



Master Lesson Plan

For

Chemical Effects of Electric Current

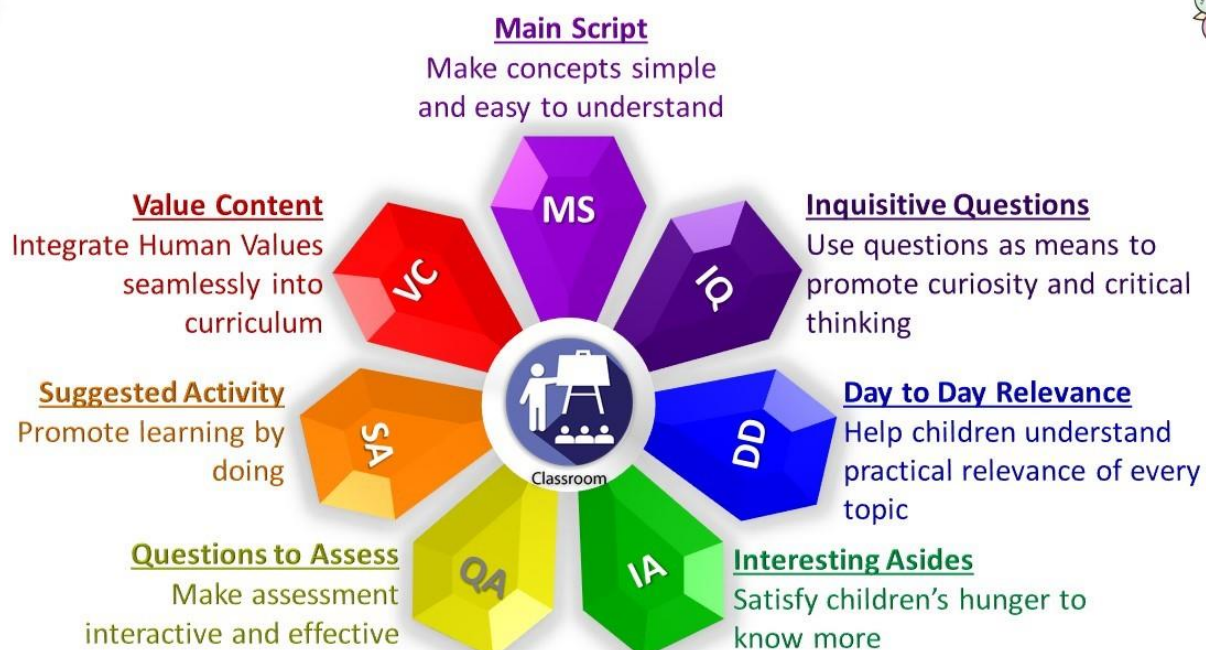
Board	Standard	Subject	Chapter	Language	Reference Link	Creation
CBSE	STD VIII	Science	Chemical Effects of Electric Current	English	Chemical Effects of Electric Current	2020-12

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Master Lesson Plan (MLP) - Covers the entire chapter with the help of these 7 asset types



For more information on how to use the lesson plan effectively, please scroll to the guidelines at the end of this document.

Chemical Effects of Electric Current

1. MS_ Objectives_ Chemical effects of electric current

Notes to the teacher: This asset lays down the proposed plan for transacting this chapter. It states the asset objectives of the MLP. This asset is for teacher's reference and need not be taught to the students:

Students will be able to...

- distinguish conductors and insulators
- examine the basics of electric current
- explain different types of electric circuits and the effect of electric current on materials
- analyse the type of liquids that conduct electricity
- determine the conductivity of solids, liquids fruits and vegetables using a tester
- appreciate the application of the heating effect of electric current
- construct a tester for testing conductivity of materials
- explain the concept of electrolysis and its uses
- identify the scientist Benjamin Franklin and his contributions in the field of physics
- describe static electricity and the phenomenon of lightning
- outline the process of electroplating and its uses
- develop precautionary measures while dealing with electricity and during thunder storms and lightning
- make a magnetic tester
- appreciate the great scientist Michael Faraday and his contributions in the field of science
- relate to the concept of keeping good friendship
- retell the basics of current and the chemical effects of electric current

Time to teach	Asset Type	Theme	Sub Theme
3 Minutes	Main Script	Electricity	Electric current, conductors, insulators and circuit

2. IQ_ Recap of Basics

[Notes to the teacher - Teacher may enable the students to think and come out with as many answers as possible before giving out the right answer/ answers]

1. What is an electric conductor? Give an example.



Answer: An electric conductor is a substance or material that allows electricity to flow through it easily. Eg: copper, silver.

2. Can insulators become conductors in certain conditions?

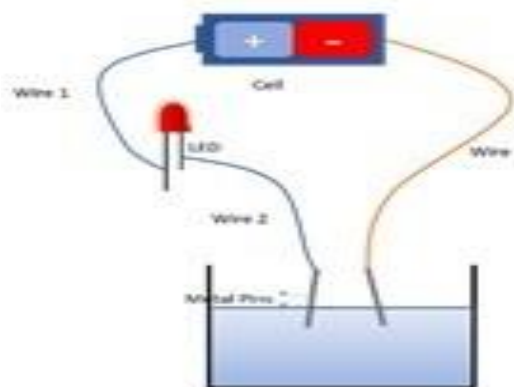
Answer: Yes. All materials have some conductivity.

Insulators usually oppose the flow of current eg : mica. However, under very high voltage, electric current can be made to flow through insulators too. eg: air is an insulator but during lightning it conducts charge.



3. Can liquids conduct electricity?

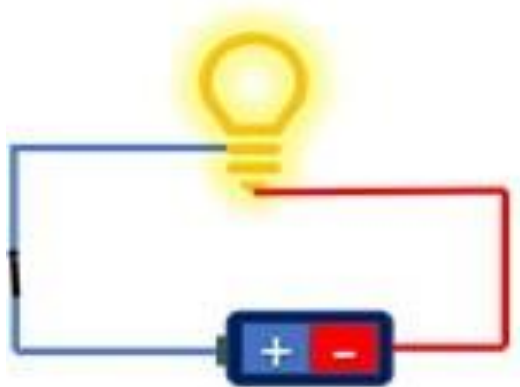
Answer:



Yes. When the ends of a tester are dipped in a salt water solution, the LED lights up showing that the liquid conducts electricity.

4. What is an electric circuit?

Answer: It is a path or line through which electricity can flow. It may be closed or open. Electricity can flow only in a closed path. So, a closed electric circuit conducts electricity.



5. What are the components of a simple electric circuit?

Answer: It has a power source (battery), wires or conductors and a bulb. It has a switch too.

6. What is a tester in electricity?

Answer: It is a device used to test if electricity is flowing through a circuit.



7. Materials which are good conductors of electricity are also good conductors of heat. True or false?

Answer: True, as the conduction of electricity and heat is based on flow of electrons.

8. Can the human body conduct electricity?

Answer: Yes, since it is made up of water and minerals it can conduct electricity. Dry skin is a good insulator. Wet or moist skin is a conductor.

9. Do fruits and vegetables conduct electricity?

Answer: Yes, many fruits and vegetables conduct electricity in varying degrees. Eg: potato conducts electricity.

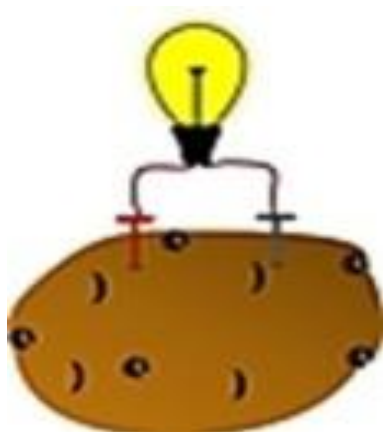


Image source-

Copper wire – CC- https://commons.wikimedia.org/wiki/File:Stranded_lamp_wire.jpg – Public domain

Lightning- SG-

https://www.srisathyaavidyavahini.org/images/joomgallery/thumbnails/nature_63/SkieS_and_cloudS_68/lightning_20141014_1977272484.jpg

OC- Radhika.bala@gmail.com

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Tester – CC - <https://pixabay.com/en/tester-electricity-tool-toolkit-205836/> - CC0

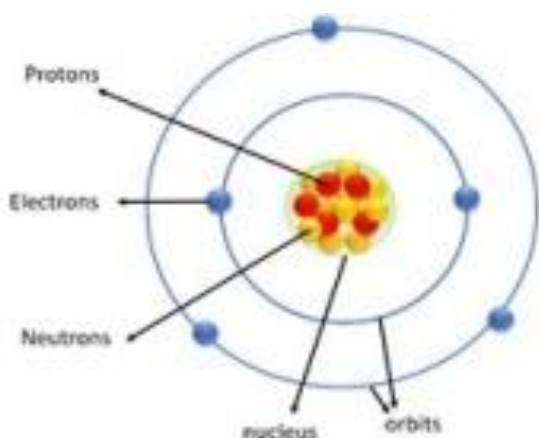
Image source - Potato – SG- <https://www.srisathyaavidyavahini.org/index.php/component/joomgallery/default/electricity-7799.html>

Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Inquisitive Questions	Electricity	Electric conductors

3. MS_ Basics of Electric current

Electric nature of matter

Matter is made up of atoms. They are composed of protons (+ve) and neutrons (neutral charge) forming the nucleus and the electrons (-ve) moving in orbits around the nucleus.

