Overview

Overview | Egg Drop Physics

Egg Drop Physics

by Dr. John Antinora

Students, using pre-defined dimensions, will create a vehicle to protect a large, raw egg from breaking when dropped from approximately 15 feet.

Grades: *10 11 12*

Discipline: *Science*

Teaching Task: *Task Template 15 (Informational or Explanatory and Procedural-Sequential)*

Course: *Physics*

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Section 1: What Task?

TEACHING TASK

Task Template 15 — [1 Level] *Informational & Procedural*

L1: After researching informational articles on the physics involved in an egg drop experiment , write process paper that relates how the egg drop vehicle was developed, tested, and how the outcome of the drop relates to the physics principles involved. . Support your discussion with evidence from your research.

STUDENT BACKGROUND

No Student Background for this Module

EXTENSION

No Extension for this Module

Rubric

Scoring Elements	Not Yet		Approaches Expectations		Meets Expectations		Advanced
	1	1.5	2	2.5	3	3.5	4
Focus	Attempts to address prompt, but lacks focus or is off-task.		Addresses prompt appropriately, but with a weak or uneven focus.		Addresses prompt appropriately and maintains a clear, steady focus.		Addresses all aspects of prompt appropriately and maintains a strongly developed focus.
Controlling Idea	Attempts to establish a controlling idea, but lacks a clear purpose.		Establishes a controlling idea with a general purpose.		Establishes a controlling idea with a clear purpose maintained throughout the response.		Establishes a strong controlling idea with a clear purpose maintained throughout the response.
Reading/Research	Attempts to present information in response to the prompt, but lacks connections or relevance to the purpose of the prompt. (L2) Does not address the credibility of sources as prompted.		Presents information from reading materials relevant to the purpose of the prompt with minor lapses in accuracy or completeness. (L2) Begins to address the credibility of sources when prompted.		Presents information from reading materials relevant to the prompt with accuracy and sufficient detail. (L2) Addresses the credibility of sources when prompted.		Accurately presents information relevant to all parts of the prompt with effective selection of sources and details from reading materials. (L2) Addresses the credibility of sources and identifies salient sources when prompted.
Development	Attempts to provide details in response to the prompt, including retelling, but lacks sufficient development or relevancy. (L2) Implication is missing, irrelevant, or illogical. (L3) Gap/unanswered question is missing or irrelevant.		Presents appropriate details to support the focus and controlling idea. (L2) Briefly notes a relevant implication or (L3) a relevant gap/unanswered question.		Presents appropriate and sufficient details to support the focus and controlling idea. (L2) Explains relevant and plausible implications, and (L3) a relevant gap/unanswered question.		Presents thorough and detailed information to strongly support the focus and controlling idea. (L2) Thoroughly discusses relevant and salient implications or consequences, and (L3) one or more significant gaps/unanswered questions.
Organization	Attempts to organize ideas, but lacks control of structure.		Uses an appropriate organizational structure to address the specific requirements of the prompt, with some lapses in coherence or awkward use of the organizational structure.		Maintains an appropriate organizational structure to address the specific requirements of the prompt.		Maintains an organizational structure that intentionally and effectively enhances the presentation of information as required by the specific prompt.

Conventions	Attempts to demonstrate standard English conventions, but lacks cohesion and control of grammar, usage, and mechanics. Sources are used without citation.		Demonstrates an uneven command of standard English conventions and cohesion. Uses language and tone with some inaccurate, inappropriate, or uneven features. Inconsistently cites sources.		Demonstrates a command of standard English conventions and cohesion, with few errors. Response includes language and tone appropriate to the audience, purpose, and specific requirements of the prompt. Cites sources using an appropriate format with only minor errors.		Demonstrates and maintains a well-developed command of standard English conventions and cohesion, with few errors. Response includes language and tone consistently appropriate to the audience, purpose, and specific requirements of the prompt. Consistently cites sources using appropriate format.
Content Understanding	Attempts to include disciplinary content in explanations, but understanding of content is weak; content is irrelevant, inappropriate, or inaccurate.		Briefly notes disciplinary content relevant to the prompt; shows basic or uneven understanding of content; minor errors in explanation.		Accurately presents disciplinary content relevant to the prompt with sufficient explanations that demonstrate understanding.		Integrates relevant and accurate disciplinary content with thorough explanations that demonstrate in-depth understanding.

