



## Biology | *Level*

### GRADE POINTS EARNED for an A = 4.0

#### PREREQUISITES

- Student needs to be able to analyze, evaluate and make inferences from data - Proficiency Level 2
- Student needs to be able to communicate valid conclusions supported by data or evidence - Proficiency Level 2

#### CROSS CURRICULAR CONNECTIONS

- Math - student will need to be able to graph data and use basic math for calculating data during lab activities

#### OUTSIDE READING

- Little to no outside reading required

#### HOMEWORK

- Can be finished in class

#### COMPLEXITY LEVEL

- 2 out of 5

#### WHAT DOES INSTRUCTION LOOK LIKE

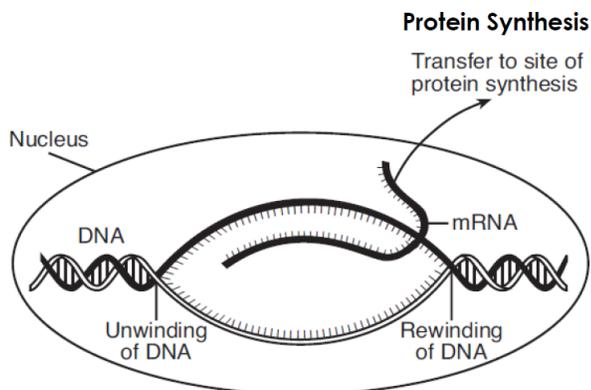
- Teacher Guided Instruction
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Structured Note-Taking (Teacher Led), Open-Ended Note-Taking (Student Led)

#### OTHER IMPORTANT INFORMATION

Biology is a lab-oriented course involving a survey of living systems and their interrelationships. Topics include scientific method, biochemistry, cell structure and function, DNA structure and function, genetics, growth and development of organisms, taxonomy, kingdoms and ecology. Laboratory skills and safety procedures are stressed.

### SAMPLE TEST QUESTIONS

Use the diagram to answer the following questions.



What process is occurring in the diagram shown above?

- |                                      |                |
|--------------------------------------|----------------|
| A. Transcription                     | C. Translation |
| B. amino acids being joined together | D. Replication |

Refer to the figure below for the following question.

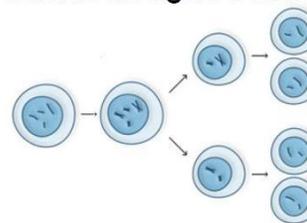


Figure 3

In Figure 3 above, which cell is normally produced as a direct result of meiosis?

- a somatic cell having half the normal species number of chromosomes.
- a gamete having half the normal species number of chromosomes
- a somatic cell having the full species number of chromosomes.
- a gamete having the full species number of chromosomes.

**Biology | *Honors / PreAP*****GRADE POINTS EARNED  
for an A = 5.0****PREREQUISITES**

- Student needs to be able to analyze, evaluate and make inferences from data - Proficiency Level 3
- Student needs to be able to communicate valid conclusions supported by data or evidence - Proficiency Level 2

**CROSS CURRICULAR  
CONNECTIONS**

- English - claims, evidence and reasoning writings
- Math - graphing data, ratios and percentages, some algebraic calculations during labs

**OUTSIDE READING**

- Little to no outside reading required

**HOMEWORK**

- 30-60 minutes per evening

**COMPLEXITY LEVEL**

- 3 out of 5

**WHAT DOES INSTRUCTION  
LOOK LIKE**

- Teacher Guided Instruction
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Application Focused Instruction
- Structured Note-Taking (Teacher Led)
- Open-Ended Note-Taking (Student Led)

**OTHER IMPORTANT  
INFORMATION**

Pre-AP Biology is a rigorous introductory biology course for students. Topics include scientific method, biochemistry, cell structure and function, DNA structure and function, genetics, human body systems, taxonomy, kingdoms and ecology. Laboratory skills and safety are stressed. Investigations, both individual and group, are integral components of

the Pre AP curriculum and may be performed both inside and/or outside of class.

Students will be expected to write CERs (claim, evidence, reasoning) in class and will be expected to write one on an exam.

