

## Science 9: Electrical Properties

1. What is the difference between a positive charge and a negative charge?

A positive charge possesses excess positive charge.

++++ - +  
-- ++ ++

A negative charge possesses excess negative charge.

--+ --+  
-- - + - +

2. Describe the Laws of Electric Charge.

1. Unlike charges attract.
2. Like charges repel.
3. Charged objects attract uncharged (neutral) objects.

3. Explain the difference between conductors, semi-conductors and super conductors. How are they different from insulators?

Conductors are materials that allow charges to move freely. (most metals)

Semi-conductors - have higher conductivity than insulators but with lower conductivity than metals.

Super-conductors - offer little resistance, if any to the flow of charges. Insulators - resist the flow of charge.

4. List and give examples of the four basic elements or types of components in a simple circuit.

Battery - a combination of cells.

Switch - opens or closes the circuit to control the current through it.

Resistor - any load, (draws current) from the circuit.

Load - convert electricity into other forms of energy.

5. Illustrate the electrical circuit component.

Wire



Cell



Battery



Lamp



Switch



Resistor



Motor



Variable Resistor



Ammeter



Voltmeter

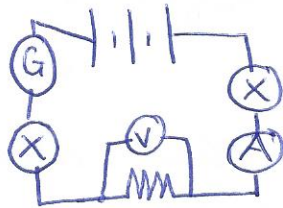


6. Illustrate how an ammeter, a galvanometer, and a voltmeter are included in a schematic drawing.

Ammeter - measures larger current.

Galvanometer - measures weaker currents.

Voltmeter - measures potential difference, (voltage).



7. What do each of the above electrical devices measure?

8. According to Ohm, what is the relationship between current, voltage and resistance and how can it be calculated?

Resistance is calculated by finding the ratio of Voltage, (V) to current (I).

$$R = \frac{V}{I}$$



Remember!

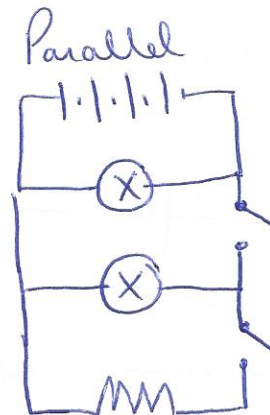
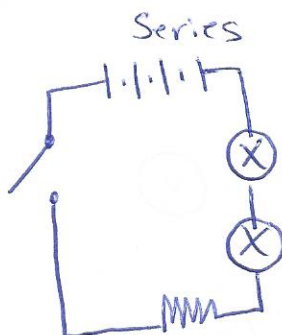
9. Illustrate a series circuit and a parallel circuit using the following:

Power Source - 4 cells

Loads - 3 resistors (e.g buzzer, 2 lamps)

As many

switches as you think you require.



10. What are the factors that affect resistance of wire, and how does each factor affect resistance?

Length - Resistance increases as length increases.

Cross-Sectional Area - Resistance decreases as area increases.

Temperature - as temp increases resistance increases.

Material - metals are less resistive than other materials.

11. Complete the table that shows energy conversions related to electricity.

Device	Type of Energy Used	Type of energy converted to
Thermopile	Heat	Electric
Piezoelectric crystal	Electricity	Motion
LED	Electricity	Light
Photovoltaic Cell	Light	Electricity.

12. What process/device enables a solar cell to transform the Sun's energy into useable electricity?

A photovoltaic cell (semiconductor), absorbs light breaking electrons off causing them to flow, (electricity)

13. What did Galvani discover and what importance did it have for science?

A frog's muscle twitched when electricity was passed through them (1<sup>st</sup> cell.)

14. What is the difference between a Wet Cell and a Dry Cell?

Wet cells use liquid electrolytes.

Dry Cells use a paste, plastic or ceramic electrolyte.

15. Explain the difference between a primary cell and a secondary cell. Give two examples of each and what devices would use them.

Primary cells cannot be recharged because the amount of chemicals gets "used up".

Secondary cells can be recharged because they use chemical reactions which can be reversed.

Toys  
Remote  
Controls

Car Battery  
Cell Phone.



16. How is an electromagnet constructed?

A soft iron core is inserted into a coil of wire and current is passed through the wire creating a temporary magnet (electromagnet).

