Guidelines for Physical Science Portfolio for Prerequisite Exemption

To be submitted by April 14, 2021

Introduction:

Physical Science is designed as an introduction to the major concepts in chemistry and physics. The course includes concepts such as: structure of atoms, periodic table principles, motion, forces, conservation of matter and energy, gravity, and the behavior of waves. These concepts are investigated through laboratory experiences designed to promote and develop appropriate skills in science inquiry.

Physical science is a requirement for graduation; however, students may obtain a waiver for this course by successfully demonstrating proficiency (a "3" or higher in each of the course competencies) in the portfolio and review process. This waiver DOES NOT meet the physical science graduation requirement. If the waiver is granted, the student will need to earn credit in either chemistry or physics.

This portfolio process is designed to be a rigorous and authentic demonstration of understanding of the physical science course content. This competency-based process mimics the experience of students currently enrolled in physical science at the Nashua High Schools (North and South). In a competency-based system, students need to represent content-specific skills and knowledge based on set learning targets for that course. For physical science, the learning targets are the standards taken from the NH Science Literacy Curriculum Framework. In addition, the portfolio is designed to align with the knowledge and skills students need to enter and succeed in postsecondary opportunities.

Purpose:

The portfolio is a self-selected collection of artifacts that demonstrates a student's knowledge and skills in physical science. Each portfolio should be selective and reflective in both process and product. The goal of the portfolio is to document the student's mastery of the course competencies in the physical science curriculum.

Eligibility:

- Any current 8th grade student enrolled in the Nashua School District.
- Any current 8th grade student enrolled in area schools which is a resident of Nashua **on or before April 1, 2021.**
- Any current 8th grade home schooled student, which is a resident of Nashua **on or before April 1, 2021**.

Any family moving to Nashua **after April 1, 2021** will need to contact Mrs. Cheryl Meesig (meesigc@nashua.edu) and Dr. Naomi Hall (halln@nashua.edu) to discuss procedure.

Requirements:

Portfolios must be brought to the Nashua High School South security office on **April 14, 2021** between 8:00 am and 3:00 pm, or prior to that date by appointment only. To schedule a drop off appointment, please contact Mrs. Cheryl Meesig and Dr. Naomi Hall at meesigc@nashua.edu and halln@nashua.edu.

- **Late portfolios will not be accepted under any circumstances.**
- Students will be allowed one submission only.
- Submitted portfolios will not be returned, please keep a copy for your own records.
- Electronic submissions will be accepted, but must be submitted on a CD, DVD or a flash drive, and must be accompanied by hard copies.
    - CD's, DVD's, and flash drives will not be returned.
- A copy of the scored rubric will be returned via parent and student email.
- It is recommended that students find a teacher or mentor at their current schools to review artifacts and provide feedback prior to submission; however, students are responsible to ensure materials meet all requirements. The approval of a teacher or mentor does not guarantee the portfolio will be accepted for Physical Science credit.

The portfolio should include:

1. A title page (Appendix A)
2. A minimum of 4 artifacts. These artifacts must demonstrate understanding of all 23 science literacy standards outlined in Appendix B. Students must demonstrate proficiency for each of the four course competencies (Appendix C), a minimum of four times, using a variety of science process skills (Appendix C). Each science process skill must be used at least twice.
    a. Each artifact can cover multiple standards and/or multiple competencies. (see example below *)
    b. Each artifact should include:
        i. A completed cover page (Appendix D)
        ii. The product – student choice (products could include diagrams, models, experiments, research papers, presentations, videos, etc.)
        iii. A minimum of a one paragraph reflection, which describes how the products meet the standards and competencies.
3. A completed checklist (Appendix E) showing which standards are met in each course competency.
4. A final reflection which focuses on the student's readiness to bypass physical science.

***Example:** Students could create one project that demonstrates all of the "forces" and "motions" standards. Within this project students could also demonstrate their understanding of multiple course competencies (ex: communication and computational thinking).

Portfolio Submission:

- All evidence must be able to fit in a copy paper box (12" x 18" x 10"), but may be submitted in a smaller binder, envelope, or box.
- All evidence must be clearly labeled with student and artifact name.
- Electronic evidence must be on CD, DVD, or flash drive.
    - Electronic evidence must be accompanied by hard copies.
    - Electronic evidence should be placed into a labeled manila envelope.
- Please remember to keep copies for your records, as portfolios will not be returned.
- Submissions will be taken:
    - On April 14th from 8 am to 3pm at Nashua High School South.
    - By appointment prior to April 14th. Contact Cheryl Meesig and Naomi Hall to set up an appointment.