**SAMPLE TEST QUESTIONS**

The table below shows the amino acid sequence of the carboxyl-terminal segment of a conserved polypeptide from four different, but related, species. Each amino acid is represented by a three-letter abbreviation, and the amino acid residues in the polypeptide chains are numbered from the amino end to the carboxyl end. Empty cells indicate no amino acid is present.

|         | Relative Amino Acid Position |     |     |     |     |     |     |     |     |     |
|---------|------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Species | 1                            | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
| I       | Val                          | His | Leu | Val | Glu | Glu | His | Val | Glu | His |
| II      | Val                          | His | Leu | Lys | Glu | Glu | His | Val | Glu | His |
| III     | Val                          | His | Leu | Val | Glu | Glu | His | Val |     |     |
| IV      | Val                          | His | Leu | Val | Arg | Trp | Ala | Cys | Met | Asp |

- (a) Assuming that species I is the ancestral species of the group, **explain** the most likely genetic change that produced the polypeptide in species II and the most likely genetic change that produced the polypeptide in species III.
- (b) **Predict** the effects of the mutation on the structure and function of the resulting protein in species IV. **Justify** your prediction.



## Chemistry | *Level*

### GRADE POINTS EARNED for an A = 4.0

#### PREREQUISITES

- Algebra I

#### CROSS CURRICULAR CONNECTIONS

- Algebra I

#### OUTSIDE READING

- Less than 30 minutes of reading required outside of class

#### HOMEWORK

- Can be finished in class

### COMPLEXITY LEVEL

- 2 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

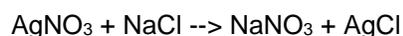
- Teacher Guided Instruction
- Lecture
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Application Focused Instruction
- Structured Note-Taking (Teacher Led)
- Open-Ended Note-Taking (Student Led)

### OTHER IMPORTANT INFORMATION

Chemistry is course that introduces the basic concepts of inorganic chemistry. Students will use scientific practices and math skills to solve investigative questions. Topics include scientific measurement and calculations, lab skills, atomic structure, chemical formulas, equations and stoichiometry, chemical bonding, states of matter, solutions, acids and bases, and nuclear chemistry.

### SAMPLE TEST QUESTIONS

Balance the reaction below:





## Chemistry | *Honors / PreAP*

### GRADE POINTS EARNED for an A = 5.0

#### PREREQUISITES

- Biology
- Algebra I w/ concurrent enrollment in Geometry or Algebra II (Pre AP recommended)

#### CROSS CURRICULAR CONNECTIONS

- Algebra I and II skills
- Solving equations
- Rearranging equations
- Solving problems using log functions and scientific notation.

#### OUTSIDE READING

- Less than 30 minutes of reading required outside of class

#### HOMEWORK

- 30-60 minutes per evening

#### COMPLEXITY LEVEL

- 4 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

- Teacher Guided Instruction
- Lecture
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Application Focused Instruction
- Intensive Writing, Structured Note-Taking (Teacher Led)
- Open-Ended Note-Taking (Student Led)

### OTHER IMPORTANT INFORMATION

Students in honors chemistry are expected to master various topics. We focus on foundational knowledge and skills that build toward future advanced science courses, such as AP Chemistry, AP Physics, or AP Environmental science. Students should have a strong mathematical background and be prepared to work in a fast paced environment. Some independent work may be necessary beyond the classroom and some memorization of content is required.

### EXAMPLE OF OBJECTIVE COMPARISON OF LEVEL AND HONORS:

#### The Level Student Will:

- Interpret Periodic Trends and predict which atom would be: Larger, More Electronegative, or have higher Ionization Energy.
- Be able to explain the concepts of Wavelength, Frequency, and Energy and the relationships between them and how they affect the EM Spectrum
- Be able to write an electron configuration (and noble gas configuration) for elements 1-20

#### The Honors Student Will:

- Interpret Periodic Trends and predict which atom would be: Larger, More Electronegative, or have higher Ionization Energy.
- Interpret trends in Ionic Radius
- Justify predictions and exceptions to periodic trends in written form and free response questions
- Be able to explain the concepts of Wavelength, Frequency, and Energy and the relationships between them and how they affect the EM Spectrum
- Be able to algebraically calculate Frequency, Energy, or Wavelength from data
- Be able to write an electron configuration (and noble gas configuration) for any element
- Be able to draw orbital notation for elements

### SAMPLE TEST QUESTIONS

Consider the following:

Silver Nitrate is combined with Sodium Chloride

- a) Predict the products for the reaction
- b) Write and balance the chemical equation



## Physics | *Level*

### GRADE POINTS EARNED for an A = 4.0

#### PREREQUISITES

- Algebraic manipulation of equations (Algebra 1)

#### CROSS CURRICULAR CONNECTIONS

- Unit Conversions from chemistry (dimensional analysis)
- Solving algebraic equations and graphing from Algebra 1 and 2.

