# MEDFORD HIGH SCHOOL
## COURSE SYLLABUS

<table>
<thead>
<tr>
<th>Department:</th>
<th>Science</th>
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<tbody>
<tr>
<td>Course Title:</td>
<td>Biology</td>
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<tr>
<td>Level and/or Grade:</td>
<td>College Prep; Grade 10</td>
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<tr>
<td>Prerequisite:</td>
<td>Passing grade in Introductory Physics 9</td>
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### Course Description:

This course examines phenomena related to genetics, the functioning of organisms, and interrelationships between organisms, populations, and the environment. Students are expected to apply a variety of science and engineering practices to four core ideas of biology:

- **From molecules to organisms: structures and processes**
- **Ecosystems: interactions, energy, and dynamics**
- **Heredity: inheritance and variation of traits**
- **Biological evolution: unity and diversity**

The high school biology course places particular emphasis on science and engineering practices of developing and using models; constructing explanations; engaging in argumentation from evidence; and obtaining, evaluating, and communicating information. Students are expected to use multiple types of models, including mathematical models, to make predictions and develop explanations, analyze and identify flaws in the model, and communicate ideas that accurately represent or simulate the biological system. Students are asked to construct and revise explanations and claims based on valid and reliable evidence and apply scientific reasoning to evaluate complex real-world problems such as the effects of human activity on biodiversity and ecosystem health.

Students must be able to find and interpret scientific literature to compare, integrate, and evaluate sources and communicate phenomena related to genetics, the functioning of organisms, and interrelationships between organisms, populations, and the environment. The application of these practices across the core ideas gives students a rich grounding in biology.

In classes where dissection is used as an instructional activity, students will be presented with alternatives as described in the district’s Dissection Policy.

### Learning Standards:

*Through inquiry, experimentation, labs, use of tools, discussion, presentation, and composition, students will be able to...*

#### From Molecules to Organisms: Structures and Processes

- Construct a model of transcription and translation to explain the roles of DNA and RNA that code for proteins that regulate and carry out essential functions of life.
- Develop and use a model to illustrate the key functions of animal body systems, including (a) food digestion, nutrient uptake, and transport through the body; (b) exchange of oxygen and carbon dioxide; (c) removal of wastes; and (d) regulation of body processes.
- Provide evidence that homeostasis maintains internal body conditions through both body-wide feedback mechanisms and small-scale cellular processes.
- Construct an explanation using evidence for why the cell cycle is necessary for the growth, maintenance, and repair of multicellular organisms. Model the major events of the cell cycle, including (a) cell growth and DNA replication, (b) separation of chromosomes (mitosis), and (c) separation of cell contents.
- Use a model to illustrate how photosynthesis uses light energy to transform water and carbon dioxide...
into oxygen and chemical energy stored in the bonds of sugars and other carbohydrates.

- Construct an explanation based on evidence that organic molecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur, and phosphorus to form monomers that can further combine to form large carbon-based macromolecules.
- Use a model to illustrate that aerobic cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and new bonds form, resulting in new compounds and a net transfer of energy.

**Ecosystems: Interactions, Energy, and Dynamics**

- Analyze data sets to support explanations that biotic and abiotic factors affect ecosystem carrying capacity.
- Use mathematical representations to support explanations that biotic and abiotic factors affect biodiversity, including genetic diversity within a population and species diversity within an ecosystem.
- Use a mathematical model to describe the transfer of energy from one trophic level to another. Explain how the inefficiency of energy transfer between trophic levels affects the relative number of organisms that can be supported at each trophic level and necessitates a constant input of energy from sunlight or inorganic compounds from the environment.
- Use a model that illustrates the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, hydrosphere, and geosphere.
- Analyze data to show ecosystems tend to maintain relatively consistent numbers and types of organisms even when small changes in conditions occur but that extreme fluctuations in conditions may result in a new ecosystem. Construct an argument supported by evidence that ecosystems with greater biodiversity tend to have greater resistance to change and resilience.
- Analyze direct and indirect effects of human activities on biodiversity and ecosystem health, specifically habitat fragmentation, introduction of non-native or invasive species, overharvesting, pollution, and climate change. Evaluate and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health.

**Heredity: Inheritance and Variation of Traits**

- Develop and use a model to show how DNA in the form of chromosomes is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction.
- Make and defend a claim based on evidence that genetic variations (alleles) may result from (a) new genetic combinations via the processes of crossing over and random segregation of chromosomes during meiosis, (b) mutations that occur during replication, and/or (c) mutations caused by environmental factors. Recognize that mutations that occur in gametes can be passed to offspring.
- Apply concepts of probability to represent possible genotype and phenotype combinations in offspring caused by different types of Mendelian inheritance patterns.
- Use scientific information to illustrate that many traits of individuals, and the presence of specific alleles in a population, are due to interactions of genetic factors and environmental factors.

**Biological Evolution: Unity and Diversity**

- Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence, including molecular, anatomical, and developmental similarities inherited from a common ancestor (homologies), seen through fossils and laboratory and field observations.
- Construct an explanation based on evidence that Darwin’s theory of evolution by natural selection occurs in a population when the following conditions are met: (a) more offspring are produced than can be supported by the environment, (b) there is heritable variation among individuals, and (c) some of these variations lead to differential fitness among individuals as some individuals are better able to compete for limited resources than others.
- Research and communicate information about key features of viruses and bacteria to explain their ability to adapt and reproduce in a wide variety of environments.
- Evaluate models that demonstrate how changes in an environment may result in the evolution of a
population of a given species, the emergence of new species over generations, or the extinction of other species due to the processes of genetic drift, gene flow, mutation, and natural selection.

**Standards for Literacy in History/Social Studies, Science, and Technical Subjects:**

### Key Ideas and Details
1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

### Craft and Structure
3. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

### Integration of Knowledge and Ideas
4. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
5. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.

### Range of Reading and Level of Text Complexity
6. Read and comprehend complex literary and informational texts independently and proficiently.

**Standards for Writing in History/Social Studies, Science, and Technical Subject:**

### Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives using effective technique, well-chosen details and well-structured event sequences.

### Production and Distribution of Writing
4. Produce clear and coherent writing in which the development organization and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, and trying a new approach.
6. Use technology, including the internet, to produce and publish writing and to interact and collaborate with others.

### Research to Build and Present Knowledge
7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9. Draw evidence from literary and informational texts to support analysis, reflection, and research.

### Range of Writing
10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and
audiences.

Course Alignment with 21st Century Learning Expectations:

Students will…
- Become self-directed learners.
- Communicate effectively.
- Apply problem-solving skills and critical and creative thinking.
- Use technology appropriately as a tool for learning, collaboration, presentation, research, and design.
- Act with integrity, respect and responsibility toward themselves, others and the environment.
- Exhibit flexibility and adaptability.
- Collaborate in diverse groups to share knowledge, build consensus, and achieve goals.
- Practice leadership in and service to their community.
- Become contributing citizens in a global society.

Assessment:
- See grading policy attached.