

**Please Note: These minutes are pending Board approval.**  
**Board of Education**  
**Newtown, Connecticut**

Minutes of the Board of Education meeting held on May 2, 2023, at 6:30 p.m. in the Council Chambers, 3 Primrose Street.

D. Zukowski, Chair	C. Melillo
J. Vouros, Vice Chair	A. Uberti
D. Ramsey, Secretary	T. Vadas (absent)
D. Cruson	12 Staff
J. Kuzma	70 Public
J. Larkin	1 Press
A. Plante	
K. Kunzweiler (absent)	
D. Godino (absent)	

MOTION: Mrs. Plante moved that the Board of Education go into executive session to discuss a personnel matter and invite Mr. Melillo. Mr. Ramsey seconded. Motion passes unanimously.

Item 1 – Executive Session

The Board went into executive session at 6:32 p.m. and discussed the personnel matter.

Ms. Zukowski called the meeting to order at 7:05 p.m.

MOTION: Mrs. Plante moved to add the discussion and possible action on a full year English/Language/Arts program for grades 6 through 8. Mr. Cruson seconded. Motion passes unanimously.

Item 2 – Pledge of Allegiance

Item 3 – Action on Executive Session Item

MOTION: Mrs. Plante moved that the Board of Education support, as recommended by the Superintendent, Kymberly Noone's request pertaining to Article 31.2 of the teacher contract. Mrs. Kuzma seconded. Motion passes unanimously.

Item 4 – Consent Agenda

MOTION: Mrs. Plante moved that the Board of Education approve the consent agenda which includes the donation to Newtown High School. Mrs. Larkin seconded. Motion passes unanimously.

Item 5 – Public Participation

Please click [here](#) to view the public participation.

Joseph Crosby spoke about book challenges.

Sarah Beyers, 7 Yogananda Street, Library Media Clerk at Reed Intermediate School, spoke about book challenges.

Michelle Buzzi, 38 Obtuse Road, spoke about book challenges.

Dan Rosen, 62 Pine Tree Hill Road, spoke about book challenges.

Katherine Lye spoke about book challenges.

Beatrice Cardamore spoke about book challenges.

Terry Scinto, 37 High Rock Road, spoke about book challenges.

Cynthia Gaffney, 15 Ridge Road, spoke about book challenges.

Elenda Calderbank, 8 Forest View Drive, spoke about book challenges.

Abbey Chinault, 32 Ridge Road, spoke about book challenges.

Matt Bracksieck, 68 Walnut Tree Hill Road, spoke about book challenges.

Kristin English, NHS English teacher, spoke about book challenges.

Wendy LaBarge, NHS English teacher, spoke about book challenges  
Timothy Stan, 6 Monitor Hill Road, spoke about book challenges.  
Barbara Woycik, 25 Horseshoe Ridge Road, spoke about book challenges.  
Beth Murphy, Head 'Meadow School Library Media Specialist, spoke about book challenges.  
Suzanne Hurley, Middle Gate School Library Media Specialist, spoke about book challenges  
Sarah Wasley, Reed Intermediate School LibraryMedia Specialist, spoke about challenges.  
Kathy Swift, NHS English teacher, spoke about book challenges.  
Christine Wilford, 30 Georges Hill Road, talked about book challenges.  
Jacqui Kaplan, 34 Osborne Hill Road, spoke about book challenges.  
Edie Kaplan spoke about book challenges.  
Rachel Heggland, 26 Shepherd Hill Road, spoke about book challenges.  
Andrew SanAngelo, middle school Library Media Specialist, spoke about book challenges.  
Lahja Kurjiaka, 10 Checkerberry Lane, spoke about book challenges.  
Brian Tenney NHS English teacher, spoke about book challenges.  
Trent Harrison, 59 Platts Hill Road, cited the CABA Code of Ethics, the Board should follow.  
Matthew Cavalaro 18 Birch Rise Drive, spoke about book challenges  
Kate McGrady, 26 Philo Curtis Road, spoke about book challenges and her daughter speaking at the last meeting.

#### Item 6 – Presentations

##### Reading Program:

Mrs. Uberti spoke about looking at programs for grades 5 through 8 and chose Imagine Learning EL Education Reading Program for grade 5.

MOTION: Mrs. Plante moved that the Board of Education approve the Imagine Learning EL Education Reading Program for Grade 5 for the 2023-2024 school year. Mr. Ramsey seconded. Motion passes unanimously.

MOTION: Mrs. Plante moved that the Board of Education approve the full year pilot English/Language/Arts program for grades 6 through 8. Mr. Cruson seconded. Motion passes unanimously.

Mrs. Uberti said they chose two programs Imagine Learning EL Education Reading Program and Into Reading for next year and will do an evaluation during the year. The pilot is little to no charge and the grade 5 program will be paid from funds in this school year.  
Motion passes unanimously.

##### Presentation of Special Review Committee Report about Challenged Books and Superintendent Recommendation:

Mrs. Uberti reported that this committee was convened to be in compliance with Board Policy 8-302 which provides guidance for selection of library materials and procedures for book challenges. The committee reviewed *Flamer* and *Blankets* and shared their opinions as to whether the two materials in question should remain part of the collection of the Newtown High School Library. Regarding the book *Flamer*, the committee's unanimous opinion was that the book is positive and despite language and images that some may find offensive, the book promotes empathy, acceptance, understanding, and resilience and should remain in circulation in the Newtown High School Library. Regarding the book *Blankets*, it was the committee's unanimous opinion that while this book contains language and images that may be offensive to some, it is an artistic work that tells the worthwhile story of a young man coming to terms with his family struggles and transcending them and should remain in circulation in the Newtown

High School Library. Mrs. Uberti respectfully submitted this report on behalf of the review committee.

Mrs. Uberti read her personal statement regarding the community's concerns about books besides *Flamer* and *Blankets* and she sincerely appreciated the parent's involvement as their opinions matter. We will work with our library media specialists to listen with an open mind and work together for a resolution. This comes down to library media specialist judgements and they take their responsibilities very seriously. There are three more books being objected to at Newtown High School. She met with the library media specialists on how to address both sides and hopes to come together to put an end to this controversy and find common ground.

Mr. Melillo read his statement and thanked our teachers, especially our library media specialists, and administrators for their efforts, time and commitment to our community. He also thanked the families and community members for providing civil discourse and input in this process. Thanks as well to the Board of Education members for their service towards helping students thrive and fulfill their greatest potential. He initially questioned the appropriateness of these books but changed his mind after reading them. His recommendation to the Board of Education is to uphold the special committee's recommendation to keep the books in the media center.

Ms. Zukowski noted that the Board will not have enough time to fully deliberate the matter tonight so action will be taken at the next meeting. Members of the Special Review Committee were asked to reconsider the shelving of the challenged books and whether they should be allowed to remain in the library as before or should be removed. She thanked Mrs. Uberti, NHS Principal, Dr. Longobucco, NHS Library Media Specialist, Ms. Zandonella, and NHS teachers Mr. Foss and Mrs. Marks for this difficult assignment, and Mr. Melillo for his recommendation and comments.

MOTION: Mrs. Plante moved to amend the agenda to include a vote on the Citizen's Request for Reconsideration of Library Media Materials as required by Policy 8-302. Mr. Cruson seconded.

Mrs. Plante read the *Bee* article and the committee report and feels comfortable to vote tonight.

Mrs. Larkin would not support that motion. Voting tonight was not consistent with the Board as we always vote twice on policies and curriculum. We should be able to hear the second public participation also. For a decision this size we need to take time to review the report.

Mr. Cruson was comfortable voting tonight to put this behind us as a Board and community. He feels strongly we will be able to move on this and get back to the work of the district.

Mrs. Kuzma agreed with Mrs. Larkin for a lot of her reasons. She has some questions and needs time to process the comments as well as hearing the second public participation.

Mr. Ramsey said the review committee did their best in the confines of the policy. Because of that, there is more to be heard from the public. He wants to review Mr. Melillo's report more. It's prudent to delay the vote until the next meeting.

Mr. Vouros agreed with Mrs. Plante and Mr. Cruson.

Ms. Zukowski said the policy doesn't specify when the Board has to act on the committee report. Also, policies and curriculum go to the Board twice before approval and feels she cannot support the motion.

Vote: 3 ayes, 4 nays (Ms. Zukowski, Mr. Ramsey, Mrs. Kuzma, Mrs. Larkin) Motion fails.

Ms. Zukowski spoke about the challenge forms and that pornography and sexually inappropriate content were the reasons the books were challenged. Regarding the book *Flamer*, she agreed with the committee that some students might benefit from reading about the issues in the book but was concerned about the graphic representations that might be seen by younger students. What age is appropriate for this material and how do we respect the differing perspectives families may have about the sexual content.

Mr. Ramsey read both books and in *Flamer* he was concerned about students seeing pictures out of context which could make a major impact on a student.

Mrs. Kuzma said that regarding the book *Flamer* it was hard to ignore the sexually explicit images and words. She questioned what was age appropriate but did see the value in the story.

Mr. Cruson has read case studies and would like to not read his comments tonight for additional editing.

Mrs. Larkin also read the books. She believe the book can potentially save a life but other material has inappropriate images and vulgarity.

Mrs. Plante read the books. She appreciates the teachers and library media specialists for coming to the meeting. She disagrees with the decision to not go forward tonight. We have to uphold the First Amendment.

Mr. Vouros reserved his comments for the next meeting.

Ms. Zukowski said that regarding the book *Blankets*, she agrees that some students may benefit reading the issues in this book but for some students the graphic representations are not educationally suitable.

Mr. Ramsey said there were complex themes in *Blankets* dealing with religion and aspects of coming of age and first love which are challenging topics but it does have literary value.

Mrs. Kuzma said *Blankets* has some literary value but the one objector was sexually explicit images, vulgarities and body parts on numerous pages.

Mr. Cruson will hold his statement until the next meeting.

Mrs. Larkin said her objection in *Blankets* are the sexually explicit images.

Mrs. Plante said, as with most things in life, this is not a black and white decision. Does the value of these outweigh the risks that some parents see? Our role is to ensure the policy is followed.

Mr. Vouros will hold his comments until the next meeting.

Mrs. Kuzma asked Mrs. Uberti if she believed that removing a book from the library shelf is in violation of the first amendment rights.



Mrs. Uberti spoke to our attorney and any time you wade into any type of restriction you never know how the court is going to decide on first amendment rights. She referred to a case where a high school library was ordered to keep material defined as obscene because it was viewed as a violation of first amendment rights. There is also a case about a restriction piece with the book *Harry Potter* and the school put the book on a separate shelf. The parents had to send a note to allow their child to read it. The parent sued because she felt it was stigmatizing to her daughter and the court found in her favor. She cautioned that schools could be viewed as government controlled so when we make decisions about what students can read we are venturing into troubled waters when it comes to First Amendment rights.

Mrs. Kuzma asked where in the First Amendment does it say the administration can remove books but the Board of Education cannot.

Mrs. Uberti said it was in two places. Library media specialists are designated to purchase books for the libraries. They also review books and make the decision to remove it. They are trained to make those decisions.

Mrs. Larkin said there was a recent case that dealt with these books that a school has the right to keep vulgar material away from students. The Board has to have information on the first amendment. The Board can benefit from the same legal guidance Mrs. Uberti and Mr. Melillo had and should have access to that information. She is in support of the First Amendment rights and would never want to do something to compromise one of them.

Mrs. Uberti stated that the Board Chair has access to the information from our attorney. Ms. Zukowski stated that she had that information and would share it with the Board as well as other court cases and will talk directly to our counsel.

Mr. Cruson noted that we had an executive session with our attorney and she provided us with a document Mr. Melillo has and it was available for us to review.

Mrs. Uberti said her only communication with our attorney was to see if she could share her report with the Board but she advised her not to share the report with the Board as it was not her read on the policy.

Mr. Ramsey said the librarians can't possibly read every book they order so they may have to depend on reviews of the books.

Mrs. Uberti said our policy can be improved. There is additional guidance if you go to the American Library Association website with a section on additional guidance. The library media specialists follow the suggested criteria on that website. As a result of this they have been going through their collection and making sure they are age appropriate according to reputable reading resources.

Mr. Ramsey said it upsets him to see communications depicting librarians as something other than the most dedicated wonderful people doing the best they can and we are very fortunate to have gifted people. The term book banning has been exaggerated a bit. Book banning is when a BOE might create a list of books to bring into the library. In this case, if a book is brought up to a challenge and the librarian and principal decide to remove the book they would not be book banners.