#### OUTSIDE READING

- Little to no outside reading required

#### HOMEWORK

- Less than 30 minutes per evening

#### COMPLEXITY LEVEL

- 2 out of 5

#### WHAT DOES INSTRUCTION LOOK LIKE

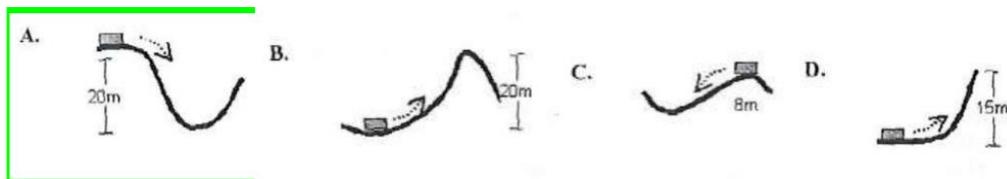
- Teacher Guided Instruction
- Independent Practice
- Collaborative Groups
- Structured Note-Taking (Teacher Led)
- Lab Activities

#### OTHER IMPORTANT INFORMATION

Students will work in collaborative groups on hands on activities as well as written practice problems. A composition notebook is required for the class. There will also be major grade projects in addition to written assessments. Topics studied include velocity, acceleration, forces, momentum, energy, heat, sound, electricity, and light.

### SAMPLE TEST QUESTIONS

1) Andrew plays a computer game where he designs roller coasters for a virtual amusement park. Each diagram below illustrates a path for the roller coaster car to travel. Which track should Andrew choose if he wants the roller coaster car to have the most potential energy?



2) You are worried about a severe storm in your area. You hear a weather report stating the storm is moving at 25km/h. Is this all you need to know for your safety? Explain using vocab words we recently studied.



# Physics | *Honors / PreAP*

## GRADE POINTS EARNED for an A = 5.0

### PREREQUISITES

- Chemistry
- Geometry
- Graphing skills

### CROSS CURRICULAR CONNECTIONS

- Solving basic trigonometry problems
- Solving algebraic equations
- Graphing on a coordinate plane

### OUTSIDE READING

- Little to no outside reading required

### HOMEWORK

- 30-60 minutes per evening

### COMPLEXITY LEVEL

- 4 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

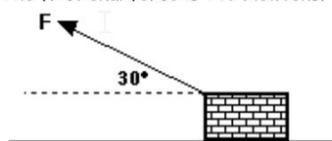
- Teacher Guided Instruction
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Application Focused Instruction
- Open-Ended Note-Taking (Student Led)
- Collaborative Whiteboard

### OTHER IMPORTANT INFORMATION

Physics students will use higher level thinking skills to solve conceptual and numerical problems in laboratory investigations and mathematical computations. A combination of laboratory experiments and theory are used to develop the following topics: velocity, acceleration, force, momentum, energy, heat, sound, light, electricity, and modern physics. Be prepared to think critically as you analyse scientific situations.

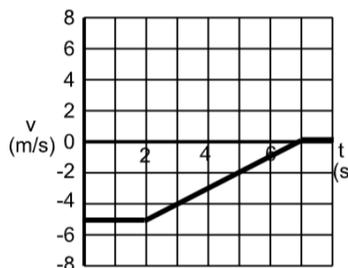
## SAMPLE TEST QUESTIONS

1. A 70 kg box is pulled by a 300 N force at an angle of  $30^\circ$  above the horizontal. The frictional force is 140 Newtons.



- a. Draw a quantitative force diagram!!
- b. Find the acceleration of the box in the horizontal direction.
- c. Find the normal force on the box.

2. The velocity vs. time graph for an object is shown below. Use the graph to describe the motion of the object as indicated.



