

Electricity SUMMARY SHEET

Learner Previous Knowledge

Represent the various components of electric circuits along with their symbols;
Different kinds of circuits;

Electromagnetism and its application;

Heating effect of electric current

Target Knowledge for this Topic

Chemical effect of current

Study the chemical effects of current and its various application;

Electric Charge and conductivity

Demonstrate electrical conductivity through liquids;

Electrolysis; electroplating

Usage of liquids to produce electricity

Learning Goals

More Complex Learning Goal- Students will be able to draw conclusions about chemical effects of electric current on liquids describe how electroplating is done, and explain the interaction between charges of static electricity.

Target Learning Goal- Students will be able to describe how electricity is conducted by liquids, the effects of current on liquids, explain electroplating and its uses and describe static electricity, the charges and how they interact and how lightning occurs.

Simpler Learning Goal- Students will be able to demonstrate how liquids conduct electricity, define electroplating with examples and state how static charges interact.

Period No.
Lesson Objectives
Teaching Learning Materials Required

1

- Demonstrate that liquids conduct electricity.

- Board and markers
- Worksheet 1
- Activity: (at each work station) LED bulb, thin connecting copper wires, cell, rubber bottle caps, switch, pins, compass, wooden tray of matchbox, lemon juice, vinegar, tap water, milk, honey, vegetable oil

2	Find out if water with and without dissolved substances is able to conduct electricity through an experiment.	- Board and markers - Worksheet 2 - Activity: (for each group) two nails, connecting wire, bulb, paper cup, pure distilled water, salt
3	Demonstrate the chemical effect of passage of electric current through conducting solution.	- Board and markers - Worksheet 3 - Activity: (for each group) cleaned carbon rods obtained from discarded cells [as mentioned in the previous class], 2 copper wires, battery, plastic bowl, pure water, salt or lemon juice,
4	Demonstrate that electric current can flow through fruit and vegetables too.	- Board and markers - Worksheet 4
5	Demonstrate the method of electroplating.	- Board and markers - Reference sheet 1 - Worksheet 5 - Activity (for each pair)- copper sulphate, 2 copper plates of identical size, 250 ml distilled water, dil. sulphuric acid, battery, wire, sand paper, glass jar

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Period 1

Lesson Objectives

At the end of this lesson students will be able to:

- Demonstrate that liquids conduct electricity.

Teaching Learning Materials required

- Board and markers
- Worksheet 1
- Activity: (at each work station) LED bulb, thin connecting copper wires, cell, rubber bottle caps, switch, pins, compass, wooden tray of matchbox, lemon juice, vinegar, tap water, milk, honey, vegetable oil

Details of Teaching Learning Experience

Seating Arrangement: - 6-8groups

Note for facilitator: Make 6-8 workstations. You may give two sets of cells, wires and LED & compass in a small wooden tray [you can take the inner tray of matchbox] but give different samples of liquid [less quantity] and identical rubber caps of the same size and pins for the activity.

Lesson Beginning <u>Time:</u> 5 min <u>Purpose:</u> Activate prior knowledge	<u>Brainstorming</u> • Introduce the topic by asking questions such as: ○ How does current flow in a circuit? How should the terminals be connected? ○ What are conductor and insulators? Give examples. ○ Why can insulators not be used in circuits? ○ Do you think only solids conduct electricity? ○ Can liquids conduct electricity too? • Collate all the answers and then inform the students that they will find out answer to the last question by doing an experiment.
Lesson Middle <u>Time:</u> 25 min. <u>Purpose:</u> • Develop conceptual understanding	<u>Experiment</u> • Let them do the activity and observe if liquids conduct electricity. • Within a group, each student can do the activity but ensure that each student uses a different liquid. The student doing the activity can fill the observation table.

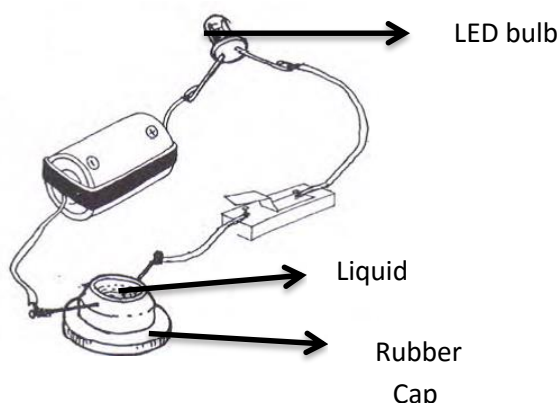
	• After the activity, all the students of a group can gather their result and fill in the observation table together. • Ask the different groups now to share their observations and answers to all the questions. • Ensure that the whole class arrives at a consensus.
Lesson End <u>Time:</u> 5 min <u>Purpose:</u> • Finish Up • Homework Distribution	<u>Finish Up</u> • Wrap up the class by clearing any doubts that the students may have. <u>Homework Assignment</u> • Air is a poor conductor of electricity. However, during lightning and thunderstorm, electric current does pass through air. It means in certain conditions; air is able to conduct electricity. Do all poor conductors allow electricity to pass through them under certain conditions? Try to find the answer. You may access the internet or encyclopedia for this.