Mrs. Uberti said they would not because it's their job to decide. She also feels the people challenging the book should be on the review committee. She understands the trouble with the word ban but we currently have ten other challenges.

Mr. Ramsey said the word banned has been used to impugn the Board of Education. If we decide these books are not appropriate, we are not banners. We are reacting to challenges that came to us.

Mr. Cruson disagreed on making a list of books we don't want in our schools. As a legislative body and we make a list, it would be banning them.

Ms. Zukowski asked Mrs. Uberti for the next meeting to see how much of a cache of books there are to support our LGBTQ students who are going through issues that would be more suitable for students. She also wants to know what books that have sexual content are appropriate for students ages 8 through 13.

Mrs. Plante said age appropriate is a great question but none of us are experts. Our policy states the freedom to read. It's a professional judgement.

Mrs. Larkin agreed and said removing a book means we will make a reconsideration. She said another book was removed which had similar content and asked what brought the decision to remove that book over these two books. What are the guiding principles if we have sexual content in a book and what is age appropriate?

Mrs. Uberti said the standard comes from the lists she mentioned in her report. It comes down to judgement. People in the school know where the students are regarding reading the books. There have been multiple books that have been reviewed by library media specialists and they are making judgements when to remove or replace.

In closing, Ms. Zukowski encouraged our library media specialists to continue supporting our students by including a broad range of age appropriate books to help better deal with difficult situations and topics they may be experiencing in their lives. She thanked the members of the Special Review Committee and everyone who provided their concerns to the Board.

#### Item 7 – Old Business

MOTION: Mrs. Plante moved that the Board of Education approve the Integrated Physical and Earth Science Curriculum. Mrs. Larkin seconded. Motion passes unanimously.

#### Item 8 – New Business

Minutes of April 18, 2023:

MOTION: Mrs. Plante moved that the Board of Education approve the minutes of April 18, 2023. Mr. Ramsey seconded.

MOTION: Ms. Zukowski moved to amend the motion to replace the date March 21, 2023 with April 4, 2023 in Item 8. Mrs. Kuzma seconded.

Amendment passes unanimously.

Main motion passes unanimously.

Minute of April 24, 2023:

MOTION: Mrs. Plante moved that the Board of Education approve the minutes of April 24, 2023. Mr. Ramsey seconded. Motion passes unanimously.

Item 9 – Public Participation

Kara Dogali, 2 Monitor Hill Road, spoke about behavior in a Middle Gate classroom.

Christine Tisi, 1 Megans Circle, spoke about behavior in a Middle Gate classroom.

Jessica Milakso, 23 Brushy Hill Road, spoke about book challenge.

Jeanette McCambely, 35 Hosey Coach Road, spoke about behavior in a Middle Gate classroom.

Motion: Mr. Vouros moved to adjourn. Mr. Cruson seconded. Motion passes unanimously.

Item 10 – Adjournment

The meeting adjourned at 10:36 p.m.

Respectfully submitted:

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Donald Ramsey  
Secretary

April 18, 2023

TO: Chris Melillo

FROM: Kimberly Longobucco

Please accept the donation of \$500 from the Newtown Lions Club Foundation to our Best Buddies Program. This is a very generous donation that will be very useful to our students.

Thank you.

A handwritten signature in blue ink, appearing to be 'K. Longobucco', written in a cursive style.

*Newtown Lions Club Foundation LLC  
PO Box 218  
Newtown, CT 06470*

## Report on the Special Review Committee's Opinions Regarding *Flamer* and *Blankets*

On April 20, 2023, a Special Review Committee was convened. Members of the committee included me, Anne Uberti, Assistant Superintendent of Curriculum and Instruction, Dr. Longobucco, Newtown High School Principal, Liza Zandonella, Newtown High School Library Media Specialist, Abi Marks, Newtown High School English Department Chair, and Dave Foss, Social Studies Teacher at Newtown High School.

The Special Review Committee was convened in compliance with Newtown Board of Education Policy 8-302, which provides guidance for selection of library materials and procedures for book challenges. The charge of the committee was to review two books, *Flamer* and *Blankets*, and share their opinions on whether the two materials in question should remain part of the collection of Newtown High School Library.

I would like to review for the Board's consideration, the events that led to the creation of the Special Review Committee.

On March 21<sup>st</sup>, an email was forwarded to me from the Board of Education in which a citizen shared concerns about the perceived graphic content of *Flamer*, which was part of the collection at both Newtown Middle and High School libraries.

On March 22<sup>nd</sup>, in compliance with the process outlined in Policy 8-302, I reached out to the principals at each school and asked that they set up a meeting with their library media specialists to review *Flamer*.

On Friday, March 23<sup>rd</sup>, I was notified that the Newtown Middle School Library Media Specialist and Principal made the decision to remove the book from circulation based on age appropriateness of the content since most book review organizations list the age for this book as 14+. Late in the day on Friday, March 23<sup>rd</sup>, Dr. Longobucco notified me that the book had been discussed but she had not yet read it and a decision had not been reached. She also notified me that the book was currently out of circulation since she had checked it out in order to read it herself.

On Saturday, March 25<sup>th</sup>, Mr. Melillo responded in error to the objector stating that *Flamer* had been removed from both schools; however, in fact that process had only been completed at Newtown Middle School.

On Monday, March 27<sup>th</sup>, I was notified that the Newtown High School Library Media Specialist and Principal had not reached consensus regarding removal of *Flamer* and I then requested the library media specialist draft the rationale for keeping the book no later than the end of the next day, Tuesday, so that I could provide it to the objector.

On Tuesday, March 28<sup>th</sup>, prior to my receiving the rationale from the high school, the original objector filed a formal Citizen's Request for Reconsideration for the book *Flamer*. I subsequently received eight others. This moved the challenge to a new phase of the process, one that calls for the formation of a special review committee.

On Thursday, March 30th, I was made aware that a Citizen's Request was received by the high school principal for the book *Blankets* which moved *Blankets* from a building discussion to a review by the special review committee.

Policy 8-302 requires that all objectors be notified within one week of the form filing the date on which the committee findings will be reported to the Board of Education. Which brings us to where we are tonight. I have compiled a summary report of the findings of the committee. Following my report, Superintendent Melillo will make his recommendation for the Board's consideration. Once the Board takes action, I will notify all objectors of the decision.

I will now share the opinions of the members of the Special Review Committee.

The committee first reviewed the Citizen's Requests for Reconsideration for *Flamer* which cited pornographic images and sexually inappropriate materials as objectionable. One objector cited a line from the book in which some characters encourage another to drink bodily fluids derived from masturbation. One objector stated that the result of exposure to this book will be sexualizing minors and providing pornography to minors. Eight objectors cite the result of exposure to this book might be poor coping skills, emotional disturbance, poor boundaries and sexual misdemeanors. All objectors believe the theme of the book is pornography and sexually explicit. All objectors request that the book be removed from the school library. All objectors stated that they have read the entire work and no one provided a suggested replacement.

Ms. Zandonella then provided the rationale for maintaining *Flamer* in circulation to begin with, which I will summarize.:

There is currently one copy of *Flamer* at Newtown High School. It was purchased in August 2022, in support of the District's initiative to increase the diversity of books in our libraries in order to be more representative of the world in which we live and in accordance with Board of Education policy.

*Flamer* has never been checked out by a student at Newtown High School.

*Flamer* is a semi-autobiographical story in which the main character is a 14-year old boy that comes to terms with the realization that he may be gay. He experiences relentless bullying and considers taking his own life. The overall message of the book is a powerful one, not only for LGBTQ+ youth, but for all students.

*Flamer* has won numerous professional awards and was featured as a suggested book on the Connecticut Governor's Summer Reading Challenge for 2022 for students in grades 9-12. In addition, it was one of the top 10 high school finalists for this year's Nutmeg Awards. The CT Nutmeg Book Award is jointly sponsored by the Connecticut Library Association and the Connecticut Association of School Librarians.

A search of the towns in proximity to Newtown geographically, as well as towns that are in Newtown's DRG, revealed 19 other high schools that have *Flamer* in their collections.

In reviewing the Citizen's Request for Reconsideration, one objector did not fill out the form and the other seven objectors submitted the same form only changing their personal information and signature. This raised concerns that some of the objectors may not have read the entire book although they indicated

- *Flamer* would not be considered legally obscene according to the Miller Test since it does not, when taken as a whole, appeal to the prurient interest, nor does it lack serious literary, artistic, political, or scientific value.
- *Flamer* has received wide critical acclaim from a number of prestigious literary organizations, including Kirkus, Booklist, School Library Journal, Horn Book and Publisher's Weekly. In addition, it has received numerous awards including, the 2021 Lambda Literary Award for LGBTQ Young Adults, Best Graphic Novel of 2020 by School Library Journal, and Best YA Graphic Novel of 2020 by Kirkus Reviews.
- While the content of the book may make some feel uncomfortable, many students and families have had conversations, and/or experiences with many of the themes of the book.

In conclusion, the committee's unanimous opinion is that the overarching theme of the book is positive, and that despite language and images that some may find offensive, taken in whole, *Flamer* promotes empathy, acceptance, understanding, and resiliency and should remain in circulation in the Newtown High School library.

The committee then moved onto a discussion regarding *Blankets*. As stated earlier, there was no request to review this book at the building level. A formal Request for Reconsideration was received on March 30th and so it was also reviewed by the Special Review Committee on April 20th. The objection cited is that the work is sexually graphic. The objector feels that the result of exposure is that it exposes minors to graphic material and is requesting that the book be removed from our schools. The objector stated that they did not read the entire book.

Again, the committee used the questions from Citizen's Request for Reconsideration to guide the discussion.

A summary of the opinions of the committee members are as follows:

- This is an autobiographical, coming of age, graphic novel in which the author tells his story of growing up in an Evangelical Christian family, experiencing his first love and his quest to find his place in young adulthood.
- *Blankets* is categorized as Young Adult (YA) which is considered age 12 to 18.
- The book references the serious but important topics of sexual, emotional and physical abuse of children but they are not explicitly depicted in the illustrations.
- While there are illustrations of breasts, they are not sexualized. Rather the illustrations are tasteful and were compared to the nudity of statues in a museum.
- One of the two illustrations of male genitalia is a scene in which the brothers, who as young children shared a bed, get silly and begin urinating on each other. This scene depicts childish behavior, not pornography. The other is when the main character is reflecting on abuse suffered as a child, also not pornography.

on the forms they had. Given that the book is essentially a coming of age book for gay youth, there were concerns about what the objectors stated that the result of exposure to this book might be: poor coping skills, emotional disturbance, poor boundaries and sexual misdemeanors and that removing a book based on those reasons would send a very negative message to gay students.

It was for these reasons that the decision was made to maintain the book in the collection after the original objection.

The committee then used the questions from the Citizen's Request for Reconsideration to guide their discussion.

A summary of the opinions of the committee members regarding *Flamer* is as follows:

- Excerpts and images taken out of context from the book are not representative of the book's overall message and, in fact, distort the message when viewed or read in isolation.
- Many of the excerpts and illustrations are not describing actual sexual acts, but rather are representative of the character's inner thoughts, forms of bullying or intended to be funny for someone of this age.
- Given that the recommended age for this book is 14+, it is age appropriate for high school students.
- It is critical that students read books that relate to what is going on in their lives or in the lives of their peers. The story line deals with sensitive subject matter in an age-appropriate and engaging way and is supportive of students who may share the types of struggles portrayed in the book.
- The book is not part of the curriculum but rather part of a comprehensive high school library collection that houses over 18,000 print, digital and audio materials and students have choice over which books they read.
- Contrary to the concerns that the book will result in poor coping skills or emotional disturbance, the character demonstrates incredible resiliency and *strong* coping skills and that the strength exhibited by this character could potentially save the life of another experiencing similar hardships.
- *Flamer* tells a story that is representative of the experiences of many students and there is a need for the library to have books that are representative of a diverse student body.
- Graphic novels, which combine text and illustrations, have soared in popularity and often provide a format that supports readers of all abilities.
- As part of the Newtown Public Schools' comprehensive health curriculum, students learn about sexuality and sexual reproduction, which more than prepares high school students to see the images and read the language contained in *Flamer*.
- Although objectors cited the book *Flamer* contains pornography, the only scene that shows any type of nudity is the shower scene and only men's torsos are shown



- This book was first published in 2003 and has been in circulation at Newtown High School since 2013. The book has only been checked out twice, most recently in 2015.
- The removal of books from the library is a serious matter and they should not be removed based on selected words, phrases and illustrations that are taken out of context. Since this objector has not read the entire work, then it is not possible for them to have considered the value of the work in its entirety.
- Although the main character faces many challenges, he is thoughtful, sensitive and reflective in both his choices and actions, even in the end when he chooses to maintain a relationship with his family as an adult, despite the family's flaws.
- There are several themes in *Blankets*, including family dysfunction, but it is not about sex.
- *Blankets* has received wide critical acclaim and was named among the best books of 2003 by Library Journal, Young Adult Library Services Association (YALSA), Booklist, & Time. It has also won numerous national and international awards for its artistic value.