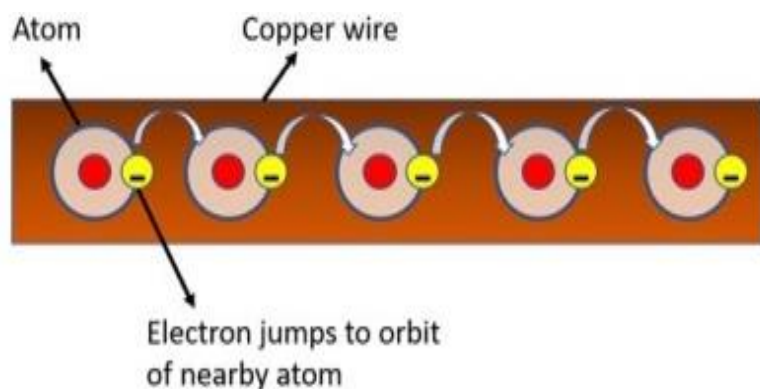


An atom is usually neutral in charge, as the charges of the protons and electrons balance each other. The attraction between the protons and the electrons keeps the structure of the atom together. However, in some atoms, the nucleus has a weaker attraction on its electrons. Thus, in these atoms, the electrons can move easily from atom to atom. Materials made of such atoms with loosely bound electrons are called conductors, which means they can transmit the charge carriers (electrons) easily.

What is an electric current?

Electricity is the flow of electrons from one atom to another. The flow of charges is called electric current. The flow usually takes place in conductors like the copper wire.

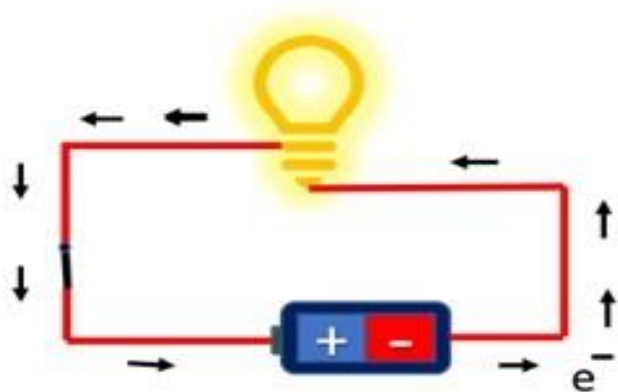
Copper has a single electron in the outer orbit which can easily latch onto the orbit of the adjoining atom.



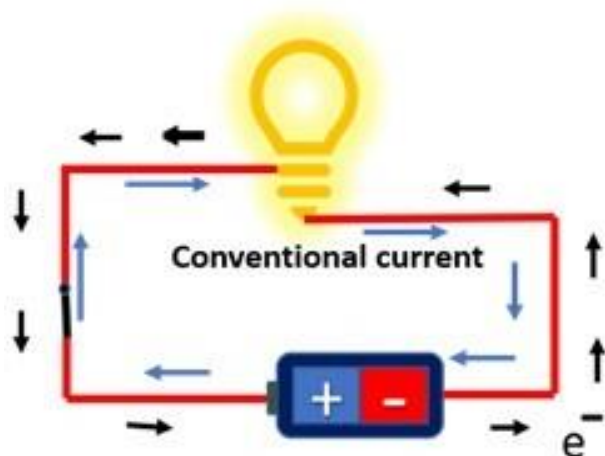
In a normal copper wire, electrons will not move.

The electrons need to be given a little push by connecting one end of the wire to a negative terminal of the battery which has an excess of negative charge. Now the electrons start pushing each other. However, if the other end of the wire is free, there will still be no flow of electrons, as air, being a bad conductor, will not accept free electrons. If we connect the other end of the circuit to the positive terminal of the battery it will easily attract electrons (opposite charges attract).

The electrons thus start moving, from the negative terminal to the positive terminal. This flow of electrons constitutes electric current. (However, one must avoid connecting just a wire across the terminals of the battery, as the heat generated by electric current can melt the wire. A component like the bulb which uses the electric power must be connected to the loop.) If a bulb is connected to the circuit, it lights up due to the heating effect of the electric current.



Direction of electric current



Electrons(e^-) flow from a negative terminal of the cell to the positive terminal of the cell. However, we refer to current as flowing from the positive terminal to the negative terminal and it is depicted as 'I' (The conventional symbol for current is 'I').

Image source–

Structure of atom- OC – Radhika.bala@gmail.com

Conventional current - OC – Radhika.bala@gmail.com

Flow of electrons - OC - Radhika.bala@gmail.com

Flow of electrons in copper wire – OC – Radhika.bala@gmail.com

Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Main Script	Electricity	Electric Current and circuit

4. SA_ Making a tester

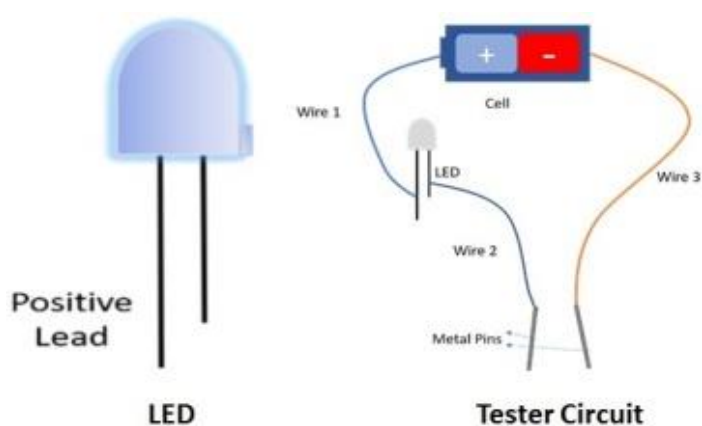
Aim : To construct a LED tester.

Materials needed: A long strip of copper wire, a wire cutter, LED light, cell of 1.5 V

Procedure:

Cut the copper wire into 3 strips and peel off about 1.5 inches of the insulation from both ends of all 3 strips.

Take one strip of copper wire (wire 1) and connect one end to the positive terminal of the cell. Connect the other end to the positive terminal of the LED (An LED has two leads; one longer than the other. The longer lead is connected to the positive terminal of the battery).



Take the second strip of the wire (wire2) and connect one end to the negative lead of the LED. The other end is left free.

Take the 3rd strip of copper wire (wire 3) and connect one end to the negative terminal of the 1.5V cell. The other end is left free. (refer image)

The free end of the wires may be attached to metal clips as shown in the figure.

The circuit as such is open and hence the LED does not glow. If we join the 2 metal pins, then the circuit becomes closed and the LED glows.

The tester connections may be checked likewise. (For more intensity of glow you may use a 3v battery too, by joining two 1.5 v batteries in series)

To test the conductivity of any substance (say a metal piece) touch the free ends of pins to the substance. If the substance connected is a conductor, then the electrons will flow in a loop and the circuit becomes closed. The LED will then glow. Thus the tester can be used to test conductivity of substances.

Once the tester is made, the children can test it with a copper and an aluminium strip and record their observations as below.

S No.	Material tested	LED glows (Yes/No)	*Result (Conductor /non-conductor)	**Comments
1.	Copper			
2.	Aluminium			

*Result - If the LED glows, the material is a conductor.

**Comments- The comments can be based on intensity of glow. The material which gives the higher intensity of glow is the better conductor).

Why is an LED used instead of a bulb?

An LED glows even when a weak current is passing through the circuit. Hence, it can be used to test all types of conductors. The intensity of the glow will give an indication of how strong or weak the conductor is.

Observation: The LED of the tester lights up if the free ends are connected to a conducting material. For a better conductor, the glow intensity of the LED is more.

Conclusion : Thus the tester is ready and it may be used to check the conductivity of various materials.

Question to Ponder:

What is LED? What are its advantages?

LED or Light Emitting Diode is a semiconductor device that emits light when an electric current is passed through it. Low consumption of energy, extended life span, high brightness and intensity are its advantages.

Precautions:

Make sure that the children do not use wet hands while assembling the tester. The connections must be securely fastened so that the apparatus works well.

LED and Tester circuit - OC - radhika.bala@gmail.com

Time to teach	Asset Type	Theme	Sub Theme
15 Minutes	Suggested Activity	Electricity	Electric conductors

5. MS_ More on Electric current

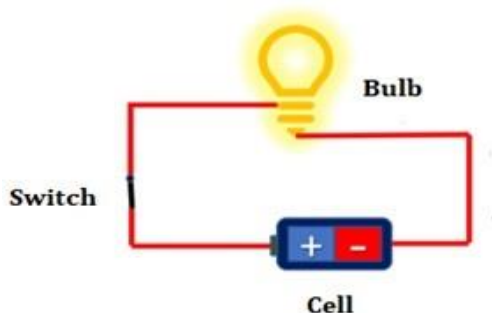
What is a circuit?

