Massachusetts Career Technical Education

Building and Property Maintenance Framework

2014

DESE is in the process of updating all CTE Frameworks. This framework was adopted in 2014. More information about the process to update frameworks will be provided in DESE’s CCTE Newsletter.

# [Strand 2: Technical Knowledge and Skills](#_bookmark0)

###### Health and Safety Knowledge and Skills for Building/Property Maintenance

* + 1. Demonstrate safety procedures and knowledge of Occupational Safety and Health (OSHA) regulations.
			1. Describe and demonstrate ladder safety practices and procedures.
			2. Identify and describe scaffold, mechanical platform life and material handling equipment safety practices and procedures.
			3. Describe the purposes and demonstrate the features of a variety of rigging and hoisting components.
			4. Demonstrate how to use lockout/tagout systems.
			5. Demonstrate use of barriers and barricades.
			6. Use power and hand tools following industry standards and OSHA guidelines.
			7. Use appropriate Personal Protective Equipment (PPE).
			8. Describe and demonstrate the storage of hazardous, flammable and combustible materials.
		2. Performance Example:
			- Obtain OSHA 10 hour general industry certification.

###### Technical Drawings and Blueprints

* + 1. Read and interpret technical drawings and prints.
			1. Explain the basic layout of a set of prints as well as the importance of the accompanying job specifications document.
			2. Define and identify basic print terms, abbreviations, line types, symbols and notes.
			3. Interpret given drawing dimensions.
			4. Convert measurements from a print using an architect’s scale.
			5. Define and interpret floor plans, elevations, sections, details, ceiling plans and finish schedules.
			6. Identify, develop and complete material quantity takeoff sheets.
			7. Define how state and/or local code requirements apply to prints.
			8. Describe how the Americans with Disabilities Act (ADA) and the Architectural Barriers Act (ABA) impact building plans.
			9. Identify and describe the unique properties of a variety of blueprints including carpentry, plumbing, electrical, fire protection and sheet metal.
			10. Follow diagrams for installation of equipment.
			11. Read exploded drawings to troubleshoot equipment and order parts.
		2. Performance Example:
			- Students will assemble shelving units following manufacturer’s instructions and diagrams.

###### Building Repair and Alteration

* + 1. Identify jobs requiring licensed professionals (i.e., electricians, pipefitters, plumbers and sheet metalworkers).
			1. Identify hardware and building materials and describe their use.
			2. Identify fasteners and describe their use (e.g., screws, nails, bolts, nuts, washers, clamps, anchors and clips).
			3. Identify types of wood used for building and repair projects (e.g., plywood, dimensional lumber, treated lumber, flooring and specialty woods).
			4. Describe the uses of brick, masonry, steel, plaster and glass for building and repair projects

2.C.02 Performance Example:

* Students will select appropriate lumber and hardware for a storage unit installation.
	+ 1. Demonstrate tool and equipment operation according to current industry and OSHA standards.
			1. Identify and demonstrate techniques in the use of hand tools.
			2. Identify and demonstrate techniques in the use of power tools.
			3. Identify and demonstrate the use of layout and measuring devices, including laser levels.

2.C.03 Performance Example:

* Students will demonstrate industry approved techniques in the use of tools to complete a given project (e.g., ripping and crosscutting on a power operated table saw).
	+ 1. Apply skills in the alteration, preparation, painting and repair of structures made of wood, plaster, concrete or brick.
			1. Install and repair drywall.
			2. Install acoustical ceiling tiles.
			3. Install and repair doors and door parts.
			4. Install and repair lock sets and door closers.
			5. Perform glass window and screen repairs.
			6. Install and repair shelving units.
			7. Replace ceramic tiles.
			8. Install and repair wood trim.

