

Upper Elementary Electricity and Electrical Safety Curriculum (Draft)

Curriculum Context – ‘Engage-Connect-Inquire’

Electricity is a challenge for many teachers because it has the attributes of being invisible and potentially dangerous. A good elementary curriculum will hopefully avoid being hung up on those attributes as it is introduced through energy use, safety, and magnets in the primary grades. Since children are exposed to electronics from an early age, it would make sense that elements of the electricity curriculum appear earlier than fourth grade. I’m an advocate of introducing (awareness level) the atom and its parts in late second or early third grades, since matter and electricity will be tested soon after fourth grade. Electricity and its transformation into other useful forms of energy can start in primary as well, perhaps as part of integrating family responsibility and safety into the daily curriculum. A solid upper elementary curriculum will enable middle school teachers to attach numbers to concepts like Ohm’s law, resistance, and kilowatt hour, and set the stage for inquiry into alternative energy sources and how decisions are made about consumption of energy.

Safe ‘engagement’ is easy with a small Van de Graaf generator. A good demo will lead naturally into good explorations with a statics kit. Making circuits is inherently engaging and practical. ‘Connecting’ with electricity is easy because every child has tons of experience with using electrically powered items. A good activity is to try a time period without them! ‘Inquiry’ with electricity may require some contracting to avoid misused or dangerous use of power supplies. As a result, inquiry activities need planning and supervision at this age level.

‘Static’ electricity

What is static electricity?

Describe the atom as a building block of matter: electrons are very small particles which carry negative charge and are attracted to positive charge
ex/demo: magnets have opposite ‘poles’

Where does static electricity come from?

Electrons without a ‘home’ atom or molecule are all around us. In dry times of the year, they collect on insulators like carpet or fur and can give you a shock when they jump to a more neutral state

Demo: Van de Graaf generator collects free electrons for experiments

What are the properties of electricity?

- 'free' (not associated with an atom or molecule) electrons are everywhere
- has energy
- two types of 'opposite' charge, positive and negative
- conductors carry electrons from one place to another
- insulators keep electrons from moving
- electricity and magnetism are related
- current electricity can do work
- can be transformed into heat or light
- electrons prefer to be neutral, or paired with an equal positive charge

*Hands on labs: static electricity exploration kit,
insulator/conductor exploration
making electromagnets with batteries and nails*

Current electricity

What are the properties of current electricity?

- carries energy and can do work
- current electricity can be stored in batteries
- transmitted by wires
- converted into other types of energy like heat/light
- with magnets, can be used to run motors
- in a circuit, electrons will 'flow' toward positive charge

How can electricity do work?

Simple circuits – open and closed circuits
series circuits
parallel circuits
'loads' and electric consumption

Where does current electricity come from?

Electrons can be stored in batteries or freed in a photocell or fuel cell. Electrons can be made to move when a magnet turns in a coil of wire (a generator). When a conductor connects a source of electrons to a 'ground', current will flow.

Demo: a 'load' demo using a hand crank generator and parallel loads will

show how much energy goes into generating electricity for common items

Hands on lab: using simple circuit symbols, design and make circuits

Be able to show open and closed circuits, series and parallel batteries and loads

Conserving electricity

- define 'watt' as a unit of work
- identify 'loads' and their wattage at home and school
- what are other ways to do work beside using electricity?

Safety and electricity

- electricity is not a 'toy'
- don't ever intentionally create a short circuit
- get adult help with electrical problems
- never touch an outside power line

Demo: have your local power company do a safety presentation

Advanced topics (for enrichment or use with higher grades)

- electric motors
- Ohms law
- resistance
- electromagnetic fields/propagation
- fluorescence