Some of the reasons cited for support of *Flamer*, were also expressed for *Blankets*, which are included in my report but in the interest of time, I will not read aloud.

- The book is not part of the curriculum but rather part of a comprehensive high school library collection that houses over 18,000 print, digital and audio materials and students have choice over which books they choose to read.
- As part of the Newtown Public Schools' comprehensive health curriculum, students learn about sexuality and sexual reproduction, which more than prepares high school students to see the images and read the language contained in *Blankets*.
- *Blankets* would not be considered legally obscene according to the Miller Test since it does not, when taken as a whole, appeal to the prurient interest, nor does it lack serious literary, artistic, political, or scientific value.
- While the content of the book may make some feel uncomfortable, many students and families have had conversations, and/or experiences with many of the themes of the book.

In conclusion, the committee's unanimous opinion is that while *Blankets* contains language and images that may be offensive to some, taken in whole, *Blankets* is an artistic work that tells the worthwhile story of a young man coming to terms with his family struggles and transcending them and should remain in circulation in the Newtown High School library.

I respectfully submit this report on behalf of the members of the Special Review Committee.

Anne Uberti,

Assistant Superintendent of Curriculum and Instruction

## Superintendent's Recommendation

First, I would like to thank our teachers, especially our media specialists and our administrators for their efforts, their time and their commitment to our community. I'd like to thank the families and community members for providing civil discourse and input in the process. I'd also like to thank the Board of Education members for their service towards helping students thrive and fulfill their greatest potential. I want to remind everyone that people are passionate on all sides of this. As such, some of our most heated negotiations and disputes involve conflict over our core values, such as our personal moral standards, our religious and political beliefs, and our family's welfare. Let's maintain decorum and be respectful of everyone's opinion.

Originally, when I was made aware of these books I made the mistake to also review the pictures and text out of context, I too questioned the appropriateness of the material. Then after reading the novels and evaluating it holistically, I've totally changed my mind. But also understand that there are families who may object to how the important messages in these books are delivered.

"In loco parentis" is a form of common law that refers to the rights and responsibilities that certain organizations or individuals have with regard to minors under their care. This term is typically used in reference to schools with respect to how the teachers and staff should behave toward the students. The Latin term literally translates to, in place of a parent. As a parent myself, I almost have a visceral reaction to in loco parentis. I am responsible and perfectly capable in instilling morals and values to my own children.

With that in mind, there are times when materials and activities in our schools may and do conflict with a family's core values and beliefs, yet we allow for individual families to decide how to handle these situations at school.

For example:

- There are some in our community that choose not to participate in the Pledge of Allegiance or National Anthem because some believe that these conflict with Bible teachings. But we do start every school day with the Pledge of Allegiance and many sporting events with the National Anthem.
- Many of our students celebrate Ramadan. During the holy month of Ramadan, all Muslims are required to abstain from food and drink from dawn to dusk for 30 days. Yet, lunch is served everyday in our schools.
- Some parents believe that Halloween teaches children to celebrate evil spirits and embrace the devil, thus they do not participate. If you walk through many of our schools on Halloween, you would think otherwise as many of our students engage in activities in costume.

In these situations there is an expectation that these families rely on their values so that their children develop an inner sense of right and wrong so that they can think for themselves and do the right thing even when no one's looking. In other words when everyone is sitting, stand up! When everyone is standing, stand out! And when everyone is standing out, be the standard. Isn't that what we want for all of our children? To distinguish between right and wrong or good and bad while promoting rational thinking and unbiased judgment.

The discussion this evening revolves around removing books from our school library that may satisfy the interests of some at the expense of limiting access for all others. A broad brush approach to in loco parentis. Today the discussion is about books, tomorrow will it be something more? This is a slippery slope.

There is no rubric for family values; it is simply what each family thinks is important, and while most families agree on certain values such as peace, integrity, and compassion, there is a lot of room for variety. Understanding

there are over 4000 students enrolled in Newtown Public Schools, it would be impossible to find a consensus around common values. The discussions around these library materials are evidence of that. The District cannot possibly unilaterally satisfy every family's wants and needs in regards to moral standards, religious and political beliefs. I quote Ben Franklin "If all printers were determined not to print anything till they were sure it would offend nobody, there would be very little printed." Therefore, it is my recommendation to the Board of Education to uphold the special committee's recommendation to keep the books in the media center.

**Board of Education  
Newtown, Connecticut**

Minutes of the Board of Education meeting held on April 18, 2023, at 6:30 p.m. in the Council Chambers, 3 Primrose Street.

D. Zukowski, Chair	C. Melillo
J. Vouros, Vice Chair	A. Uberti
D. Ramsey, Secretary	T. Vadas
D. Cruson	4 Staff
J. Kuzma	14 Public
J. Larkin	1 Press
A. Plante	
K. Kunzweiler (excused)	
D. Godino (excused)	

Ms. Zukowski called the meeting to order at 7:37 p.m.

Item 1 – Executive Session

MOTION: Mrs. Larkin moved that the Board of Education go into executive session to discuss confidential attorney/client privileged material in regards to Board policy and invite Mr. Melillo and Attorney Dori Antonetti. Mrs. Kuzma seconded. Motion passes unanimously.

Item 2 – Pledge of Allegiance

Item 3 – Consent Agenda

MOTION: Mrs. Larkin moved that the Board of Education approve the consent agenda which includes the donation to Newtown High School and the correspondence report. Mrs. Kuzma seconded. Motion passes unanimously.

Item 4 – Public Participation

Item 5 – Reports

Chair Report: Ms. Zukowski reported that the book challenge process outlined in Policy 8-302 will be discussed by the Special Review Committee this Thursday, April 20 at 10:30 a.m. The committee is presenting their report to the Board at the May 2 meeting to be considered by the members.

Superintendent's Report: Mr. Melillo stated he would participate in the Lacrosse golf tournament this Sunday. We had our final meeting with the Legislative Council regarding our budget adjustments and expressed pride in his team for developing this budget. It was reduced by \$450,000 and we will work to allocate a budget that is in the best interest of our students. He looks forward to the community support.

Committee reports:

Mrs. Larkin reported on the CFF Committee meeting last night. The Director of Facilities interview phase is complete and expects to move to an offer this week. Our new Hawley project manager also provided an update. Regarding transportation we are looking good with drivers and will have spare drivers starting also. The Transportation Committee is still talking about contingency plans if needed.

Student Reports:

Dr. Longobucco read the students' report which noted that AP testing begins in two weeks and spring sports are in full spring with baseball, lacrosse, softball and tennis seeing great success in early competition. The annual "Senior Assassins" game is underway with students scheming

to win the cash prize. This past week was filled with college commitments as seniors finalize their decisions.

**Financial Report:**

MOTION: Mrs. Larkin Moved that the Board of Education approve the financial report and transfers for the month ending March 31, 2023. Mrs. Plante seconded.

Mrs. Vadas presented the financial report.

Motion passes unanimously.

**Grants and Funding Updates:**

Judy DeStefano joined Mrs. Vadas and gave an overview on grants.

Mr. Ramsey asked how many grants from the level of a teacher or staff member are used for innovative programs.

Mrs. DeStefano reported that she has received calls from the teachers and makes a note of what they are looking for to meet their needs.

Mr. Ramsey referred to the Perkins Grant and asked if that was for staff for innovative programs and equipment.

Mrs. DeStefano said teachers need to have certain certifications to be eligible for the classroom grants and part of it has to pay for professional development and travel if necessary.

Ms. Zukowski asked which competitive grants imply funding from the budget. She also asked about the art request from the borough and the amount.

Mrs. DeStefano said her initial request changed to \$40,000. She was hoping to get funding from Novo up to \$80,000 but was not sure how it will work out. There are no other positions being created from grants. Some grants are just for new positions. The Teen Talk counselor we are hoping to move to a grant for next year and possibly the fourth year. The counselor is more of a crisis interventionist counselor. They also work in the classroom with teachers and students struggling to attend school.

Item 6 – Presentations

**Integrated Physical and Earth Science Presentation:**

Fawn Georgina, the course teacher, and Chris Canfield, Department Chair, spoke about this curriculum.

Mrs. Plante inquired what grade level this course was offered to and was told it was for grade nine students but we also get a few sophomores.

Mrs. Plante also asked the number of students taking this course and was told there were ten sections with between 240 and 250 students.

Ms. Zukowski asked if all ninth graders took this course.

Ms. Georgina said that some advanced students skip to biology.

Mr. Ramsey asked if they got involved in food sustainability and supply chains to which

Ms. Georgina stated that they got into waste management and food sustainability.

Mr. Ramsey also asked if they ever work with the culinary department.

Ms. Georgina stated they did and have tapped trees on campus for maple syrup and also planted fruit trees.

Item 7 – Old BusinessStrategic Plan Update:

Dr. Richard Lemons presented an overview of what the committee has accomplished so far and spoke about the various focus groups. He also spoke about the survey participants and questions. The four strategic priorities that emerged include #1 to ensure stimulating, engaging and challenging learning opportunities tailored to the individual needs of students, #2 prepare students life beyond graduation, #3 retain, develop and diversify faculty and staff, and #4 ensure organizational excellence.

Mr. Ramsey referred to Priority #2 as sees it as the real purpose we have schools. He asked that such things as what we do in life, curiosity, and self-actualization be made more tangible in the plan.

Dr. Lemons said those sentiments don't come up that much in the survey but have come up in the planning committee multiple times. This could also emerge in working on the profile of a graduate.

Mr. Cruson noted that in Priority #3 he didn't see anything about the diversification of learning materials.

Dr. Lemons said those who mentioned it wanted students to see other things besides the teachers.

Mrs. Plante asked that regarding the survey how would we improve on these things and felt it was exciting to see what comes next.

Dr. Lemons said this creates where the district is going. We want a clear articulation of how the schools use this during different parts of the year.

Mrs. Larkin didn't see all of the data fitting in here but saw things we should explore and things that were concerning, but had opportunities. When the time is right, we might put some of that on the back burner but revisit and consider the stakeholder input.

Mr. Melillo noted that we want to make sure we create something we can actually leverage. As a committee we are going to try to find the buckets we were talking about and use the data to be better. There's information around special education and how we run our schools and how we communicate.

Ms. Zukowski asked for clarification on the six different focus groups for middle and high school students.

Dr. Lemons said there were 8 to 12 in the student focus group, 5 to 8 educators in their group, and there were three parent focus groups with a few dozen participants. We had six meetings with designated schools.

Ms. Zukowski asked the makeup of the committee.

Mr. Melillo stated there were two Board members, six administrators, five teachers and a couple of paras and clerks, and there were no parents other than those who were staff members.

Mr. Lemons stated that by the end of June we will provide a strategic plan with priorities and the work needed, portrait of a graduate, core values, and what continuous improvement would be for the district. He also spoke about their discussions regarding the portrait of the graduate which many school districts are discussing. They have also have had conversations around the Newtown core values.

Policy 5114 Suspension and Expulsion/Due Process:

MOTION: Mrs. Larkin moved that the Board of Education approve the Policy 5114 Suspension and Expulsion/Due Process. Mrs. Plante seconded. Motion passes unanimously.

Chemistry (CPA Honors) Curriculum:

MOTION: Mrs. Larkin moved that the Board of Education approve the Chemistry (CPA Honors) Curriculum. Mrs. Plante seconded. Motion passes unanimously.

Multivariable Calculus Curriculum:

MOTION: Mrs. Larkin moved that the Board of Education approve the Multivariable Calculus Curriculum. Mrs. Plante seconded. Motion passes unanimously.

#### Item 8 – New Business

MOTION: Mrs. Larkin moved that the Board of Education approve the minutes of April 4, 2023. Mrs. Plante seconded.

Ms. Zukowski moved to amend the minutes of March 21, 2023 to replace the words “banning the book” and “banning books” with “the book challenges.” Mrs. Larkin seconded. Motion passes unanimously.

