The Washington State Board of Education

Governance | Accountability | Achievement | Oversight | Career & College Readiness

Title:	**CTE Equivalency Credit—A Practitioner's Perspective**	
As Related To:	☐ Goal One: Effective and accountable P-13 governance. ☐ Goal Two: Comprehensive statewide K-12 accountability. ☐ Goal Three: Closing achievement gap.	☐ Goal Four: Strategic oversight of the K-12 system. ☒ Goal Five: Career and college readiness for all students. ☐ Other
Relevant To Board Roles:	☐ Policy Leadership ☒ System Oversight ☒ Advocacy	☐ Communication ☒ Convening and Facilitating
Policy Considerations / Key Questions:	What role should the SBE play in supporting CTE equivalency credit? What other actions could the SBE consider to support career and college readiness through CTE?	
Possible Board Action:	☒ Review ☐ Adopt ☒ Approve ☐ Other	
Materials Included in Packet:	☒ Memo ☐ Graphs / Graphics ☐ Third-Party Materials ☐ PowerPoint	
Synopsis:	SBE will hear from a panel of CTE directors on equivalency credits in their district. The SBE will have the opportunity to ask questions and discuss issues.	

CTE EQUIVALENCY CREDIT

Policy Consideration

RCW 28A.230.097 requires that each high school or school district board shall adopt course equivalencies for Career and Technical Education (CTE) classes. These are CTE courses that meet, academic requirements including state and district graduation requirements. Implementation of the Common Core State Standards, and the Next Generation Science Standards that may be adopted this summer, provides an occasion to reexamine the CTE equivalency credit process.

CTE equivalency credit is critical to implementation of the 24-credit Career- and College-Ready Graduation Requirements. The Career- and College-Ready requirements are intended to enhance students' preparation for careers and post-secondary education, and not impede students from pursuing a rigorous CTE Program of Study.

The SBE may consider approving action that would support the development of CTE equivalency credits, and other activities that could help students fulfill graduation requirements through CTE. Activities could include:

- Working with OSPI on a taskforce to update the *Equivalency Credit Toolkit: An Implementation Guide for Local School Districts*; the Toolkit provides guidance to districts in developing a policy and procedure for equivalency credit.
- Working with school boards to establish and maintain an equivalency credit policy and process.
- Opening a discussion on converting the occupational education graduation requirement to a CTE graduation requirement.
- Working with the Washington Student Achievement Council to recognize some CTE courses as meeting academic distribution requirements for college admission

Current proposed legislation may affect CTE equivalency credit. HB 2051 establishes a task force to identify strategies to improve the integration of career education into secondary education, including maximizing statewide use of a list of recommended CTE equivalencies recommended by the Office of the Superintendent of Public Instruction.

Summary

All CTE programs must meet standards established by the Office of the Superintendent of Public Instruction (OSPI). CTE programs are characterized by:

- A close alignment of coursework to the needs of industry
    - Programs must meet a proven workforce need.
    - Course content must be aligned with industry standards.
    - CTE programs must be informed by advisory committees of industry representatives.

- Educators with substantial work experience in the industry associated with their teaching assignment
- A mix of funding sources including state and local funds and, in most cases, federal Perkins funds.

RCW 28A.230.097 (complete section is in Background below) requires schools or district to adopt career and technical high school course equivalencies. In summary, the law requires that districts:

1. Adopt district-approved course equivalencies for CTE courses
2. Develop school board policy and procedures for approving course equivalencies
3. Transcribe CTE courses approved for equivalency by the equivalent academic course and title
4. Retain records of completion of the CTE course and issue certificates of completion to the student to be kept in their High School and Beyond Plan or their Culminating Project

CTE courses offered for equivalency credit are transcribed by their corresponding academic course credit and title so they will be recognized by higher education as meeting the College Academic Distribution Requirements (CADRs) required for admission to state universities. CTE courses transcribed with the CTE course title are rarely accepted as meeting CADRs.

