The Search for EHE: Breakout Activity

Curriculum Connections

ALBERTA, NORTHWEST TERRITORIES, NUNAVUT—Physics 20 and Physics 30

Note: These curriculum connections are meant to be a quick reference guide only. If you have any suggestions for additional curriculum connections, or if you are aware of changes in your curriculum, please contact outreach@perimeterinstitute.ca.

Physics Curriculum Connections (Physics 20 and Physics 30)
(2007, updated 2014)

Skills Outcomes

Initiating and Planning

Students will develop skills of questioning, identifying problems and developing preliminary ideas and plans.

Performing and Recording

Students will develop skills of carrying out a plan of action that include gathering evidence by observation and, in most cases, manipulating materials and equipment.

Analyzing and Interpreting

Students will develop skills of examining information and evidence; of processing and presenting data so that they can be interpreted; and of interpreting, evaluating and applying the results.

Communication and Teamwork

Students will develop science-communication skills in which ideas are developed, tested, interpreted, debated and agreed upon. Students will develop teamwork skills through collaborative processes both in society and in the classroom.

Attitude Outcomes

Interest in Science

show interest in science-related questions and issues and confidently pursue personal interests and career possibilities within science-related fields; *e.g.,*

- *research the answers to questions they generate*
- *explore and use a variety of methods and resources to increase their knowledge and skills*
- *be critical and constructive when considering new theories and techniques*
- *use scientific vocabulary and principles in everyday discussions*
- *recognize the usefulness of being skilled in mathematics and problem solving*
- *be interested in science and technology topics not directly related to their formal studies*
- *recognize the importance of making connections among various science disciplines*
- *maintain interest in pursuing further studies in science*

Mutual Respect

appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds; *e.g.,*

- *recognize the research contributions of both men and women*
- *recognize the research contributions of Canadians*

Scientific Inquiry

seek and apply evidence when evaluating alternative approaches to investigations, problems and issues; *e.g.,*

- *criticize arguments that are based on faulty, incomplete or misleading use of numbers*
- *recognize the importance of reviewing the basic assumptions from which a line of inquiry has arisen*
- *insist that the critical assumptions behind any line of reasoning be made explicit so that the validity of the position taken can be judged*
- *evaluate inferences and conclusions, being cognizant of the many variables involved in experimentation*
- *ask questions and conduct research to ensure understanding*
- *expend the effort and time needed to make valid inferences*

Collaboration

work collaboratively in planning and carrying out investigations and in generating and evaluating ideas; *e.g.,*

- *provide the same attention and energy to the group's product as they would to a personal assignment*
- *be attentive when others speak, seek the point of view of others, and consider a multitude of perspectives*
- *use appropriate communication technology to elicit feedback from others*

Safety

show concern for safety in planning, carrying out and reviewing activities, referring to the Workplace Hazardous Materials Information System (WHMIS) and consumer product labelling information; *e.g.,*

- *manipulate materials carefully, being cognizant of the risks and consequences of their actions*
- *assume responsibility for the safety of all those who share a common working environment by cleaning up after an activity and disposing of materials according to safety guidelines*

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Curriculum Connections

BRITISH COLUMBIA AND YUKON—Physics 12

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*Elaborations are **not** included in this chart.

Physics 12 Curriculum Connections
(2018)

Curriculum Competencies

Questioning and predicting

- Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest
- Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world
- Formulate multiple hypotheses and predict multiple outcomes

Planning and conducting

- Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)
- Assess risks and address ethical, cultural, and/or environmental issues associated with their proposed methods
- Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data
- Apply the concepts of accuracy and precision to experimental procedures and data:
  - significant figures
  - scientific notation

Processing and analyzing data and information

- Experience and interpret the local environment
- Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies
- Construct, analyze, and interpret graphs, models, and/or diagrams
- Use knowledge of scientific concepts to draw conclusions that are consistent with evidence
- Analyze cause-and-effect relationships

Evaluating

- Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions
- Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and in primary and secondary sources
- Consider the changes in knowledge over time as tools and technologies have developed
- Exercise a healthy, informed skepticism and use scientific knowledge and findings to form their own investigations to evaluate claims in primary and secondary sources
- Critically analyze the validity of information in primary and secondary sources and evaluate the approaches used to solve problems
- Assess risks in the context of personal safety and social responsibility

Applying and innovating

- Contribute to care for self, others, community, and world through individual or collaborative approaches
- Implement multiple strategies to solve problems in real-life, applied, and conceptual situations

Communicating

- Formulate physical or mental theoretical models to describe a phenomenon
- Communicate scientific ideas and information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations

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Curriculum Connections

MANITOBA—Senior 4 Physics

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Senior 4 Physics (40S) Curriculum Connections
(2005)

Skills and Attitudes Outcomes

S4P-0-2b Propose problems, state hypotheses, and plan, implement, adapt, or extend procedures to carry out an investigation where required.