2.C.04 Performance Example:

* Students will repair a hole in a sheetrock wall.
* Student will change a deadbolt lock.
	+ 1. Demonstrate preparation and application skills for painting and finishing projects.
			1. Define the chemical properties of paints, stains and finishes.
			2. Identify tools and equipment specific to painting and finishing projects.
			3. Prepare surfaces (i.e., walls, ceilings, wood, masonry and metal) for the application of paint and other finishes.
			4. Apply paint, stain and other finishes to various surfaces (i.e., drywall, plaster, wood, masonry and metal) using brushes and rollers.
			5. Apply paint, stain and other finishes to various surfaces (i.e., drywall, plaster, wood, masonry and metal) using spray equipment.
			6. Demonstrate applications of graphics and signage in buildings.
			7. Determine type and quantity of materials required for a given project.
			8. Demonstrate proper equipment clean up and storage according to current industry and OSHA standards.

2.C.05 Performance Example:

* Students will complete a painting project including preparing the area, protecting surfaces, priming and finishing and cleaning the area and equipment.

###### Building and Ground Maintenance

* + 1. Demonstrate building maintenance skills.
			1. Explain the importance of scheduled maintenance.
			2. Demonstrate methods used to maintain lighting fixtures including replacing bulbs.
			3. Demonstrate methods used to maintain hand and power tools including sharpening, oiling and cleaning.
			4. Install fasteners on a variety of materials.
			5. Perform maintenance on an air filter system including checking oil and belts and replacing filters.
			6. Repair faucets by installing washers or seats and springs.
			7. Clear stoppages in drains and in toilets.
			8. Demonstrate basic procedures to troubleshoot common problems in heating and cooling systems.
			9. Define and demonstrate how to clean and maintain heating and air conditioning systems according to current industry standards.
			10. Demonstrate carpet and floor care using appropriate equipment (e.g., steam cleaners, floor machines).
			11. Perform room set-up operations including audio-visual set-up.
			12. Demonstrate hard surface cleaning using appropriate equipment (e.g., power washer, sanitizer).
			13. Demonstrate interior and exterior caulking.
		2. Performance Examples:
			- Students will use a closet auger to clear a toilet stoppage.
			- Students will change filters in a furnace.
		3. Demonstrate landscaping and ground skills.
			1. Demonstrate procedures used to maintain a lawn including mowing, trimming and edging.
			2. Demonstrate procedures used to care for shrubs including trimming, pruning, planting and fertilization.
			3. Demonstrate procedures for lawn care maintenance for all seasons.
			4. Demonstrate procedures used to plant annuals and perennials.
			5. Demonstrate snow clearance using hand tools and snow blowers.
			6. Demonstrate and perform basic repairs on grounds equipment.
			7. Demonstrate safe operation of outdoor power equipment.

2.D.02 Performance Examples:

* Students will perform maintenance on a line trimmer following manufacturer’s instructions.

###### Recordkeeping and Client Relations.

* + 1. Demonstrate skills in client relations and recordkeeping.
			1. Explain the importance of completing work orders and maintenance records.
			2. Maintain an inventory log.
			3. Complete a purchase order.
			4. Describe the elements of good customer service.
		2. Performance Example:
			- Students will prepare a work order in response to a client request for repair services.

###### Energy Efficiency and Green Building Technologies.

* + 1. Demonstrate knowledge and skills in the use of green technologies and green cleaners.
			1. Identify and explain components of a green building design.
			2. Define and demonstrate energy efficiency in the selection and use of building materials.
			3. Identify and explain green building rating systems.
			4. Identify green cleaning materials and demonstrate their use.
			5. Implement a materials recycling program.
			6. List the elements of an Integrated Pest Management plan for both interior and exterior structures.
			7. Compare and contrast Integrated Pest Management with traditional pest management.
		2. Performance Example:
			- Students will select and install energy efficient replacement bulbs appropriate to a given fixture.