A circuit is a closed path through which electric current flows. Usually it will have a source of electricity like the battery, and an appliance that uses the electricity generated, to produce light in a bulb, or heat in an electric oven. The path must be a closed loop for the electrons to flow.

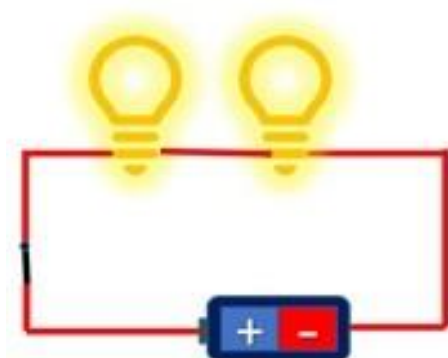
Depending on the number of appliances to be connected to the electric source there are 3 main types of circuit.

Simple Circuit

Here the circuit has a bulb, a cell and a switch. When the circuit path is closed, and the switch is on, the bulb glows.

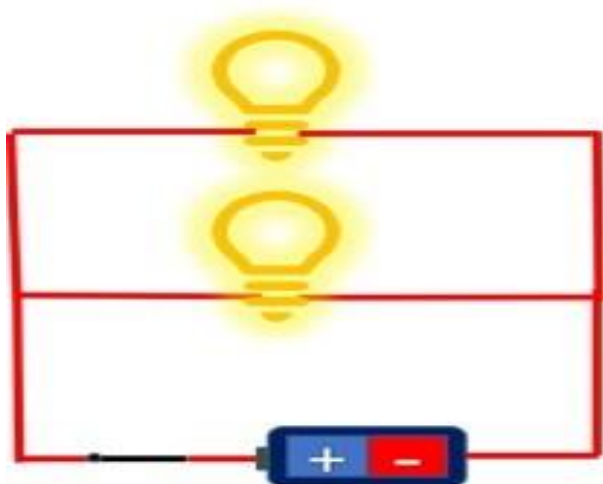
**Series circuit**

In a series circuit the components are connected in a series. E.g. the decorative strip lamps hung during festivities. The disadvantage is that even if one component fails then the circuit is cut.



Parallel circuit

In parallel circuits the components are connected along multiple paths. Though it needs more wires, here, even if one component fails, the electric flow to other components is not affected. e.g.: the wiring in our homes follows parallel circuits. Hence each component can be put off and on independently.



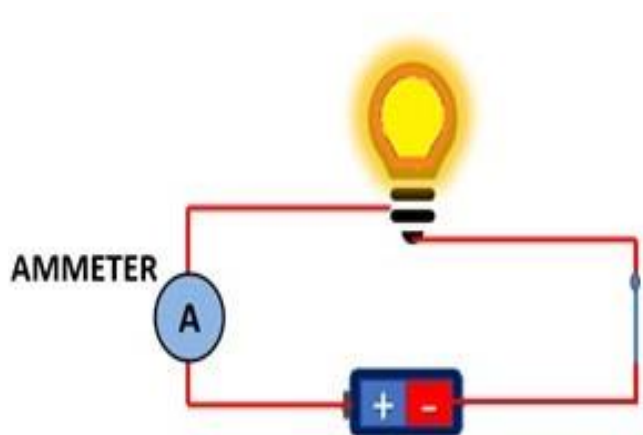
Measuring electric current

Electric current is measured using a device called ammeter. The SI unit is Ampere or A. It is the flow of electric charge across a surface at the rate of one coulomb per second, where coulomb is a unit for charge. One coulomb is the charge in 6.24×10^{18} electrons.

$$1 \text{ A} = 1 \text{ C/s}$$



To measure electric current in a simple circuit, we need to connect the leads of the ammeter to the circuit such that the current flows through it. We need to break the circuit first and connect the ammeter in series. When current flows through it, the reading on the ammeter will show the measure of the current flowing in Amperes.



Voltage - Voltage is the push that causes charges to move in an electric conductor. It is measured in volts and is the electric potential difference between 2 points.

Effects of Electric current

1. **Thermal effect**– The glowing of an incandescent bulb is due to the heating effect of the electric current which makes the tungsten filament glow.



2. **Magnetic effect** – A compass brought near an electric circuit will show deflection. Hence the electric current has a magnetic effect and this principle is used in electric motors.



3. **Chemical effect** – Electricity affects the substances at the molecular level and causes chemical changes in the conducting liquids. This effect of current is used in electroplating, etc.

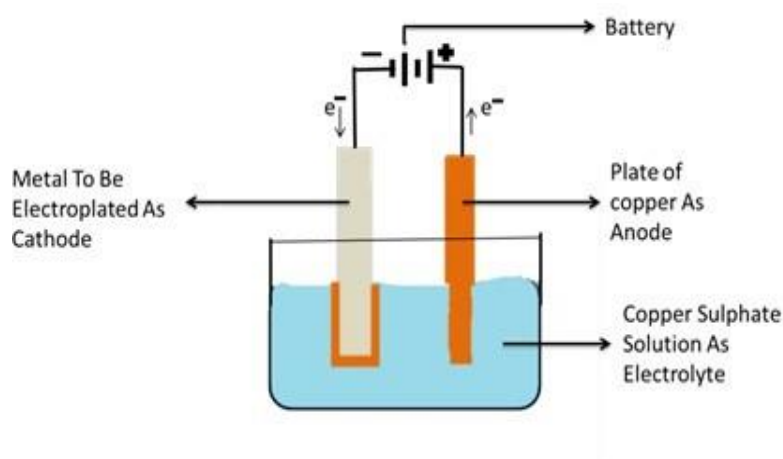


Image source –

Simple Circuit – OC – Radhika.bala@gmail.com Image

source– Series circuit- OC – Radhika.bala@gmail.com

Parallel circuit- OC – Radhika.bala@gmail.com

Ammeter- CC- <https://pixabay.com/en/amp-ammeter-electricity-current-2717819/> - CC0

OC- Radhika.bala@gmail.com

Glowing bulb – SG - https://www.srisathyaivaividyaahini.org/images/joomgallery/thumbnails/images/glowing_bulb_20180619_1405021358.jpg

Motor- SG-https://www.srisathyaivaividyaahini.org/images/joomgallery/thumbnails/images/motor_pump_20180429_1038215291.jpg

Electroplating- OC-kmandalappu@gmail.com

Time to teach	Asset Type	Theme	Sub Theme
12 Minutes	Main Script	Electricity	Electric Current and circuit

6. SA_ Testing Conductivity

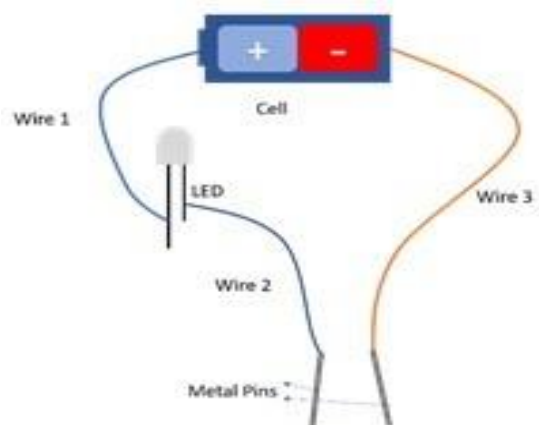
Aim : To test the conductivity of some solids, liquids and some vegetables and fruits.

Materials needed:

Salt water, distilled water, lime juice, salt, water, vinegar, orange, lime, a tester made with wires, LED bulb and batteries, wood piece, chalk, iron piece.

Method:

Make a list of things you need to test for conductivity.

**Tester circuit**

With the help of the tester, test the conductivity of each material and mark the observations in a table. If the LED bulb glows in the tester we know that the material is a conductor. The intensity of the glow of the LED bulb will show how good the conductor is. For each material to be tested, record if the bulb shines and if so, the intensity of the glow of the bulb on a scale of 1–5. If the bulb is very bright it is 5 and if there is no glow then it is zero.

For solid materials place the ends of the tester on the material and record observations.

S No	Material	Conductor Yes/No	LED bulb glow intensity 1-5
1.	Wood		
2.	Chalk		
3.	Iron		

For testing liquids dip the ends of the tester in the liquid and observe.

S No	Liquids	Conductor Yes/No	LED bulb glow intensity 1-5
1.	Distilled water		
2.	Lime juice		
3.	Salt water		
4.	Vinegar solution		

**SALT WATER TEST****VINEGAR TEST**

For fruits and vegetables stick the ends of the tester into the fruit or vegetable and observe.

S No	Vegetables and fruits	Conductor Yes/No	LED bulb glow intensity 1-5
1.	Lime		
2.	Orange		
3.	Tomato		
4.	Potato		
5.	Carrot		



Conductivity in ORANGE



Conductivity in LIME

Children can then infer which of these are the best conductors in each category.

Conclusion :

The best conductors from each category tested can be listed below.

Category	Name of Substance
Solid material	
Liquid	
Vegetables and fruits	

Questions to Ponder:

1)What does the juice of lemon and orange contain that helps in conducting electricity?

