

**Amity Region #5**  
**Science 3<sup>rd</sup> Generation CAPT Review**  
**INTRODUCTION**

These packages have been designed to prepare students for the Science Connecticut Academic Performance Test (CAPT) exam administered in the spring of 10<sup>th</sup> grade. The CAPT was given for the first time in 1994, and the second generation of the test was administered for the first time in May 2001. The third generation of the test will be administered for the first time in March 2007.

The third generation of the CAPT Science will change significantly from the second generation. To better align with the new Science Curriculum Framework, the following content strands will be reported:

- I. Energy Transformations
- II. Chemical Structures and Properties
- III. Global Interdependence
- IV. Cell Chemistry & Biotechnology
- V. Genetics, Evolution & Biodiversity

In addition, scores will be reported for the following:

- Conceptual Understanding
- Scientific Inquiry, Literacy and Numeracy

Students will respond to 60 multiple choice (MC) and 5 open-ended (OE) items. The test will continue to be divided into two 50- minute sessions. The following table shows the distribution of items.

**Test Design**

Content Strand	Conceptual Understanding	Scientific Inquiry, Literacy and Numeracy		Total Points
	MC Items* (1 point each)	MC Items (1 point each)	OE Items (3 points each)	
I. Energy Transformations	8	4	1	15
II. Chemical Structures & Properties	8	4	1	15
III. Global Interdependence	8	4	1	15
IV. Cell Chemistry & Biotechnology	8	4	1	15
V. Genetics, Evolution & Biodiversity	8	4	1	15
<b>Total Points</b>	<b>40</b>	<b>35</b>		<b>75</b>

The selected response items will be scored electronically as correct or incorrect. Open-ended (constructed response) items will be hand-scored by trained readers using a 4-point scale (0-3).

### Curriculum-Embedded Science Performance Tasks

There will no longer be a single CAPT Science Performance Task administered just prior to the written CAPT Science test. Instead, a curriculum-embedded science performance task and Science, Technology and Society (STS) activity have been developed for each of the five content strands that will be utilized for the entire third generation of the test. Schools are encouraged to embed these ten activities into their regular grade 9 and 10 science curricula at the appropriate time. All of the open-ended items on the written test will be related to the ten performance tasks and STS activities.

At Amity Region 5, these performance tasks and STS activities will be completed prior to the CAPT exam given to 10th grade students in March, regardless what sophomore class the student is in. They are:

Content Strand	Performance Task	STS Activity	At Amity
Strand I: Energy Transformations	Solar Cooker (or Energy Transfer Lab)	Connecticut Energy Use	10th
Strand II: Chemical Structures and Properties	Synthetic Polymers Investigation	Plastics Controversy (or Paper vs. Plastics Controversy)	10th
Strand III: Global Interdependence	Acid Rain	Connecticut Brownfields	10 <sup>th</sup> - in '06-07 9 <sup>th</sup> - afterwards
Strand IV: Cell Chemistry and Biotechnology	Enzyme Lab	Labeling Genetically Altered Food	9th
Strand V: Genetics, Evolution and Biodiversity	Yeast Population Dynamics	Human Population Dynamics	9th

**PROCESSES AND CONTENT FOR THE THIRD GENERATION SCIENCE TEST****SCIENTIFIC INQUIRY, LITERACY AND NUMERACY**

*Students are expected to:*

- D INQ.1** Identify questions that can be answered through scientific investigation.
- D INQ.2** Read, interpret and examine the credibility and validity of scientific claims in different sources of information.
- D INQ.3** Formulate a testable hypothesis and demonstrate logical connections between the scientific concepts guiding the hypothesis and the design of the experiment.
- D INQ.4** Design and conduct appropriate types of scientific investigations to answer different questions.
- D INQ.5** Identify independent and dependent variables, including those that are kept constant and those used as controls.
- D INQ.6** Use appropriate tools and techniques to make observations and gather data.
- D INQ.7** Assess the reliability of the data that was generated in the investigation.
- D INQ.8** Use mathematical operations to analyze and interpret data, and present relationships between variables in appropriate forms.
- D INQ.9** Articulate conclusions and explanations based on research data, and assess results based on the design of the investigation.
- D INQ.10** Communicate about science in different formats, using relevant science vocabulary, supporting evidence and clear logic.