S4P-0-2d Estimate and measure accurately, using Système International (SI) units.

S4P-0-2e Evaluate the relevance, reliability, and adequacy of data and data-collection methods. Include: discrepancies in data and sources of error.

S4P-0-2f Record, organize, and display data, using an appropriate format. Include: labelled diagrams, tables, graphs.

S4P-0-2g Interpret patterns and trends in data, and infer or calculate linear relationships among variables.

S4P-0-2h Analyze problems, using vectors. Include: adding and subtracting vectors in straight lines and at right angles, vector components.

S4P-0-2i Select and integrate information obtained from a variety of sources. Include: print, electronic, and/or specialist sources, resource people.

S4P-0-4a Demonstrate work habits that ensure personal safety, the safety of others, and consideration of the environment.

S3P-0-4b Work cooperatively with a group to identify prior knowledge, initiate and exchange ideas, propose problems and their solutions, and carry out investigations.

S3P-0-4e Demonstrate a continuing and more informed interest in science and science-related issues.

S3P-0-4f Value skepticism, honesty, accuracy, precision, perseverance, and open-mindedness as scientific and technological habits of mind.

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Curriculum Connections

NEW BRUNSWICK—Physics 11 and Physics 12

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Physics 11 and 12 Curriculum Connections
(2003)

Appreciation of Science

436 value the role and contribution of science and technology in our understanding of phenomena that are directly observable and those that are not

Interest in Science

439 show a continuing and more informed curiosity and interest in science and science-related issues

440 acquire, with interest and confidence, additional science knowledge and skills using a variety of resources and methods, including formal research

Scientific Inquiry

442 confidently evaluate evidence and consider alternative perspectives, ideas, and explanations

443 use factual information and rational explanations when analysing and evaluating

Collaboration

445 work collaboratively in planning and carrying out investigations, as well as in generating and evaluating ideas

Safety in Science

449 show concern for safety and accept the need for rules and regulations

450 be aware of the direct and indirect consequences of their actions

The Search for EHE: Breakout Activity

Curriculum Connections

NEWFOUNDLAND AND LABRADOR—Physics 3204

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Physics 3204 Curriculum Connections
(2018)

Skills Outcomes

5.0 evaluate and select appropriate instruments for collecting evidence and appropriate processes for problem solving, inquiring, and decision making

6.0 develop appropriate sampling procedures

7.0 estimate quantities

9.0 select and integrate information from various print and electronic sources or from several parts of the same source

11.0 interpret patterns and trends in data, and infer or calculate linear and nonlinear relationships among variables

12.0 evaluate the relevance, reliability, and adequacy of data and data collection methods

13.0 identify and explain sources of error and uncertainty in measurement and express results in a form that acknowledges the degree of uncertainty

14.0 identify and apply criteria, including the presence of bias, for evaluating evidence and sources of information

15.0 explain how data support or refute the hypothesis or prediction

17.0 identify and evaluate potential applications of findings

18.0 communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others

19.0 select and use appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate ideas, plans, and results

20.0 synthesize information from multiple sources or from complex and lengthy texts and make inferences based on this information

Attitudes Outcomes

- value the role and contribution of science and technology in our understanding of phenomena that are directly observable and those that are not
- show a continuing and more informed curiosity and interest in science and science-related issues
- acquire, with interest and confidence, additional science knowledge and skills, using a variety of resources and methods, including formal research
- confidently evaluate evidence and consider alternative perspectives, ideas, and explanations
- use factual information and rational explanations when analyzing and evaluating
- value the processes for drawing conclusions
- work collaboratively in planning and carrying out investigations, as well as in generating and evaluating ideas
- project the personal, social, and environmental consequences of proposed action
- show concern for safety and accept the need for rules and regulations
- be aware of the direct and indirect consequences of their actions

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Curriculum Connections

NOVA SCOTIA—Physics 11 and 12

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Physics 11 and 12 Curriculum Connections
(2002)

Attitudes

Interest in Science

439 show a continuing and more informed curiosity and interest in science and science-related issues