Worksheet 1**Skill: Observation and Investigation**Do Liquids Conduct Electricity?Activity

I. Material: LED bulb, thin connecting copper wires, cell, rubber bottle caps/ thermocol cups, switch, pins, lemon juice, vinegar, tap water, milk, honey, vegetable oil

Instructions

1. Connect the switch, cell, wires and bulb in a simple circuit as shown in the figure but keep the two ends of the wire free, thus keeping it an open circuit.
2. Take a rubber cap and stick 2 pins in it such that they don't touch each other.
3. Fill the rubber cap with any one liquid.
4. Touch the two free ends of the wire with the two pins. Observe what happens. Does the bulb glow?
5. Record your observation.



Observation Table

Sr. No.	Material	LED Bulb glows/doesn't glow	Compass needle deflects/doesn't deflect	Good conductor/bad conductor
1	Lemon juice			
2	Milk			
3	Tap water			
4	Honey			
5	Vinegar			
6	Vegetable oil			

* The two terminals dipped in liquid for testing conduction of electricity are called **electrodes**.

In this activity, which were the two **electrodes**? _____

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Conclusion

What have you demonstrated with this activity?

I have demonstrated that _____

* Liquids sometimes may not conduct electricity as easily as solids. So we usually use LED bulbs. LED glows even when the current flowing through it is weak.

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Period 2

Lesson Objectives

At the end of this lesson students will be able to:

- Find out if water with and without dissolved substances is able to conduct electricity through an experiment.

Teaching Learning Materials required

- Board and markers
- Worksheet 2
- Activity: (for each group) two nails, connecting wire, bulb, paper cup, pure distilled water, salt

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4 or 5

Lesson Beginning <u>Time:</u> 5 min <u>Purpose:</u> Activate prior knowledge	<u>Brainstorming!</u> - Ask the students to share the response of their homework question. - Begin the class by asking questions such as: - Insulators at all times do not allow electricity to pass through them while conductors allow little or more electricity to pass through them, depending on the conditions. So which is a better term for materials: insulators or poor conductors? - In that case is air insulator or poor conductor? - Collect response from the students and ensure that all are on the same page. Ask the students to first predict if water is a good conductor or poor conductor of electricity. Inform the students that they will now find out the answer with an experiment.
Lesson Middle <u>Time:</u> 25 min. <u>Purpose:</u> Develop conceptual understanding	<u>Experiment</u> - Distribute worksheet 2 to all groups. - Assign the items needed to do the activity. - Let them follow the instructions in the annexure. - Instruct the students to write their observation and attempt the questions. They must attempt the worksheet too.

	After the students have attempted the activity, let there be a discussion on the answers within the groups. Let the groups discuss arrive at a common consensus.
Lesson End <u>Time:</u> 5 min <u>Purpose:</u> Finish Up	<u>Finish Up</u> Wrap up the class by clearing doubts. <u>Note to the students:</u> Take 2 discarded cells. Remove the outer covering and extract the carbon rods carefully. Clean their metal caps with sand paper. Bring them to the class for an experiment in the next class.

Worksheet 2**Skill: Drawing Inferences**

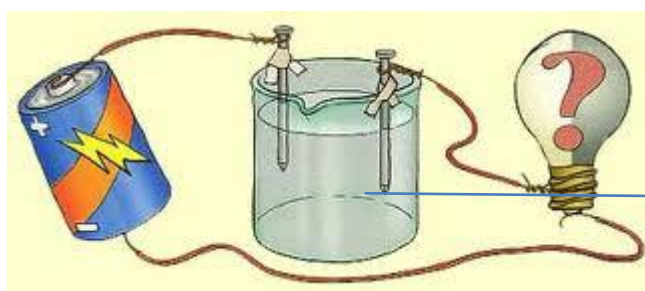
Is water good conductor or poor conductor of electricity?