STANDARDS

National Science Education Standards — Physical Science

HS.B4: As a result of their activities in grades 9-12, all students should develop an understanding of motions and forces.

HS.B6: As a result of their activities in grades 9-12, all students should develop an understanding of interactions of energy and matter.

Common Core Anchor Standards — Reading

R.CCR.1: Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

R.CCR.2: Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

R.CCR.4: Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

R.CCR.6: Assess how point of view or purpose shapes the content and style of a text.

R.CCR.7: Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

R.CCR.10: Read and comprehend complex literary and informational texts independently and proficiently.

Common Core Anchor Standards — Writing

W.CCR.2: Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

W.CCR.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

W.CCR.5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

W.CCR.6: Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

W.CCR.7: Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

W.CCR.8: Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

W.CCR.9: Draw evidence from literary or informational texts to support analysis, reflection, and research.

W.CCR.10: Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

Custom Standards

Section 2: What Skills?

Selected Skills

Required Physics Concepts

FREE FALL: Students will read current event articles involving free fall as a way to connect to free fall physics formulas & concepts.

CRASH SAFETY: Students will complete MAX framework reading on Crash Safety & make connections to physics involved in impulse & momentum during egg drop.

Preparing for the Task

TASK ENGAGEMENT: Using acquired knowledge about physics of free fall and impact from the reading assignments, students will connect this content connect to the Egg Drop experiment.

EGG DROP EXPERIMENT OVERVIEW: Explain the parameters of the experiment and also introduce the scoring rubric.

REVIEW PRIOR PHYSICS CONCEPT KNOWLEDGE: Review of what the students know about force, acceleration, impulse/momentum, gravity and the design principles involved in dropping an egg vehicle 15 feet.

Reading Process

TEXT SELECTION FOR EGG DROP EXPERIMENT: Utilize various NYT, and Discover Magazine readings on Sports Impacts, Car Crashes, & Plane Crashes, Free Fall.

INSERT NOTE TAKING: Students will use small Post-It notes during their reading identifying any unfamiliar Tier 2 & 3 vocabulary terms.

ESSENTIAL VOCABULARY - INSERT NOTE TAKING: Utilizing Insert Note Taking students will identify unfamiliar Tier 2 & 3 vocabulary words from the reading(s).

ACADEMIC INTEGRITY: When handing in any writing assignment students must use either APA or MLA format to properly give credit to reference materials.

NOTE-TAKING: During note taking students will utilize Cornell Notebook where they will write questions about their notes in the LH column and create a daily summary at the end of the notes.

Transition to Writing

BRIDGING RESEARCH TO EGG DROP VEHICLE: Utilizing information from the reading assignments and note, students will write a design paper giving rationale of the materials and methods they selected during egg drop vehicle design.

Writing Process

CONTROLLING IDEA - PROCESS PAPER DRAFT: Collaborating in groups of 2 students will consolidate information from the reading assignments relevant to egg drop i.e. free fall, impact, momentum, force.

PLANNING: Ability to develop a line of thought and text structure appropriate to an information/explanation task.

DEVELOPMENT - EGG DROP VEHICLE DESIGN: Using their knowledge of physics and established constraints, student's will submit an initial design draft of their vehicle.

REVISION - EGG DROP VEHICLE DESIGN: Students will build a prototype and drop the vehicle with a plastic egg making any design revisions they feel necessary for a successful egg drop with a real raw egg.

COMPLETION - EGG DROP DESIGN: After the "test" drop and subsequent revisions to their design, students will submit final the final process paper that meets expectations.

Section 3: What Instruction?

MiniTasks

Required Physics Concepts

FREE FALL: Students will read current event articles involving free fall as a way to connect to free fall physics formulas & concepts.

SHORT CONSTRUCTED RESPONSE

After watching the demo of throwing an egg at a wall and an 2nd egg at a hanging sheet explain why you think the egg hitting the sheet doesn't break.

Scoring Guide: work meets expectations if:

Students write 3-5 complete sentences using Tier 1 & 2 vocabulary such as "soft" "give" "force"

CRASH SAFETY: Students will complete MAX framework reading on Crash Safety & make connections to physics involved in impulse & momentum during egg drop.