In 2007, the legislature established the CTE Curriculum Advisory Committee, a task force representing CTE Directors, OSPI, legislators and members of the Workforce Training and Education Coordinating Board. Among their charges was to support districts in implementing policies and procedures which establish core academic credit equivalencies for CTE courses in accordance with state statutory requirements. A product of the Taskforce was the *Equivalency Credit Toolkit: An Implementation Guide for Local School Districts*. The Toolkit outlines a well-developed process for districts to initiate and implement policies and procedures for establishing core academic credit equivalencies for CTE; however, the latest version of the Toolkit is dated June 2010, and some sections are out of date.

In practice, the application of CTE equivalency credit policy is uneven around the state, and students do not have equal access to opportunities created by credit equivalency.

Some SBE members and staff met with OSPI staff, CTE directors and teachers, WA-ACTE, Workforce Training and Education Coordinating Board, and Washington STEM representatives on April 3, 2013, to discuss CTE equivalency credit best practices, challenges, opportunities, and ways of supporting the policy. Some highlights from that meeting are included below.

CTE Equivalency Credit Meeting Highlights—April 3, 2013
OSPI Office Building, Olympia, WA

Attending: Betty Klanttenhoff, OSPI; Caroline King, WA STEM; Tim Knue, WA-ACTE; Shep Seigel, WA-ACTE; Marianna Goheen, OSPI; Teri Pablo, Yelm SD and WAVA; Ellen Ebert, OSPI; Tamara Whitcomb, Mount Baker SD; Tre' Maxie, SBE Member; Cindy McMullen, SBE Member; Justin Montermini, WTECB; Linda Drake, SBE; and, Ben Rarick, SBE.

Highlights of best practices:

- Some districts have teachers who are highly qualified in both science and CTE.
- CTE funding may help with the extra cost of laboratory classes.
- Well-developed partnerships between departments are important
- OSPI developed and promoted a math/financial literacy class as a math/CTE equivalency course.
- The Equivalency Credit Toolkit provides a well-developed process.

Challenges:

- Some districts do not address standards, both academic and technical; there are both perceived and sometimes real rigor issues.
- Skill centers face extra challenges, including varied policies of feeder districts and uneven access to skill centers across the state.
- The student records system is currently not set up to be able to handle flexible credits.
- 'Two for one' policy is not well-understood.

Opportunities:

- New standards (NGSS and CC) offer a timely opportunity for re-examining and re-energizing equivalencies.
- NGSS engineering components means that science faculty will have to collaborate with CTE engineering faculty.
- Engineering/science and Human Biology/science are underutilized potential equivalencies—we may look at expanding the definition of science beyond biology, chemistry, physics and get higher education onboard with recognizing new science classes.

What can be done to support CTE equivalency credits?:

- Spread the word on model best practices, elevating and shining a light on the process.
- Train school boards in the equivalency process
- Creating a new FAQ on equivalency
- Update the Tool kit
- Marketing to parents
- Work with OSPI to explore the possibility of statewide equivalencies

Background

The SBE's role in evaluating graduation requirements for CTE students is stated in:

> RCW 28A.230.090 (2)
> (b) The state board shall reevaluate the graduation requirements for students enrolled in vocationally intensive and rigorous career and technical education programs, particularly those programs that lead to a certificate or credential that is state or nationally recognized. The purpose of the evaluation is to ensure that students enrolled in these programs have sufficient opportunity to earn a certificate of academic achievement, complete the program and earn the program's certificate or credential, and complete other state and local graduation requirements.

High School Graduation and Career-Technical Education Program Completion: A Status Report to the State Board of Education, January 2008, was created in response to an assignment by the legislature, associated with RCW 28A.230.090, to report findings and recommendations for additional flexibility in graduation requirements if necessary, to the legislature by December 1, 2007.

The requirement for schools or districts to establish CTE course equivalencies is in:

> RCW 28A.230.097 Career and technical high school course equivalencies
> (1) Each high school or school district board of directors shall adopt course equivalencies for career and technical high school courses offered to students in high schools and skill centers. A career and technical course equivalency may be for whole or partial credit. Each school district board of directors shall develop a course equivalency approval procedure.
>
> (2) Career and technical courses determined to be equivalent to academic core courses, in full or in part, by the high school or school district shall be accepted as meeting core requirements, including graduation requirements, if the courses are recorded on the student's transcript using the equivalent academic high school department designation and title. Full or partial credit shall be recorded as appropriate. The high school or school district shall also issue and keep record of course completion certificates that demonstrate that the career and technical courses were successfully completed as needed for industry certification, college credit, or preapprenticeship, as applicable. The certificate shall be either part of the student's high school and beyond plan or the student's culminating project, as determined by the student. The office of the superintendent of public instruction shall develop and make available electronic samples of certificates of course completion.