**STRAND I: ENERGY TRANSFORMATIONS****9.1 - Energy cannot be created or destroyed; however, energy can be converted from one form to another.**

- ◆ Energy enters the Earth system primarily as solar radiation, is captured by materials and photosynthetic processes, and eventually is transformed into heat.

*Students are expected to:*

- D 1.** Describe the effects of adding energy to matter in terms of the motion of atoms and molecules, and the resulting phase changes.
- D 2.** Explain how energy is transferred by conduction, convection and radiation.
- D 3.** Describe energy transformations among heat, light, electricity and motion.

**9.2 - The electrical force is a universal force that exists between any two charged objects.**

- ◆ Moving electrical charges produce magnetic forces, and moving magnets can produce electrical force.
- ◆ Electrical current can be transformed into light through the excitation of electrons.

*Students are expected to:*

- D 4.** Explain the relationship among voltage, current and resistance in a simple series circuit.
- D 5.** Explain how electricity is used to produce heat and light in incandescent bulbs and heating

elements.

**D 6.** Describe the relationship between current and magnetism.

**9.3 - Various sources of energy are used by humans and all have advantages and disadvantages.**

- ◆ During the burning of fossil fuels, stored chemical energy is converted to electrical energy through heat transfer processes.
- ◆ In nuclear fission, matter is transformed directly into energy in a process that is several million times as energetic as chemical burning.
- ◆ Alternative energy sources are being explored and used to address the disadvantages of using fossil and nuclear fuels.

*Students are expected to:*

**D 7.** Explain how heat is used to generate electricity.

**D 8.** Describe the availability, current uses and environmental issues related to the use of fossil and nuclear fuels to produce electricity.

**D 9.** Describe the availability, current uses and environmental issues related to the use of hydrogen fuel cells, wind and solar energy to produce electricity.

**STRAND II: CHEMICAL STRUCTURES AND PROPERTIES**

**9.4 - Atoms react with one another to form new molecules.**

- ◆ Atoms have a positively charged nucleus surrounded by negatively charged electrons.
- ◆ The configuration of atoms and molecules determines the properties of the materials.

*Students are expected to:*

**D 10.** Describe the general structure of the atom, and explain how the properties of the first 20 elements in the Periodic Table are related to their atomic structures.

**D 11.** Describe how atoms combine to form new substances by transferring electrons (ionic bonding) or sharing electrons (covalent bonding).

**D 12.** Explain the chemical composition of acids and bases, and explain the change of pH in neutralization reactions.

**9.5 - Due to its unique chemical structure, carbon forms many organic and inorganic compounds.**

- ◆ Carbon atoms can bond to one another in chains, rings and branching networks to form a variety of structures, including fossil fuels, synthetic polymers and the large molecules of life.

*Students are expected to:*

**D 13.** Explain how the structure of the carbon atom affects the type of bonds it forms in organic and inorganic molecules.

**D 14.** Describe combustion reactions of hydrocarbons and their resulting by-products.

**D 15.** Explain the general formation and structure of carbon-based polymers, including

synthetic polymers, such as polyethylene, and biopolymers, such as carbohydrate.

**9.6 - Chemical technologies present both risks and benefits to the health and well-being of humans, plants and animals.**

- ◆ Materials produced from the cracking of petroleum are the starting points for the production of many synthetic compounds.
- ◆ The products of chemical technologies include synthetic fibers, pharmaceuticals, plastics and fuels.

*Students are expected to:*

- D 16.** Explain how simple chemical monomers can be combined to create linear, branched and/or cross-linked polymers.
- D 17.** Explain how the chemical structure of polymers affects their physical properties.
- D 18.** Explain the short- and long-term impacts of landfills and incineration of waste materials on the quality of the environment.

**STRAND III - GLOBAL INTERDEPENDENCE**

**9.7 - Elements on Earth move among reservoirs in the solid earth, oceans, atmosphere and organisms as part of biogeochemical cycles.**

- ◆ Elements on Earth exist in essentially fixed amounts and are located in various chemical reservoirs.
- ◆ The cyclical movement of matter between reservoirs is driven by the Earth's internal and external sources of energy.

