Curriculum Framework – Gateway
Science of Technology – Lesson 1 Applied Chemistry

Desired Results *(stage 1)*

ESTABLISHED GOALS
It is expected that students will…

- G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
- G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
- G5 – Demonstrate an ability to use the techniques, skills, and

Transfer

TRANSFER: *Students will be able to independently use their learning to …*

- T1 –Design and conduct an experiment, and analyze and interpret data as a chemical engineer would.
- T2 - Identify, formulate, and attempt to solve an environmental accident using engineering problem solving skills.

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – Chemical engineers design, construct, and operate machines and plants that perform chemical reactions to solve practical problems or make useful products.
- U2 – Chemical engineers apply the knowledge and discoveries of a chemist to solve real life problems.
- U3 – Chemical engineers work in many industries including manufacturing, pharmaceuticals, healthcare, environmental, materials, and alternative energy.
- U4 – Chemical engineers often work on teams with other engineers, scientists, and technologists.

ESSENTIAL QUESTIONS: *Students will keep considering …*

- Q1 - What real-life problems does a chemical engineer attempt to solve?
- Q2 - What is the difference between a chemical engineer and a chemist?
- Q3 – How are people and the environment affected by an oil spill?

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	Acquisition	
modern engineering tools necessary for engineering practice. • G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. • G7 – Demonstrate an understanding of professional and ethical responsibility. • G8 – Demonstrate an ability to function on multidisciplinary teams. • G9 – Demonstrate an ability to communicate effectively. • G10 – Gain knowledge of contemporary issues. • G11 – Recognize the need for, and develop an ability to engage in life-long learning.	***KNOWLEDGE:*** *Students will …* • K1 – Describe the difference between a chemist and a chemical engineer. U1, U2 • K2 – Describe how salt affects the melting point of ice. U2 • K3 – Describe how an adhesive bond holds two items together. U2 • K4 – Outline the steps required to clean up an oil spill. U2, U3	***SKILLS:*** *Students will …* • S1 – Apply science and engineering skills to make ice cream. U1, U2 • S2 – Utilize the steps of the design process to create product. U1, U2, U3 • S3 – Work as a part of a team to solve an oil spill engineering simulation problem. U3, U4

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Evidence *(stage 2)*		
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning
A.1.1 Let's Make Ice Cream (Yogurt)	• Essential Questions	• Conclusion Questions
A.1.2 Gluing It All Together	• Essential Questions	• Conclusion Questions
P.1.3 Oil Spill Clean Up	• Essential Questions • Oil Spill Clean Up Grading Rubric	• Conclusion Questions • Oil Spill Clean Up Grading Rubric

Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems(B)	Knowledge and Skills
A.1.1 Let's Make Ice Cream (Yogurt)	K1, K2, S1
A.1.2 Gluing It All Together	K3, S2
P.1.3 Oil Spill Clean Up	K4, S3

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Curriculum Framework – Gateway
Science of Technology – Lesson 2 Nanotechnology

Desired Results *(stage 1)*

ESTABLISHED GOALS
It is expected that students will…

- G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
- G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
- G5 – Demonstrate an ability to use the techniques, skills, and modern engineering tools

Transfer

TRANSFER: *Students will be able to independently use their learning to …*

- T1 – Explain the advantages and disadvantages of nanotechnology uses and its effect on our lives.

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – Nanotechnology is building innovative tools to study and manipulate objects at the nanometer scale, one billionth of a meter.
- U2 – Properties of materials, such as strength, color, and resistance can be changed by nanotechnology.
- U3 – Molecules can be arranged using nanotechnology in a way that they do not normally occur in nature.
- U4 – Nanotechnology will have an impact on many areas, including but not limited to electronics and computing, materials, manufacturing, energy, environment, health, medicine, national security, and space exploration.
- U5 – Scanning Probe and Atomic Force microscopes are used to see and move individual atoms.
- U6 – Engineers, designers, and engineering technologists are needed in high demand for the development of future technology to meet societal needs and wants.

ESSENTIAL QUESTIONS*: Students will keep considering …*

- Q1 - What are the challenges related to nanotechnology?
- Q2 - Why do we want to make or study such small things?
- Q3 - How does nanotechnology and nanotechnology-enhanced products affect your life?

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	Acquisition	
necessary for engineering practice. • G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. • G7 – Demonstrate an understanding of professional and ethical responsibility. • G8 – Demonstrate an ability to function on multidisciplinary teams. • G9 – Demonstrate an ability to communicate effectively. • G10 – Gain knowledge of contemporary issues. • G11 – Recognize the need for, and develop an ability to engage in life-long learning.	***KNOWLEDGE:*** *Students will …* • K1 – Identify facts regarding nanotechnology including properties of materials at nanoscale. U1, U2 • K2 – Describe the relative size of a nanometer. U1 • K3 – Describe how nano-products are used in society today. U4 • K4 – Identify tools and processes used to see and manipulate matter at the nanoscale. U5	***SKILLS:*** *Students will …* • S1 – Discuss the impact that nanotechnology has on their lives today and will have in the future. U2, U3, U4 • S2 – Identify examples of nanotechnology-enhanced products. U4 • S3 – Describe engineering and engineering technology careers related to the advancement of nanotechnology. U6