17. What is the difference between AC and DC current?

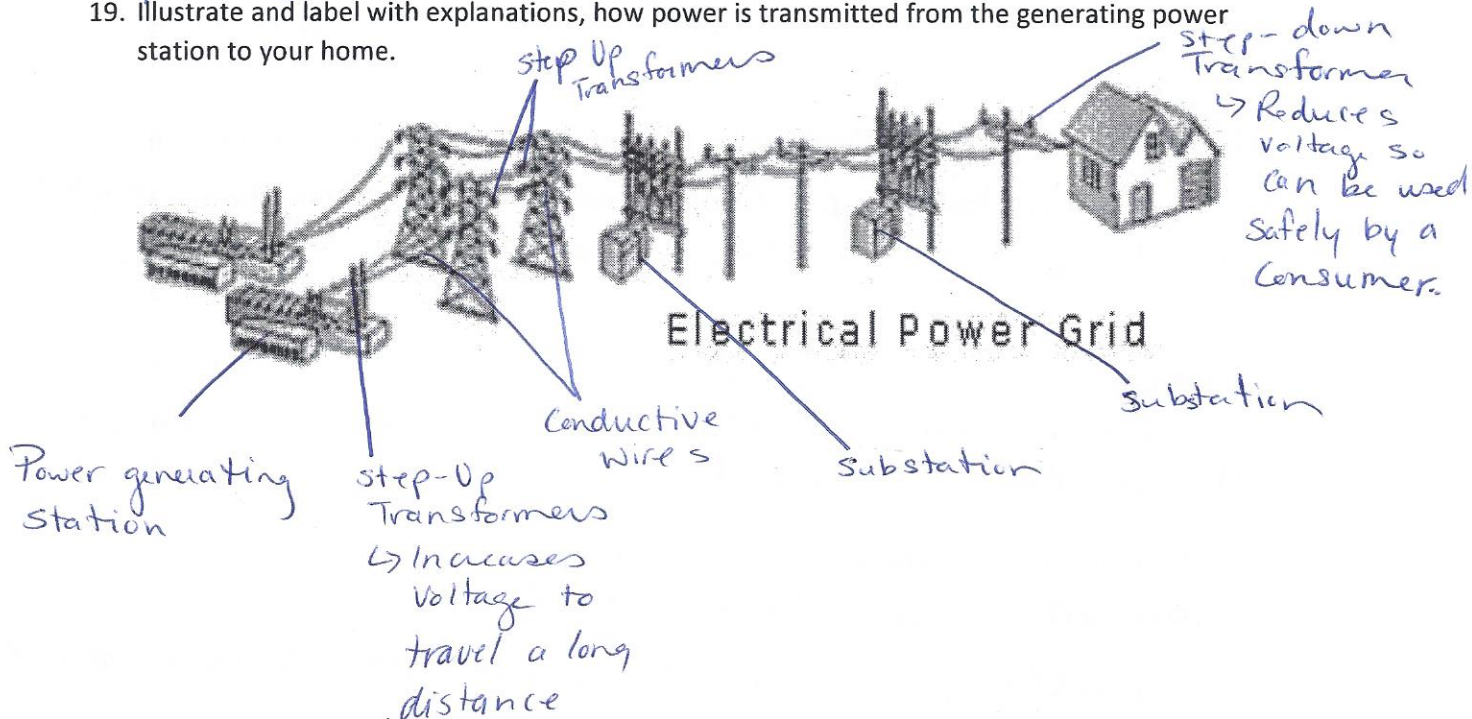
AC - alternating current changes <sup>direction</sup> when its generator rotates.

DC - direct current travels in one direction.

18. How does an AC Motor differ from a DC Motor?

A DC motor has a ~~split~~ split-ring commutator which cuts off the current so the armature does not stall and change directions. The momentum keeps the armature spinning in its original direction.

19. Illustrate and label with explanations, how power is transmitted from the generating power station to your home.



20. Describe what a service panel in your house is and what function it serves.

The Service Panel distributes the current to various areas of the house.

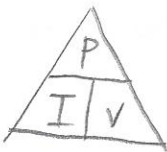
21. Explain the difference between a fuse and a circuit breaker.

A Fuse has a metallic conductor that melts under excessive current. It must be replaced once it melts. A circuit breaker is a switch that will cut off all power coming into the home if current exceeds a safe level.

22. What are transistors used as and in what devices are they commonly found?

Electronic switches in modern digital devices that are made of solid-state components that can be turned on and off by electrical signals.