*Students are expected to:*

- D 19.** Explain how chemical and physical processes cause carbon to cycle through the major earth reservoirs.
- D 20.** Explain how solar energy causes water to cycle through the major earth reservoirs.
- D 21.** Explain how internal energy of the Earth causes matter to cycle through the magma and the solid earth.

**9.8 - The use of resources by human populations may affect the quality of the environment.**

- ◆ Emission of combustion by-products, such as SO<sub>2</sub>, CO<sub>2</sub> and NO<sub>x</sub> by industries and vehicles is a major source of air pollution.

*Students are expected to:*

- D 22.** Explain how the release of sulfur dioxide (SO<sub>2</sub>) into the atmosphere can form acid rain, and how acid rain affects water sources, organisms and human-made structures.
- D 23.** Explain how the accumulation of carbon dioxide (CO<sub>2</sub>) in the atmosphere increases Earth's "greenhouse" effect and may cause climate changes.
- D 24.** Explain how the accumulation of mercury, phosphates and nitrates affects the quality

of water and the organisms that live in rivers, lakes and oceans.

**9.9 - Some materials can be recycled, but others accumulate in the environment and may affect the balance of the Earth systems.**

- ◆ New technologies and changes in lifestyle can have positive and/or negative effects on the environment.

*Students are expected to:*

- D 25.** Explain how land development, transportation options and consumption of resources may affect the environment.
- D 26.** Describe human efforts to reduce the consumption of raw materials and improve air and water quality.

**STRAND IV: CELL CHEMISTRY AND BIOTECHNOLOGY**

**10.1 - Fundamental life processes depend on the physical structure and the chemical activities of the cell.**

- ◆ Most of the chemical activities of the cell are catalyzed by enzymes that function only in a narrow range of temperature and acidity conditions.
- ◆ The cellular processes of photosynthesis and respiration involve transformation of matter and energy.

*Students are expected to:*

- D 27.** Describe significant similarities and differences in the basic structure of plant and animal cells.
- D 28.** Describe the general role of DNA and RNA in protein synthesis.
- D 29.** Describe the general role of enzymes in metabolic cell processes.
- D 30.** Explain the role of the cell membrane in supporting cell functions.

**10.2 - Microorganisms have an essential role in life processes and cycles on Earth.**

- ◆ Understanding the growth and spread patterns of viruses and bacteria enables the development of methods to prevent and treat infectious diseases.

*Students are expected to:*

- D 31.** Describe the similarities and differences between bacteria and viruses.
- D 32.** Describe how bacterial and viral infectious diseases are transmitted, and explain the roles of sanitation, vaccination and antibiotic medications in the prevention and treatment of infectious diseases.
- D 33.** Explain how bacteria and yeasts are used to produce foods for human consumption.

**10.3 - Similarities in the chemical and structural properties of DNA in all living organisms allow the transfer of genes from one organism to another.**

- ◆ The principles of genetics and cellular chemistry can be used to produce new foods and medicines in biotechnological processes.

*Students are expected to:*

- D 34. Describe, in general terms, how the genetic information of organisms can be altered to make them produce new materials.
- D 35. Explain the risks and benefits of altering the genetic composition and cell products of existing organisms.

### **STRAND V - GENETICS, EVOLUTION AND BIODIVERSITY**

#### **10.4. - In sexually reproducing organisms, each offspring contains a mix of characteristics inherited from both parents.**

- ◆ Genetic information is stored in genes that are located on chromosomes inside the cell nucleus.
- ◆ Most organisms have two genes for each trait, one on each of the homologous chromosomes in the cell nucleus.

*Students are expected to:*

- D 36. Explain how meiosis contributes to the genetic variability of organisms.
- D 37. Use the Punnet Square technique to predict the distribution of traits in mono- and di-hybrid crossings.
- D 38. Deduce the probable mode of inheritance of traits (e.g., recessive/dominant, sex-linked) from pedigree diagrams showing phenotypes.
- D 39. Describe the difference between genetic disorders and infectious diseases.