CTE resources:
Report to the Legislature: Statewide Strategic Plan for Secondary Career and Technical Education. December 2012.

(http://www.k12.wa.us/LegisGov/2012documents/StrategicePlanforCTE2012.pdf)

Equivalency Credit Toolkit 3.2. June 2010.

(http://www.k12.wa.us/CareerTechEd/Forms/EquivalencyCreditToolkit.pdf)

High School Graduation and Career-Technical Education Program Completion: A Status Report to the State Board of education, January 2008.

(http://www.sbe.wa.gov/documents/2013.04.25%2011%20Career%20and%20Technical%20Education%20Study.pdf)

Action

The SBE may consider approving action that would support the development of CTE equivalency credits, and other activities that could help students fulfill graduation requirements through CTE.

Appendix D: Model Equivalency Procedures and Flowchart

The following written equivalency procedures and flowchart address the key questions of an effective equivalency procedure, and are designed to serve as a model which may be modified to best support individual district needs.

The Equivalency Committee

The Equivalency Committee will be responsible for evaluating and making decisions regarding course equivalencies for Career and Technical Education and core academic courses, and will be comprised of:

- Director of Secondary Education
- Director of Career and Technical Education
- Director of Curriculum
- Principal or Assistant Principal
- High School Counselor
- Content Specialist(s) (will vary)

Procedures and Timeline for Submitting an Initial Course Equivalency Request

1. Teacher(s) and department head will submit the appropriate completed Equivalency Request Form from the OSPI Equivalency Toolkit along with their course Curriculum Framework, sample assessments, and other supporting documents to their building principal for signature and comments.
2. The building principal will submit the requests and required materials to the Equivalency Committee in either the fall or spring according to specified deadlines. The fall submission deadline is October 31st. The spring deadline is June 15th.
3. Teachers should submit their requests and required materials to their department heads and building principals at least one week prior to the specified deadlines to allow time for review prior to submission to the Equivalency Committee.

Procedures and Timeline for Evaluating Requests and Determining Course Equivalencies

1. The Equivalency Committee will convene during the first week of November and last week of June to review submitted equivalency requests.
2. For all equivalency requests, the Equivalency Committee will:
   a. Review the course curriculum framework to determine if required standards for equivalency from the appropriate Equivalency Request Form in Appendix B are evident throughout the course.
   b. Review the course assessments to determine if students are demonstrating the required standards for equivalency from the appropriate Equivalency Request Form in Appendix B.
3. The committee will make determinations on fall submissions by November 9th and June 30th for submissions made in the spring. The committee will make one of the following decisions during the Initial Evaluation regarding the equivalency request:
   a. Meets Standard for Equivalency – the course meets the standards required for equivalency and will be listed as an equivalency in the course guide for the following school year.
   b. Does Not Meet Standard for Equivalency – the course does not adequately meet the standards required for equivalency. Feedback is given regarding gaps and areas that need to be addressed if an equivalency is to be requested again.