The Citric Acid in the lemon and orange acts as an electrolyte that conducts electricity.

2)How does potato conduct electricity?

Potato contains salt and water in its cells. Salt combines with water to break apart into positive and negative charges which helps to conduct electricity.

Precautions to be taken :

Teacher should ask the students to use gloves while handling vinegar and other liquids to avoid any allergic reaction.

Also students should ensure that their hands are dry when the connections are made.

Tester circuit - OC - radhika.bala@gmail.com

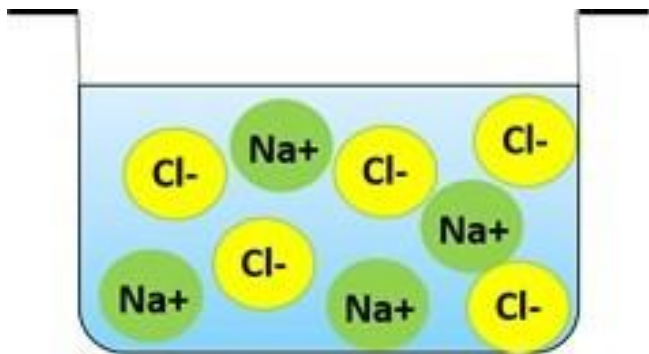
OC - kavithamanadaappu@gmail.com

OC - Radhika.bala@gmail.com

Time to teach	Asset Type	Theme	Sub Theme
20 Minutes	Suggested Activity	Electricity	Electric conductors

7. MS_ Conductivity of liquids

Conductivity in liquids is its ability to conduct electricity. All liquids do not conduct electricity. We have seen that solutions of acids, bases and salts conduct electricity. This is because these solutions have charged particles in them, called ions. For example, in a salt solution (Sodium chloride–NaCl solution) there are positive sodium ions, and negative chloride ions, besides the hydrogen and hydroxide ions of water.



A solution that does not have ions is neutral and hence a poor conductor eg: Distilled water.

Salts and conductivity

The more dissolved salts a liquid has, the more conductive it is. Drinking water is a conductive liquid. If we add table salt to it, its salinity increases, and it becomes more conductive. For the very same reason sea water is more conductive than water from rivers as sea water has more dissolved salts and minerals.

Chemistry of conducting liquids

When electricity is passed through electrodes into a conducting liquid, the positive ions move to the negative electrode (cathode) and the negative ions move to the positive electrode (anode). The positive ions are called cations and negative ions are called anions. The more the number of ions in the liquid, the better the conductivity of the liquid. Conductivity is thus a measure of the ionic strength of the liquid. A solution that conducts electricity is known as electrolyte.

Salt Solution (NaCl) -OC – radhika.bala@gmail.com

Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Main Script	Electricity	Conduction of electricity

8. IA_ Heating effects of current

Electric current is nothing but the flow of electrons in a conducting material. When electrons flow they vibrate and collide with each other and generate heat energy. Thus, flow of electric current in a conductor generates heat.

Applications of heating effect of current

The heating effect of electric current has various uses-

1. The heating effect is what causes the filament of an electric bulb to glow. Due to the high temperature produced, the filament becomes heated and emits light.



2. The electric fuse also works on this principle. A fuse is a safety device, which consists of a wire, that melts in the heat produced by a large current. Thus, the circuit is cut, and damage is prevented.



3. This effect is used in electric heaters, electric iron, room heaters, etc. Here the coils on getting heated by current, pass the heat to the liquids or surroundings, by convection, conduction or radiation.



4. The heating effect of electric current is also used to melt filler metal or work pieces as in soldering or welding.



Image Source-

Bulb - CC - <https://pixabay.com/en/light-bulb-lighting-hanging-ceiling-931979/>

Fuse and Fuse wire- SG-

https://www.srisathyaivaividyaahini.org/images/joomgallery/thumbnails/images/fuSe_and_fuSe_wire_20180810_1303498803.jpg

Room Heater – SG - https://www.srisathyaivaividyaahini.org/images/joomgallery/thumbnails/images/room_heater_20180418_2086364180.jpg

Induction heater- SG- https://www.srisathyaivaividyaahini.org/images/joomgallery/thumbnails/images/induction_heater_20180421_1938998501.jpg

Heated coils : <https://pixnio.com/objects/electric-stove-red-hot-burner> - CC0

soldering – CC - <https://pixabay.com/en/soldering-circuitry-electricity-3280085/> - CC0

Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Interesting Asides	Electricity	Practical applications of heat, electric current, heating effects of electric current

9. MS_ Electrolysis

Effect of electric current in liquids-

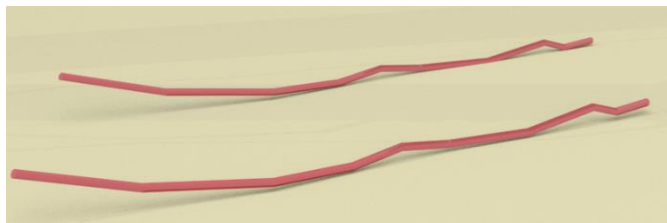
We all know about the heating and magnetic effects of electric current. The first man to produce a chemical reaction by electricity was **William Nicholson**.

What happens when an electric current is passed through a conducting liquid? Does it cause any changes in these solutions? Let us find out through an experiment.

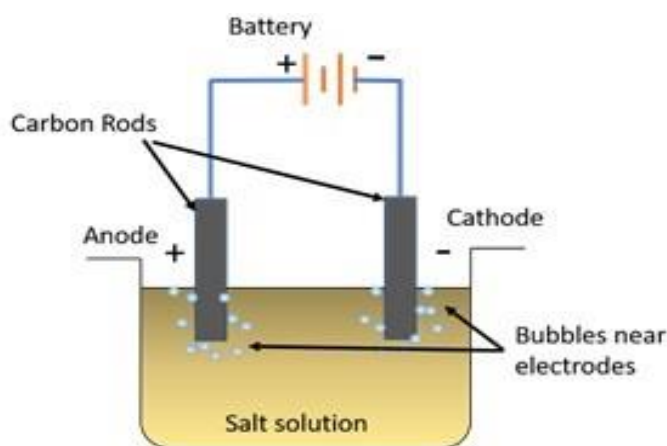
Step 1. Take 2 carbon rods (they may be taken from discarded cells) and clean their caps with sand paper.



Step 2. Take 2 wires and connect one end of the wires to the caps of the carbon rods. The other ends may be connected to the battery (see figure)..



Step 3. Immerse the rods in a plastic container having salt solution (electrolyte)



What we have made above is an electrolytic cell. It consists of -

1. The 2 carbon rods are called electrodes. The negatively charged electrode is the cathode and the positively charged electrode is the anode.
2. The electrolyte which is the salt solution.

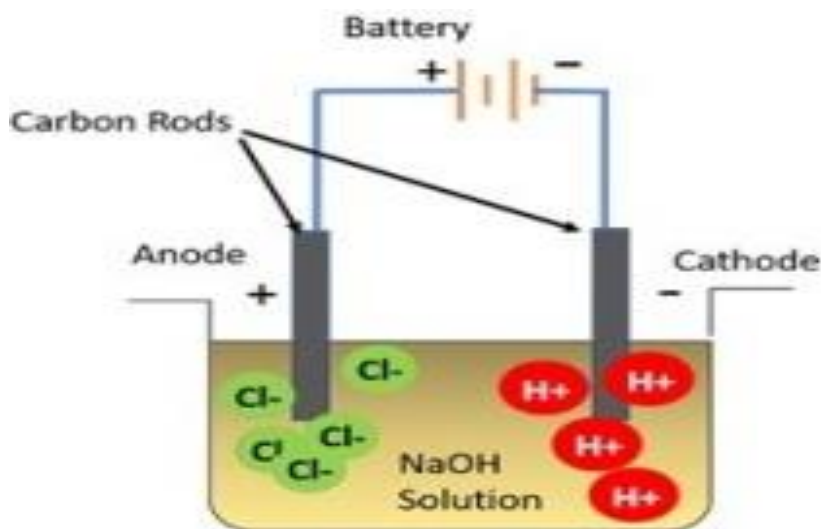
Electricity starts flowing as the salt solution is a conductor and the circuit is complete. Since the electrolyte has positive and negative ions they get attracted to the electrode with the opposite charge. After sometime, it is observed that bubbles start forming at the electrodes. So, what exactly would have occurred?

The Inside story of the salt solution - Electrolysis

The salt solution conducts electricity as it has the following ions-

Sodium	Na^+
Chloride	Cl^-
Hydrogen	H^+
Hydroxide ions	OH^-

When electricity is passed, the negative chloride ions move towards the anode. Ions attracted to the anode are called anions. The chlorine ions lose their electrons at the anode and chlorine gas bubbles up the surface of the solution near the anode. If we collect the gas at the anode in a test tube, it will be a pale greenish gas.



The positive hydrogen ions move towards the cathode. Ions attracted to cathode are called cat ions. Hydrogen gains electrons at the cathode thus forming hydrogen molecules. The hydrogen gas is seen bubbling up at the cathode. If the gas is collected in a test tube and a lighted splint is shown near it, it will extinguish with a pop to show it is hydrogen.