1. Give a written description of the motion.
2. Determine the displacement from  $t = 2$  s to  $t = 4$  s. Show your work!
3. Determine the object's acceleration at  $t = 3$  seconds. Show your work.
4. Make a qualitative motion map for the object's motion. Include velocity and acceleration vectors.



## Physics | AP

**GRADE POINTS EARNED**  
for an **A = 6.0**

### PREREQUISITES

- Algebra 2
- Solving algebraic equations
- Effectively communicate solutions and justifications in your own words

### CROSS CURRICULAR CONNECTIONS

- Solving algebraic equations in Chemistry and Algebra 1 and Algebra 2
- Written communication skills (there is a lot of writing in the free response questions)

### OUTSIDE READING

- Less than 30 minutes of reading required outside of class

### HOMEWORK

- 30-60 minutes per evening

### COMPLEXITY LEVEL

- 5 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Open-Ended Note-Taking (Student Led)

### OTHER IMPORTANT INFORMATION

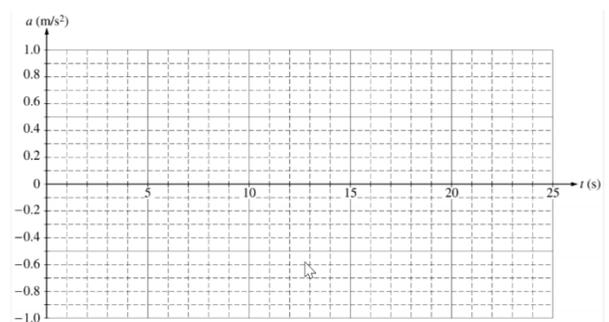
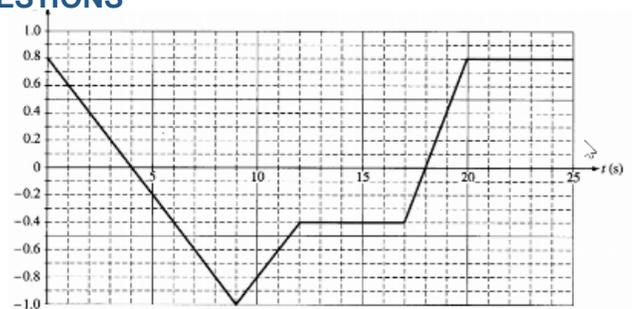
Physics I AP is equivalent to a firstsemester college-level physics course. Major topic areas of study include Newtonian mechanics, work, energy, power, mechanical waves, and sound. Problem-solving will be rigorous.

From current students: Be prepared to think outside the box and find outside sources/sources in addition to those given in class to enhance your learning. Be prepared to plan and execute your own lab explorations to meet the objective/challenge given in class.

### SAMPLE TEST QUESTIONS

A 0.50 kg cart moves on a straight horizontal track. The graph of velocity versus time  $t$  for the cart is given on the right.

- At which moments and/or intervals is the cart at rest?
- On axis to the right, plot the acceleration  $a$  versus time graph for the motion of the cart from  $t = 0$  to  $t = 25$  s.
- A group of students are discussing the conditions in which acceleration is positive vs negative. A student claims that acceleration is negative when an object is slowing down because acceleration always has the same sign as  $\Delta v$ .
  - What part of the student's argument (if any) is correct?
  - What part of the student's argument (if any) is incorrect?
  - Chose one motion interval from the graphs above that is consistent with the student's argument and identify the supporting features.
  - Choose one motion interval from the graphs above that contradicts the student's argument and identify the contradicting features.





## Forensic Science | *Level*

### GRADE POINTS EARNED for an A = 4.0

#### PREREQUISITES

- Biology
- Chemistry

#### CROSS CURRICULAR CONNECTIONS

- Biology concepts
- Chemistry concepts

#### OUTSIDE READING

- Less than 30 minutes of reading required outside of class

#### HOMEWORK

- Less than 30 minutes per evening

#### COMPLEXITY LEVEL

- 3 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

- Teacher Guided Instruction
- Lecture
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Application Focused Instruction
- Structured Note-Taking (Teacher Led)
- Open-Ended Note-Taking (Student Led)

### OTHER IMPORTANT INFORMATION

Please be aware that cases related to sensitive topics such as physical abuse, homicide, and sexual abuse will be discussed and investigated.