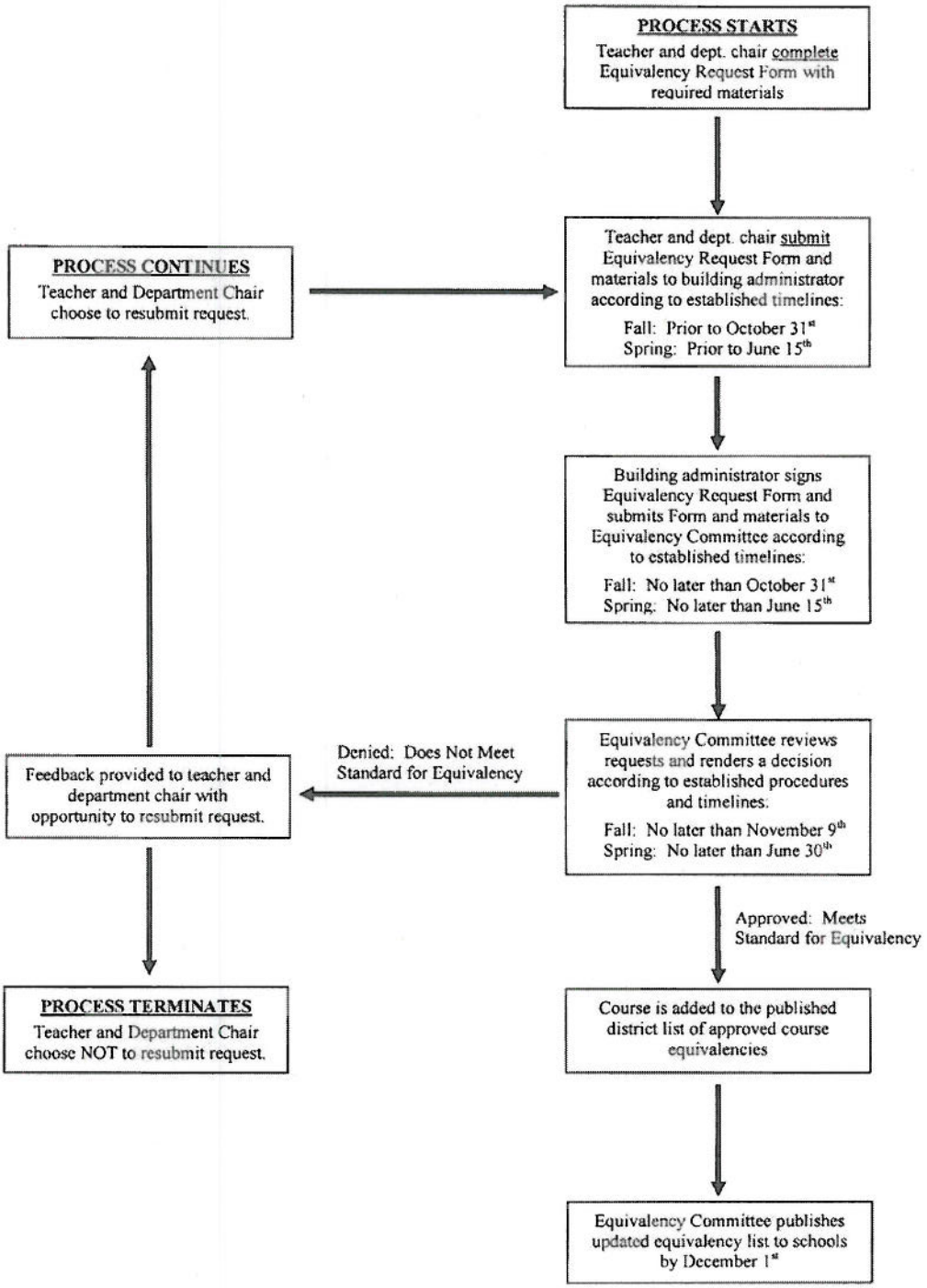
Procedures and Timeline for Resubmitting a denied Equivalency Request

1. If an equivalency request is denied upon initial review, a teacher may address identified gaps and resubmit their request by the next scheduled deadline – either October 31st or June 15th.
2. The resubmission of an equivalency request will follow the same procedural requirements as an initial equivalency request outlined in these procedures.

Publishing District Approved Equivalencies

1. The Equivalency Committee will annually publish a list of approved course equivalencies no later than **December 1st** of the school year for inclusion in each high school's course catalog.
2. Additions to the published equivalency list will apply to all students the following school year.
3. Deletion of equivalencies from the existing equivalency list will apply only to the following year's freshman students. Students who will be sophomores, juniors and seniors that following year will be allowed to use the previously published equivalencies.