What remains in the solution are the sodium and hydroxide ions which form the sodium hydroxide solution. To put it in the form of an equation



This process of splitting a substance through electric current is known as electrolysis. In this case we got hydrogen gas, chlorine gas and an alkali.

Thus, we see that the chemical composition of the conducting solution is changed when electricity is passed through it. If metals are used as electrodes, then we may see deposits of metal on the electrodes. In some cases, the colour of the solution may change based on the decomposition of the electrolyte.

To sum up what we have learnt, electric current passing through liquids causes chemical changes. It may be physically seen as one or more of the following-

1. Gas bubbles may be formed at the electrodes.
2. Metal deposits may be seen on the electrodes.
3. The colour of the solution may change.

Points to ponder-

The positive ions in the electrolyte are attracted to the cathode where they gain electrons. This is called reduction. (Remember RIG – Reduction is Gain)

The negative ions in the electrolyte are attracted to the anode where they lose electrons and this is called oxidation. (Remember OIL- Oxidation is Loss)

Uses of electrolysis-

1. Electrolysis is used in purifying metals extracted from it ore. This is called electro refining.
2. It is used in the production of various metals, non-metals and compounds eg: Magnesium, chlorine, compounds like sodium hydroxide, etc.)
3. It is used in coating an inferior metal with a superior metal (electroplating).

Image source:

Electrolysis (NaCl solution) -OC – radhika.bala@gmail.com

Electrolysis of salt solution – OC- Radhika.bala@gmail.com

OC: Sowmya (mudambisowmya@gmail.com)

Time to teach	Asset Type	Theme	Sub Theme
10 Minutes	Main Script	Electricity	Conduction of electricity

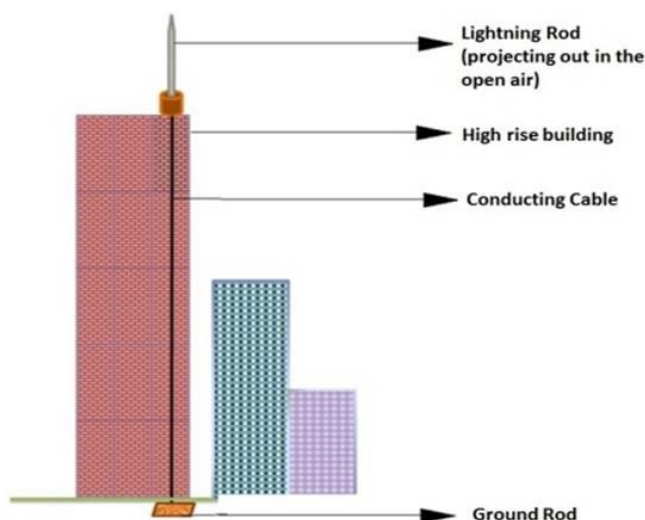
10. IA_ Benjamin Franklin

Benjamin Franklin

Who was Benjamin Franklin?

Benjamin Franklin was an American scientist, but he was also an expert in different subject areas like being a leading author, politician, civic activist, to name a few. He was a man of high intelligence.

Franklin has contributed a lot in the field of physics, especially on electricity. He invented a lightning rod, bifocal lens (lens used by those with both long and short sightedness) and Franklin stove (fire place lined with metal designed to produce more heat and less smoke).



Benjamin Franklin performed his famous kite experiment to show that lightning is an electrical phenomenon. In the experiment, he used a kite with a pointed wire attached to its top end. The other end was connected to a metal key through a hemp string. The kite was then flown close to the thunder cloud. He observed an electric spark near the key as he moved his hand closer to the key. This helped him prove lightning's electric nature.

This experiment termed 'Franklin and Electricity' was engraved on the US\$10 dollar note from 1860's to 1890's.

Benjamin Franklin's Famous Kite Experiment

Franklin stove also called 'Circulating Stove' or 'Pennsylvania Fire place'

Two unique features of Franklin's stove were a hollow metal baffle (a device used to direct the flow of fumes from fire) at the rear and an upside-down siphon (U-shaped tube). It was designed mainly to transfer more heat and less smoke compared to a regular fire place.

Bifocals by Benjamin Franklin (18th century eye glasses)



Bifocal glasses are used by people suffering from both near sightedness and far sightedness (presbyopia). Earlier designs of bifocals had two different lenses. Lens in the lower half of the frame for near sight and upper half for far sight. It is said that Franklin himself suffered from presbyopia, which is gradual loss of ability to focus on nearby objects.

Glass Harmonica Invented by Benjamin Franklin

Benjamin Franklin called his first musical instrument "Armonica" based on the Italian word armonia meaning harmony.



In this musical instrument 37 glass bowls were mounted on an iron spindle horizontally and it was turned wholly with the help of a foot pedal. When the rims of the bowls were touched with moistened fingers it produced different sounds. Rims were painted with different colours based on the pitch of the note.

Image Source:

https://commons.wikimedia.org/wiki/File:Franklin_Stove_MET_131087.jpg Creative Commons CC0 1.0 Universal Public Domain Dedication.

https://commons.wikimedia.org/wiki/File:Bifocals_by_Benjamin_Franklin_-_Franklin_Institute_-_DSC06605.JPG public domain

Armonica- Original Contribution – rushmish@gmail.com

<https://search.creativecommons.org/photos/b07cb5bd-9665-4bbe-af86-51165c48e372>

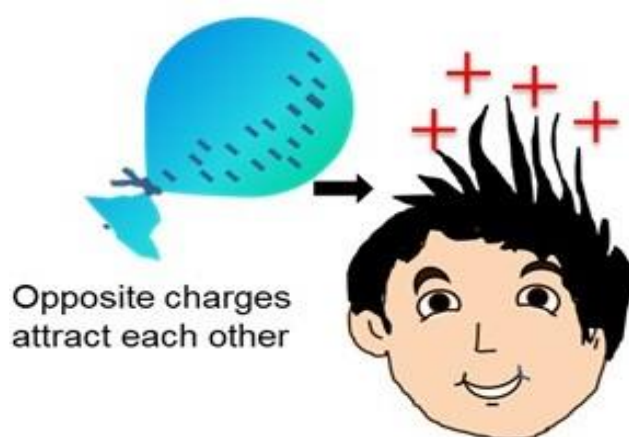
Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Interesting Asides	Electricity	Electric conductors

11. MS_ Lightning Facts

Can you name a natural phenomenon where light from the sky comes crashing down to earth? Well, that's lightning. Lightning is caused by static electricity. Firstly let us learn a little about static electricity before learning about lightning in detail.

What is static electricity?

- As we already know, matter is made up of atoms which are basically neutral as they have the same number of protons (positive charge) and electrons (negative charge).
- When the electrons do not equal the number of protons in an atom, then the atom is charged.
- Static electricity is when another wise neutral object becomes charged (by gaining or losing electrons) by rubbing against another object. Here the charges do not move (as in the case of current electricity) hence it is called static.
- For eg: let us see what happens when an inflated balloon is rubbed against your hair. Both the hair and balloon initially had electrically neutral atoms. The rubbing causes the hair to give off some electrons to the balloon. So the hair gets a net positive charge and the balloon gets a net negative charge (as it gains electrons). The hair thus sticks to the balloon (opposite charges attract) while the individual strands of hair stand out (like charges repel).



Now that we learnt about static electricity, let's see how lightning occurs.

Lightning:

1. The thunder clouds moving in the sky get charged by the particles present in the air, due to friction.
2. These charges get accumulated in the clouds and the positive and negative charges separate themselves within the clouds, i.e. the lighter positive charges move to the upper part of the cloud while the heavier negative charges sink to the lower part of the clouds as shown in the picture below:

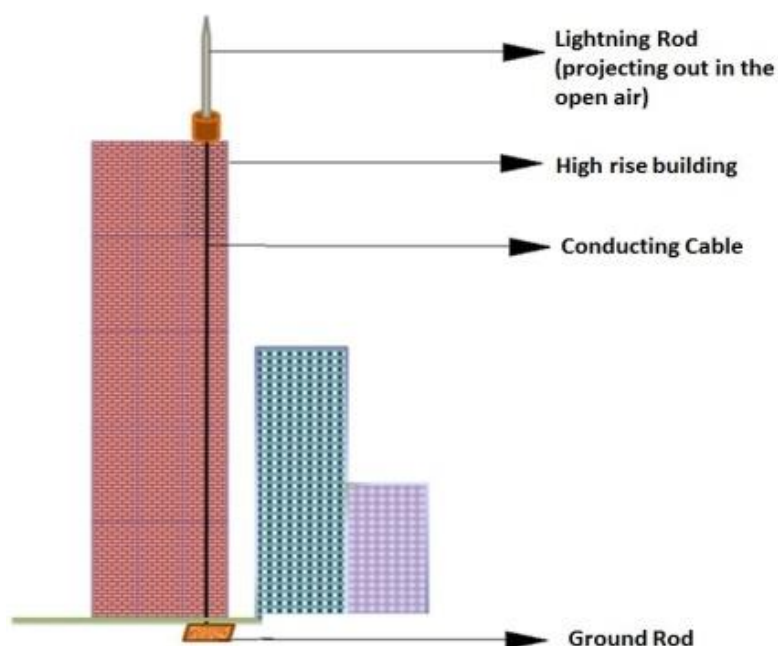


3. As the charges keep getting accumulated, there is a heavy build up inside the cloud.
4. This accumulated charge now tries to flow from one part of the cloud to another but the air (which is a poor conductor of electricity) present in it resists the flow of charges between them.
5. When the amount of charge in the cloud increases massively, the air cannot resist and suddenly breaks down.
6. Therefore an electric discharge takes place between two opposite charges inside the clouds (positive and negative charges) due to which a bright streak of light is produced in the sky, that we call as lightning.
7. Mostly electric discharge happens within the cloud called intra-cloud lightning but sometimes it can happen between two clouds or between a cloud and the ground.