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Evidence *(stage 2)*		
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning
A.2.1 Nanotechnology, Fact or Myth	• Essential Questions	• Conclusion Questions
A.2.2 How small is a billionth	• Essential Questions	• Conclusion Questions
A.2.3 Exploring Nano Products	• Essential Questions	• Conclusion Questions
A.2.4 Testing Nano Fabrics	• Essential Questions	• Conclusion Questions
A.2.5 Nanotechnology is Amazing	• Essential Questions	• Conclusion Questions
Introduction to Gateway Engineering A.A.5 Engineering Careers	• Essential Questions	• Conclusion Questions

Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems(B)	Knowledge and Skills
A.2.1 Nanotechnology, Fact or Myth	K1, S1
A.2.2 How small is a billionth	K2
A.2.3 Exploring Nano Products	K3, S1, S2
A.2.4 Testing Nano Fabrics	K3, S2
A.2.5 Nanotechnology is Amazing	K2, K3, K4, S2
Introduction to Gateway Engineering A.A.5 Engineering Careers	S3

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Curriculum Framework – Gateway
Science of Technology – Lesson 3 Applied Physics

Desired Results *(stage 1)*

ESTABLISHED GOALS
It is expected that students will…

- G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
- G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.

Transfer

TRANSFER: *Students will be able to independently use their learning to …*

- T1 – Apply scientific knowledge to design a mechanical system that transfers energy

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – Simple machines can make work easier by increasing mechanical advantage.
- U2 – Mechanical advantage is the ratio of the force produced by a machine to the force applied to the machine.
- U3 – Compound machines are made from a combination of several simple machines.
- U4 – Energy cannot be created or destroyed but may be transferred into different types of energy.
- U5 – Humans use their energy, along with simple machines, to do work by changing the state of energy of an object from potential to kinetic.
- U6 – Prototyping is an important step in the design process and provides the designer with a scaled working model that can be used for testing.

ESSENTIAL QUESTIONS: *Students will keep considering …*

- Q1 - What are the advantages and tradeoffs of using simple machines or compound machines?
- Q2 - If energy cannot be created or destroyed, why do we need to be concerned about our energy sources?
- Q3 - Why is using a design process important when attempting to invent or innovate?
- Q4 – How and where are simple machines used in everyday life?

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	Acquisition	
• G5 – Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. • G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. • G7 – Demonstrate an understanding of professional and ethical responsibility. • G8 – Demonstrate an ability to function on multidisciplinary teams. • G9 – Demonstrate an ability to communicate effectively. • G10 – Gain knowledge of contemporary issues. • G11 – Recognize the need for, and develop an ability to engage in life-long learning.	***KNOWLEDGE:*** *Students will …* • K1 – Identify the six simple machines: the lever, pulley, wheel and axle, inclined plane, wedge, and screw. U1 • K2 – Identify a machine as something that helps use energy more efficiently. U1 • K3 – Describe work as the force applied over a distance. U5	***SKILLS:*** *Students will …* • S1 – Explain the applications of the six simple machines. U1 • S2 – Distinguish between the three classes of levers. U1 • S3 – Determine mechanical advantage from assembled simple machines. U1, U2, U3 • S4 – Compare and contrast kinetic and potential energy. U4, U5 • S5 – Predict the relative kinetic energy based on the mass and speed of the object. U5 • S6 – Recognize and demonstrate safety rules for using lab tools and machines. U6 • S7 – Build, test, and evaluate a model of a design problem. U6 • S8 – Analyze a product through testing methods and make modifications to the product. U6

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Evidence *(stage 2)*		
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning
A.3.1 Simple Machines Video	• Essential Questions	• Conclusion Questions
A.3.2 Simple Machines Scavenger Hunt	• Essential Questions	• Conclusion Questions
A.3.3 Simple Machines Exploration	• Essential Questions	• Conclusion Questions
A.3.4 Energy	• Essential Questions	• Conclusion Questions
P.3.5 Roller Coaster Mania	• Essential Questions	• Conclusion Questions • Roller Coaster Design Brief
A.3.6 Systems and Subsystems	• Essential Questions	• Conclusion Questions
P.3.7 Product Creation	• Essential Questions • Green Car Grading Rubric • Dragster Grading Rubric	• Conclusion Questions • Green Car Grading Rubric • Dragster Grading Rubric

Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems(B)	Knowledge and Skills
A.3.1 Simple Machines Video	K1, K2, S1
A.3.2 Simple Machines Scavenger Hunt	K1, K2, S1
A.3.3 Simple Machines Exploration	K1, K2, S1, S2, S3
A.3.4 Energy	S4
P.3.5 Roller Coaster Mania	S4, S5
A.3.6 Systems and Subsystems	
P.3.7 Product Creation	S6, S7, S8

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