Activity

Material: two nails, connecting wire, bulb, paper cup, pure distilled water, salt

Instructions

1. Attach the wires to the nails and the other end to bulb terminals through a cell as shown in figure.
2. Connect the wire to the cell to complete the circuit.
3. Observe what happens.
4. Now remove the connections.
5. Add salt to the water and connect the circuit again.
6. Observe what happens.



Pure distilled water

Observation questions

1. What is acting as electrodes here? _____
2. Did the bulb glow with pure water? _____
3. What happened when you added salt to the water? _____

What do you deduce from this activity?

1. Is water a good conductor or poor conductor of electricity?

2. Will water obtained from river conduct electricity? Why?

3. Why should electrical appliances not be handled with wet hands?

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Period 3

Lesson Objectives

At the end of this lesson students will be able to:

- Demonstrate the chemical effect of passage of electric current through conducting solution.

Teaching Learning Materials required

- Board and markers
- Worksheet 3
- Activity: (for each group) cleaned carbon rods obtained from discarded cells [as mentioned in the previous class], 2 copper wires, battery, plastic bowl, pure water, salt or lemon juice,

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4 or 5

Lesson Beginning <u>Time:</u> 5 min <u>Purpose:</u> Activate prior knowledge	<u>Whole Class Discussion</u> • Begin the class by asking groups to recall their knowledge of chemical and physical reactions. Pose questions such as: ○ What is chemical reaction? ○ What happens in chemical reaction? Is a new substance formed? Which effects are seen when conductor is solid and current flows through it? [Answer: Heating and magnetic] ○ Do you think passing electricity through conducting liquid also shows any effect? • Let the whole class participate in the discussion and ensure that all agree with the answers. • Inform the students that now they will find out the answer to the last question mentioned here.
Lesson Middle <u>Time:</u> 25 min. <u>Purpose:</u> • Develop conceptual understanding	<u>Experiment</u> • Distribute worksheet 3 to each group. • Ask the groups to follow instructions and do the given activity. • They must attempt the questions. • There can be a whole class discussion in which the groups can exchange their observations as well as answers. • Ensure that all the students are on the same page.

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Lesson End <u>Time:</u> 5 min <u>Purpose:</u> • Finish Up • Homework Assignment	<u>Finish Up</u> • Wrap up the class by clearing doubts. <u>Note to the students</u> • Bring fruit such as apple, orange and lemon from home and also bring vegetables like potato, carrot and onion for an experiment in the next class.

Worksheet 3**Skill: Observation and Investigation**

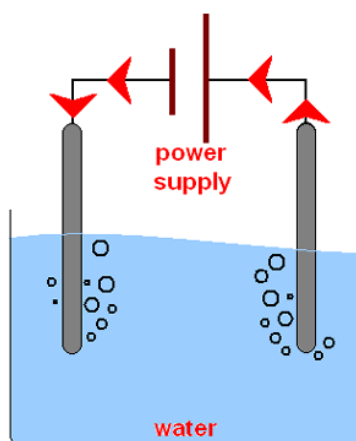
What effect does current produce when it flows through conducting solution?

Experiment

Material: cleaned carbon rods obtained from discarded cells [as mentioned in the previous class], 2 copper wires, battery, plastic bowl, pure water, salt or lemon juice,

Instructions:

1. Put the carbon rods inside the plastic bowl upright.
2. Pour water in the cup such that the rods are jutting out of the water level.
3. Make connections of a simple circuit using the wire and the battery.
4. Put some lemon juice in the water.
5. Connect the wires.
6. Wait for 5 minutes and observe the electrodes carefully.
7. Note the observation.



I. Questions:

1. What happens when you switch on the current? _____
2. What do you see near the electrodes?

3. Can we call this a chemical change or physical change? _____
4. Do you observe same amount of bubbles at both the electrodes? _____
5. What is water made of? Do you know? _____
6. Based on your observation, can you say that the gas produced at both electrodes is of same quantity?

II. Water is made of hydrogen and oxygen, both of which are gases. In your own words, describe what has happened in the above experiment by completing the sentences.

- a. The gases given out at the two electrodes are _____

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- b. The reaction that has taken place is a _____
- c. When the current was passed through water with lime juice, the water must have split into_____
- d. The 2 gases must have collected separately at_____.
- e. Since the bubbles near one electrode are a lot more than the other, one of the gases must be _____in amount than the other in water.

What have you demonstrated through this experiment?