Vote on amended minutes: Passes unanimously.

Ms. Zukowski spoke about the updated structure of the minutes. Discussions related to the Board are recorded exceptionally well but the issue at hand is how to best represent public comments. Since every meeting is recorded, we will be providing a link to access the recording along with names and addresses of the speakers and an overall topic. This is an attempt to ensure the accuracy of the comments.

#### Item 9 – Public Participation

Please click [here](#) to view the public participation.

Joseph Crosby, 5 Blanches Walk, spoke about book challenges.

Jennifer Nicoletti, 68 Totem Trail, spoke about book challenges.

Sayward Parsons, 10 Checkerberry Lane, spoke about book challenges.

Jacqui Kaplan, 34 Osborne Hill Road, Newtown High School English teacher spoke about student learning and book challenges.

Jack Tanner, 13 Dodgingtown Road, thanked the Board for their service and addressed book challenges.

Connie Hoover, 13 Todds Road, addressed book challenges.

Kristin English, 28 Gisella Road, Trumbull, Newtown High School English teacher, spoke about student learning and book challenges.

MOTION: Mr. Vouros moved to adjourn. Mr. Cruson seconded. Motion passes unanimously.

#### Item 10 – Adjournment

The meeting adjourned at 9:49 p.m.

Respectfully submitted:



Donald Ramsey  
Secretary



**Board of Education  
Newtown, Connecticut**

Minutes of the special Board of Education meeting held on April 24, 2023, at 12:30 p.m. in the Board of Education conference room, 3 Primrose Street.

D. Zukowski, Chair  
D. Cruson  
J. Kuzma  
J. Larkin  
A. Plante

T. Vadas

Item 1 – Call to Order

Ms. Zukowski called the meeting to order at 12:32 p.m.

MOTION: Mr. Cruson moved that the Board of Education go into executive session for a discussion and possible action on the appointment of the Director of Facilities and invite Mrs. Vadas. Mrs. Larkin seconded. Motion passes unanimously.

Item 2 – Executive Session

The Board had a discussion regarding the candidate for Director of Facilities.

Item 3 – Public Session for Action on the Appointment of the Director of Facilities

MOTION: Mr. Cruson moved that the Board of Education appoint John Barlow as Director of Facilities with the start date to be determined. Mrs. Kuzma seconded. Motion passes unanimously.

Ms. Zukowski stated that she felt we have a new Director of Facilities that will serve this district well and looks forward to working with him.

MOTION: Mr. Cruson moved to adjourn. Mrs. Plante seconded. Motion passes unanimously.

Item 4 – Adjournment

The meeting adjourned at 12:45 p.m.

Respectfully submitted:

  
Deborra Zukowski  
Chair

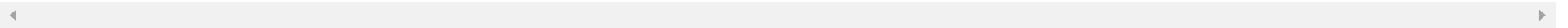


# Integrated Physical and Earth Science

8 Curriculum Developers | Last Updated: Thursday, Jan 5, 2023 by Georgina, Fawn

## Unit Calendar by Year

Unit	Lessons	Au	Sep				Oct				Nov				Dec				Jan				Feb				Mar				Apr				May				Ju		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
Lab skills and density	0	█																																							
01a Big Bang and The...	0				█																																				
01b Formation and Life cycle of...	0							█																																	
02 Motion of the solar system	0												█																												
03 Formation and History of the...	0																█																								
04 Climate Change (Historical an...	0																								█																
05 Energy Resources	0																																				█				



7 Units found

[Previous Year](#)



# Lab skills and density

8 Curriculum Developers

## Concept-Based Unit Development Graphic Organizer (Download)

[Unit Web Template \(Optional\)](#)

### Concepts / Conceptual Lens

Please attach your completed Unit Web Template here

Lens: Gathering Information

Concepts: scientific inquiry, evaluation, design, numeracy, calculation, analysis, data, evidence, measurement, observation, scientific ideas, experimentation, objectivity

### G Generalizations / Enduring Understandings

1. Scientific inquiry inspires critical evaluation and communication of scientific ideas to generate further experimentation, product design, and solutions to problems.
2. Scientific numeracy provides the foundation for the ability to calculate, analyze, and interpret scientific data and ideas.
3. Reliable evidence that supports scientific ideas must be valid, replicable, and objective.
4. Precise measurement and close, accurate observations create the evidence scientists need.

### Guiding Questions

Please identify the type of question: (F) Factual, (C) Conceptual, (P) Provocative [Debatable]

- 1a. What is the scientific method? (F)
- 1b. What are the steps of the scientific method? (F)
- 1c. How does the scientific method attempt to remain totally objective? (C)
- 1d. What is the nature of science? (C)
- 1e. Is the scientific method important to modern society? (P)
- 2a. Which type of graph is appropriate for a particular set of data? (F)
- 2b. How are simple mathematical relationships applied to scientific problems? (C)
- 2c. How does one determine the type of graph based on the data? (C)
- 2d. How do scientists use data to show relationships between variables, draw conclusions and make inferences? (C)
- 2e. How can mathematical operations be used to analyze and interpret data and present relationships between variables in appropriate terms? (C)
- 2f. Is mathematics essential to the study of science? (P)
- 3a. What is data? (F)
- 3b. How do scientists assess the reliability of the data that was generated in the investigation? (C)
- 3c. Why is evidence a necessity for explaining scientific ideas? (C)
- 3d. Does all science need evidence? (P)
- 3e. Can the public trust scientific studies? (P)
- 4a. What is mass, volume, and density? (F)
- 4b. How does one measure in science? (F)
- 4c. How do scientists choose the appropriate equipment and techniques to make observations and gather data? (F)
- 4d. What is the relationship between mass, volume, and density? (C)
- 4e. Why do scientists use certain equipment and techniques to make observations and gather data? (C)
- 4f. Why is it important for scientists to use data and observations as evidence? (C)
- 4g. Should the United States switch to the metric system? (P)

# Standard(s)

## Connecticut Core Standards / Content Standards

### NGSS: Science and Engineering Practices

#### NGSS: 9-12

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##### Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
- Evaluate a question to determine if it is testable and relevant.
- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

##### Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.
- Select appropriate tools to collect, record, analyze, and evaluate data.

##### Practice 5. Using mathematics and computational thinking

Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.

##### Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

##### Connections to the Nature of Science: Most Closely Associated with Practices

###### Scientific Investigations Use a Variety of Methods

- Scientific investigations use a variety of methods, tools, and techniques to revise and produce new knowledge.

###### Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based on empirical evidence.

# Critical Content & Skills

*What students must **KNOW** and be able to **DO***

## **Students must KNOW:**

Physical Properties

Mass

Length

Volume

Density

$D=M/V$

Area

Meter

Liter

Gram

Metric system

Customary system

Scientific notation

Scientific method

Variables

Hypothesis

Experiment

Data

Results

Conclusion

Error analysis

Validity

Testable

Measurable

Objective

Observation

Claim

Evidence

Reasoning

Beaker

Graduated Cylinder

Meter Stick

Ruler

Balance

Pie chart

Line graph

Bar graph

Scatter plot

Trend

Precision vs. Accuracy

Percent Error

Qualitative vs. Quantitative data

## **Students will be able to DO:**

### **Asking questions and defining problems**

Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

Evaluate a question to determine if it is testable and relevant.

Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

### **Planning and carrying out investigations**

Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

Select appropriate tools to collect, record, analyze, and evaluate data.

### **Mathematical and computational thinking**

Apply techniques of algebra and functions to represent and solve scientific and engineering problems.

### **Constructing explanations and designing solutions**

Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

# Core Learning Activities

1. Density of Aluminum Lab Practical or Density Cube Lab: Students measure mass and volume of varied aluminum shapes then calculate the density of each shape within a small percent error to make conclusions about how shape/size affects density of objects made from the same material.
2. Density of Water: Students measure the mass of different volumes of water to determine basic properties of density.
3. Density of Fluids: Students measure the density of various fluids, then layer them in a graduated cylinder according to their density and suspend small solids in each layer to determine relative density.
4. Scientific Method Comic: Students create a comic strip that shows a character using the scientific method to solve an experimental problem to show their understanding of the steps of the scientific method.
5. Measuring activity: Students measure basic properties such as mass, volume, length, area, temperature, etc. using appropriate lab equipment to practice getting accurate measurements.
6. Questioning using Snapple bottle activity: Students see an engaging demonstration (Balloon in a Snapple Bottle) to generate scientific questions then evaluate them according to criteria for scientific questions (testable, measurable, objective).
7. The Obscertainer: Using little black containers, students predict, observe, and hypothesize about the unseen shapes contained within. This is an exercise in using different senses to make observations and collect data.
8. Converting metric units worksheets: Students engage in a math workshop to convert metric units into different scales or to convert between metric and standard units. Also known as "dimensional analysis".

 [Density practical - aluminum - short version.doc](#)

 [density of water - graph m&V.doc](#)

 [Density Cube Lab.doc](#)

 [ob-scertainer activity.pdf](#)

 [questioning activity with snapple-water balloon.docx](#)

 [Conversions and dimensional analysis.docx](#)

 [lab safety worksheet.pdf](#)

## Assessments

### Density of Aluminum Lab Practical

#### Summative: Lab Assignment

Uses aluminum rectangular prism, cylinder, can, foil to reinforce writing procedures, making data tables, and calculating density

 [Density practical - aluminum - short version.doc](#)

### Scientific Method Comic

#### Summative: Other Visual Assessments

Create comic illustrating the scientific method

 [comic sci method - K.doc](#)

### Density of Fluids

#### Summative: Lab Assignment

Measures and calculates the density of several fluids and small objects then predicts which fluids the objects would float in

 [density of fluids.doc](#)

### Measuring Activity

#### Formative: Lab Assignment

Practice measuring using various tools and then converting metric units

 [measuring activity.pdf](#)

### Measuring and Lab skills test

#### Summative: Written Test

 [HIES quest 1 - 2014.doc](#)

## Resources

### *Professional & Student*

Glencoe Physical Science with Earth Science text, Unit 1, chapters 1 and 2 pages 4-36  
Text book resources for relevant math skills are found on page 16. Also on multiple pages throughout the chapter in the form of practice problems.

# Student Learning Expectation & 21st Century Skills

[Information Literacy](#)

[Critical Thinking](#)

[Spoken Communication](#)

[Written Performance](#)

- Problem Solving

Students will engage in lab scenarios to practice commonly used lab skills that will be carried through the year. Students will be required to design and conduct a procedure and will learn and practice the scientific method. This unit will lay the groundwork for all following units that require lab skills.

# Interdisciplinary Connections

Math: This unit has a strong focus on Math integration. Using the metric system to measure in base 10's is a practiced skill and will be used in data collection and calculations. Math is also integrated through the use of graphs to interpret data which is a skill that will be used throughout the course and during lab experiences.

English: Creation of the comic strip requires clear use of language and communication to express understanding of the scientific method.



# 01a Big Bang and The electromagnetic Spectrum

8 Curriculum Developers

**Concept-Based Unit Development Graphic Organizer (Download)**

[Unit Web Template \(Optional\)](#)

## Concepts / Conceptual Lens

*Please attach your completed Unit Web Template here*

Lens: Scale, Proportion, and Quantity

Universe, models, observation, indirect and direct observation, limitations, ,measurement theory, technology, mathematical representations, wave, evidence, relationships ,matter, phenomenon

 [01A Earth in the Universe Unit plan](#)



## Generalizations / Enduring Understandings

1. Indirect observation allows for studying objects that are too distant at scale for the limits of direct observation.
2. Models use scale and proportion to communicate relationships between different parts of the model.
3. Observational evidence and measurements support theories about distant objects or past events, such as The Big Bang Theory.
4. Wave behaviors and their mathematical representations explain many phenomena such as the expansion of the Universe.
5. Technological devices use wave behavior and interactions with matter to transmit and capture information.
6. Technology produces, transmits, and captures signals for storing and interpreting information used as evidence to support theories.