Students will learn terminology and investigative procedures related to crime scenes, questioning and interviewing, and scientific procedures used to solve criminal acts. Using scientific methods, students will collect and analyze evidence through case studies and simulated crime scenes. Students will conduct fingerprint, ballistics, and blood spatter analysis. Students will gain knowledge and understanding of forensic science by studying the history, legal aspects, and career opportunities in the field of forensics.

### SAMPLE TEST QUESTIONS

How do experts determine where in a space (such as a room) a blood spatter-producing event occurred?

Which skeletal features are most useful in estimating skeletal age?



## Aquatic Science | *Level*

### GRADE POINTS EARNED for an A = 4.0

### PREREQUISITES

- 3 Science Credits

### CROSS CURRICULAR CONNECTIONS

- Biology concepts
- Chemistry concepts
- 

### OUTSIDE READING

- Little to no outside reading required

### HOMEWORK

- Less than 30 minutes per evening

### COMPLEXITY LEVEL

- 2 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

- Teacher Guided Instruction
- Lecture
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Structured Note-Taking (Teacher Led)

### OTHER IMPORTANT INFORMATION

This course introduces students to the study of aquatic environments and organisms. Topics include: water quality, chemical and physical properties of water, fresh and saltwater plants and animals.

### SAMPLE TEST QUESTIONS

Which of the following is the least effective water treatment method for eliminating harmful microbes?

What would most immediately happen to this ecosystem if all of the orca died?



## Anatomy & Physiology | *Honors / PreAP*

### GRADE POINTS EARNED for an A = 5.0

#### PREREQUISITES

- Biology
- Chemistry

#### CROSS CURRICULAR CONNECTIONS

- Biology | Understanding of basic cell structure and function
- Biology | Understanding Macromolecules function

#### OUTSIDE READING

- Less than 30 minutes of reading required outside of class

#### HOMEWORK

30-60 minutes per evening

#### COMPLEXITY LEVEL

- 4 out of 5

#### WHAT DOES INSTRUCTION LOOK LIKE

- Teacher Guided Instruction
- Lecture
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Structured Note-Taking (Teacher Led)

#### OTHER IMPORTANT INFORMATION

Please This course is a systematic approach to studying the structures of the body. forensics.

#### SAMPLE TEST QUESTIONS

Tetanus is a disease caused by a bacteria known as Clostridium tetani. When the bacteria enters your body it causes a condition known as lock-jaw. In which your jaw stays shut and cannot be opened. Identify what muscle is being affected and give a well thought-out explanation for why lock jaw is occurring based on what you know about the process of muscle contraction (what is the bacteria doing to the muscle that is causing it to not relax and explain why your explanation would cause the muscle not to relax). (10 points)



## Chemistry | AP

### GRADE POINTS EARNED for an A = 6.0

### PREREQUISITES

- Pre-AP Chemistry recommended
- Algebra I (Algebra II concurrent or completed)

### CROSS CURRICULAR CONNECTIONS

- Applying scientific content to Algebraic problem solving methods

### OUTSIDE READING

- 30-60 minutes of reading required outside of class

### HOMEWORK

- 30-60 minutes per evening

### COMPLEXITY LEVEL

- 4 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

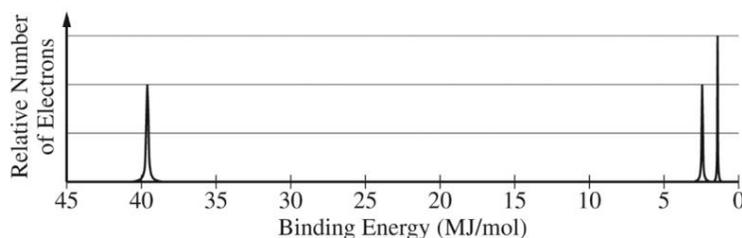
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Structured Note-Taking (Teacher Led)
- Laboratory Investigations

### OTHER IMPORTANT INFORMATION

AP Chemistry covers the material from General Chemistry I & II—effectively the first year of college level chemistry. Students will spend significant time in the lab doing investigations of concepts as well as a research project each semester on a chemical concept/product. We extend the learning from the first (Pre-AP or Level) chemistry course and work toward a deeper understanding of chemical concepts, while learning new ones such as Equilibrium, Kinetics, Thermodynamics, and Acids, Bases, & Buffers.