23. What is the Power (watts and kilowatts) of a hair dryer that requires 8A of current on a 240 V circuit?



$$\begin{aligned} P &= IV \\ &= (8 \times 240) \\ &= 1920 \text{ W} \end{aligned}$$

24. An 850 W oven requires a 7A current. What is the voltage?

$$V = \frac{P}{I} = \frac{850}{7} = 121 \text{ V}$$

25. A flashlight uses 2 1.5 V D-cells to light a bulb that can work on a current up to 0.5A. What is the maximum power of the bulb?

$$\begin{aligned} P &= IV & 2 \times 1.5 \text{ V} &= 3 \text{ V} \\ &= (0.5 \times 3) \\ &= 1.5 \text{ W} \end{aligned}$$

26. You go around your house and find out there are 35, (60W), lights in your house. If they all are on for about 5 hours every day. What does it cost your parents for 1 year? Cost of electricity is \$0.11/kwh.

$$\begin{aligned} 60 \text{ W} &= 0.06 \text{ kW} & (5 \text{ h})(365 \text{ d}) &= 1825 \text{ h} \\ (35 \times 0.06) &= 2.1 \text{ kW} & \text{Cost} &= (3832.5 \times 0.11) \\ \text{kwh} &= (2.1)(1825) = 3832.5 \text{ kwh} & &= \$421.58 \end{aligned}$$

27. Your stereo is on 4 hours every day. It operates on 120V, using 4A of current. How much does it cost your parents for 1 year if the cost of electricity is \$0.11 per kWh?



$$P = IV$$

$$= (4)(120)$$

$$= 480W$$

$$480W = 0.48kW$$

$$(4h)(365d) = 1460h$$

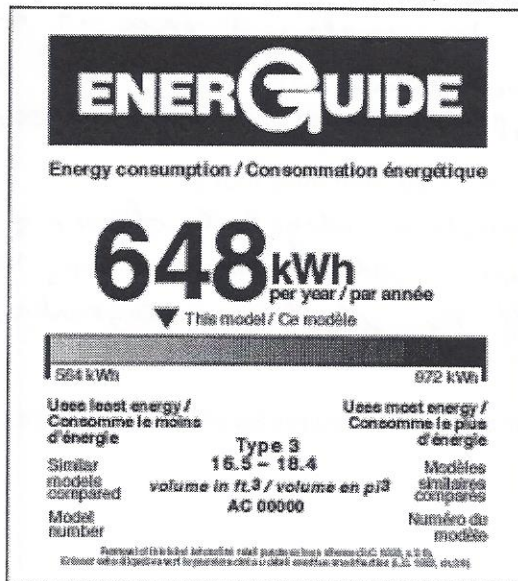
$$kWh = (0.48)(1460h)$$

$$= 700.8kWh$$

$$\text{cost} = (700.8)(0.11)$$

$$= \$77.09$$

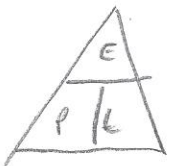
28. Explain what this illustration means, and how does it help the consumer?



This model uses less than the average amount of energy compared to other models of the same appliance.

This guide helps consumers be more aware of how much the appliance will cost to run compared to other models.

29. Calculate the efficiency of an 800W kettle that takes 6 min to boil water. To heat the water to boiling point, it takes 20 000 J of energy.



$$E = Pt$$

$$= (800)(360s)$$

$$= 288000J$$

$$(6min)(60) = 360s$$

$$Eff = \frac{20000}{288000} \times 100\%$$

$$= 7.14\%$$

30. What are four simple rules to follow, to protect yourself against fatal electrical shock, from electrical hazards?

1. Do not overload a circuit, (Plug too many devices in)
2. Do not clean appliances while they are still plugged in.
3. Replace frayed/worn out electric cords.
4. Use receptacle covers, (plug), covers to protect children.



31. What consequences – affecting Land and Air – result from the use of Fossil Fuels to generate electricity?

Open pit mining disturbs soil and vegetation.

Underground mines produce tailings which can acidify & contaminate ground water.

Burning fossil fuels allow gas & toxic particles to escape into the atmosphere.

32. How can gravity produce electricity?

High pressure from ~~as~~ rapidly flowing/falling water turns large turbines which turn generators.

33. How is electricity generated in Nuclear Reactors?

Uranium atoms split into two smaller atoms during nuclear fission. This process releases huge quantities of energy.

34. What is thermal pollution?

It occurs when warm water is returned directly to the source it was taken from increasing its water temperature affecting aquatic plant and animal life.

35. What are four alternative sources to coal burning to generate electricity?

1. Wind turbines

2. Solar cells.

3. Ocean tides

4. Geothermal Energy.

\* Biomass.

The first part of the paper is devoted to a general discussion of the problem. It is shown that the problem is well-posed in the sense of Hadamard. The second part is devoted to the construction of the solution. The third part is devoted to the study of the properties of the solution.

In the first part of the paper, we consider the problem of finding the solution of the equation  $\Delta u = f$  in the domain  $\Omega$ . It is shown that the problem is well-posed in the sense of Hadamard. The second part is devoted to the construction of the solution. The third part is devoted to the study of the properties of the solution.

The fourth part of the paper is devoted to the study of the properties of the solution. It is shown that the solution is unique and depends continuously on the data. The fifth part is devoted to the study of the properties of the solution. It is shown that the solution is unique and depends continuously on the data.