Lightning is a high energy electric discharge. It is nearly 27,000 degree Celsius which is three times hotter than the surface of the sun. A huge amount of heat is produced during lightning which causes the air to expand suddenly. This sudden expansion of air leads to vibration which in turn causes thunder.

Lightning Conductor (Lightning Rod)

When lightning strikes the earth with a massive amount of energy and heat it can be dangerous and destructive to buildings. So to protect the high rise buildings from lightning, a device called a lightning conductor is used. It is a metal rod which has a pointy edge fixed at the top most part of the building (projecting out in the air). The other end of the rod is buried deep in the ground using a conducting cable which is made of copper (good conductor of electricity). When lightning strikes the rod the charges will be carried to the ground without any harm to the building.



Tidbits

Can anyone guess what is study of lightning called? The study of lightning is called 'Fulminology'.

The person who studies it is called 'Fulminologist'.

Image Source:

Static Electricity- OC- kmandalappu@gmail.com

Accumulation of electric charges within the cloud- OC- kmandalappu@gmail.com

Lightning conductor- OC- kmandalappu@gmail.com

Time to teach	Asset Type	Theme	Sub Theme
10 Minutes	Main Script	Electricity	Electric conductors

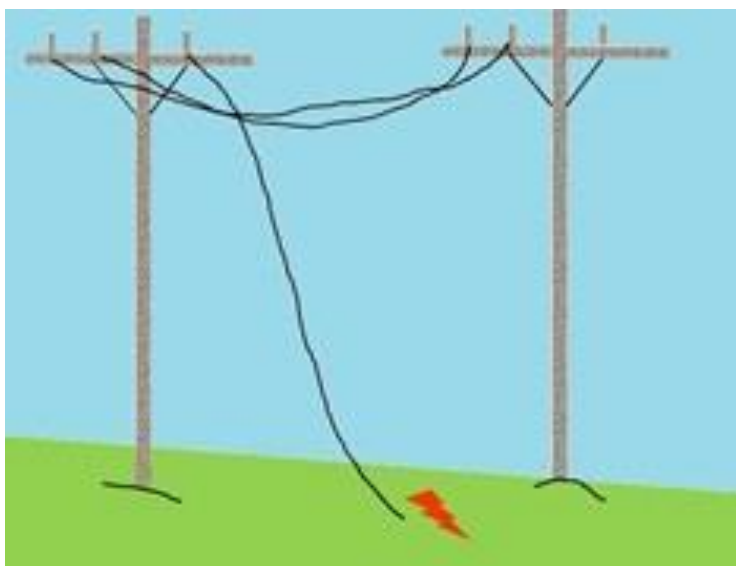
12. DD_ Take care

Precautionary measures while handling electricity:

- Avoid working with or repairing electrical cords, wires, switches, or plugs with the power on or wet hands.
- Be careful with the electric supply from the mains, generator or an inverter. Never try to experiment with it.
- Never touch anyone who has been electrocuted as you may also be electrocuted. Call an adult immediately for help.



- Stay away from fallen power lines especially during rains. Inform an adult if you see a fallen line. Do not step in water puddles during rains as sometimes live wires may have fallen in it and by stepping in the puddle you may be electrocuted.



- While playing outdoors, never climb a tree, electrical poles or cell towers if a power line is nearby or touching, stay away from them.
- Fly kites and remote control airplanes in a wide open field or park, not near overhead electrical wires.
- Do not touch a lighted electric bulb connected to the mains. It may be very hot and your hand may get burnt badly.

Precautionary measures to prevent electrical fire:

Electrical fires are caused mainly due to faulty electrical outlets, old and out dated electrical appliances or worn out cords of appliances. To prevent such fires follow the precautions below:

- Never use extension cords for longer time for the bigger appliances and never use multiple appliances on a single extension cord, it may lead to fire. Extension cords are for temporary purpose only.
- Avoid using appliances with worn out cords which can produce heat to the surrounding area like curtains, wood frame which are combustible leading to fire.
- Make sure that all the light fixtures are plugged into the socket that matches there commended wattage. Do not use a higher wattage bulb.

Precautionary measures during lightning:

- Never be in an open area or playground, take shelter inside a building immediately. If travelling, stay inside the vehicle.
- If caught out doors with nothing around just crouch down low (as shown in the picture below) but don't lie down flat on the bare ground.



- Do not use land line phones, television and other electrical appliances which conduct electricity. Remove the plugs from sockets during lightning as it may damage the appliances.

Image Source:

person electrocuted- <https://pixabay.com/en/flash-tesla-coil-experiment-113270/> - CC0

Fallen power line- OC- (kmandalappu@gmail.com)

Crouching during lightning-OC-(kmandalappu@gmail.com)

Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Day-to-day Relevance	Electricity	Electric power

13. MS_ Electroplating

Have you all heard of 1gram gold jewellery ? What does it mean?

It means ornaments which are made with cheaper metals like copper, bronze or silver is layered with gold to make it look like a gold ornament as it is economical than ornaments made with complete gold. We will see how it is done.

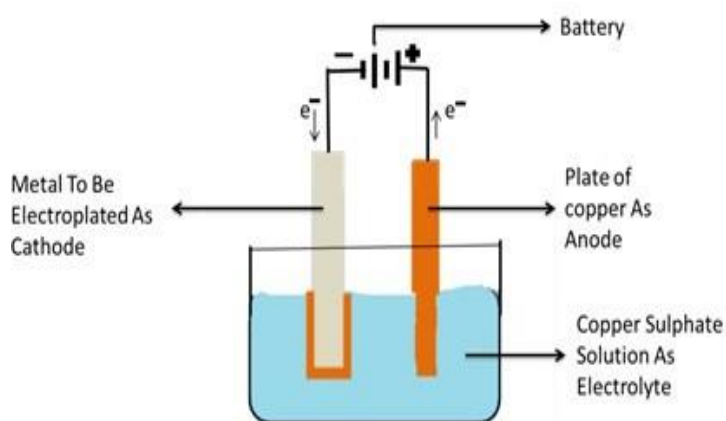
The process of depositing a layer of a metal over another metal by passing electricity through a solution is called electroplating.

Electroplating is also known as electro deposition. Let us learn how a cheaper metal can be coated with copper For this we need a metal plate, a copper plate and acidified solution of copper sulphate (electrolyte) and a battery.

The metal which has to be coated with copper is cleaned first to remove the dirt on its surface, then the copper plate and the metal plate is immersed in the electrolyte solution (copper sulphate solution) which allows the electricity to flow. There should be space between two plates when immersed in the electrolyte.

Both the plates are connected to the battery. The metal which has to be electroplated becomes the cathode in the circuit while a thick plate of copper to be deposited will be taken as anode. Now the circuit is complete, allow the electric current to flow for sometime, slowly the electrons will start flowing from the anode to cathode making deposit of copper on the metal plate. The rate at which copper (anode) is dissolved is equal to the rate of deposit on the metal plate (cathode). The metal plate will look like copper after it is completely plated.

This is how electroplating is done.



Apart from enhancing the appearance of the base metal, electroplating is done to improve upon the existing properties of the metal. Abrasion resistance, resistance to corrosion and rust, etc., are the additional properties the electroplated metal acquires.

Chromium coating is a best example to explain this as, chromium does not corrode and is scratch resistant, many objects like the taps, bicycle handle bars, car parts, etc., are plated with chromium.

You might wonder why these parts can't be entirely made using chromium.

This is because chromium is expensive and it wouldn't be economical to make these parts with it. Hence, these parts are made with a cheaper metal and only coated with chromium.

In canned food, electroplating of tin over iron is done. Tin retains the freshness of food.

Tin used in canning food products



Bridges are made of iron with a coating of zinc to make it anti corrosive and rust free.