I have demonstrated that passage of an electric current through a conducting liquid [in this case, water with lemon juice] results in_____ type of reaction

Information

- Passage of an electric current through conducting liquid results in chemical reaction.
- When electricity is passed through water, it breaks into its component gases, oxygen and hydrogen.
- These gases collect at the two electrodes.
- Hydrogen is more in volume than oxygen in single unit of water. Hence at one electrode you see more bubbles than other.

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Period 4

Lesson Objectives

At the end of this lesson students will be able to:

- Demonstrate that electric current can flow through fruit and vegetables too.

Teaching Learning Materials required

- Board and markers
- Worksheet 4

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4 or 5

Lesson Beginning <u>Time:</u> 5 min <u>Purpose:</u> Activate prior knowledge	<u>Whole class Discussion</u> • Begin the class by asking groups to discuss the effects of electric current in solids and liquids. Let the students recap what effect is seen when the current flows through them. Now pose questions: ○ Does electricity pass through human body? ○ Does it mean living things are good conductors of electricity? ○ Do you think electricity can pass through plants? ○ Are solids and liquids the only material or objects through which electricity passes? Or can it also pass through fruit and vegetables? • Gather responses and arrive at a common consensus. • Inform the students that they will now try to find out the answer to the last question.
Lesson Middle <u>Time:</u> 25 min. <u>Purpose:</u> • Develop conceptual understanding	<u>Experiment</u> • Distribute worksheet 4 to each group. • Ask the groups to do the experiment carefully and discuss how it will work. • Let the group attempt the observation questions based on it. • There can be a whole class discussion in which the groups can exchange their answers. • Ensure that all the students are on the same page.

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Lesson End <u>Time:</u> 5 min <u>Purpose:</u> Finish Up	<u>Finish Up</u> - Wrap up the class by clearing any doubts that the student may be having. <u>Homework Assignment</u> - Find out the meaning of electroplating either from your textbook or from internet.
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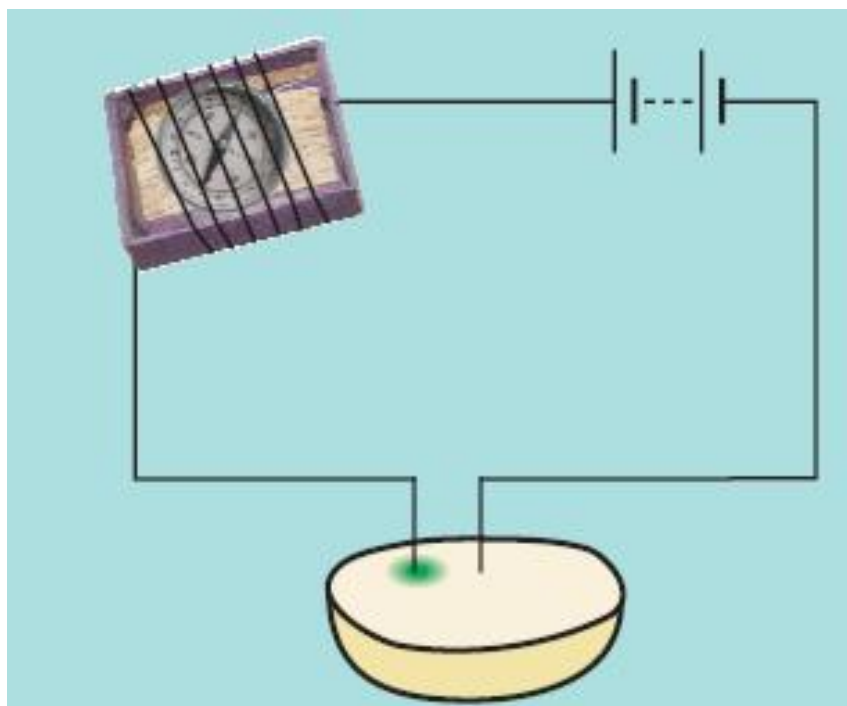
Worksheet 4**Skill: Observation and Investigation**Experiment

Aim: To find out if electricity can be conducted through fruit and vegetables

Material: copper wire, zinc electrode, 2 cells, compass, matchbox tray, potato, tomato, lemon, apple carrot, orange

Instructions

1. Clean the potato, cut in half and use one half of it.
2. Stick a copper wire in the potato.
3. Stick the zinc electrode also inside the potato. Take care the copper wire and the electrode do not touch.
4. Wrap up another end of the copper wire to the wooden tray in which the compass needle has been kept.
5. The remaining part of the wire can be connected to an end of a cell.
6. Take another wire. Connect it to the other terminal of the battery of torch and the loose end of the wire must be connected to the zinc electrode stuck in the potato.
7. Leave it aside for a few minutes.
8. What do you observe when you connect the circuit?
9. Repeat the activity with different fruit and vegetables. Remember to wipe clean and dry the electrodes before every use.
10. Observe the extent of deflection.