Model Equivalency Procedures Flowchart



Request for Life Science Equivalency

Recommended Standards and Requirements for Life Science Equivalency

It is recommended that CTE courses be considered equivalent with Life Science courses that prepare students for the state assessment in Science, and/or remediation/skill building courses offered in the upper grades for students who failed to meet standard in Science on their initial attempt at the state assessment, when the CTE course meets the following criteria:

1. Standards within the CTE course are aligned to those Life Science EALRs/Big Ideas and Content Standards that are measured by the state assessment.

2. Life Science EALRs/Big Ideas and Content Standards are integrated throughout the scope of the course.

3. Evidence of criteria 1 is demonstrated through the course framework/curriculum map and assessments.

Excerpt from Science Instructional Materials Review Report: Evaluating your program in light of the parameters below would provide a measure of program coherence that supports conceptual development vital to true learning in the sciences. The Program Coherence scale measures how well the materials present content in an organized and deliberate sequence designed to develop conceptual understanding. It also evaluates how well the materials make explicit the big ideas of science and ground learning in a larger framework. The following items measure Program Coherence. The scale uses a four point response, with a Likert pattern of *Not Evident, Somewhat Evident, Mostly Evident,* or *Strongly Evident*.

7. Program presents content in an organized and deliberate sequence designed to develop conceptual understanding. Facts and concepts are linked and developed in ways that facilitate retrieval and application, and engages student thinking about phenomena, experiences, and knowledge.
8. Program meets and makes explicit the big ideas of science.
9. Program is organized into units, modules or other structures, focused on student learning experiences that provide sufficient time to develop deep understanding of a few concepts.
10. Program provides opportunities for students to apply understanding to new situations, to relate material to real-world experiences and situations, and to draw connections between personal and classroom experiences.
11. Program promotes interdisciplinary and cross-curricular connections.
12. Program contains little or no extraneous material outside of expected grade level standards.

REQUEST FOR LIFE SCIENCE EQUIVALENCY – Page 1 of 6

To Be Completed by Person(s) submitting Equivalency Request	
CTE Course Code and Title:	**School(s) where course is offered:**
Person(s) requesting equivalency:	**Date of Initial Equivalency Request:**

CTE courses will be considered equivalent with a) Life Science courses that prepare students for the Science state assessment, and/or b) Remediation/skill building courses offered in the upper grades for students who failed to meet standard in Science on their initial attempt at the state assessment, when the CTE course meets the following criteria:

4. Standards within the CTE course are aligned to those Life Science EALRs/GLE's measured by the state assessment.
5. Life Science EARLs/GLEs are integrated throughout the scope of the course.
6. Evidence of criteria 1 and 2 are demonstrated through the course framework/curriculum map and course assessments.

Assurance of Criteria:

1. **Do the course standards align to those Life Science EALRs/GLEs measured by the state assessment?** ___ Yes ___ No
1. **Are the Life Science EALRs/GLEs integrated throughout the scope of the course?** ___ Yes ___ No
2. **Do the Curriculum Framework and Assessments submitted with this request provide evidence of 1 and 2 above?** ___ Yes ___ No

To Be Completed by Department Head and Building Administrator	
Signature of Requesting Teacher's Department Head:	**Signature of Building Administrator:**

To Be Completed by Equivalency Committee Only

☐ **Meets Standard for Equivalency.** Course will be listed as an equivalency in the course guide

☐ **Does Not Meet Standard for Equivalency.** Feedback is given regarding gaps and areas that need to be addressed if an equivalency is to be requested again

If request meets standard for equivalency, list the Life Science Equivalency and the amount of equivalency credits granted as it will appear on the approved district equivalency list and in course catalogs:

REQUEST FOR LIFE SCIENCE EQUIVALENCY – Page 2 of 6

LIFE SCIENCE EALR'S AND GLE'S	Where Taught And How Assessed
EALR 1: SYSTEMS (Predictability and Feedback)	
9-12 SYSA: *Feedback* is a process in which the *output* of a *system* provides information used to regulate the operation of the *system*. *Positive feedback* increases the disturbance to a *system*. *Negative feedback* reduces the disturbance to a *system*. • Give examples of a positive *feedback system* and *explain* its regulatory mechanism (e.g., global warming causes Earth's ice caps to melt, reflecting less energy to space, increasing temperatures). • Give examples of a negative *feedback system* and *explain* its regulatory mechanism (e.g., when a human body overheats, it produces sweat that cools the body by evaporation).	
9-12 SYSB: Systems thinking can be especially useful in *analyzing* complex situations. To be useful, a *system* needs to be specified as clearly as possible. • Determine if a *systems* approach will be helpful in answering a *question* or solving a problem. • Represent the *system* with a diagram specifying components, boundaries, flows, and *feedbacks*. • *Describe* relevant *subsystems* and the larger *system* that contains the *system* being analyzed. • Determine how the *system functions* with respect to other *systems*.	
9-12 SYSC: In complex *systems*, entirely new and unpredictable *properties* may emerge. Consequently, modeling a complex *system* in sufficient detail to make *reliable* predictions may not be possible. • Create a simplified *model* of a complex *system*. Trace the possible consequences of a change in one part of the *system* and *explain how* the simplified *model* may not be adequate to reliably *predict* consequences.	
9-12 SYSD: *Systems* can be changing or in *equilibrium*. • *Analyze* whether or not a *system* (e.g., population) is changing or in *equilibrium*. • Determine whether a *state of equilibrium* is static or dynamic (e.g., inflows equal outflows).	
EALR 2: INQUIRY (Conducting Analysis and Thinking Logically)	
9-12 INQA: Scientists *generate* and *evaluate questions* to *investigate* the *natural world*. • *Generate* and *evaluate* a *question* that can be answered through a scientific *investigation*. Critique *questions generated* by others and *explain* whether or not the *questions* are scientific.	
9-12 INQB: Scientific progress requires the use of various methods appropriate for answering different kinds of research *questions*, a thoughtful plan for gathering data needed to answer the *question*, and care in collecting, *analyzing*, and displaying the data. • Plan and conduct a scientific *investigation*, choosing a method appropriate to the *question* being asked. • Collect, *analyze*, and display data using calculators, computers, or other technical devices when available.	
9-12 INQC: *Conclusions* must be logical, based on *evidence*, and consistent with prior *established* knowledge. • Draw *conclusions* supported by *evidence* from the *investigation* and consistent with established scientific knowledge. • Analyze alternative explanations and decide which best fits the data and *evidence*.	
9-12 INQD: The methods and procedures that scientists use to obtain *evidence* must be clearly reported to enhance opportunities for further *investigation*. • Write a detailed laboratory report that includes: the *question* that motivated the study, a justification for the kind of *investigation* chosen, *hypotheses* (if any), a description of what was done, a summary of data in tables and graphs, and a *conclusion*, based on the *evidence*, that responds to the *question*.	

REQUEST FOR LIFE SCIENCE EQUIVALENCY – Page 3 of 6

LIFE SCIENCE EALR'S AND GLE'S	Where Taught And How Assessed
EALR 2: INQUIRY (Conducting Analysis and Thinking Logically)	
9-12 INQE: The essence of scientific *investigation* involves the development of a *theory* or conceptual *model* that can *generate* testable predictions. • Formulate one or more *hypotheses* based on a *model* or *theory* of a causal *relationship*. Demonstrate creativity and critical thinking to formulate and *evaluate* the *hypotheses*.	
9-12 INQF: *Science* is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new *evidence* comes to light. • *Evaluate* an *investigation* to determine if it was a *valid* means of answering the *question*, and whether or not the results were *reliable*. • *Describe* the development of a scientific *theory* that illustrates logical reasoning, creativity, testing, revision, and replacement of prior *ideas* in light of new *evidence*.	
9-12 INQG: *Public communication among scientists is an essential aspect of research. Scientists evaluate the validity of one another's investigations, check the reliability of results, and explain inconsistencies in findings.* • Participate in a scientific discussion about one's own investigations and those performed by others. • Respond to questions and criticisms, and if appropriate, revise explanations based on these discussions.	
9-12 INQH: *Scientists carefully evaluate sources of information for reliability before using that information. When referring to the ideas or findings of others, they cite their sources of information.* • Provide appropriate citations for all ideas, findings, and information used in any and all written reports. • Explain the consequences for failure to provide appropriate citations.	
EALR 3: APPLICATION (Science, Technology, and Society)	
9-12 APPA: *Science* affects society and cultures by influencing the way many people think about themselves, others, and the *environment*. Society also affects *science* by its prevailing views about what is important to study and by deciding what research will be funded. • *Describe* ways that scientific *ideas* have influenced society or the development of differing cultures. • List *questions* that scientists *investigate* that are stimulated by the needs of society (e.g., medical research, *global climate* change).	
9-12 APPB: The *technological design process* begins by defining a problem in terms of *criteria* and *constraints*, conducting research, and generating several different *solutions*. • Work collaboratively with other students to *generate ideas* for solving a problem. Identify *criteria* and *constraints*, research the problem, and *generate* several possible *solutions*.	
9-12 APPC: Choosing the best *solution* involves comparing alternatives with respect to *criteria* and *constraints*, then building and testing a *model* or other representation of the final design. • Choose the best *solution* for a problem, create a model or drawing of the final design, and devise a way to test it. Redesign the *solution*, if necessary, then present it to peers.	
9-12 APPD: The ability to solve problems is greatly enhanced by use of mathematics and information technologies. • Use proportional reasoning, functions, graphing, and estimation to solve problems. • Use computers, probes, and software when available to collect, display, and analyze data.	