## Guiding Questions

*Please identify the type of question: (F) Factual, (C) Conceptual, (P) Provocative [Debatable]*

- 1a. How is the universe 's size discovered? (F)
  - 1b. How did stars and galaxies form? (F)
  - 1c. How long would it take to get to the closest star? (F)
  - 1d. How big is the Milky Way Galaxy? (F)
  - 1e. How did the stars and galaxies form? (C)
  - 1f. How does one gather evidence about objects incapable of being directly observe? (C)
  - 1g. Did anything come (exist) before the Big Bang? (P)
- 2a. How old is the universe?(F)
  - 2b. Where is Earth located within the Milky Way Galaxy? (F)
  - 2c. How big is the universe? (C)
  - 2d. How is the age of the Universe determined? (C)
  - 2e. Why are there so many different models of the Universe? (C)
  - 2f. Can anyone travel to the edge of the universe? (C)
  - 2g. Is there one center to the Universe? (P)
- 3a. What is the Big Bang Theory? (F)
  - 3b. How fast is the Universe expanding? (F)
  - 3c.What do redshift and blueshift reveal about the expansion of the Universe? (F)
  - 3d. What does the Cosmic Background Radiation reveal about the formation of the universe? (C)
  - 3e. What is causing the Universe to expand at its current rate? (C)
  - 3f. Why have scientists theorized about the existence of dark matter and energy even though they cannot be readily observed? (C)
  - 3g. How do redshift/blue shift to describe motion in the Universe? (C)
  - 3h. Does the multiverse exist? (P)
  - 3i. What did the universe come from? (P)
  - 3j.What is beyond the edge of the universe? (P)
- 4a. What is the light limit? (F)
  - 4b. What travels fastest in the known Universe? (F)
  - 4c. What does it sound like in space? (F)
  - 4d.What is the speed of light? (F)
  - 4e. Why does the frequency of a wave apparently change when it is moving towards/away from the observer? (C)
  - 4 f. When one looks into space can one see objects in the present, past, or future? (C)
  - 4g. How does change in velocity affect the flow of time? (C)
  - 4h. Can humans travel at the speed of light? (C)
- 5a. What at the benefits and drawbacks of using electromagnetic waves in technology? (F)
  - 5c. What kinds of technological devices use waves to collect or transmit information? (F)
  - 5d. What practical applications do technological devices have to collect or store information? (F)
  - 5e. How can the human body be affected by the use of devices that use waves? (C)
  - 5f. Why is a lead apron necessary at the dentist's office? (C)
- 6a. Which technological devices collect the information scientists use as evidence for astronomical theories? (F)
  - 6b. What types of evidence are collected with wave technology to support astronomical theories?
  - 6c.How does information gathered by telescopes help determine the origin of the universe? (C)
  - 6d. Is the telescope the most important invention contributing to scientific knowledge? (P)

# Standard(s)

## Connecticut Core Standards / Content Standards

### NGSS: Science and Engineering Practices

#### NGSS: 9-12

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##### Practice 2. Developing and using models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism or system in order to select or revise a model that best fits the evidence or design criteria.
- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.

### NGSS: Disciplinary Core Ideas

#### NGSS: 9-12

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##### ESS1: Earth's Place in the Universe

###### ESS1.A: The Universe and Its Stars

- The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe.(HSESS1-2)

##### PS4: Waves and Their Applications in Technologies for Information Transfer

###### PS4.A: Wave Properties

- The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1)
- Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. (HS-PS4-2),(HSPS4-5)

###### PS4.B: Electromagnetic Radiation

- Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features.(HS-PS4-3)
- Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary to HS-ESS1-2)

###### PS4.C: Information Technologies and Instrumentation

- Multiple technologies based on the understanding of waves and their interactions with matter are part of everyday experiences in the modern world (e.g., medical imaging, communications, scanners) and in scientific research. They are essential tools for producing, transmitting, and capturing signals and for storing and interpreting the information contained in them.(HS-PS4-5)

# Critical Content & Skills

*What students must **KNOW** and **be able to DO***

## **Students must KNOW:**

Universe  
Observable Universe  
Galaxy  
Milky way galaxy  
Star  
Lightyear  
Big Bang theory  
Theory  
Cosmic background radiation  
Hubble's law  
Matter  
Expansion  
Space  
Time  
Telescope  
Detector  
Hubble space telescope  
Refraction  
Reflection  
Doppler effect  
Red/Blueshift  
EM radiation  
Gamma, x-ray, ultraviolet, visible, infrared, micro, radio waves  
Spectroscopy  
Wave  
Speed of light  
Wavelength  
Frequency  
Speed = wavelength x frequency  
Amplitude  
Transverse waves  
Longitudinal waves  
Sound  
Light  
Medium  
Vacuum

## **Students must be able to DO:**

### **Constructing Explanations and Designing Solutions**

Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

### **Using Mathematics and Computational Thinking**

Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations.

### **Obtaining, Evaluating, and Communicating Information**

Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

### **Engaging in Argument from Evidence**

Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

### **Developing and using models**

Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism or system in order to select or revise a model that best fits the evidence or design criteria.

Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.

# Core Learning Activities

1. **Scale and Proportion:** Students explore their place in the Universe by gaining an understanding of the full scale of the Universe. Videos, models, and analogies are presented to students to give them a sense of how large or small they are in relation to other objects in the Universe.

[-How big is the Universe? Scale of the Universe video](#)

Crash Course Video - [Distances](#)

Students draw a model of the universe (pre-model takes place before students do any major new learning and a post-model summative assessment will happen after students have completed the content about the expansion of the Universe and the Big Bang Theory)

2. **Expansion of the Universe:** Students will take notes on the concepts and supporting evidence of the Big Bang Theory. Students will then engage in models and activities that simulate and help explain how scientists know the Universe is expanding.

[The Beginning of Everything -Big Bang:](#) video explaining the general concept of the Big Bang Theory and some further implications as well as the limitations of current scientific knowledge.

[Balloon expansion activity:](#) Students use a balloon as a model of the expanding Universe by measuring the changes in spacing between marks made on the balloon.

[Visualizing expansion of space:](#) Paper based activity that shows how the space between galaxy clusters changes over time.

[Graph Hubble's constant](#)

[Questions from Hubble Graphing activity.](#)

Theory, law, hypothesis lesson: Students are presented with the scientific language of "theory, law, and hypothesis" and that each means something specific and different in the scientific community.

- [TedEd video](#)

3. **Wave properties.**

[Cymatics-science vs. music video:](#) Music video to explore properties of waves such as frequency, movement, shape, etc. used as an introductory phenomenon.

[Slinky lab:](#) Hands on lab where students measure the wavelength and frequency of slinky waves.

Math workshop on speed = wavelength x frequency calculations

4. **Doppler effect.**

[Doppler sound \(car horn\):](#) Introductory video to the show real world experience of the Doppler Effect

[Red shift/Blue shift activity.\(CSI galaxies\):](#) Students calculate how fast a galaxy is moving based on the change in wavelength of the galaxy's light.

5. **Telescopes and detectors.**

Pictures of celestial objects in different portions of the EM spectrum.

Building/Using telescopes

[Telescope research project](#)

6. **EM Radiation**

Demos of different types of technologies that utilize EM radiation such as radios, remote controllers, UV lights, toaster, etc.

Build a [Scale model of the EM spectrum](#)

## Assessments

### Slinky Lab

**Formative: Lab Assignment**

See attachments below for link to handout.

### Big Bang Balloon Lab

**Formative: Lab Assignment**

See attachments below for link to handout.

### Waves Test

**Summative: Written Test**

[Waves, EM, and Doppler test.pdf](#)

### Model of Universe

**Summative: Group Project**

[Model \(drawing\) of the universe.docx.pdf](#)

[Copy of Waves, EM, and Doppler test.pdf](#)

[Big Bang Balloon Lab.pdf](#)

[Slinky Lab.pdf](#)

## Resources

### *Professional & Student*

Phet simulation that shows electromagnetic waves in relationship to electron movement. <https://phet.colorado.edu/en/simulation/legacy/radio-waves>

Crash Course Astronomy: Telescopes video used to introduce telescope technology and EM waves technology. <https://www.youtube.com/watch?v=mYhy7eaazlk&list=PL8dPuualjXtPAJr1ysd5yGlyjSFuh0mLL&index=6>

Resource website for EM spectrum and radiation basics.

<https://science.hq.nasa.gov/kids/imagers/ems/waves3.html>

Phet simulation of transverse waves. Very simple and basic introduction to wave properties. <https://phet.colorado.edu/sims...>

# Student Learning Expectation & 21st Century Skills

[Information Literacy](#)

[Critical Thinking](#)

[Spoken Communication](#)

[Written Performance](#)

# Interdisciplinary Connections

Math: Mathematical models of scale and proportion are useful in conceptualizing the true vastness of the Universe. Wave forms, like those created by electromagnetic radiation, can be described by classical math formulae such as sine and cosine waves.

Technology: Technological advancements have aided our observations of the Universe.



# 01b Formation and Life cycle of Stars

8 Curriculum Developers

**Concept-Based Unit Development Graphic Organizer (Download)**

[Unit Web Template \(Optional\)](#)

## Concepts / Conceptual Lens

*Please attach your completed Unit Web Template here*

**Lens: Energy and Matter**

Concepts: energy, matter, conservation, model, pattern, transformation, sequence, data, cycle, prediction, radiation, fusion, nuclear processes, structure, life cycle, transport, energy output, wave

 [01B Earth in the Universe](#)

## Generalizations / Enduring Understandings

1. A wave model or a particle model describes electromagnetic radiation, and for some situations one model is more useful than the other.
2. The Sun, a typical main sequence star, has a structure and life cycle pattern representative of all stars in the galaxy.
3. Nuclear fusion in the Sun's core transforms and releases energy that transports to Earth through radiation.
4. The life cycle of a star produces all natural elements on the periodic table through nuclear fusion while conserving matter and transforming energy.
5. All stars follow a sequence of stages as they produce new elements through nuclear processes and will end their "life" depending on their starting mass.
6. Scientists study the historical data of sunspot activity and use these patterns to help predict the Sun's cycle and its energy output.

## Guiding Questions

*Please identify the type of question: (F) Factual, (C) Conceptual, (P) Provocative [Debatable]*

- 1a. Do all electromagnetic waves travel at the same speed? (F)
  - 1b. Does energy move the medium it travels through? (F)
  - 1c. Do all types of waves behave the same? (F)
  - 1d. Can all types of waves travel through empty space? (F)
  - 1e. How is wavelength related to energy and frequency? (C)
  - 1f. Why do some electromagnetic waves have more energy? (C)
  - 1g. Is there a cosmic speed limit? (P)
- 2a. How do scientists know details about the sun and stars? (F)
  - 2b. Will the sun devour the Earth as it goes through its life cycle? (F)
  - 2c. What is a star? (F)
  - 2d. What type of star is most abundant in the Universe? (F)
  - 2e. Are all stars the same? (F)
  - 2f. Why does all life on Earth depend on the sun? (C)
- 3a. How does the sun generate energy? (F)
  - 3b. Why do stars twinkle? (C)
  - 3c. Why are there no green stars? (C)
  - 3d. How are elements created inside a star? (C)
- 4a. Where do the elements that make up the Earth come from? (F)
  - 4b. What element do all main sequence stars fuse together? (F)
  - 4c. How can a star produce elements in its core through its life cycle? (C)
  - 4d. How do elements reveal detailed information about astronomical bodies? (C)
- 5a. What is going to happen to the sun when it "dies"? (F)
  - 5b. How long do stars live? (F)
  - 5c. How are stars born? (F)
  - 5d. How do stars die? (F)
  - 5e. Why do some stars become black holes? (C)
  - 5f. How big can stars get? (C)
  - 5g. Will Earth be devoured by a black hole? (P)
- 6a. What are sunspots? (F)
  - 6b. Are sunspots predictable? (F)
  - 6c. How does energy output correlate to the number of sunspots present? (C)
  - 6d. How do scientists know that the Sun goes through cycles? (C)
  - 6e. What caused the Little Ice Age? (P)

# Standard(s)

Connecticut Core Standards / Content Standards

## NGSS: Science Performance Expectations (2017)

### NGSS: HS Physical Sciences

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#### HS.Energy

##### Performance Expectations

- HS-PS3-2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

#### HS.Waves and Electromagnetic Radiation

##### Performance Expectations

- HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

### NGSS: HS Earth & Space Science

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#### HS.Space Systems

##### Performance Expectations

- HS-ESS1-1. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy in the form of radiation.
- HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements.