**Observation Questions**

1. When the circuit was completed, did the needle of compass deflect? _____
2. Did all the fruit and vegetables show similar deflection? _____
3. What did you notice near one electrode the potato after the circuit was complete? _____

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4. Name the fruit /vegetable which showed maximum and minimum deflection of compass needle.

Conclusion:

Fruits and vegetables _____

Think!!!

You must have noted that the wire connected to positive terminal of the battery only showed green colour on the potato. How can you make use of this fact?

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Lesson Plan 5

Lesson Objectives

At the end of this lesson students will be able to:

- Demonstrate the method of electroplating.

Teaching Learning Materials required

- Board and markers
- Reference sheet 1
- Worksheet 5
- Activity (for each pair)- copper sulphate, 2 copper plates of identical size, 250 ml distilled water, dil. sulphuric acid, battery, wire, sand paper, glass jar

Details of Teaching Learning Experience

Seating Arrangement: - In groups of 4-5 students

Lesson Beginning <u>Time:</u> 5 min <u>Purpose:</u> Activate prior knowledge	<u>Group Discussion</u> • Ask the groups to share their response to the question given in homework. • Pose questions such as: • What happens when electricity is passed through conducting liquid? • What happened to water when electric current was passed through it? • What is electroplating? • Gather responses and arrive at a common consensus. • Inform the students that they too will now do the experiment and demonstrate electroplating themselves.
Lesson Middle <u>Time:</u> 25 min. <u>Purpose:</u> • Develop conceptual understanding	<u>Electroplating Experiment</u> • Distribute worksheet 5 to the students of all groups. • Ask the groups to discuss how to do the experiment first. • Extend help only if really needed. • After they have done the activity, there can be a whole class discussion in which the groups can exchange their answers. • Discuss electroplating with the help of the reference sheet 1. • Ensure that all the students are on the same page.

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Lesson End <u>Time:</u> 5 min <u>Purpose:</u> • Finish Up	<u>Finish Up</u> • Wrap up the class by clearing any doubts.
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Worksheet 5**Skill: Drawing Inferences**

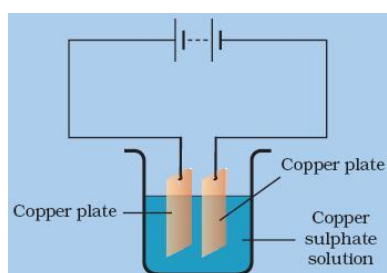
* Information: The process of depositing a layer of one metal over the other by passing electricity is called **electroplating**.

Activity: Electroplating

Material: copper sulphate, 2 copper plates of identical size, 250 ml distilled water, dil. sulphuric acid, battery, wire, sand paper, glass jar

Instructions

1. Clean the copper plates with sand paper. Rinse and dry them.
2. Add 2 teaspoons of copper sulphate in distilled water to make a blue coloured solution. Add a few drops of sulphuric acid to it.
3. Connect the copper plates to the terminals of battery and immerse them in copper sulphate solution.
4. Allow the current to pass through solution for some time.
5. Now remove the copper plates and observe them carefully.
6. Interchange the electrodes now and repeat the activity.

**Observation Questions**

1. Is there any difference between the two copper plates?

2. Is there any coating over the plates? Which plate has obtained coloured coating?

3. What is the terminal of the battery connected to the plate which is coated? _____

4. What did you observe when the electrodes terminal connections were interchanged?

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Reference sheet 1

Electroplating

- The process of depositing a layer of one metal over the other by passing electricity is called **electroplating**.
- Electrolysis is used to electroplate objects. This is useful for coating a cheaper metal with a more expensive one, such as copper or silver.
- The **negative electrode** should be the object that is to be electroplated.
- The **positive electrode** should be the metal that you want to coat the object with.
- The **conducting solution** should be a solution of the coating metal, such as its metal sulphate.

Electroplating with copper

- The object to be plated is connected to the negative terminal of the power supply. A piece of copper is connected to the positive terminal. The solution is copper sulphate solution.
- This process can be used to purify copper during copper manufacture. In this case, both electrodes are made from copper.
- The negative electrode gradually gets coated with pure copper as the positive electrode gradually disappears.