LIST

ENTER A PROMPT

Scoring Guide: work meets expectations if:

None

Preparing for the Task

TASK ENGAGEMENT: Using acquired knowledge about physics of free fall and impact from the reading assignments, students will connect this content connect to the Egg Drop experiment.

LIST

In a quick write, write 2 or more reasons why you think the egg being thrown at the sheet did not break. Add some notes of things you know about this issue.

Pacing: Day 1

Scoring Guide: work meets expectations if:

they write at least 2 reactions to the demonstration.

Teaching Strategies:
• Link this task to Egg Throw demo.
• Discuss student responses.
• Clarify the timetable (draft, final, vehicle test, drop day) and support plans for the task.

Notes:
Due to budgetary constraints students need to supply their own materials for this standard.

EGG DROP EXPERIMENT OVERVIEW: Explain the parameters of the experiment and also introduce the scoring rubric.

LIST
In your own words, what are the important features of a good response to this prompt?

Pacing: Day 2

Scoring Guide: work meets expectations if:
Students actively participate in peer-to-peer discussion.

Teaching Strategies:
• Share example videos of prior egg drops showing types of vehicles they will produce (past students).
• Identify or invite students to identify key features of successful egg drop vehicles.
• Pair students to share and improve their ideas.
• Create a classroom list: Choose one student to share a few ideas on the board, and ask other to add to it.
• Clarify the challenge (Egg Drop) and constraints (dimensions, materials)

REVIEW PRIOR PHYSICS CONCEPT KNOWLEDGE: Review of what the students know about force, acceleration, impulse/momentum, gravity and the design principles involved in dropping an egg vehicle 15 feet.

NOTES
Using Questioning Cycle students will be called upon utilizing random Popsicle method to answer questions force, acceleration, and gravity and the design principles.

Pacing: Day 3-6

Scoring Guide: work meets expectations if:
If students are actively engaged in peer-to-peer conversation about the physics concepts.

Teaching Strategies:
They create properly annotated notes of prior physics concepts.

Reading Process

TEXT SELECTION FOR EGG DROP EXPERIMENT: Utilize various NYT, and Discover Magazine readings on Sports Impacts, Car Crashes, & Plane Crashes, Free Fall.

NOTES
For each reading assignment, list the needed bibliographic information. Add bullets on why you think the work is credible and/or worthy of study.

Pacing: Day 7

Scoring Guide: work meets expectations if:
• Identifies author, title, publisher, date, and any other needed information (for example, the volume for a periodical or the editor for an anthology).
• Includes reasonable evidence that work is credible and/or worthy of study.

Teaching Strategies:
• Provide citation guide APA or MLA and discuss why each element of citation is needed.
• Ask students to brainstorm what makes an author credible and/or worthy of study.
• Provide access to research sources for students to assess the texts.

INSERT NOTE TAKING: Students will use small Post-It notes during their reading identifying any unfamiliar Tier 2 & 3 vocabulary terms.

SHORT CONSTRUCTED RESPONSE
What is the author trying to accomplish? Which parts of the text show you that?
• L2 What competing arguments have you encountered or can you think of?
• L3 What historical or current examples can you note that relate to the task prompt?

Pacing: Day 8

Scoring Guide: work meets expectations if:
• Answers questions with credible response.

Teaching Strategies:
• Invite students to brainstorm ways to create a successful egg drop vehicle within the building restraints.
• Invite students to share and discuss their design ideas.
• After the discussion, allow them to add to their entries.

ESSENTIAL VOCABULARY - INSERT NOTE TAKING: Utilizing Insert Note Taking students will identify unfamiliar Tier 2 & 3 vocabulary words from the reading(s).

LIST
Using the Post-it Notes you created while reading the texts/articles, in your Cornell notebook, list unfamiliar words and phrases.

Pacing: Day 9

Scoring Guide: work meets expectations if:
• Lists appropriate phrases.
• Provides accurate definitions.

Teaching Strategies:
• After scoring, ask some students to share definitions of terms that others overlooked or misunderstood.
• After scoring, be willing to provide direct instruction or guide a close reading if needed to work through a key phrase most students missed.

ACADEMIC INTEGRITY: When handing in any writing assignment students must use either APA or MLA format to properly give credit to reference materials.