REQUEST FOR LIFE SCIENCE EQUIVALENCY – Page 4 of 6

LIFE SCIENCE EALR'S AND GLE'S	Where Taught And How Assessed
EALR 3: APPLICATION (Science, Technology, and Society)	
9-12 APPE: Perfect *solutions* do not exist. All technological *solutions* involve *trade-offs* in which decisions to include more of one quality means less of another. All *solutions* involve consequences, some intended, others not. • *Analyze* a societal issue that may be addressed through *science* and/or *technology*. *Compare* alternative *solutions* by *considering trade-offs* and unintended consequences (e.g., removing dams to increase salmon spawning).	
9-12 APPF: It is important for all citizens to *apply science* and *technology* to critical issues that influence society. • Critically *analyze* scientific information in current events to make personal choices or to understand public-policy decisions.	
EALR 4: LIFE SCIENCE – STRUCTURES AND FUNCTIONS OF LIVING ORGANISMS (Processes within Cells)	
9-11 LS1A: Carbon-containing *compounds* are the building blocks of life. *Photosynthesis* is the process that plant cells use to combine the energy of sunlight with *molecules* of carbon dioxide and water to produce energy-rich *compounds* that contain carbon (*food*) and release oxygen. • *Explain how* plant cells use *photosynthesis* to produce their own food. Use the following equation to illustrate how plants rearrange *atoms* during *photosynthesis*: 6CO2+6H2O+light energy —> C6H12O6+6O2 • *Explain* the importance of *photosynthesis* for both plants and animals, including humans.	
9-11 LS1B: The gradual combustion of carbon-containing *compounds* within cells, called *cellular respiration*, provides the primary energy source of living *organisms*; the combustion of carbon by burning of *fossil fuels* provides the primary energy source for most of modern society. • *Explain how* the process of *cellular respiration* is similar to the burning of *fossil fuels* (e.g., both processes involve combustion of carbon-containing *compounds* to transform chemical energy to a different *form* of energy).	
9-11 LS1C: Cells contain specialized parts for determining essential *functions* such as regulation of cellular activities, energy capture and release, formation of proteins, waste disposal, the *transfer* of information, and movement. • Draw, label, and *describe* the *functions* of components of essential structures within cells (e.g., *cellular membrane*, *nucleus*, *chromosome*, *chloroplast*, *mitochondrion*, *ribosome*)	
9-11 LS1D: The cell is surrounded by a membrane that separates the interior of the cell from the outside world and determines which substances may enter and which may leave the cell. • *Describe* the structure of the *cell* and how the membrane regulates the flow of materials into and out of the cell.	
9-11 LS1E: The *genetic information* responsible for inherited *characteristics* is encoded in the DNA *molecules* in *chromosomes*. DNA is composed of four subunits (A,T,C,G). The sequence of subunits in a *gene* specifies the amino acids needed to make a protein. *Proteins* express inherited traits (e.g., eye color, hair texture) and carry out most cell *function*. • *Describe* how DNA *molecules* are long chains linking four subunits (smaller *molecules*) whose sequence encodes *genetic information*. • Illustrate the process by which *gene* sequences are copied to produce proteins.	
9-11 LS1F: All of the functions of the cell are based on chemical reactions. Food molecules are broken down to provide the energy and the chemical constituents needed to synthesize other molecules. Breakdown and synthesis are made possible by proteins called enzymes. • Some of these enzymes enable the cell to store energy in special chemicals, such as ATP, that are needed to drive the many other chemical reactions in a cell. • Explain how cells break down food molecules and use the constituents to synthesize proteins, sugars, fats, DNA and many other molecules that cells require. • Describe the role that enzymes play in the breakdown of food molecules and synthesis of the many different molecules needed for cell structure and function. • Explain how cells extract and store energy from food molecules.	