# [Strand 3: Embedded Academics](#_bookmark0)

### [Embedded English Language Arts and Literacy](#_bookmark0)

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| CTELearning Standard Number | Strand Coding Designation Grades ELAsLearning Standard Number | Text of English Language Arts Learning Standard |
| 2.B.01. | WHST.6-12.5-8Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects | Develop and strengthen writing as needed by planning, revising, editing, rewriting or trying a new approach. Use technology including the Internet to produce and publish writing and to interact and collaborate with others. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation. Gather relevant information from multiple print and digital sources, assess thecredibility and accuracy of each source and integrate the information while avoiding plagiarism.Performance Example:Students will work with assigned partner to identify, develop and complete material quantity takeoff sheets from designated project using electronic resources – all resources must be validated. |
| 2F.01 | RI.6.3Reading Standards for Informational Text | Analyze in detail how a key individual, event or idea is introduced, illustrated and elaborated in a text.Performance Example:Student will elaborate on the components of and rating systems for green buildings. |
| 2.B.01. | SL.9-12.1-3Speaking and Listening Standards | Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups and teacher-led) with diverse partners on grades 9-12 topics, texts and issues building on others’ ideas and expressing their own clearly and persuasively. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. Evaluate a speaker’s point of view, reasoning and use of evidence and rhetoric, assessing the stance, premises, links amongideas, word choice, points of emphasis and tone used.Performance Example:Students will present to the class how state and/or local code requirements apply to prints. |
| 2.D.01 | SL.9-12.4-6Speaking and Listening Standards | Present information, findings and supporting evidence conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. Make strategic use of digital media (e.g., textual, graphical, audio, visual and interactive elements) in presentations to enhance understanding of findings, reasoning and evidence and to add interest.Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate.Performance Example:Students will present to the class a description and demonstration of how to properly clean and maintain air conditioning systems. |
| 2.B.01 | L.6-12.4(c-d)Language Standards | Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology or its standard usage.Verify the preliminary determination of the meaning of a word orphrase (e.g., by checking the inferred meaning in context or in a dictionary).Performance Example:Students will utilize the Massachusetts Architectural Access Board regulations definitions section to determine “clear floor space” and how it applies to building design. |
| 2.B.01. | WHST.6-12.8Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overrelianceon any one source and following a standard format for citation.Performance Example:Students will research and describe how Federal, State and Local Codes requirements apply to construction areas. |
| 2.F.01. | WHST.6-12.2(a-f), 4Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects | Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments or technical processes. Introduce a topic and organize ideas, concepts and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. Develop the topic with well-chosen, relevant and sufficient facts, extended definitions, concrete details, quotations or other information and examples appropriate to the audience’s knowledge of the topic. Use varied transitions and sentence structures to link the major sections of the text, create cohesion and clarify the relationships among ideas and concepts. Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).Produce clear and coherent writing in which the development, organization and style are appropriate to task, purpose andaudience.Performance Example:Students research the components of a green building design and write a proposal to develop a green building design for their own school. |

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### [Embedded Mathematics](#_bookmark0)