## NGSS: Disciplinary Core Ideas

### NGSS: 9-12

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#### ESS1: Earth's Place in the Universe

##### ESS1.A: The Universe and Its Stars

- The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1)
- The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1-2),(HS-ESS1-3)
- Other than the hydrogen and helium formed at the time of the BigBang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1- 2),(HS-ESS1-3)

#### PS3: Energy

##### PS3.D: Energy in Chemical Processes and Everyday Life

- Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary to HS-ESS1-1)

#### PS4: Waves and Their Applications in Technologies for Information Transfer

##### PS4.B: Electromagnetic Radiation

- Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features.(HS-PS4-3)
- Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary to HS-ESS1-2)



# Critical Content & Skills

*What students must KNOW and be able to DO*

## Students must KNOW:

Star  
Sun  
First generation star  
Second generation star  
Energy  
Light  
Spectrum  
Waves  
Photon  
Absorption  
Radiation  
Gravity  
Nuclear fusion  
H-R diagram  
Main sequence  
Giant  
Supergiant  
White dwarf  
Neutron star  
Black hole  
Supernova  
Nebula  
Planetary nebula  
Solar mass  
Corona  
Chromosphere  
Photosphere  
Radiative zone  
Convection zone  
Solar wind  
Sunspot  
Prominence  
Solar flares  
Element  
Proton  
Neutron  
Electron  
Electron energy level (orbital)  
Hydrogen  
Helium

## Students must be able to DO:

### Developing and Using Models

Develop a model based on evidence to illustrate the relationships between systems or between components of a system.

Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4)

### Obtaining, Evaluating, and Communicating Information

Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

### Engaging in Argument from Evidence

Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

# Core Learning Activities

1. Spectroscopy lab (see attachments below) using spectrometers and emission tubes and the solar/continuous spectrum
2. Layers of the Sun: [Sun-ion](#); students research properties of each layer of the sun and construct a simple flipbook to keep as a resource.
3. Modeling Nuclear Fusion in Stars: Students construct a diagram of nuclear fusion by combining atomic particles to make new elements and show the release of energy. [Nuclear fusion activity template](#)
4. [Life cycle of a star card sort instructions](#): Students explore and reinforce the life cycle of a star by matching images with descriptions. [Life cycle of a star card sort cards](#)
5. [Graphing sunspot cycles](#): Students graph the amount of sun spots over several years to show a clear pattern that scientists call the "solar cycle"
6. [HR-Diagram](#) Graphing Activity: Students plot many stars on the HR-Diagram based on their temperature. They will then group the stars based on the scatter plot into their commonly named star categories (red giants, white dwarves, main sequence, etc.) This is a critical activity because the content has been known to show up on the NGSS state-level test.

- [Sun-ion instructions.pdf](#)
- [Modeling Nuclear Fusion in stars.pdf](#)
- [nuclear fusion activity template.pdf](#)
- [Life cycle of a star card sort instructions.pdf](#)
- [Life Cycle of Stars Card Sort cardspdf.pdf](#)
- [Graphing Sunspot Cycles.pdf](#)
- [HR Diagram Graphing Activity \(1\).docx.pdf](#)

## Assessments

### Spectroscopy Lab

Formative: Lab Assignment

[spectroscopy lab.docx](#)

### Modeling Nuclear Fusion

Formative: Lab Assignment

See attachments under Core Learning activities.

### Star Stations

Summative: Group Project

Multiple day assessment activity

[Folder containing Star Station material](#)

## Resources

### Professional & Student

Phet simulation: Models of a hydrogen atom. Can be used to introduce atomic structure as it relates to fusion in stars. <https://phet.colorado.edu/en/simulation/legacy/hydrogen-atom>

Lesson-Level Phenomenon: [video of a star being eaten by a black hole](#)

Crash Course Astronomy - [Stars](#)

Crash Course Astronomy- [Sun](#)

Crash Course Astronomy- [Black Holes](#)

Video about elements used during nuclear fusion activity.

<https://cptv.pbslearningmedia...>

## Student Learning Expectation & 21st Century Skills

[Information Literacy](#)

[Critical Thinking](#)

[Spoken Communication](#)

[Written Performance](#)

## Interdisciplinary Connections

Math: Scale and proportions can aid in the understanding of immense sizes, distances, and lengths of time associated with the scale of the Universe! Complex understanding of astronomy would not be possible without mathematical relationships that explain patterns and sizes observed in space. Astronomy would be reduced to the types of simple observations made by ancient humans.



# 02 Motion of the solar system

8 Curriculum Developers

## Concept-Based Unit Development Graphic Organizer (Download)

[Unit Web Template \(Optional\)](#)

### Concepts / Conceptual Lens

Please attach your completed Unit Web Template here

Lens: Patterns

Concepts: motion, scale, systems, patterns, astronomical events, predictability, laws, observation, gravity, distance, mass, models, properties, cause and effect, evidence, scientific principles, change, space

[02 Earth in the Solar System](#)

### G Generalizations / Enduring Understandings

1. Patterns in star systems observed at different scales provide evidence for cause and effect explanations of observed astronomical events.
2. Laws of orbital motion describe the patterns of movement of objects in the Solar System and can predict astronomical events with accuracy.
3. Gravity from the objects in motion in space changes based on the mass of the objects and distance between objects.
4. Scientific models capture important aspects of scientific principles, but they cannot accurately depict all properties simultaneously.

### Guiding Questions

Please identify the type of question: (F) Factual, (C) Conceptual, (P) Provocative [Debatable]

- 1a. How have humans used astronomical observations throughout history? (F)
- 1b. What is a meteor shower? (F)
- 1c. Do all comets return like Halley's comet? (F)
- 1d. Why do planets orbit a star? (C)
- 1e. How have humans perceived/interpreted astronomical observations throughout history? (C)
- 1f. Why do meteor showers happen at the same time every year? (C)
- 1g. Do astronomical events have meaning? (P)
- 2a. How do the planets travel around the sun? (F)
- 2b. What factors affect an object's orbit? (F)
- 2c. What does eccentricity measure? (F)
- 2d. How does the acceleration of an object change throughout its orbit around an ellipse? (F)
- 2e. What are Kepler's Laws of Planetary Motion? (F)
- 2f. What is Newton's Law of Universal gravitation? (F)
- 2g. How does high eccentricity affect a comet's orbit? (C)
- 2h. How do scientists predict future comet appearances and solar eclipses? (C)
- 2i. Are far-future predictions of astronomical events accurate? (P)
- 3a. What is gravity? (F)
- 3b. What is the shape of the asteroid belt? (F)
- 3c. What is the effect of gravity on different masses? (C)
- 3d. Does the effect of gravity extend out from a mass forever? (C)
- 3e. How does Jupiter affect the shape and orbit of the asteroid belt? (C)
- 3f. How are Kepler's and Newton's Laws related? (C)
- 3g. How can laws of planetary motion help with understanding motion in the Universe? (C)
- 4a. How is scale used to make models more accurate? (F)
- 4b. How big would an accurate model of the solar system have to be? (F)
- 4c. Why do scientific models have limits? (C)
- 4d. What does an accurate model of the Solar System look like? (C)
- 4e. Why is it difficult to produce a model of the solar system that shows both accurate sizes and distances? (C)
- 4f. Are all posters of the Solar System wrong? (P)

# Standard(s)

Connecticut Core Standards / Content Standards

## NGSS: Science Performance Expectations (2017)

### NGSS: HS Physical Sciences

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#### HS.Forces and Interactions

##### Performance Expectations

- HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- HS-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
- HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

### NGSS: HS Earth & Space Science

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#### HS.Space Systems

##### Performance Expectations

- HS-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

## NGSS: Disciplinary Core Ideas

### NGSS: 9-12

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#### ESS1: Earth's Place in the Universe

##### ESS1.B: Earth and theSolar System

- Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. (HS-ESS1-4)

#### PS2: Motion and Stability: Forces and Interactions

##### PS2.A: Forces and Motion

- Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1)
- If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objectsoutside the system. (HS-PS2-2),(HS-PS2-3)

##### PS2.B: Types of Interactions

- Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects.(HS-PS2-4)
- Forces at a distance are explained by fields (gravitational,electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4),(HS-PS2-5)

# Critical Content & Skills

What students must **KNOW** and be able to **DO**

## Student must KNOW:

Solar system

Dwarf planet

Moon

Kuiper belt

Oort cloud

Comet

Asteroid/meteor/meteorite

Kepler

Kepler's Laws

Ellipse

Foci (focus point)

Eccentricity

Orbit/Revolution

Rotation

Perihelion

Aphelion

Orbital period

Newton

Gravity

Mass

Acceleration

Force

$F=ma$

Newton's law of universal gravitation

Distance

Gravitational field

Center of mass

Centripetal

Collision

## Students must be able to DO:

### Using Mathematical and Computational Thinking

Use mathematical or computational representations of phenomena to describe explanations.

### Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

### Constructing Explanations and Designing Solutions

Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects.

## Core Learning Activities

1. See-Think-Wonder Protocol: The class discusses a variety of astronomical phenomena such as planetary transits, eclipses, meteor showers, and comet sightings to explore the idea that astronomical phenomena are highly predictable due to laws of motion.
2. Drawing of a model of the solar system: Used as a pre-model to assess students' learning about scale and proportion and motion in the solar system.
3. Kepler's 1st law; Drawing elliptical orbits and identifying the effect of changing aspects of the ellipse.
4. Kepler's 2nd law; Computer simulation activity exploring the orbits of inner solar system objects and the effect on speed of objects through the course of their orbit to achieve equal area over equal time.
5. Kepler's 3rd law; Rubber stopper lab Students swing rubber stoppers around on a string to measure how distance affects orbital period.
6. Gravity Well (Lycra-balls): a simple demonstration that can show orbital motion as described by Kepler's Laws as well as integrate topics about gravity and space-time.
7. Gravity and Motion worksheet: Reading and Math workshop practicing and exploring the effects of the law of universal gravitation in different scenarios.

 [Copy of Kepler's 1st law activity](#)

 [Copy of Kepler's 2nd Law activity](#)

 [Copy of keplers 3rd law activity](#)

 [Gravity - \(lycra-balls\) Investigation\\_Guide.pdf](#)

 [Copy of Model Rubric.pdf](#)

 [Gravity and Motion Worksheet.pdf](#)

 [see\\_think\\_wonder\\_template.pdf](#)

## Assessments

### Gravity Well Activity

#### Formative: Lab Assignment

See attachments under Core Learning Activities.

### Kepler's 3rd Law Activity

#### Formative: Lab Assignment

See attachments under Core Learning Activities.

### Kepler's 2nd Law Simulation

#### Formative: Lab Assignment

See attachments under Core Learning Activities.

### Kepler's 1st Law Activity (Ellipses)

#### Formative: Lab Assignment

See attachments under Core Learning Activities.

### Kepler's Laws Quiz

#### Summative: Written Test

[Kepler Quiz 2019.pdf](#)

### Solar System Model

#### Summative: Group Project

See attachments under Core Learning Activities for rubric.

## Resources

### Professional & Student

Text book: Glencoe Physical Science with Earth Science. 2006. (Chapters 3,4,7,8)  
PhET orbital simulations can be used as introduction or exploration of orbital motion and Kepler's laws.

[https://phet.colorado.edu/sims/html/gravity-and-orbits/latest/gravity-and-orbits\\_en.html](https://phet.colorado.edu/sims/html/gravity-and-orbits/latest/gravity-and-orbits_en.html)

<https://phet.colorado.edu/en/simulation/legacy/my-solar-system>

<https://phet.colorado.edu/en/simulation/gravity-force-lab>

### Video

Crash Course Astronomy: Gravity

<https://www.youtube.com/watch?..>

## Student Learning Expectation & 21st Century Skills

[Information Literacy](#)

[Critical Thinking](#)

[Spoken Communication](#)

[Written Performance](#)

## Interdisciplinary Connections

Math: Mathematical/computational skills will be used when analyzing data related to elliptical orbits. Mathematical/computational models will be used to predict motion of orbiting objects in the solar system. Without Mathematical connections astronomy would not have the complex modern understanding of space. Humans would be confined to the simple observations of heavenly bodies that ancient humans were.

Social Studies: Historical references to scientists and navigators who used similar techniques to initially gather information about heavenly bodies and their impact on the progress of science. Many of the famous scientists in this chapter made their contributions to science in the 1400-1600's which is known as a period of scientific renaissance.