Portfolio Assessment:

Portfolios that are incomplete or late will not be scored. If the portfolio meets the above requirement, the portfolio will be assessed using the science competency rubric (Appendix F). A copy of the scored rubric will be returned via parent and student email.

If the student demonstrates proficiency (a "3" or higher) in each of the course competencies a minimum of 4 times, the student will be invited to a 30-60 minute interview with a review panel for their final defense.

The review panel at a minimum will include a building/district administrator, the head science teachers at North and South, a middle school science liaison, and one additional high school science teacher. Students will be required to defend their portfolios, clarify any questions about their submission, and answer questions about the course content.

The review panel will then meet to determine whether or not to grant the physical science prerequisite waiver. Parents and students will be notified in writing about the decision. All decisions are final, and no appeals will be heard.

Questions? Please contact Mrs. Cheerly Meesig and Dr. Naomi Hall at meesigc@nashua.edu and halln@nashua.edu

Appendix A

Physical Science Portfolio – Title Page

To be completed by student/parent:

Student Name	
Student Email	
Current School	
Future High School	
Parent Name(s)	
Parent Email	
Parent Phone	

I acknowledge that I have checked my child's submission to ensure all required materials have been included for the Physical Science portfolio. I also acknowledge that each competency has been demonstrated at least four times and each skill has been demonstrated at least twice.

Parent Signature: _____

Student Signature: _____

To be completed by school personnel:

Date of Submission: _____

Received by: _____

(cut here)

Physical Science Portfolio – Student/Parent Receipt of Submission

Student Name: _____

Date of Submission: _____

(to be completed by district office personnel)

Received by: _____

(to be completed by district office personnel)

Appendix B

Physical Science Standards:

These standards have been taken from the NH Science Literacy Curriculum Framework and serve as the basis for the physical science curriculum at the high schools. Each standard should be demonstrated one to two times throughout the portfolio.

ESS1- The Earth and Earth materials, as we know them today, have developed over long periods of time, through constant change processes.

Processes and Rates of Change

- S:ESS1:8:5.3 Explain the role of differential heating or convection in ocean currents, winds, weather and weather patterns, atmosphere, or climate. [ESS1(5-8)SAE+POC-4]

ESS3- The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across distances and time.

Stars and Galaxies

- S:ESS3:11:2.3 Explain the relationships between or among the energy produced from nuclear reactions, the origin of elements, and the life cycles of stars. [ESS3(9-11)POC+SAE-8]

Universe

- S:ESS3:11:3.3 Provide scientific evidence that supports or refutes the "Big Bang" theory of how the universe was formed. [ESS3(9-11)NOS-6]
- S:ESS3:11:3.4 Based on the nature of electromagnetic waves, explain the movement and location of objects in the universe or their composition (e.g., red shift, blue shift, line spectra). [ESS3(9-11)SAE-7]
- S:ESS3:11:3.5 Explain how scientific theories about the structure of the universe have been advanced through the use of sophisticated technology (e.g., space probes and visual, radio and x-ray telescopes). [ESS3(9-11)NOS-5]

PS1– All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size/amount of substance).

Composition

- S:PS1:8:1.7 Given graphic or written information, classify matter as atom/molecule or element/compound (not the structure of an atom). [PS1(5-8)MAS-5]
- S:PS1:11:1.5 Scientific thought about atoms has changed over time. Using information (narratives or models of atoms) provided, cite evidence that changed our understanding of the atom and the development of atomic theory. [PS1(9-11)MAS+NOS-2]
- S:PS1:11:1.6 Model and explain the structure of an atom or explain how an atom's electron configuration, particularly the outermost electron(s), determines how that atom can interact with other atoms. [PS1(9-11)MAS+FAF-4]

Properties

- S:PS1:8:2.4 Investigate the relationships among mass, volume and density. [PS1(5-8)INQ-1]
- S:PS1:8:2.5 Given data about characteristic properties of matter (e.g., melting and boiling points, density, solubility), identify, compare, or classify different substances. [PS1(5-8)INQ+POC-2]
- S:PS1:8:2.6 Represent or explain the relationship between or among energy, molecular motion, temperature, and states of matter. [PS1(5-8)SAE+MAS-4]
- S:PS1:11:2.6 Use physical and chemical properties as determined through an investigation to identify a substance. [PS1(9-11)INQ-1]
- S:PS1:11:2.7 Explain how properties of elements and the location of elements on the periodic table are related. [PS1(9-11)POC-3]

PS2– Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.

