03: Thermodynamics

Content Area: **Science**
Course(s): **AP Physics 2**
Time Period: **November**
Length: **1**
Status: **Published**

Enduring Understandings:

- Entropy of a system can never decrease
- Pressure is a result of a large number of microscopic collisions
- PV Diagrams are a way to look at the flow of energy into and out of a cylinder.
- The Boltzmann Distribution shows the speeds of different molecules at a given temperature.
- The ideal gas law is an expression of Newton's Laws acting on a large number of particles simultaneously
- The temperature of a collection of gas molecules can increase even if heat is not added to the system

Essential Questions:

- How are the macroscopic properties of a system determined by the microscopic make up of a system?
- How can we extract energy from a system of chaotic motion?

Lesson Titles:

- Engines
- Gas Laws
- Gas Pressure
- Heat Pumps
- Laws of Thermodynamics
- PV Diagrams
- Refrigerators
- The Boltzmann Distribution

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Equity Considerations

Climate Change

Students will engage in discussion centered around climate change and its relationship to physics.

https://tropicsu.org/tag/physics-toolkit/

This lesson plan will help you teach various Physics concepts such as power, energy, and dynamics through the working of a wind turbine. In the context of global warming due to carbon emissions, wind power is a renewable and clean source of energy that can be harnessed as electricity by wind turbines. Thus, this lesson plan will enable the students to apply the concepts of energy, electrical energy, and power in a real-world scenario.

- Economic

SCI.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 (i.e., climate change).

LGBTQ and Disabilities Mandate

Lessons will include multiple perspectives from the LGBTQ and Disabilities population, including Sally Ride (NASA Scientist).

STEM	LGBTQ: Sir Francis Bacon (1561–1626) Florence NightingaleFrancis Bacon | Philosophy, Scientific Method, & Facts | Britannica(1820-1910) George Washington Carver (1861-1943) Sara Josephine Baker (1873-1945) Alan Turing (1912-1954) Allan Cox (1926-1987) Sally Ride (1951-2012) Ben Barres (1954-2017)

Ruth Gates (1962-2018)

Tim Cook (1960)

Disabilities:

Leonardo da Vinci (1452-1519)- Dyslexia

Isaac Newton (1664-1727)- Epilepsy

Thomas Edison (1847-1931)- Hearing

Charles Darwin (1809-1882)- Stutter, Dyslexia

Alexander Graham Bell (1847-1922)- Deaf

Albert Einstein (1879-1955)- Aspergers

Florence B. Seibert (1897-1991)- Mobility

Stephen Hawking (1942-2019)- ALS

John Forbes Nash (1928-2015)- Schizophrenia

Temple Grandin (1947)- Autism

- Social

Asian American and Pacific Islander Mandate

Lessons will include multiple perspectives from the Asian American and Pacific Islander population.

https://ideas.ted.com/8-asian-americans-and-pacific-islanders-whose-innovations-have-changed-your-life-really/

- Social

Inter-Disciplinary Connections:

LA.RH.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, qualitatively, as well as in words) in order to address a question or solve a problem.
LA.RST.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
LA.RST.11-12.10	By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR

	text complexity band independently and proficiently.
LA.WHST.11-12.1.A	Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
LA.WHST.11-12.1.B	Develop claim(s) and counterclaims using sound reasoning and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.
LA.WHST.11-12.1.C	Use transitions (e.g., words, phrases, clauses) to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.11-12.2.E	Provide a concluding paragraph or section that supports the argument presented.
LA.WHST.11-12.10	Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

- Chromebook Activity
- Independent Studies
- Lectures on the Boltzmann Distribution, Gas Pressure, Gas Laws, Laws of Thermodynamics, PV Diagrams, Engines, Heat Pumps, Refrigerators
- Problem Solving
- Science Labs

Modifications

Formative Assessment:

- Anticipatory Set
- Closure
- Quizzes on The Boltzmann Distribution, Gas Pressure, Gas Laws, Laws of Thermodynamics, PV Diagrams, Engines, Heat Pumps, Refrigerators
- Warm-Up

Summative Assessment:

- Alternate Assessment
- Benchmark Assessment on Thermodynamics

- Marking Period Assessment

Alternative Assessments:

Performance tasks
Project-based assignments
Problem-based assignments
Presentations
Reflective pieces
Concept maps
Case-based scenarios
Portfolios

Benchmark Assessments:

Skills-based assessment
Reading response
Writing prompt
Lab practical

Resources & Materials:

- https://sites.google.com/site/delseaphysics1/Home