Appendix IX
Relevant Contexts for Teaching Science and Technology/Engineering

Science, technology, and engineering influence many aspects of people's lives, and in turn people influence the direction and use of scientific, engineering, and technological endeavors. A real-world context can make a curriculum relevant to students, helping them understand and apply core ideas and practices. It can engage and motivate students to deepen their understanding, apply their learning, build identity as civic participants, communicate their ideas, and prepare for college and careers.

Relevant contexts can be drawn from science, technology, and engineering in society; nature and history of science; cultural and technological perspectives; current issues; community issues; and a variety of professions. Listed below are *examples* of specific contexts or topics that can be used to effectively teach Massachusetts' STE standards. Educators can use one or more of them to design an entire unit, theme, or course. They can be applied to elementary, middle, or high school curricula.

Biotechnology

Biotechnology is a rapidly expanding field that uses a growing set of techniques to derive valuable products from organisms and their cells. Biotechnology is already commonly used to identify potential suspects in crimes or exonerate persons wrongly accused, determine paternity, diagnose diseases, make high-yield pest-resistant crops, and treat genetic ailments. Introducing students to biotechnology as a way of understanding the molecular basis of heredity can highlight the application and importance of related biological concepts and processes. Biotechnology can also provide students with methods and critical thinking skills needed to evaluate the benefits and risks of this technology.

Green Chemistry

Green chemistry provides a framework and lens for learning, teaching, and investigating chemistry concepts. Green chemistry is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Introducing students to green chemistry helps them to incorporate chemistry concepts into relevant contexts, particularly when applied to the life cycle of a chemical product, including its design, manufacture, use, and disposal. Green chemistry also gives students opportunities to explain and research how to reduce the negative impacts of chemical products and processes on human health and the environment.

Ocean Literacy

The ocean covers most of the planet, contains important food sources, and regulates the temperature and climate of the globe. Massachusetts is a coastal state: the ocean affects us in many ways, and we affect the ocean. People's actions, such as overfishing, habitat destruction, and actions leading to climate change, have negative effects on the health of the planet and our state. Increasing ocean literacy helps to build a public that can make informed and responsible decisions about their own community. Ocean literacy can help students develop an understanding of the interdisciplinary nature of ocean sciences and build connections between the ocean, its resources, and human actions.

Environmental Literacy/Sustainability

Environmental literacy is focused on a fundamental understanding of the systems of the natural world and the relationships and interactions between the living and non-living environments. It involves the ability

to understand scientific evidence and use it to make informed decisions regarding environmental issues, as well as developing and implementing solutions to key challenges. The concept of sustainability comes from the increasing concern that current patterns of human behavior, such as over-consumption and population growth, could lead to negative consequences for the environment, including human populations. Environmental literacy can give students a framework for understanding our natural resources, connected systems, and how to balance environmental needs across communities. It also can provide students with methods to evaluate the various viewpoints on environmental topics so they can think critically about the issues facing the environment.

Forensics

Forensic sciences include any scientific field that is applied to the field of law. Forensics is a necessary factor in criminal investigations, using science to link a crime to its perpetrator. It is an excellent context to show students the diversity of scientific and technical careers, both in the lab and in the field. The interdisciplinary nature of forensics requires students to apply core ideas from different disciplines, critically analyze information, construct explanations based on evidence, and communicate findings.

Clean Energy/Renewable Energy

Clean energy, or renewable energy, has gained increased interest as society's demand for energy increases. Government, industry, and communities are seeking innovative ways to meet their energy needs. Clean energy uses natural sources (e.g., sunlight, geothermal energy, wind) to produce energy such as electricity. From wind to solar to biomass, Massachusetts has increased its diversity of energy resources. Using clean energy to illustrate how STE is interconnected helps students to appreciate the complexities of energy issues. Clean energy provides many different examples of how science, technology, and engineering influence each other and how aspects of each discipline play a role in helping explain and connect concepts, practices, and applications.

Computer Science

Computer science includes a wide variety of applications across many different fields—entertainment, medicine and health care, finance, and astronomy, among many others. Daily changes in technology, communication, and the information life cycle have contributed to the changing face of society and the practice of science and engineering. This is an exciting and creative pursuit, which involves designing and building software; developing effective ways to solve computing problems; collecting and analyzing new and larger data sets; and devising new and better ways of using computing devices, digital tools, and software to address particular challenges, such as robotics, computer vision, or digital forensics.

Nanotechnology

Nanotechnology is the study and application of micro-scale materials being used across all fields of science and technology. Nanotechnology is used to make everything from stain-proof clothing to microfilms to medicine. Nanobots created by engineers who work on a very tiny scale could revolutionize medicine and manufacturing. Curricula focused on nanotechnology can make students aware of how nanotechnology is transforming tools, techniques, and highly advanced products, and engage them in applying core ideas and practices from a variety of disciplines.

Robotics

Robots have become an important ally in manufacturing, everyday living, and entertainment. Engineers create robots to perform specific tasks, sometimes autonomously and sometimes with deliberate instructions or human interaction. Robotics is the study of these machines and how they carry out their functions; it illustrates the many relevant and current uses and designs of robots, and as such it can engage students in learning and applying science and engineering practices and ideas. How engineering principles

and processes are used in robotics is a key element in teaching and learning about science, technology, and engineering in this context.