Change

- S:PS2:8:1.5 Given a real-world example, show that within a system, energy transforms from one form to another (i.e., chemical, heat, electrical, gravitational, light, sound, mechanical). [PS2(5-8)SAE+POC-6]
- S:PS2:11:1.5 Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles. [PS2(9-11)SAE-7]

Conservation

- S:PS2:8:2.2 Collect data or use data provided to infer or predict that the total amount of mass in a closed system stays the same, regardless of how substances interact (conservation of matter). [PS1(5-8)INQ+SAE-3]
- S:PS2:11:2.5 Demonstrate how transformations of energy produce some energy in the form of heat and therefore the efficiency of the system is reduced (chemical, biological, and physical systems). [PS2(9-11)POC+SAE-5]

Energy

- S:PS2:8:3.6 Use data to draw conclusions about how heat can be transferred (convection, conduction, radiation). [PS2(5-8)INQ+SAE+POC-7]
- S:PS2:11:3.10 Using information provided about chemical changes, draw conclusions about the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions). [PS2(9-11)INQ+SAE-6]

PS3– The motion of an object is affected by force.

Forces

- S:PS3:8:1.3 Use data to determine or predict the overall (net) effect of multiple forces (e.g., friction, gravitational, magnetic) on the position, speed, and direction of motion of objects. [PS3(5-8)INQ+POC-8]
- S:PS3:11:1.8 Given information (e.g., graphs, data, diagrams), use the relationships between or among force, mass, velocity, momentum, and acceleration to predict and explain the motion of objects. [PS3(9-11)INQ+POC-8]

Motion

- S:PS3:11:2.3 Apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions. [PS3(9-11)POC-9]
- S:PS3:11:2.4 Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffraction, blue sky). [PS3(9-11)SAE-10]

Appendix C

Course Competencies:

Students must demonstrate proficiency in each competency a minimum of four times.

1. Solutions: Develop and test proposed solutions to complex problems with no obvious answer.
2. Communication: Speak, read, and write to infer, interpret, draw conclusions, and support arguments in science.
3. Computational Thinking**:** Utilize mathematics and computational thinking to model, analyze, and interpret scientific data and concepts.
4. Patterns: Utilize patterns to connect observable or unobservable phenomena between systems, processes, or objects.

Science Process Skills:

Students should be able to use these eight practices to demonstrate their understanding of the topics covered in physical science. Each practice should be used a minimum of two times.

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Appendix D

Physical Science Portfolio - Artifact Cover Sheet

Student Name:

Artifact Title:

Standards Addressed (list standards here)

Course Competencies – Place a checkmark next to each competency demonstrated in this artifact.

☐ **Solutions:** Develop and test proposed solutions to complex problems with no obvious answer.
☐ **Communication:** Speak, read, and write to infer, interpret, draw conclusions, and support arguments in science.
☐ **Computational Thinking:** Utilize mathematics and computational thinking to model, analyze, and interpret scientific data and concepts.
☐ **Patterns:** Utilize patterns to connect observable or unobservable phenomena between systems, processes, or objects.

Science Process Skills – Place a checkmark next to each skill demonstrated in the artifact.

☐ Asking questions (for science) and defining problems (for engineering)
☐ Developing and using models
☐ Planning and carrying out investigations
☐ Analyzing and interpreting data
☐ Using mathematics and computational thinking
☐ Constructing explanations (for science) and designing solutions (for engineering)
☐ Engaging in argument from evidence
☐ Obtaining, evaluating, and communicating information

Reflection of the Assignment:

Appendix E

Physical Science Portfolio – Competency and Standard Checklist

	Solutions	Communication	Computational Thinking	Patterns
ESS1 - THE EARTH AND EARTH MATERIALS, AS WE KNOW THEM TODAY, HAVE DEVELOPED OVER LONG PERIODS OF TIME, THROUGH CONSTANT CHANGE PROCESSES.				
Processes and Rates of Change				
S:ESS1:8:5.3				
ESS3 - THE ORIGIN AND EVOLUTION OF GALAXIES AND THE UNIVERSE DEMONSTRATE FUNDAMENTAL PRINCIPLES OF PHYSICAL SCIENCE ACROSS DISTANCES AND TIME.				
Stars and Galaxies				
S:ESS3:11:2.3				
Universe				
S:ESS3:11:3.3				
S:ESS3:11:3.4				
S:ESS3:11:3.5				
PS1 - ALL LIVING AND NONLIVING THINGS ARE COMPOSED OF MATTER HAVING CHARACTERISTIC PROPERTIES THAT DISTINGUISH ONE SUBSTANCE FROM ANOTHER (INDEPENDENT OF SIZE/AMOUNT OF SUBSTANCE).				
Composition				
S:PS1:8:1.7				
S:PS1:11:1.5				
S:PS1:11:1.6				
Properties				
S:PS1:8:2.4				
S:PS1:8:2.5				
S:PS1:8:2.6				
S:PS1:11:2.6				
S:PS1:11:2.7				

