Year Two – 360

Evaluation Policy:

Performance Grades (45% of final grade)

- Performance or skill tests
- Homework
- Written Assignments

Academic Grade (55% of final grade)

- Test grades will be based on a 100-point scale.
- Test grades include written and/or skills tests.
- A test will be given for each unit of instruction.
- Tests are to be taken as a unit is completed.
- Tests must be completed within allotted time.

Final Grade (9 Weeks Period)

9-weeks grade will be calculated by averaging grades in each category and summing each category according to their assigned weight. Progress reports will be sent to home schools at six and twelve-week intervals each semester as required or requested. Grades are accessible on-line at <http://sonisweb.greatplains.edu/studsect.cfm>

Grading Scale: The grading scale as adopted by the Board of Education is as follows:

A = 90 – 100	W = Withdrawn
B = 80 – 89	I = Incomplete
C = 70 – 79	N = No Grade (Refer to Student Handbook)
D = 60 – 69	
F = Below 60	

Make-Up Work Policy:

All Make-Up Work Is the Responsibility Of The Student. Make-up work will be handled as specified in the Student Handbook. Please be sure to read and understand all student policies, especially make-up of assignments, tests, and employability due to absences. Students should always arrange for any make-up work with the instructor as per the Student Handbook. Students should keep track of his or her progress and grades.

Attendance Policy:

For specific information related to attendance and tardiness refer to the Student Handbook. Students should keep a written record of their absences and tardiness.

Course Requirements and Expectations:

The general course requirements and expectations include:

- Training methods will consist of lecture, individualized instruction and practical application.
- All students must adhere to policies and procedures in the GPTC student handbook.
- Health Occupations Students of America (HOSA) is the student organization for Biomedical Science and Medicine. This student organization offers an outstanding opportunity to develop leadership and social skills. Students are highly encouraged to participate.
- Upon satisfactory completion of Biomedical Science courses (excluding academic courses), students will receive a Competency Profile. A skill rating will be given for more specific tasks.

Student Behavior Includes:

- **Be Prompt:** Enter the classroom quickly and quietly ready to start the lesson for each day. Students who provide their own transportation must arrive by the following times: 8:15 for AM students and 11:50 for PM students.
- **Be Prepared:** Ensure that you have all materials needed for each day.
- **Be Respectful:** Disrespect for others and authority will not be tolerated.
- **Be Responsible:** Take responsibility for all your actions academically as well as socially.

NOTE: For additional information or questions regarding the GPTC School policies and procedures, please refer to the Student Handbook and/or the instructor.

Accountability Measures and Assessments:

- Principles of Biomedical Science, Human Body Systems, and Medical Intervention End of Course Tests administered through Project Lead The Way (PLTW)
- Oklahoma Academic Standards
- Principles and Standards for School Mathematics (4th Ed) (2005). National Council of Teachers of Mathematics, Reston, VA
- National Science Standards (5th Ed) (1998). National Research Council, Washington, D.C., National Academy of Sciences
- Students are expected to take AP Physics Exam upon completion of course.
- All AP Courses undergo an AP Course Audit through College Board.

Industry Alignments:

Curriculum content has been developed by Project Lead the Way and cross-walked with the following standards:

- National Academy of Sciences
- National Council of Teachers and Mathematics
- International Technology Education Association
- National English Language Arts

Certification Outcomes:

- First Aid/CPR 5310
- NHA Certified Phlebotomy Technician 8712

CIP & SOC:

- CIP: 15.0401 – Biomedical Technology/Technician
- SOC: 17-3029 – Engineering Technicians, Except Drafter, All Other

OCAS program codes:

- 9852 - Biomedical Science and Medicine Program
- 9870 - Biomedical Science and Medicine Program—Advanced

OCAS course codes:

- 8705 - PLTW STEM Capstone
- 8854 – PLTW Environmental Sustainability
- 8706 – PLTW Principles of Biomedical Sciences
- 8707 – PLTW Human Body Systems

- 8708 – PLTW Medical Interventions
- 8719 – PLTW Biomedical Innovations
- 5213 – AP Physics I Algebra Based
- 4412 – Adv. Algebra II
- 4520 – Adv. Geometry
- 4750 – Adv. Trigonometry
- 4611 – Adv. Pre-Calculus
- 4614 – AP Precalculus
- 4615 – AP Calculus AB
- 5333 – Anatomy
- 5220 – Physiology
- 5051 – AP Chemistry
- 5035 – AP Biology
- 8720 - Crime Scene Investigation
- 5336 – Microbiology

Instructional Materials and Supplies:

Students are not required to purchase textbooks or supplemental materials.

eLearning Curricula:

Applied Educational Systems, Inc. “HealthCenter21 Easily Saves Time for Health Science Instructors.” *HealthCenter21: Health Science Curriculum*, www.aeseducation.com/healthcenter21.

Textbooks:

Campbell, Neil, et al. Campbell Biology. 9th ed. 0321739752. San Francisco: Pearson, 2011.

Marieb, Elane. Essentials of Human Anatomy & Physiology. 9th ed. 798-0-13-600165-2. San Francisco: Pearson Education, 2009.

Martini, Fredric H. Fundamentals of Anatomy and Physiology. 7th ed. 0-13-195644-2. Upper Saddle River: Pearson Education, 2006.

Zumdahl, Steven S. Chemistry: AP Edition. 9th ed. 978-1133611103. Independence: Brooks/Cole Cengage Learning, 2013.