



$$E=mc^2$$



STEM and the Next Generation Framework



In the K–12 context, “science” is generally taken to mean the traditional natural sciences: physics, chemistry, biology, and (more recently) Earth, space, and environmental sciences. . . . We use the term “engineering” in a very broad sense to mean any engagement in a systematic practice of design to achieve solutions to particular human problems. Likewise, we broadly use the term “technology” to include all types of human-made systems and processes—not in the limited sense often used in schools that equates technology with modern computational and communications devices. Technologies result when engineers apply their understanding of the natural world and of human behavior to design ways to satisfy human needs and wants. (NRC 2011, pp. 1–3, 4)

Cary Sneider, “Core Ideas of Engineering and Technology”, Jan. 2012.

The Framework

Three Dimensions

- Scientific & Engineering Practices
- Cross Cutting Concepts
- Core Ideas in Four Disciplinary Areas

Scientific & Engineering Practices

Terminology we currently use -

“Inquiry”

Terminology in Framework –

“PRACTICES”

“Scientists and engineers use evidence-based argumentation”

Concept Storyline: Sound

Unifying Concept	Unit Concept	Grade-Level Concept
Sound is generated by a kinetic disturbance.	Sound varies in frequency (pitch) and loudness (volume).	Sound is produced by vibrations that move through objects and the air. Pitch and volume are important properties of sound.

Subconcept 1

Sound is a form of kinetic energy that may be generated by a variety of means. Sound travels as kinetic waves through different media.

Lesson 1: Pre-Unit Assessment: Thinking about Sound

Students discuss sound and explore tuning forks.

Lesson 2: How Sound Travels

Students investigate how sound produced by a tuning fork travels through different media.

Subconcept 2

The pitch of sound varies with the frequency of vibration of the generating mechanism.

Lesson 3: Making Sounds with Nails

Students investigate the difference between pitch and volume.

Lesson 4: Making Sounds with Rulers

Students investigate length as a variable that affects pitch.

Lesson 5: Exploring Pitch

Students continue to explore the relation of the frequency of vibrations and pitch.

Lesson 6: Vibrations We Can't See

Using a slide whistle, students investigate the sounds generated by a column of vibrating air.

Lesson 7: Designing a Reed Instrument

Students use a vibrating reed to examine the characteristics of pitch.

Lesson 9: Making Sounds with String

Students examine how a vibrating string makes sound and how the length of a vibrating string affects pitch.

Lesson 10: Changing Pitch by Changing Tension

Students study how the tightness of a vibrating string affects pitch.

Lesson 11: Tuning a Stringed Instrument

Students experiment with varying the length and tension of strings on a harp.

Lesson 12: How Do Different Strings Sound?

Students discover how the thickness of strings affects pitch.

Subconcept 3

The volume, or loudness, of sound is dependent on the amplitude of the vibration.

Lesson 13: Making Louder Sounds from Strings

Students examine how to vary the volume of the sound.

Subconcept 4

Humans can both hear and produce sound.

Lesson 8: Making a Model Eardrum

Students discuss vibrations of the human eardrum.

Lesson 14: Making Sounds with Air and Strings: The Human Vocal Cords

Students use rubber bands to model the sounds produced by humans.

Subconcept 5

Sound may be generated by a variety of types of instruments.

Lesson 15: What Have We Learned about Sound?


Students plan how to design a musical instrument.

Lesson 16: Sharing What We Have Learned

Students complete their instrument design, test and improve it, and present their results to the class.

Lesson 17: Post-Unit Assessment: Sharing What We Have Learned about Sound

Students discuss and reflect on what they have learned.



Describe a whistle you have seen or used.

How do you think a whistle produces sounds?

What would you need to make a whistle?

What might you do to change the pitch of the sound that a whistle makes?

Name _____

Date _____

Whistle Sounds

Recording Our Observations	
Pitch of the Whistle	Length of Air Column
Highest	
High, but not highest	
Low, but not lowest	
Lowest	

Graphing Our Observations										
Pitch of the Whistle	Length of Air Column									
Highest										
High, but not highest										
Low, but not lowest										
Lowest										

3 4 5 6 7 8 9 10 11 12

(cm)

Informational Text

Research from Shanahan, Stahl & Heubach, and Chall & Colleagues all support the Common Core in encouraging us to teach reading with much more complex texts (those previously considered to be at a child's frustration level).

Neil Duke has written a lot about the importance of including informative texts in the classroom. Vacca & Vacca speak on the topic of vocabulary and three kinds (**general, specialized and technical**). Technical words are those specific to a topic, like in science, so children don't have a lot of exposure to them anywhere else and it makes the text more complex.

Common Core

***I identified “big ideas” in text and found the “supporting details”.**

**** I compared two different accounts of the same event.**

Expository Writing

Gather Information:

- I gathered information from experience, print, and digital resources.**
- I summarized notes from multiple resources.**
- I provided basic bibliographic information.**

Expect More, Anne Reichel

Lesson 7

Engineering your own reed instrument.

Note: You and your students may have to practice before you succeed in making a sound with the straw reed. You may find it helpful to flatten the reed by pulling it between your thumbnail and forefinger before blowing through it (see the Student Instructions). Then, to play the straw reed instrument, try closing your lips around the straw, pressing gently on the “reed” (the cut end), partially closing it as you blow. You might also try slightly squeezing the straw with your fingers just in front of your lips as you blow. Take rests between breaths and blow gently to avoid becoming light-headed. You will find that you do not have to blow very hard to make a sound.

Common Core Reading Informational Text

**I identified the author’s “claim”
and the “evidence” the author
used to support the claim.**

**I used the “evidence” I found in
informational text to support or
argue my “claim”.**

Common Core

Persuasive Writing

- I stated a “claim” and supported my “claim” with “evidence”.
- I created an organized way of sharing my “claim” and “evidence” with my reader.
- I provided “evidence” from my data, conversations with other scientists, and my research.
- I linked my ideas together with words. (e.g. *consequently, generally, specifically*)
- I kept my reader interested and used persuasive language in my writing.
- I organized my thinking in a concluding sentence that restates my main idea.



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