Iron bridge coated with zinc



Image Source:

Process of Electroplating-OC-kmandalappu@gmail.com

canned food- SSSVV Gallery

Bridge- SSSVV Gallery

Time to teach	Asset Type	Theme	Sub Theme
10 Minutes	Main Script	Electricity	Electroplating - Uses, Process

14. IA_ More About Electroplating

More about Electroplating (Gilding)

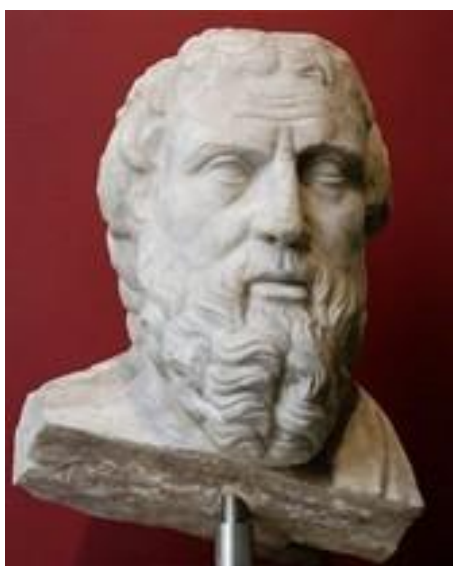
You know that electroplating means coating an object with a metal using electric current. Did you know that the electroplating process was in use during ancient times itself?

It was called 'Gilding' then, which means the art of layering gold over the solid surface such as wood, stone or metal. It was mainly for ornamental purposes. A gilded material was called 'Gilt'.

In History, gilding of material has been in use from the 4th century BC and in early medieval period.

According to Herodotus (A Greek historian) it was customary in Egypt to gild wood and metal.

Herodotus (A Greek historian)



Apart from gold, metals like silver, bronze and copper were also used for gilding. Silver – gilt was widely used in the west while gilt-bronze was common among Chinese. Gilding of copper was used mostly in temple domes for decorative purposes.

Gilded Bronze Statue of Buddha Done in China in 1600'S



Copper Clock Gilded with Mercury Year 1810



Image Source:

Herodotus- https://commons.wikimedia.org/wiki/File:Herodotus_Massimo_Inv124478.jpg

https://commons.wikimedia.org/wiki/File:Sakyamuni_Buddha,_China,_Ming_dynasty,_1600s,_bronze_with_lacquer_and_gilding_-_Mainfr%C3%A4nkisches_Museum_-_W%C3%BCrzburg,_Germany_-_DSC04778.jpg

https://commons.wikimedia.org/wiki/File:Clock,_copper_alloy_with_mercury_gilding,_Jacques-Francois_Baudin,_Paris,_c._1810_-_Nelson-Atkins_Museum_of_Art_-_DSC08952.JPG

Time to teach	Asset Type	Theme	Sub Theme
3 Minutes	Interesting Asides	Electricity	Electroplating-Uses

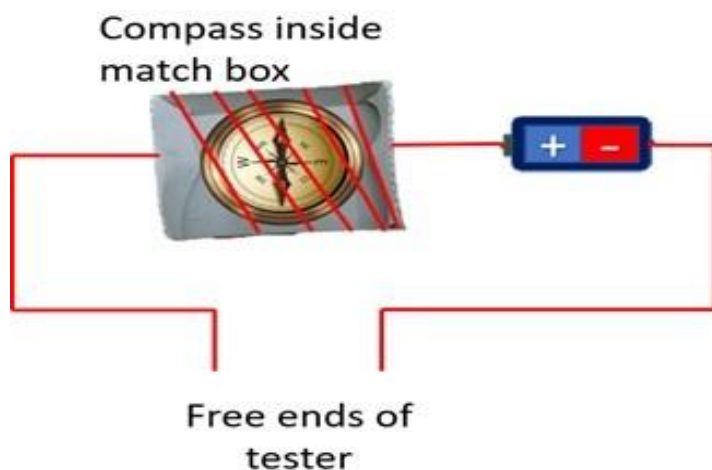
15. SA_ Making a magnetic tester

Aim: To make a tester using the magnetic effect of electric current.

Materials required: An empty match box, compass needle, a battery ,2wires

Procedure:

- A compass needle is placed in a tray of a match box.
- An electric wire is wound around the tray which has the compass needle.
- The free end of the wire is connected to one terminal of a battery. The other end is left free.
- Another piece of wire is taken and one end is connected to the other terminal of the battery. The other end is left free.
- If the two free ends are momentarily connected the circuit is complete and current flows through the circuit.
- This is observed by the deflection of the compass.



Observation: The compass needle shows deflection when electricity flows through the circuit.

Conclusion: Thus, the magnetic tester works on the principle of magnetic effect of electric current. This tester can be used to test the conductivity of materials. The free ends of magnetic tester can be connected to various objects to test them for conductivity. If the object is a conductor, then the circuit becomes closed and current flows. This causes the compass to deflect.

Discussion Questions

1. Why do you think the compass deflects?

Answer: The flow of electric current causes a magnetic field around the wire and thus the compass which is a bar magnet, deflects.

2. Do you think the compass would deflect if we change the direction of current?

Answer: Yes, it would deflect.

Precautions: Care has to be taken that wet hands are not to be used while making connections. The connections should be well bound.

Compass- <https://pixabay.com/en/compass-north-south-east-west-2925824/>

Matchbox and Tester- OC – Radhika.bala@gmail.com

Time to teach	Asset Type	Theme	Sub Theme
15 Minutes	Suggested Activity	Electricity	Electric conductors

16. IA_ Michael Faraday

Michael Faraday

Michael Faraday was a British scientist who is known for his contributions like the discovery of electromagnetic induction, electrolysis, etc.

Though Faraday received only basic formal education, he was a significant scientist of the nineteenth century. He educated himself out of self-interest by reading books and developed an interest in science, particularly electricity.

In 1831, his experiments of electromagnetic induction led him to create electromagnetic rotary devices called 'Faraday Disk' which was the first electromagnetic generator. This laid a foundation for the development of modern day electric motors, generators and transformers.

Faraday Disk (first electric generator) is displayed at the National Museum of Nature and Science in Tokyo, Japan.



Apart from Physics, he has contributed a lot in the field of Chemistry too. He discovered a chemical substance called benzene. He also invented an early form of Bunsen burner which we use in science labs even today.



He along with another scientist came up with the popular terms such as anode, cathode, electrode and ion.

Albert Einstein (a famous physicist) was very much inspired by Michael Faraday and kept his picture on his office wall along with two other famous scientists.

To honour Faraday's role in the advancement of science in Britain, the Bank of England introduced a £20 bill with his portrait on June 5, 1991."

Image Source:

Both the images of Bunsen burner- SSSVV Gallery

https://commons.wikimedia.org/wiki/File:Faraday_disk_-_National_Museum_of_Nature_and_Science,_Tokyo_-_DSC07366.JPG- Public domain

Time to teach	Asset Type	Theme	Sub Theme
3 Minutes	Interesting Asides	Electricity	Electro-magnetic induction

17. VC_ Keeping good friendship

Learning Domain- Classroom

The process of depositing a layer of any desired metal on another material by means of electricity is called electroplating. For example, Iron is used in bridges and automobiles to provide strength. However, iron tends to corrode and rust. So, a coating of zinc is deposited on iron to protect it from corrosion and formation of rust.

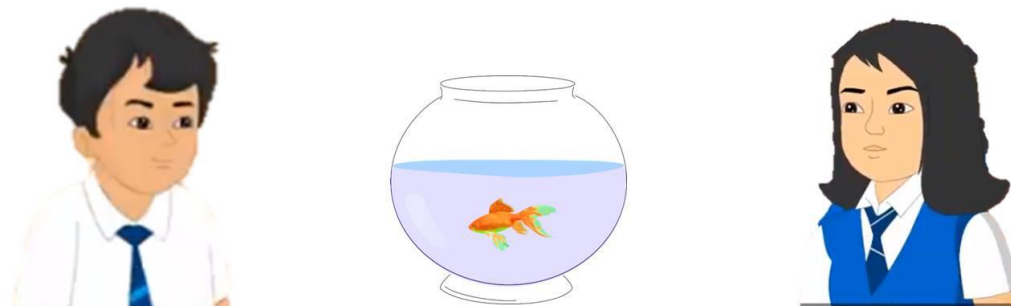
In life, when we add good friends to our group, the goodness of the entire group strengthens. Our friendship should be such that we stand by each other and protect each other in times of need. Here's a story that defines it:



Story--Be a good friend

A nine-year-old boy was sitting in class, when suddenly he realized that his pants were wet and there was a puddle at his feet. He felt very embarrassed, nervous and worried that his classmates would find out and make fun of him.

He quickly wanted to do something and saw the teacher and his good friend Susie walking towards him. Susie was carrying a bowl of gold fish. As they came closer, the boy thought that the teacher noticed his wet pants, and suddenly Susie tripped and dropped the fish bowl in his lap. While thanking God for helping him, he pretended to get angry with Susie and yelled at her.



Everyone in the class thought it was Susie's fault that the boy's pants got wet. The teacher helped the boy change into dry clothes, and the class continued.

Later that evening, the boy asked Susie, "You purposely tripped that bowl on me, didn't you?" "It happened with me too once....!", whispered and laughed Susie.

Friendships can have a major impact on your health and well-being, but it's not always easy to build or maintain friendships. Understand the importance of friendships in your life and what you can do to develop and nurture friendships.

Good friends will stay with you throughout your life, depend able and be of help to you. Your goodness too will blossom in their presence. Choosing good Friends is extremely important.