# 03 Formation and History of the Earth

8 Curriculum Developers

## Concept-Based Unit Development Graphic Organizer (Download)


[Unit Web Template \(Optional\)](#)

### Concepts / Conceptual Lens

*Please attach your completed Unit Web Template here*

**Lens: Stability and Change**

Concepts: **evidence, processes, quantifications, models, change, formation, properties, materials, tectonics, geologic event, geologic history, record, time, scale, preservation, synthesis, cause, human comprehension**

 [03 Formation and History of Earth](#)

## Generalizations / Enduring Understandings

1. Different scales of time require quantifying and modeling change and rates of change to facilitate human comprehension.
2. Rocks preserve evidence of geologic events that occurred in the past and processes that are happening today.
3. Because active geologic processes have destroyed most of the very early rock record on Earth, other objects in the solar system that have changed little over billions of years provide critical information about Earth's formation and geologic history.
4. Properties of Earth materials drive internal processes which cause immense changes on the surface.
5. Surface processes and Earth materials provide evidence of how plate tectonics works and that it is still happening today.
6. Because the rock record preserves geologic events, absolute dating can be synthesized with relative dating to make a more complete record of Earth's history.

## Guiding Questions

*Please identify the type of question: (F) Factual, (C) Conceptual, (P) Provocative [Debatable]*

- 1a. What is the geologic time scale?(F)
  - 1b. What is the evidence scientists use to construct Earth's history? (F)
  - 1c. What types of phenomena are considered major geologic events? (F)
  - 1d. How do scientists construct a timeline of Earth's 4.6 billion year old history?(C)
  - 1e. How do humans fit into Earth's history?(P)
- 2a. What are the major events in Earth's history?(F)
  - 2b. What information do rocks provide? (F)
  - 2c. What is the evidence for continental drift?(F)
  - 2d. How old are rocks? (C)
  - 2e. How does the rock record give evidence for plate tectonics?(C)
  - 2f. How do scientists support the idea that Pangea existed? (C)
  - 2g. What is the evidence for the formation of Earth?(C)
- 3a. What does Earth have in common with the other terrestrial planets in the solar system?(F)
  - 3b. How do scientists know about conditions of early Earth?(F)
  - 3c. How can evidence from space be used to support theories about early Earth?(C)
  - 3d. How was the Earth formed?(C)
- 4a. Why is Earth organized in distinct layers?(F)
  - 4b. What is the magnetosphere? (F)
  - 4c. What causes plate tectonics? (F)
  - 4d. What is convection?(F)
  - 4e. What causes the Earth's magnetosphere?(F)
  - 4f. How can movement of interior layers affect surface processes?(C)
  - 4g. What is the significance of Earth having layers?(C)
  - 4h. Why was the magnetosphere so important for the development of life on Earth? (C)
  - 4i. How is the surface of the crust affected by the movement of the plates?(C)
  - 4j. What would Earth be like if it did not have layers?(P)
- 5a. What is the theory of plate tectonics?(F)
  - 5b. What geologic surface processes are a result of tectonic movements? (F)
  - 5c. How fast do tectonic plates separate? (F)
  - 5d. How can rock hand samples be evidence of large plates moving?(C)
  - 5e. How can fossils tell scientists what latitudes continents used to be in? (C)
  - 5f. How do we know plate tectonics are happening today if it's too slow to see? (C)
  - 5g. Is understanding plate tectonics an essential part of telling Earth's whole history? (P)
- 6a. What is relative dating of rocks?(F)
  - 6b. What techniques are used to estimate a relative age on a rock layer or geologic event?
  - 6c. How are dating techniques used to estimate a relative age on a rock layer or geologic event?(F)
  - 6d. How does absolute dating of rocks work?(F)
  - 6e. What is stratigraphy? (F)
  - 6f. How do scientists know the age of rocks?(C)
  - 6g. Can scientists rely on the estimated ages of rocks?(P)



# Standard(s)

## Connecticut Core Standards / Content Standards

### NGSS: Disciplinary Core Ideas

#### NGSS: 9-12

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##### ESS1: Earth's Place in the Universe

###### ESS1.C: The History of Planet Earth

- Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history. (HS-ESS1-6)

##### ESS2: Earth's Systems

###### ESS2.A: Earth Materials and Systems

- Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HSESS2-1), (HS-ESS2-2)
- Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. (HSESS2-3)

###### ESS2.B: Plate Tectonics and Large-Scale System Interactions

- The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection. (HS-ESS2-3)
- Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. (ESS2.B Grade 8 GBE) (HS-ESS2-1) (secondary to HS-ESS1-5)

##### PS1: Matter and Its Interactions

###### PS1.C: Nuclear Processes

- Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. (secondary to HS-ESS1-5), (secondary to HS-ESS1-6)

##### PS4: Waves and Their Applications in Technologies for Information Transfer

###### PS4.A: Wave Properties

- Geologists use seismic waves and their reflection at interfaces between layers to probe structures deep in the planet. (secondary to HS-ESS2-3)

# Critical Content & Skills

*What students must **KNOW** and **be able to DO***

## **Students must KNOW:**

Late Heavy Bombardment

Accretion

Meteorites

Craters

Volcanoes

Crust

Mantle

Outer Core

Inner Core

Felsic

Mafic

Continental Crust

Oceanic Crust

Direct Evidence

Indirect Evidence

Convection Currents

Thermal Expansion

Radioactive Decay

Rocks

Igneous

Metamorphic

Sedimentary

Minerals

Continental Drift

Plate Tectonics

Convergent Boundary

Divergent Boundary

Transform Boundary

Subduction

Deep Ocean Trench

Mid-Ocean Ridge

Mountain Building

Relative Dating

Law of Superposition

Law of Original Horizontality

Law of Cross-Cutting Relationships

Extrusion

Intrusion

Fault

Unconformity

Erosion

Fossils

Trace Fossils

Index Fossils

Fossil Correlation

Absolute Dating

Half Life Decay

Parent Isotope

Daughter Isotope

Radioactivity

Radiometric Dating

## **Students will be able to DO:**

### **Engaging in Argument from Evidence**

Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments.

### **Constructing Explanations and Designing Solutions**

Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

### **Developing and Using Models**

Develop a model based on evidence to illustrate the relationships between systems or between components of a system.

### **Planning and Carrying Out Investigations**

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

# Core Learning Activities

1. Head-line Prompt (Unit Phenomenon): Strange teacher talks to rocks, rocks talk back! Students respond to the opening headline then engage in a stations activity. Investigation stations of local CT rocks of various types that tell stories about CT's geologic history including plate tectonics and fossil organisms.
2. Evidence of Earth's Formation Stations: Students will engage in "evidence stations" of interplanetary rock evidence that suggests that similar processes found on the terrestrial planets can help to explain the origin of our own planet.  
**Density of Earth materials lab:** Students measure the density of rock and mineral samples then categorize them into groups based on their density and physical properties like crystal size, color, luster, etc.
3. Continental vs. Oceanic Crust lab: Students observe rocks and minerals to determine the component parts of the rocks based on visible properties.
4. Plate Tectonics (Slip, slide, collide) WebQuest: Students use computers to use an interactive website to gain general knowledge about plate boundaries and plate tectonics in place of traditional lecture-style notes based on their previous background knowledge of this topic from middle school.
5. Geologic History Project: Students create a piece of media such as a brochure or a website pretending they are taking a vacation to a geologic time period. This is a research project to introduce students to Geologic history.
5. Fossil Correlation Lab: Students construct a fictional fossil timeline based on the appearance and disappearance of fossil species in samples and make conclusions about extinction and relative dating.
6. Fossil Exploration Lab: Students observe and identify different fossils by using a field guide and the fossil's morphology.

 [density of earth materials activity \(densities given - KB version\).docx](#)

 [Coninental vs. Oceanic crust lab](#)

 [Plate Tectonics webquest.pdf](#)

 [Copy of 06 Fossil Correlation Activity](#)

 [Do Now\\_ Headline Prompt.pdf](#)

 [fossil exploration lab.pdf](#)

## Assessments

### Density of Earth Materials Lab

**Formative: Lab Assignment**

See attachments in Core Learning Activities.

### Plate tectonics test/quiz

**Summative: Written Test**

 [Copy of Inside earth and plate tectonics quiz.pdf](#)

### Geologic time website project

**Formative: Personal Project**

 <https://sites.google.com/newtown.k12.ct.us/ipes-earth-history-project/home>

 [geologic time project packet.pdf](#)

### Relative dating Quiz

**Summative: Written Test**

 [relative dating quiz.pdf](#)

## Resources

### *Professional & Student*

Dynamic Earth Interactive website can be used with the webquest assignments and as a general learning and studying tool. <https://www.learner.org/series...>

Video to be used with Continental vs. Oceanic Crust lab:

<https://www.youtube.com/watch?v=DHWavJf4SLE>

## Student Learning Expectation & 21st Century Skills

[Information Literacy](#)

[Critical Thinking](#)

[Spoken Communication](#)

[Written Performance](#)

## Interdisciplinary Connections

**Math:** Using exponential decay curves when calculating half-lives. The half-life decay rate of radioactive isotopes follows the mathematically predictable exponential decay curve so reliably that scientists are able to form an accurate story of Earth's history around absolute dates of specific rocks samples.

**Social Studies:** There are connections to students' understanding of historical context to the Carboniferous Era in geologic history as this is when all the coal deposits were formed that were later discovered and utilized starting during the industrial revolution. Human history is also put into context with geologic history. Students will be presented with the fact that Earth's history spans 4.6 billion years and recorded human history is such a small fraction of that.



# 04 Climate Change (Historical and Modern)

8 Curriculum Developers

## Concept-Based Unit Development Graphic Organizer (Download)

[Unit Web Template \(Optional\)](#)

### Concepts / Conceptual Lens

Please attach your completed Unit Web Template here

Lens: Cause and Effect

Concepts: geologic time, cause and effect, extinction, climate change, empirical evidence, models, feedback loops, changes, ratios, correlation, claims, systems, pattern, climate, relationships

[04 Climate Change](#)

### G Generalizations / Enduring Understandings

1. Geologic time periods and their mass extinctions show correlation with global climate change and provide models that suggest current repetition of this pattern.
2. Positive feedback loops in Earth systems cause global climate change.
3. Models of the Earth's changing climate throughout geologic time suggest another mass extinction is in progress.
4. Drastic changes in the ratios of carbon within earth systems can cause an increase in global temperature.
5. Empirical evidence permits differentiation between cause and correlation and allows scientists to make claims about specific cause and effect relationships.

### Guiding Questions

Please identify the type of question: (F) Factual, (C) Conceptual, (P) Provocative [Debatable]

- 1a. What does the fossil record say about past climate changes? (F)
- 1b. What has caused the climate to cool and warm in the past? (F)
- 1c. What caused the mass extinctions in Earth's past? (C)
- 1d. Should society care about climate change? (P)
- 2a. What is an atmospheric feedback loop? (F)
- 2b. What is the difference between weather and climate? (F)
- 2c. How do scientists use models to predict changing climate? (C)
- 2d. How are feedback loops making the climate crisis worse? (C)
- 2e. What can citizens of all ages do to mitigate the effects of climate change? (C)
- 2f. Who is responsible for "fixing" climate change? (P)
- 3a. What do current climate models say about the extinction rate of current species? (F)
- 3b. What are the effects climate change has on the future of the Earth? (C)
- 3c. How can climate change cause mass extinctions? (C)
- 3d. Is the Earth currently experiencing the sixth mass extinction? (P)
- 3e. Is the sixth mass extinction unavoidable? (P)
- 4a. What are the gasses that have the biggest impact on global temperature? (F)
- 4b. What are the ways that matter flows through the carbon cycle? (F)
- 4c. How do greenhouse gasses warm the atmosphere? (C)
- 4d. How can human activities cause imbalance in the carbon cycle? (C)
- 4e. How are humans increasing global temperature? (C)
- 4f. Is global warming irreversible? (P)
- 5a. What is the Sun's effect on the Earth's climate system? (F)
- 5b. What effect do solar cycles have on climate and climate change? (C)
- 5c. What is the current evidence for global climate change? (C)
- 5d. How do increases of average global temperatures, rising sea levels, reduced glaciation, and the accelerated extinction of species serve as evidence for climate change? (C)
- 5e. Are human activities causing climate change? (P)
- 5f. Is published climate data trustworthy/reliable? (P)

# Standard(s)

## Connecticut Core Standards / Content Standards

### NGSS: Science Performance Expectations (2017)

#### NGSS: HS Earth & Space Science

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##### HS.Earth's Systems

###### Performance Expectations

- HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
- HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

##### HS.Weather and Climate

###### Performance Expectations

- HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
- HS-ESS3-5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

##### HS.Human Sustainability

###### Performance Expectations

- HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

### NGSS: Disciplinary Core Ideas

#### NGSS: 9-12

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##### ESS2: Earth's Systems

###### ESS2.A: Earth Materials and Systems

- Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HSESS2-1),(HS-ESS2-2)
- The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4)

###### ESS2.C: The Roles of Water in Earth's Surface Processes

- The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HSESS2-5)

###### ESS2.D: Weather and Climate

- The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (HS-ESS2-4)
- Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HSESS2-6),(HS-ESS2-7)
- Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-6),(HS-ESS2-4)
- Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary to HSESS3-6)

##### ESS3: Earth and Human Activity

###### ESS3.D: Global Climate Change

- Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5)
- Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6)

# Critical Content & Skills

*What students must **KNOW** and **be able to DO***

## Terms students need to KNOW:

Solar Radiation  
Absorption  
Reflection  
Albedo  
Climate  
Weather  
Earth System  
Climate System  
Carbon  
Carbon Cycle  
Carbon sink  
Carbon source  
Fossil fuels  
Emissions  
Carbon Dioxide  
Atmosphere  
Hydrosphere  
Lithosphere  
Biosphere  
Feedback loops  
Positive/Negative feedback  
Greenhouse Effect  
Greenhouse gases  
Global warming  
Glaciation  
Ice age  
Mass Extinction  
Solar Cycles  
Seasons  
Precession  
Carboniferous Era  
The Great Dying

## Skills students need to DO:

### Using Mathematics and Computational Thinking

Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations.