441 consider further studies and careers in science- and technology-related fields

442 confidently evaluate evidence and consider alternative perspectives, ideas, and explanations

443 use factual information and rational explanations when analysing and evaluating

444 value the processes for drawing conclusions

445 work collaboratively in planning and carrying out investigations, as well as in generating and evaluating ideas

449 show concern for safety and accept the need for rules and regulations

450 be aware of the direct and indirect consequences of their actions

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Curriculum Connections

ONTARIO—Grade 11 and Grade 12 Physics

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Grade 11 and Grade 12 Physics Curriculum Connections (SPH3U and SPH4U)

Scientific Investigation Skills and Career Exploration

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research [IP]

A1.2 select appropriate instruments (e.g., pendulums, springs, ripple tanks, lasers) and materials (e.g., sliding blocks, inclined planes), and identify appropriate methods, techniques, and procedures, for each inquiry [IP]

A1.3 identify and locate a variety of print and electronic sources that enable them to address research topics fully and appropriately [IP]

A1.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data [PR]

A1.7 select, organize, and record relevant information on research topics from a variety of appropriate sources, including electronic, print, and/or human sources, using suitable formats and an accepted form of academic documentation [PR]

A1.8 synthesize, analyse, interpret, and evaluate qualitative and quantitative data; solve problems involving quantitative data; determine whether the evidence supports or refutes the initial prediction or hypothesis and whether it is consistent with scientific theory; identify sources of bias and/or error; and suggest improvements to the inquiry to reduce the likelihood of error [AI]

A1.9 analyse the information gathered from research sources for logic, accuracy, reliability, adequacy, and bias [AI]

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions with reference to scientific knowledge [AI]

A1.12 use appropriate numeric (e.g., SI and imperial units), symbolic, and graphic modes of representation (e.g., vector diagrams, free-body diagrams, vector components, and algebraic equations) [C]

A1.13 express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places or significant figures [C]

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Curriculum Connections

PRINCE EDWARD ISLAND—Physics 621A

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Physics 621A Curriculum Connections
(2010)

Appreciation of Science

436 value the role and contribution of science and technology in our understanding of phenomena that are directly observable and those that are not

Interest in Science

439 show a continuing and more informed curiosity and interest in science and science-related issues

440 acquire, with interest and confidence, additional science knowledge and skills using a variety of resources and methods, including formal research

Scientific Inquiry

442 confidently evaluate evidence and consider alternative perspectives, ideas, and explanations

443 use factual information and rational explanations when analysing and evaluating

Collaboration

445 work collaboratively in planning and carrying out investigations, as well as in generating and evaluating ideas

Safety in Science

449 show concern for safety and accept the need for rules and regulations

450 be aware of the direct and indirect consequences of their actions

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Curriculum Connections

SASKATCHEWAN—Physics 30

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Physics 30 Curriculum Connections
(2016)

Scientific Inquiry [SI]

Inquiry is a defining feature of the scientific way of knowing nature. Scientific inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. Scientific inquiry is a multifaceted activity that involves:

- making observations, including watching or listening to knowledgeable sources;
- posing questions or becoming curious about the questions of others;
- examining books and other sources of information to see what is already known;
- reviewing what is already known in light of experimental evidence and rational arguments;
- planning investigations, including field studies and experiments;
- acquiring the resources (financial or material) to carry out investigations;
- using tools to gather, analyze, and interpret data;
- proposing critical answers, explanations, and predictions; and,
- communicating the results to various audiences.

Technological Problem Solving [TPS]

The essence of the technological problem solving learning context is that students seek answers to practical problems. This process is based on addressing human and social needs and is typically addressed through an iterative design-action process that involves steps such as:

- identifying a problem;
- identifying constraints and sources of support;
- identifying alternative possible solutions and selecting one on which to work;
- planning and building a prototype or a plan of action to resolve the problem; and,
- testing, evaluating and refining the prototype or plan.

Foundation 4: Attitudes

Interest in Science

Students will be encouraged to develop curiosity and continuing interest in the study of science at home, in school and in the community.

Inquiry in Science

Students will be encouraged to develop critical beliefs concerning the need for evidence and reasoned argument in the development of scientific knowledge.

Collaboration

Students will be encouraged to nurture competence in collaborative activity with classmates and others, inside and outside of the school.

Safety

Students engaged in science and technology activities will be expected to demonstrate a concern for safety and doing no harm to themselves or others, including plants and animals.