#### **10.5 - Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.**

- ◆ Mutations and recombination of genes create genetic variability in populations.
- ◆ Changes in the environment may result in the selection of organisms that are better able to survive and reproduce.

*Students are expected to:*

- D 40. Explain how the processes of genetic mutation and natural selection are related to the evolution of species.
- D 41. Explain how the current theory of evolution provides a scientific explanation for fossil records of ancient life forms.
- D 42. Describe how structural and behavioral adaptations increase the chances for organisms to survive in their environments.

#### **Living organisms have the capability of producing populations of unlimited size, but the environment can support only a limited number of individuals from each species.**

- ◆ Human populations grow due to advances in agriculture, medicine, construction and the use of

energy.

- ◆ Humans modify ecosystems as a result of rapid population growth, use of technology and consumption of resources.

*Students are expected to:*

- D 43.** Describe the factors that affect the carrying capacity of the environment.
- D 44.** Explain how change in population density is affected by emigration, immigration, birth rate and death rate, and relate these factors to the exponential growth of human populations.
- D 45.** Explain how technological advances have affected the size and growth rate of human populations throughout history.



## HOW TO PROCEED

Your science teacher will advise you in which content area(s) you appear to need review. This determination is based upon the "Practice Science CAPT Exam" you took in 9<sup>th</sup> grade. Students will be using at least one (1) Science Study Hall per cycle to review content in their area of weakness using a classroom copy of "Achieving Competence in Science" (1993, I SBN 0-87720-018-1) and free electronic downloads of "Preparing for FCAT – Science – Grade 10" (Amsco Publications, 2003, I SBN 0-87720-2870) and "Preparing for FCAT – Science – Grade 8" (Amsco Publications, 2004, I SBN 0-87720-194-3). Once a particular content area is reviewed, the student will complete a CAPT-style assessment, and grade it him/herself using an answer key provided by the teacher. Upon completion of the content review and self-assessment the student will return the materials to the classroom teacher for verification of completion.

The following table is a chapter and page number key for the 3<sup>rd</sup> Generation Science CAPT.

Connecticut Framework	"Achieving Competence in Science" - Pages	"Preparing for FCAT - Science - Grade 10" - Pages	"Preparing for FCAT - Science - Grade 8" - Pages
<b>I. ENERGY SOURCES AND TRANSFORMATIONS</b>	99-104	55-68 <a href="http://www.amscopub.com/images/file/File_363.pdf">http://www.amscopub.com/images/file/File_363.pdf</a>	
- ELECTRICITY			
<b>II. CHEMICAL STRUCTURES AND PROPERTIES</b>	124-135	32-54 <a href="http://www.amscopub.com/images/file/File_362.pdf">http://www.amscopub.com/images/file/File_362.pdf</a>	37-73 <a href="http://www.amscopub.com/images/file/File_385.pdf">http://www.amscopub.com/images/file/File_385.pdf</a>
- CARBON CHEMISTRY			
<b>III. BIOGEOCHEMICAL CYCLES</b>		231-235 <a href="http://www.amscopub.com/images/file/File_371.pdf">http://www.amscopub.com/images/file/File_371.pdf</a>	
<b>USE OF RESOURCES &amp; THE ENVIRONMENT</b>			
<b>IV. CELL CHEMISTRY</b>	32-40	184-192 <a href="http://www.amscopub.com/images/file/File_370.pdf">http://www.amscopub.com/images/file/File_370.pdf</a>	241-245 <a href="http://www.amscopub.com/images/file/File_392.pdf">http://www.amscopub.com/images/file/File_392.pdf</a>
<b>IV. CELL FUNCTION</b>		192-209	245-267
- MICROORGANISMS			
-BIOTECHNOLOGY			
<b>V. GENETICS</b>		193-217	-
<b>V. EVOLUTION &amp; BIODIVERSITY</b>	1-16	218-231 <a href="http://www.amscopub.com/images/file/File_371.pdf">http://www.amscopub.com/images/file/File_371.pdf</a>	296-326 <a href="http://www.amscopub.com/images/file/File_394.pdf">http://www.amscopub.com/images/file/File_394.pdf</a>
- CONSEQUENCES OF LIMITING RESOURCES			