### Developing and Using Models

Develop a model based on evidence to illustrate the relationships between systems or between components of a system.

Use a model to provide mechanistic accounts of phenomena.

### Planning and Carrying Out Investigations

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

### Analyzing and Interpreting Data

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

Analyze data using computational models in order to make valid and reliable scientific claims.

## Core Learning Activities

1. Albedo Lab: Students perform an experiment to test variables around reflection and absorption of light/heat to make conclusions about the effect of sunlight on different surfaces on Earth.
2. Melting glaciers "gallery walk": Students view a series of pictures that show well known glaciers and bodies of water and the striking differences in conditions decades ago and modern day. Students are asked to think critically, evaluate the validity of the pictures, and make inferences.
3. Energy and resource efficiency check list: Students reflect on how their daily practices has an overall environmental impact.
4. Carbon Cycle Game: Students engage in a life-size board game style simulation that has them travel through carbon sinks.
5. Human Impact and Climate Change Test (link to test available below under "Assessments")

 [Albedo lab.pdf](#)

 [Energy\\_Resource Efficiency Survey.pdf](#)

 [Melting glacier gallery walk of climate change.pdf](#)

 [Carbon Cycle Game Handout.pdf](#)

## Assessments

### Carbon Cycle Game

#### Formative: Group Project

See attachments under Core Learning Activities.

### Albedo Lab

#### Formative: Lab Assignment

See attachments under Core Learning Activities.

### Human Impact on Earth Quiz

#### Summative: Written Test

[Human Impact on Earth Quiz.pdf](#)

## Resources

### Professional & Student

[Climate Change Notes Presentation](#)

[Albedo article\(s\)](#)

[Greenhouse Effect \(Notes\)](#)

[Carbon cycle \(Notes\)](#)

[Sun's effect on climate](#) (NASA website that provides data and evidence for melting ice caps)

## Student Learning Expectation & 21st Century Skills

[Information Literacy](#)

[Critical Thinking](#)

[Spoken Communication](#)

[Written Performance](#)

## Interdisciplinary Connections

Data Analysis of climate data such as rising sea levels, carbon dioxide concentrations in the oceans, and extinctions of species per year can link to math application. All climate data is typically displayed in graphical form such as on scatter plots and show a trend which is usually accompanied with a best fit line or rolling average line which are concepts covered in math.

Historically, climate change events have happened on a minor or more regional scale within the limits of human history. These historic examples can be used to analyze the effects that climate change can have on the course of history and their social, political, and economical impacts. (Examples; the year without a summer and the little ice age)





# 05 Energy Resources

8 Curriculum Developers

## Concept-Based Unit Development Graphic Organizer (Download)

[Unit Web Template \(Optional\)](#)

### Concepts / Conceptual Lens

*Please attach your completed Unit Web Template here*

Lens: Influence of Science, Engineering, and Technology on Society and the Natural World

Concepts: energy, systems, resources, renewability, development, constraints, evaluation, impact, solutions, sustainability, transformation, technology, demand, electricity, magnetism

[05 Electromagnetism, Energy transformations, and Energy Resources](#)

### G Generalizations / Enduring Understandings

1. Technological solutions to energy demand often reduce impacts of human activities on natural systems and resources.
2. Renewable energy resources enjoy sustainability because they transform energy from the Sun into usable technological solutions.
3. Evaluating energy solutions demands accounting for a range of natural and human constraints.
4. Electricity and magnetism interact to transform energy used for the development of society and technology, such as those used for generating power for human demand.

### Guiding Questions

*Please identify the type of question: (F) Factual, (C) Conceptual, (P) Provocative [Debatable]*

- 1a. What are the current technological advances in renewable energy? (F)
- 1b. What is the role of energy in the modern world? (C)
- 1c. How do resource usage and availability affect the environment? (C)
- 1d. Is it critical to develop and utilize low impact energy sources? (P)
- 1e. Should non-renewable energy sources be outlawed? (P)
- 2a. What is the difference between renewable and non renewable resources? (F)
- 2b. How does heat energy generate electricity? (F)
- 2c. What is sustainability? (C)
- 2d. How does all the energy on Earth originate from the Sun? (C)
- 2e. Is sustainable energy better than non-renewable energy? (P)
- 3a. What factors affect human demand on energy/power? (F)
- 3b. What are the advantages and disadvantages of the different energy resources? (C)
- 3c. How do people choose the best energy resource for a particular location? (C)
- 3d. Can all renewable and nonrenewable resources be utilized in locations all over the world? (P)
- 3e. Are all renewable and nonrenewable resources available to the whole world's population? (P)
- 3f. Which method of generating electricity is the best? (P)
- 3g. Should the amount of usable energy influence human decisions and behaviors? (P)
- 4a. What is energy (F)
- 4b. What does it mean for energy to be conserved? (F)
- 4c. How can energy be conserved in a system? (C)
- 4d. What energy transformations are used to generate electricity? (C)
- 4e. How are electricity and magnetism related? (C)
- 4f. How do the properties of magnets allow them to be useful to society? (C)
- 4g. Is energy technology essential for the development of a global society? (P)



# Standard(s)

## Connecticut Core Standards / Content Standards

### NGSS: Science Performance Expectations (2017)

#### NGSS: HS Physical Sciences

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##### HS.Forces and Interactions

###### Performance Expectations

- HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

##### HS.Energy

###### Performance Expectations

- HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
- HS-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.\*
- HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

#### NGSS: HS Earth & Space Science

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##### HS.Human Sustainability

###### Performance Expectations

- HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
- HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.\*
- HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.\*

### NGSS: Disciplinary Core Ideas

#### NGSS: 9-12

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##### ESS3: Earth and Human Activity

###### ESS3.A: Natural Resources

- Resource availability has guided the development of human society.(HS-ESS3-1)
- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulationscan change the balance of these factors. (HS-ESS3-2)

###### ESS3.B: Natural Hazards

- Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)

###### ESS3.C: Human Impacts on Earth Systems

- Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

##### PS2: Motion and Stability: Forces and Interactions

###### PS2.B: Types of Interactions

- Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects.(HS-PS2-4)
- Forces at a distance are explained by fields (gravitational,electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4),(HS-PS2-5)

##### PS3: Energy

###### PS3.A: Definitions of Energy

- Energy is a quantitative property of a system that depends on the motionand interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HSPS3-1),(HS-PS3-2)
- At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HSPS3-2) (HS-PS3-3)

###### PS3.B: Conservation of Energy and Energy Transfer

- Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1)
- Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HSPS3-4)
- Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1)
- The availability of energy limits what can occur in any system. (HS-PS3-1)

###### PS3.C: Relationship Between Energy and Forces

- When two objects interacting through a field change relative position, theenergy stored in the field is changed. (HS-PS3-5)

###### PS3.D: Energy in Chemical Processes and Everyday Life

- Although energy cannot be destroyed, it can be converted to less usefulforms—for example, to thermal energy in the surrounding environment.(HS-PS3-3),(HS-PS3-4)

##### ETS1: Engineering Design

###### ETS1.A: Defining and Delimiting an Engineering Problem

- Criteria and constraints also include satisfying any requirements setby society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such away that one can tell if a given design meets them. (HS-ETS1-1)(secondary to HS-PS2-3) (secondary to HS-PS3-3)

###### ETS1.B: Developing Possible Solutions

- When evaluating solutions it is important to take into account arange of constraints including cost, safety, reliability and aestheticsand to consider social, cultural and environmental impacts.(secondary to HS-LS2-7) (secondary to HS-LS4-6) (secondary to HSESS3-2),(secondaryHS-ESS3-4) (HS-ETS1-3)

# Critical Content & Skills

*What students must **KNOW** and **be able to DO***

## Terms Students must KNOW:

Renewable  
Non-Renewable  
Photovoltaic  
Solar Energy  
Wind Energy  
Hydroelectric Energy  
Biomass  
Nuclear Power  
Geothermal Energy  
Turbine  
Generator  
Power Plant  
Transformer  
Conservation of Energy  
Energy Transformation  
Potential Energy  
Kinetic Energy  
Mechanical Energy  
Chemical Energy  
Radiant Energy  
Nuclear Energy  
Thermal Energy  
Electron  
Electromagnetism  
Electrical Field  
Magnetic Field  
Magnet  
Electricity  
Current  
Amps  
Volts  
 $V=IR$   
Resistance  
Battery

## Students must be able to DO:

### **Developing and Using Models**

Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.

### **Constructing Explanations and Designing Solutions**

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations.

Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

### **Using Mathematics and Computational Thinking**

Create a computational model or simulation of a phenomenon, designed device, process, or system.

### **Planning and Carrying Out Investigations**

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

### **Engaging in Argument from Evidence**

Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).

# Core Learning Activities

1. Modern Marvels: Renewable Energy movie to offer background knowledge about renewable energy resource to aid in poster project.
2. Energy Resource Research and Presentation: Students create a poster detailing pros and cons of a renewable resource and how it works to generate electricity.
3. Wind Turbine: Students design and build a wind turbine that produces small amounts of voltage.
4. Testing PV Cells: Students use small photovoltaic cells (Solar Cells) to test the effects of different variables such as angle and light intensity on voltage production.
5. Energy Transformation Stations: Students engage in hands-on activities to explore simple energy transformations.
6. Using Electromagnetism Presentation: Basic notes and discussion on how various forms of energy are converted to electricity.
7. Build an Electromagnet: Students construct a simple electromagnet and determine which variables can affect the strength of the magnet.

 [design a wind turbine.docx](#)

 [Testing PV Cells.doc](#)

 [Modern Marvels: Renewable Energy](#)

 [UsingElectroMagnetism.ppt.pdf](#)

 [Energy Transformation Stations.pdf](#)

 [Energy Sources Research and Presentations Rubric.pdf](#)

 [build an electromagnet.pdf](#)

## Assessments

### Build an Electromagnet

#### Formative: Lab Assignment

See attachments under Core Learning Activities.

### Energy Sources Research and Presentation

#### Formative: Group Project

See attachments under Core Learning Activities.

### Wind Turbine Build

#### Summative: Personal Project

See attachments under Core Learning Activities.

## Resources

### Professional & Student

Text Book; Glencoe *Physical Science with Earth Science*. 2006. Unit 4. Chapter 16, pages 484-409.

#### Videos:

Introductory video to electromagnets and their use, effects, and how to build one.

<https://www.youtube.com/watch?...>

Crash Course Physics: Magnetism, a more detailed look at magnetism

<https://www.youtube.com/watch?...>

Sick Science: basic instructions on how to make a simple electromagnet. Use this video as in-class instructions for electromagnet activity. <https://www.youtube.com/watch?...>

## Student Learning Expectation & 21st Century Skills

[Information Literacy](#)

[Critical Thinking](#)

[Spoken Communication](#)

[Written Performance](#)

- Information Literacy
- Problem Solving

## Interdisciplinary Connections

Social Studies integration; In studying energy resources and how society generates power/electricity students will have to consider constraints such as population density, economics, and cost efficiency to determine the energy resources that would be best suited for certain regions. These social aspects of constraints on the power grid will help students synthesize a more complex solution to the energy crisis question and to more deeply weigh the pros and cons of each available resource. Further study of the effect of electric technology on society and modern first world life will be connected to the electromagnet investigations. Electromagnets are at the core of all electronic technology that makes life in the first world possible and could be part of the solution for lifting poorer nations out of poverty.