	Solutions	Communication	Computational Thinking	Patterns
PS2 - ENERGY IS NECESSARY FOR CHANGE TO OCCUR IN MATTER. ENERGY CAN BE STORED, TRANSFERRED AND TRANSFORMED, BUT CANNOT BE DESTROYED.				
Change				
S:PS2:8:1.5				
S:PS2:11:1.5				
Conservation				
S:PS2:8:2.2				
S:PS2:11:2.5				
Energy				
S:PS2:8:3.6				
S:PS2:11:3.10				
PS3 - THE MOTION OF AN OBJECT IS AFFECTED BY FORCE.				
Forces				
S:PS3:8:1.3				
S:PS3:11:1.8				
Motion				
S:PS3:11:2.3				
S:PS3:11:2.4				

Appendix F

Physical Science Portfolio – Evaluation Rubric

	4 Proficient with Distinction	3 Proficient	2 Partially Proficient	1 In Progress
Solutions Develop and test proposed solutions to complex problems with no obvious answer.	• The student effectively developed a solution to a complex problem. • The student applied the solution to a new and different situation. • The student successfully tested the proposed solution to solve a complex problem. • The student used their solution to generate further questions or ideas to investigate.	• The student effectively developed a solution to a complex problem. • The student applied the solution to a new and different situation. • The student successfully tested the proposed solution to solve a complex problem.	• The student partially developed a solution to a complex problem. • The student tested the proposed solution to solve a complex problem.	• The student attempted to develop a solution to a complex problem, but did not demonstrate an understanding of the problem.
Comments:				
Communication Speak, read, and write to infer, interpret, draw conclusions, and support arguments in science.	• The student spoke, read, **and/or** wrote effectively about scientific information. • The student made appropriate inferences, interpretations, and conclusions, while citing evidence. • The student included outside sources **and/or** prior knowledge/ experiences to support their claim.	• The student spoke, read, **and/or** wrote effectively about scientific information. • The student made appropriate inferences, interpretations, and conclusions, while citing evidence.	• The student inconsistently spoke, read, **and/or** wrote about scientific information. • The student made inferences, interpretations, and conclusions, but misconceptions are evident. • The student did not use evidence **or** inappropriately cited evidence to support their claim.	• The student spoke, read **and/or** wrote about scientific information, but did not demonstrate an understanding of the course content.
Comments:				

	4 Proficient with Distinction	3 Proficient	2 Partially Proficient	1 Not Yet Proficient
Computational Thinking Utilize mathematics and computational thinking to model, analyze, and interpret scientific data and concepts.	• The student used math to effectively model, analyze, and interpret scientific data and concepts. • The student used their model, analysis, or interpretations to make connections to other situations, **or** the student applied other models to the same situation appropriately.	• The student used math to effectively model, analyze, and interpret scientific data and concepts. • Mathematical errors are present, but do not take away from the student's demonstration of understanding of content or skills.	• The student used math to model, analyze, and interpret scientific data and concepts. • Mathematical errors show an inconsistent understanding of the content or skills.	• The student made an attempt to use math to model, analyze, and interpret scientific data and concepts. • Mathematical errors show that the student does not understand the necessary content or skills.
Comments:				
Patterns Utilize patterns to connect observable or unobservable phenomena between systems, processes, or objects.	• The student used patterns to effectively connect, predict, investigate, and describe systems, processes, or objects. • The student used these patterns to make connections to and predictions about other situations.	• The student used patterns to effectively connect, predict, investigate, and describe systems, processes, or objects.	• The student inconsistently used patterns to connect, predict, investigate, and describe systems, processes, or objects. • The student's misconceptions are evident.	• The student made an attempt to use patterns to connect, predict, investigate, and describe systems, processes, or objects, but does not understand the necessary content or skills.
Comments:				