REQUEST FOR LIFE SCIENCE EQUIVALENCY – Page 5 of 6

LIFE SCIENCE EALR'S AND GLE'S	Where Taught And How Assessed
EALR 4: LIFE SCIENCE – STRUCTURES AND FUNCTIONS OF LIVING ORGANISMS (Processes within Cells)	
9-11 LS1G: Cells use the DNA that forms their genes to encode enzymes and other proteins that allow a cell to grow and divide to produce more cells, and to respond to the environment. • Explain that regulation of cell functions can occur by changing the activity of proteins within cells and/or by changing whether and how often particular genes are expressed.	
9-11 LS1H: Genes are carried on chromosomes. Animal cells contain two copies of each chromosome with genetic information that regulate body structure and functions. Cells divide by a process called mitosis, in which the genetic information is copied so that each new cell contains exact copies of the original chromosomes. • Describe and model the process of mitosis, in which one cell divides, producing two cells, each with copies of both chromosomes from each pair in the original cell.	
9-11 LS1I: Egg and sperm cells are formed by a process called meiosis in which each resulting cell contains only one representative chromosome from each pair found in the original cell. Recombination of genetic information during meiosis scrambles the genetic information, allowing for new genetic combinations and characteristics in the offspring. Fertilization restores the original number of chromosome pairs and reshuffles the genetic information, allowing for variation among offspring. • Describe and model the process of meiosis in which egg and sperm cells are formed with only one set of chromosomes from each parent. • Model and explain the process of genetic recombination that may occur during meiosis and how this then results in differing characteristics in offspring. • Describe the process of fertilization that restores the original chromosome number while reshuffling the genetic information, allowing for variation among offspring. • Predict the outcome of specific genetic crosses involving two characteristics	
EALR 4: LIFE SCIENCE – ECOSYSTEMS (Maintenance and Stability of Populations)	
9-11 LS2A: *Matter* cycles and *energy* flows through living and nonliving components in *ecosystems*. The transfer of *matter* and *energy* is important for maintaining the health and sustainability of an *ecosystem*. • *Explain how* plants and animals cycle carbon and nitrogen within an *ecosystem*. • *Explain how* matter cycles and energy flows in ecosystems, resulting in the formation of differing chemical compounds and heat.	
9-11 LS2B: Living *organisms* have the capacity to produce very large *populations*. *Population density* is the number of individuals of a particular *population* living in a given amount of space. • *Evaluate* the conditions necessary for rapid *population growth* (e.g., given adequate living and nonliving resources and no disease or predators, *populations* of an *organism* increase at rapid rates). • Given *ecosystem* data, calculate the *population density* of an *organism*.	
9-11 LS2C: *Population growth* is limited by the availability of matter and energy found in resources, the size of the *environment*, and the presence of competing and/or predatory *organisms*. • *Explain factors*, including matter and energy, in the *environment* that limit the growth of plant and animal *populations* in natural *ecosystems*.	
9-11 LS2D: Scientists represent *ecosystems* in the *natural world* using mathematical *models*. • Draw a *systems* diagram to illustrate and *explain* why introduced (nonnative) *species* often do poorly and have a tendency to die out, as well as why they sometimes do very well and force out native *species*.	