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| CTELearning Standard Number | Math Content Conceptual Category and Domain Code Learning Standard Number | Text of Mathematics Learning Standard |
| 2.A.01 | 7.G.2Geometry/Draw, construct and describe geometrical figures and describe the relationships between them. | 7.G.2 - Draw (freehand, with ruler and protractor and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle or no triangle. (MA 2011 specifies constructing trianglesgiven measures of angles).Performance Example:Students will draw ladders at different angles to the building showing the safe and unsafe angles for ladder use. |
| 2.F.01 | 6.NS.6The Number System/Apply and Extend previous understandings of numbers to the system of rational numbers.6.NS.6cThe Number System/Apply and Extend previous understandings of numbersto the system of rational numbers. | 6.NS.6 – Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.6S.6c – Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.Performance Example:Students will do a cost analysis between a natural gas and oil fired furnace with the same efficiency. |
| 2.D.02 | 9-12.G.CO.9Geometry/Congruence/ Prove geometric theorems9-12.G.C.2Geometry/Circles/ Understand and apply theorems about circles7.G.5Geometry/Solve real-life and mathematical problems involving angle measure,area, surface, area and volume. | 9-12.G.CO.9 – Prove theorems about lines and angles.*Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment’s endpoints.*9-12.G.C.2 – Identify and describe relationships among inscribed angles, radii and chords. *Include the relationship between central, inscribed and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*7.G.5 – Use facts about supplementary, complementary, vertical and adjacent angles in a multi-step problem to write and use them to solve simple equations for an unknown angle in a figure.Performance Example:Students will perform lawn maintenance based on given specific angles from a given print. |
| 2.C04 | 9-12.G.GPE.5Geometry/ExpressingGeometric Properties with Equations. | 9-12.G.GPE.5 – Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find theequation of a line parallel or perpendicular to a given line that passes through a given point).Performance Example:Students will install sheetrock/plywood on a wall that requires cutting the material by figuring solving the given points. |
| 2.C.04 | 9-12.G.GMD.4Geometry/Geometric Measurement and Dimension | 9-12.G.GMD.4 – Identify the shapes of two-dimensional cross-sections of three-dimensional objects and identify three-dimensional objects generated by rotations of two-dimensional objects.Performance Example:Students will sketch a cross-section of a door molding or another three-dimensional object. Students will then cut molding with a meter box and compare cut piece with sketch. |

### [Embedded Science and Technology/Engineering](#_bookmark0)

#### [Physical Science (Chemistry and Physics)](#_bookmark0)

#### RELATED CHEMISTRY, Grades 9-12

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| CTELearning Standard Number | Subject Area, Topic Heading andLearning Standard Number | Text of Chemistry Learning Standard |
| 2.C.05 | Properties of Matter 1.1 and 1.2 | * 1. – Identify and explain physical properties (e.g., density, melting point, boiling point, conductivity, malleability) and chemical properties (e.g., the ability to form new substances). Distinguish between chemical and physical changes.
	2. – Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous

and homogeneous mixtures.Performance Example:Students will research various types of paint and stains and identify which are oil and water-based and what applications they are used for. |

RELATED PHYSICS, Grades 9-12

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| CTELearning Standard Number | Subject Area, Topic Heading andLearning Standard Number | Text of Physics Learning Standard |
| 2.F.01 | Conservation of Energy 2.3 | 2.3 – Describe both qualitatively and quantitatively how work can be expressed as a change in mechanical energy.Performance Example:Students will discuss the Conservation of Energy law with class. |

#### [Technology/Engineering](#_bookmark0)

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| CTELearning Standard Number | Subject Area, Topic Heading andLearning Standard Number | Text of Technology/Engineering Learning Standard |
| 2.A.01 | Materials, Tools and Machines 2.2 | 2.2 – Distinguish among tension, compression, shear and torsion and explain how they relate to the selection of materials in structures.Performance Example:Students working in groups will create a model which demonstrates a purpose of rigging and hoisting equipment. |
| 2.A.01 | Materials, Tools and Machines 2.5 | 2.5 – Identify and demonstrate the safe and proper use of common hand tools, power tools and measurement devices used inconstruction.Performance Example:Student will complete a safety project prior to uses of tools. |
| 2.B.01 | Engineering Design 1.4 and 1.5 | * 1. – Interpret and apply scale and proportion to orthographic projections and pictorial drawings (e.g., ¼” = 1’0”, 1 cm = 1 m).
	2. – Interpret plans, diagrams and working drawings in the construction of prototypes or models.

Performance Example:Student will create a scaled plan that includes measurements and layout of project. |
| 2.B.01 | Materials, Tools and Machines 2.6 | 2.6 – Recognize the purposes of zoning laws and building codes in the design and use of structures.Performance Example:Student will present to the class how federal, state and local codes apply to prints. |

[Industry Recognized Credentials](#_bookmark0) (Licenses and Certifications/Specialty Programs)

* Occupational Safety and Health Administration (OSHA) – Ten-hour Card - Construction