



Homopolar Motor - Curriculum Connections

Suggested Grades: 4-12

Curriculum Connections: Energy (Gr 4, 6), Computer Science (Gr 4), Scientific Methods (Gr 5), Heat and Temperature (Gr 7), Mechanical Systems (Gr 8), Electrical Principles and Technologies (Gr 9), Energy Flow in Technological Systems (Science 10), Understanding Common Energy Conversion Systems (Science 24), Dynamics (Physics 20), Circular Motion, Work, and Energy (Physics 20), Electromagnetic Energy (Science 30), Forces and Fields (Physics 30)

Specific Learning Outcomes:

Grade 4

- *Energy* - Investigate how forces can act on objects without contact (magnetism).

Grade 5

- *Scientific Methods* - Investigate how evidence is gathered and explain the importance of ethics in science (observe phenomenon, variables).

Grade 6

- *Energy* - Analyze forces and relate them to interactions between objects (friction); students investigate energy resources and explain factors that influence their use (uses of electricity).

Grade 7

- *Heat and Temperature* - Illustrate and explain how human needs have led to technologies for obtaining and controlling thermal energy and to increased use of energy resources (use of engines - some heating/cooling tech uses electrical motors).

Grade 8

- *Mechanical Systems* - Illustrate the development of science and technology by describing, comparing and interpreting mechanical devices that have been improved over time (connect to history of motors).

Grade 9

- *Electrical Principles and Technologies* - Investigate and interpret the use of devices to convert various forms of energy to electrical energy, and electrical energy to other forms of energy; describe technologies for transfer and control of electrical energy.



Science 10

- *Energy Flow in Technological Systems* - Describe, qualitatively, current and past technologies used to transform energy from one form to another, and that energy transfer technologies produce measurable changes in motion, shape or temperature.

Science 24

- *Understanding Common Energy Conversion Systems* - Design, construct and evaluate a simple model or device that transforms energy from one form to another (homopolar motor transforms electrical energy into mechanical/kinetic energy).

Physics 20

- *Dynamics* - Explain the effects of balanced and unbalanced forces on velocity (Lorenz force causes the wire to accelerate; friction may create heat and/or cause the wire to slow or stop).
- *Work and Energy* - Explain that work is a transfer of energy and that conservation of energy in an isolated system is a fundamental physical concept (Homopolar motor is not an isolated system - energy is lost to heat/friction).

Science 30

- *Electromagnetic Energy* - Describe, in general terms, examples of technological devices based on electric and magnetic fields and describe their impact on daily life; Explain the significance of a simple electric generator or motor in society.

Physics 30

- *Forces and Fields* - Explain how the properties of electric and magnetic fields are applied in numerous devices.