### SAMPLE TEST QUESTIONS

#### 2018 AP<sup>®</sup> CHEMISTRY FREE-RESPONSE QUESTIONS



7. The complete photoelectron spectrum of an element is represented above.
- Identify the element.
- A radioactive isotope of the element decays with a half-life of 10. minutes.
- Calculate the value of the rate constant,  $k$ , for the radioactive decay. Include units with your answer.
  - If 64 atoms of the radioactive isotope are originally present in a sample, what is the expected amount of time that will pass until only one atom of the isotope remains? Show how you arrived at your answer.



## Biology AP | AP

### GRADE POINTS EARNED for an A = 6.0

### PREREQUISITES

- Biology
- Chemistry PreAP  
(*recommended*)

### CROSS CURRICULAR CONNECTIONS

- Chemistry content
- Solving algebraic
- Geometric equations
- Graph and chart creation and analysis

### OUTSIDE READING

- 30-60 minutes of reading required outside of class

### HOMEWORK

- 30-60 minutes per evening

### COMPLEXITY LEVEL

- 5 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

- Teacher Guided Instruction
- Lecture
- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Application Focused Instruction
- Intensive Writing, Structured Note-Taking (Teacher Led)

### OTHER IMPORTANT INFORMATION

AP Biology students will be introduced to advanced topics and current aspects of biology, including these areas: biochemistry, cell structure and function, energy transformations, molecular genetics, heredity, natural selection, an overview of organisms and populations, plant and animal physiology, and ecology. Laboratory work is emphasized.

### SAMPLE TEST QUESTIONS

The pyruvate dehydrogenase complex (PDC) catalyzes the conversion of pyruvate to acetyl-CoA, a substrate for the Krebs (citric acid) cycle. The rate of pyruvate conversion is greatly reduced in individuals with PDC deficiency, a rare disorder.

(a) Identify the cellular location where PDC is most active.

(b) Make a claim about how PDC deficiency affects the amount of NADH produced by glycolysis AND the amount of NADH produced by the Krebs (citric acid) cycle in a cell. Provide reasoning to support your claims based on the position of the PDC-catalyzed reaction in the sequence of the cellular respiration pathway.

(c) PDC deficiency is caused by mutations in the PDHA1 gene, which is located on the X chromosome. A male with PDC deficiency and a homozygous female with no family history of PDC deficiency have a male offspring. Calculate the probability that the male offspring will have PDC deficiency.



## Environmental Science AP | AP

### GRADE POINTS EARNED for an A = 6.0

### PREREQUISITES

- Chemistry
- Geometry

### CROSS CURRICULAR CONNECTIONS

- Biology content
- Chemistry content
- Solving algebraic equations
- Creating and analyzing graphs

### OUTSIDE READING

- Less than 30 minutes of reading required outside of class

### HOMEWORK

- 30-60 minutes per evening

### COMPLEXITY LEVEL

- 4 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

- Teacher Guided Instruction
- Lecture, Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Application Focused Instruction
- Intensive Writing
- Structured Note-Taking (Teacher Led)

### OTHER IMPORTANT INFORMATION

The Advanced Placement course in Environmental Science is designed to be the equivalent of a one-semester, introductory college course in environmental science. Its goal is to provide students with the scientific principles, concepts, and methodologies to understand the interrelationships of the natural world; to identify and analyze environmental problems, both natural and human-made; to evaluate the relative risks associated with these problems; and to examine alternative solutions for resolving and/or preventing them.

### SAMPLE TEST QUESTIONS

As conventional sources of crude oil are depleted, unconventional sources such as oil sands (also known as tar sands) are being utilized. Oils sands contain bitumen, which can be processed into a synthetic crude oil. A region of boreal forest in Alberta, Canada, that covers a deposit of oil sands will be cut and removed during the process of bitumen extraction. It is estimated that the deposit contains 73 billion barrels of recoverable bitumen. The rate of extraction from the deposit will be approximately 1 million barrels of bitumen per day.