SHORT CONSTRUCTED RESPONSE
Define "plagiarism" and list ways to avoid it.

Pacing: Day 10

Scoring Guide: work meets expectations if:
• Provides accurate definition

• Lists several appropriate strategies to avoid plagarism.

Teaching Strategies:
• Have student attend an in-service with the Librarian discussing how to properly give credit to other author and avoid plagarism.
• Discuss respect for others' work to assemble evidence and create texts.
• Discuss academic penalties for stealing others thoughts and words.

NOTE-TAKING: During note taking students will utilize Cornell Notebook where they will write questions about their notes in the LH column and create a daily summary at the end of the notes.

NOTES
•During review of physics concepts, make a list of the concepts that are important for your vehicle design.
• L3 Why is it important in the process of inquiry to "identify gaps" or "unanswered questions" about the egg drop vehicle?

Pacing: Day 11-14

Scoring Guide: work meets expectations if:
• Identifies relevant concepts.
• Includes information to support design.

Teaching Strategies:
• Teach a model format for note taking.
• Check that early student work is in the assigned format (or in another format that gathers the needed information effectively).

Transition to Writing

BRIDGING RESEARCH TO EGG DROP VEHICLE: Utilizing information from the reading assignments and note, students will write a design paper giving rationale of the materials and methods they selected during egg drop vehicle design.

LIST
In a quick write, write about what you know now that you've read about (content).

Scoring Guide: work meets expectations if:

None

Teaching Strategies:
• Discussion-based strategies, such as seminar.
• Small group discussion using question.

Writing Process

CONTROLLING IDEA - PROCESS PAPER DRAFT: Collaborating in groups of 2 students will consolidate information from the reading assignments relevant to egg drop i.e. free fall, impact, momentum, force.

SHORT CONSTRUCTED RESPONSE
Write an opening paragraph that includes a controlling idea and sequences the key points you plan to make in your composition

Scoring Guide: work meets expectations if:
• Writes a concise summary statement or draft opening.
• Provides direct answer to main prompt requirements.
• Establishes a controlling idea.
• Identifies key points that support development of argument.

Teaching Strategies:
• Offer several examples of opening paragraphs.
• Ask class to discuss what makes them strong or weak.
• Review the list that students created earlier to identify needed elements (from Cluster 1, skill 2).

PLANNING: Ability to develop a line of thought and text structure appropriate to an information/explanation task.

OUTLINE
Create an outline based on your notes and reading in which you state your claim, sequence your points, and note your supporting evidence.

Scoring Guide: work meets expectations if:
• Creates an outline or organizer.
• Supports controlling idea. Uses evidence from texts read earlier.

Teaching Strategies:
• Provide and teach one or more examples of outlines or organizers.
• Invite students to generate questions in pairs about how the format works, and then take and answer questions.

DEVELOPMENT - EGG DROP VEHICLE DESIGN: Using their knowledge of physics and established constraints, student's will submit an initial design draft of their vehicle.

LONG CONSTRUCTED RESPONSE
Write an initial draft complete with opening, development, and closing; insert and cite textual evidence.

Scoring Guide: work meets expectations if:
• Provides complete draft with all parts.
• Supports the opening in the later sections with evidence and citations.

Teaching Strategies:
• Encourage students to re-read prompt partway through writing, to check that they are on track.

REVISION - EGG DROP VEHICLE DESIGN: Students will build a prototype and drop the vehicle with a plastic egg making any design revisions they feel necessary for a successful egg drop with a real raw egg.

LONG CONSTRUCTED RESPONSE
Refine composition's analysis, logic, and organization of ideas/points. Use textual evidence carefully, with accurate citations. Decide what to include and what not to include.

Scoring Guide: work meets expectations if:
• Provides complete draft with all parts.
• Supports the opening in the later sections with evidence and citations.
• Improves earlier edition.

Teaching Strategies:
• Sample useful feedback that balances support for strengths and clarity about weaknesses.
• Assign students to provide each other with feedback on those issues.

COMPLETION - EGG DROP DESIGN: After the "test" drop and subsequent revisions to their design, students will submit final the final process paper that meets expectations.

LONG CONSTRUCTED RESPONSE

Turn in your complete set of drafts, plus the final version of your piece

Scoring Guide: work meets expectations if:

• Fits the “Meets Expectations” category in the rubric for the teaching task.