- Identify one ecological benefit, other than providing habitat, that is provided by forests.
- Identify one economic benefit that is provided by forests.
- Describe TWO environmental consequences, other than those related to the loss of boreal forest habitat, that result from the extraction of bitumen or the transportation of synthetic oil to customers.
- Assuming the above extraction rate, calculate how many days will be needed to extract the recoverable volume of bitumen from the oil sands.
- Calculate how many years will be needed to fully extract the recoverable volume of bitumen from the oil sands.
- Monthly production of synthetic crude oil is 30 million barrels. Producing one barrel of synthetic crude oil uses two barrels of heated freshwater. Calculate the number of barrels of freshwater needed each year to supply this demand.



## Physics C: Mechanics | AP

### GRADE POINTS EARNED for an A = 6.0

### PREREQUISITES

- Concurrent enrollment in Precalculus or Calculus is required
- Students need to be able to complete algebraic manipulations similar to Algebra 1 and Algebra 2
- Students will also need to use some basic Calculus to solve some problems
- The calculus required for the course will be taught with the physics content

### CROSS CURRICULAR CONNECTIONS

- Basic problem solving using forces
- Conservation of energy
- Conservation of motion
- Simple harmonic motion
- Rotational motion
- Kinematics will be required
- The basics of these concepts will not be retaught.

### OUTSIDE READING

- Less than 30 minutes of reading required outside of class

### HOMEWORK

- 30-60 minutes per evening

### COMPLEXITY LEVEL

- 4 out of 5

### WHAT DOES INSTRUCTION LOOK LIKE

- Independent Practice
- Collaborative Groups
- Higher Critical Thinking (Analysis, Debates, Evaluations, Open-Ended Questions, etc.)
- Open-Ended Note-Taking (Student Led)

### OTHER IMPORTANT INFORMATION

Students will work mostly in collaborative groups with some guidance from the teacher. Prerequisite skills will not be retaught, any review students need to do will need to be done on their own; resources will be provided for review.

### SAMPLE TEST QUESTIONS

**FREE RESPONSE:** Answer all three questions. The suggested time is about 15 minutes for answering each of the questions, which are worth 15 points each. The parts within a question may not have equal weight. Show all your work in this booklet in the spaces provided after each part.

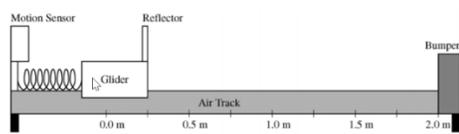


Figure 1

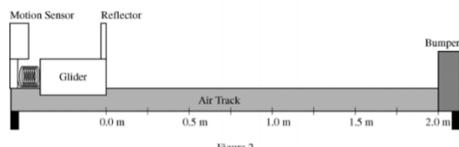


Figure 2

Mech 1. A student places a 0.40 kg glider on an air track of negligible friction and holds it so that it touches an uncompressed ideal spring, as shown in Figure 1 above. The student then pushes the glider back to compress the spring by 0.25 m, as shown in Figure 2. At time  $t = 0$ , the student releases the glider, and a motion sensor begins recording the velocity of the reflector at the front of the glider as a function of time. The data points are shown in the table below. At time  $t = 0.79$  s, the glider loses contact with the spring.

| Time (s)       | 0 | 0.25 | 0.50 | 0.75 | 1.00 | 1.50 | 2.00 |
|----------------|---|------|------|------|------|------|------|
| Velocity (m/s) | 0 | 0.25 | 0.43 | 0.48 | 0.50 | 0.49 | 0.51 |

On the axes below, plot the data points for velocity  $u$  as a function of time  $t$  for the glider, and draw a smooth curve that best fits the data. Be sure to label an appropriate scale on the vertical axis.

(b) The student wishes to use the data to plot position  $x$  as a function of time  $t$  for the glider. i. Describe a method the student could use to do this. ii. On the axes below, sketch the position  $x$  as a function of time  $t$  for the glider. Explicitly label any intercepts, asymptotes, maxima, or minima with numerical values or algebraic expressions, as appropriate.

(c) Calculate the time at which the glider makes contact with the bumper at the far right.

(d) Calculate the force constant of the spring. (e) The experiment is run again, but this time the glider is attached to the spring rather than simply being pushed against it. i. Determine the amplitude of the resulting periodic motion. ii. Calculate the period of oscillation of the resulting periodic motion.