Resources

Selected Articles

Energy.
(http://modulecreator.com/ModuleCreator/#page=login&moduleId=18703&scrollTo=articles)
Columbia Electronic Encyclopedia, 6th Edition (11/1/2011)—
Energy, in physics, the ability or capacity to do work or to produce change. Forms of energy include heat, light, sound, electricity, and chemical energy. Energy and work are measured in the same units—foot-pounds, joules, ergs, or some other, depending on the system of measurement being used. When a force acts on a body, the work performed (and the energy expended) is the product of the force and the distance over which it is exerted.

1240L

Energy to spare.
(http://modulecreator.com/ModuleCreator/#page=login&moduleId=18703&scrollTo=articles)
Astronomy (May2007)—Berman, Bob
The article discusses how energy can never be lost or destroyed, only transformed. Kinetic energy and gravitational potential energy are discussed. The star Betelgeuse is discussed in terms of its potential energy being transformed into kinetic energy, forming a supernova. The fundamental forces of the strong force, the weak force, electromagnetism, and gravity are discussed.

810L

45: Highest. Jump. Ever.
(http://modulecreator.com/ModuleCreator/#page=login&moduleId=18703&scrollTo=articles)
Discover (Jan/Feb2013)—FISHER, ADAM
The article discusses the world record-setting jump by Austrian skydiver Felix Baumgartner who became the first person ever to jump from a balloon 24 miles above the ground.

1310L

Huck Off.
(http://modulecreator.com/ModuleCreator/#page=login&moduleId=18703&scrollTo=articles)
Skiing (Nov2003)—Story, Rob
Focuses on cliff jumping and skiing. Discussion of the cliff jumping attempts of skier Jamie Pierre; Difference between cliff huckers from jibbers and Olympic ski jumpers; Information on the world record earned by Paul Ahern of New Zealand.

1100L

Uploaded Files

Keywords

*Links**

* These Lexile measures were computed automatically and did not undergo human review. They are not certified measures and should not be published or recorded in any way.

Other Resources

The Joy of Falling
NYT article on Einstein's view of gravity

Study Says Minicar Buyers Sacrifice Safety
NYT article on crash safety (i.e. impule & momentum)

Insurers Raising Liability on Bigger Vehicles
NYT article describing crumple zones during crashes of varying sized vehicles

Physics of "the Hit"
NYT article on impulse and momentum of a football tackle

After the Crash
Discover Magazine article NHTSA crash test data and how it applies to crash safety

24 miles, 4 minutes, and 834 mph, all in one jump
NTY article on Felix Baumgartner's free fall from the edge of outer space

National Science Education Standards
pages 162-164...Egg Drop Experiment

Section 4: What Results?

Classroom Assessment Rubric

Not Yet	
Focus	Attempts to address prompt but lacks focus or is off-task.
Reading/Research	Attempts to present information relevant to prompt.
Controlling Idea	Controlling idea is weak and does not establish a purpose and/or address a research question.
Development	Tends to retell rather than present information in order to answer questions, solve problems; lacks details to develop topic. *L2 Implications are weak or not relevant to topic. L3 Does not identifies a relevant gap or unanswered question.
Organization	Applies an ineffective structure; composition does not address requirements of the prompt.
Conventions	Demonstrates a weak command of standard English conventions; lacks cohesion; language and tone are inappropriate to audience and purpose.
Meets Expectations	
Focus	Addresses prompt with a focused response.
Reading/Research	Presents and applies relevant information with general accuracy.
Controlling Idea	Establishes a controlling idea that states the main purpose and/or question for the tasks. L2 Addresses the credibility of sources.
Development	Presents sufficient information in order to examine or convey topics or issues, answer questions, solve problems; identifies salient themes or features; explains key information with sufficient detail. *L2 Discusses relevant implications to topic. L3 Identifies a gap or unanswered question.
Organization	Applies a generally effective structure to address specific requirements of the prompt.
Conventions	Demonstrates a command of standard English conventions and cohesion; employs language and tone appropriate to audience and purpose.

Classroom Assessment Task

No Classroom Assessment Task for this module

Exemplar Work

Uploaded Files

Comments

Author Notes

Other Comments