Developing and maintaining healthy friendships involves give-and-take. It's as important for you to be a good friend as it is to surround yourself with good friends.

<https://www.youtube.com/watch?v=TEyY8aPQ3K4>

<https://pixabay.com/en/bowl-water-glass-empty-round-fish-304492/>

<https://pixabay.com/en/goldfish-fish-gold-water-cichlid-799744/>

<https://www.youtube.com/watch?v=GvFLdEiPrEM>

Time to teach	Value Type	Value Sub Type	Value Attribute
3 Minutes	Love	A friend in need is a friend indeed	Stories

18. QA_ Knowledge Check

A. True or False

1. Electro refining is the process of purifying a metal through electrolysis.
2. LEDs consume very little electricity to glow.
3. An electrode connected to the negative terminal of the battery releases hydrogen gas when immersed in water.
4. Solutions of acids are bad conductors of electricity.
5. The flow of neutrons in a circuit is responsible for conducting electricity.

B. Answer the following–

1. Why does rain water conduct electricity?
2. Which effect of electricity is seen in the following?
 - a. Burning of bulb.....
 - b. Fuse wire of home wiring.....
 - c. Deflection of a compass in a circuit.....
 - d. Gold plating.....
3. Why should you unplug the power sockets of televisions, computers, modems, etc. during the thunderstorm?
4. Will electroplating take place if we reverse the flow of current at frequent intervals?
5. Why do we use LED bulbs?

C. Fill in the blanks

1. The _____ lead of LED is always connected to the positive terminal of the lead.
2. We can add _____ to distilled water to make it to conduct electricity.
3. Hydrochloric acid is a _____ conductor of electricity.
4. Electric current passing through any conducting liquid causes _____ reaction.
5. Electroplating is very often done on materials for _____ and _____.

Answers**A. True or False**

1. Electro refining is the process of purifying a metal through electrolysis. True
2. LEDs consume very little electricity to glow. True
3. An electrode connected to the negative terminal of the battery releases hydrogen gas when immersed in water. True
4. Solutions of acids are bad conductors of electricity. False...(Acids undergo dissociation in aqueous solution to form H^+ ions, which conduct electricity)
5. The flow of neutrons in a circuit is responsible for conducting electricity. False (Neutrons have no electric charge)

B. Answer the following

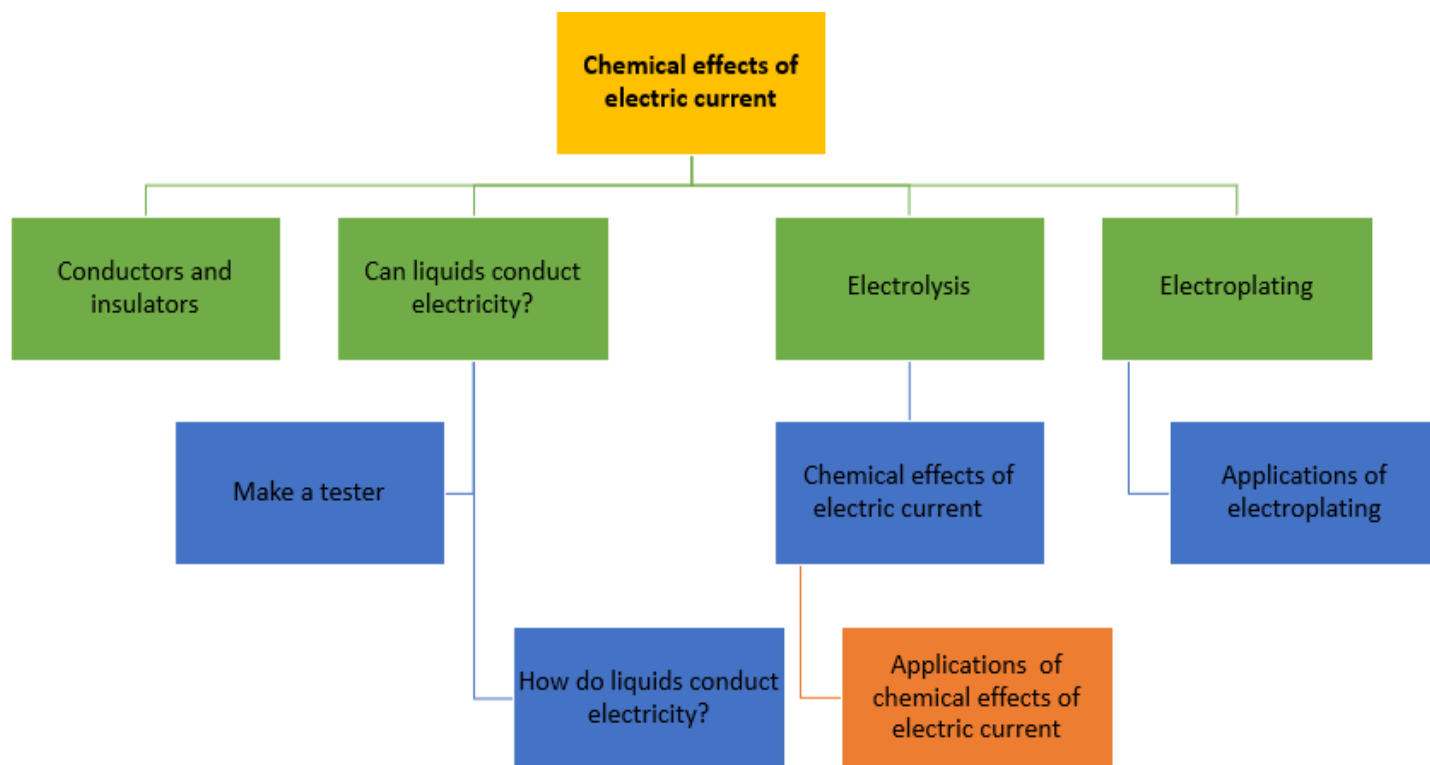
1. Rainwater, though pure, absorbs carbon dioxide and other salts from the atmosphere. Hence it becomes a conductor.
2. Which effect of electricity is seen in the following
 - a. Burning of bulb (Heating effect–this is what causes the filament to glow)
 - b. Fuse wire of home wiring (Heating effect– too much electricity flowing through the fuse wire causes it to heat and melt thus cutting electric flow.)
 - c. Deflection of a compass in a circuit (Magnetic effect- flow of electricity through a wire creates magnetic fields which causes the compass to deflect.)
 - d. Gold plating (Chemical Effect– This is done by electroplating which is by flow of electricity through an electrolyte causing chemical changes)
3. During a thunder storm, there is a possibility of lightning to strike the power lines. This can cause a huge increase in electric flow through the wiring, and destroy circuits. Hence it is advisable to unplug devices.
4. In electroplating, the electroplating ions must continuously get deposited on the metal to be electroplated over a period. For this to happen, the direction of current must remain a constant. If we keep reversing the flow of current, the ions would just keep oscillating in the electrolyte and no plating would take place.
5. LED is a light emitting diode which needs less current to glow than filament bulbs. They consume less power and are more long lasting than other types of bulbs. They also do not generate heat like other bulbs. In experiments where very little current is generated in the circuits, the LED bulb is always preferred as an indicator.

C. Fill in the blanks

1. Longer
2. Salt
3. Good
4. Chemical reaction
5. Corrosion resistance, decorative purposes

Time to teach	Asset Type	Theme	Sub Theme
15 Minutes	Assessments	Electricity	Electric Current and circuit

19. MS_Summary_Chemical effects of electric current



Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Main Script	Electricity	Conduction of electricity

Master Lesson Plan

Seven Asset Methodology for MLP	
What is the purpose of this Master lesson Plan?	This Master Lesson Plan (MLP) prepared by Sri Sathya Sai Vidya Vahini, covers the entire chapter for the given board. The chapter given in the textbook is broken down into smaller modules known as assets. One of seven teaching methods is applied to each asset. Several different assets together complete the entire chapter. Each asset is supported by a teaching aid such as animated presentation, audio, video, worksheet; that the teacher can use in the class, while teaching that module. The MLP is for the teacher's preparation and the teaching aids are for use in the classroom.
How to use it?	You can prepare for your class with this MLP by following 3 simple steps: 1. Read your textbook; 2. Go through the information given in the assets (document & multimedia); 3. Prepare your teaching notes. Great! Now you are ready to transact the chapter.
Duration	Kindly note the duration given for each asset. Due care has been taken in planning the assets, to ensure the chapter is completed within the time specified by the Board. Note: Preparation time is not included in the asset duration. The teaching time depends on the duration of the teaching aids and is not impacted by the length of the MLP.
What is a 'Main Script' (MS) Asset?	The Main Script asset is there for explaining the main concepts of the chapter clearly. The information given in the textbook is simplified, organised and structured to give more clarity. Additionally, you may find a video or mnemonics or a graphic organiser to deepen the understanding of the concept.
How to teach using the MS asset?	Please use the blackboard, slides and interaction to develop the concept.
What is an 'Inquisitive Questions' (IQ) asset?	The Inquisitive Questions asset uses questions to promote higher order thinking like the n^{th} why, what-if, new perspectives, cause-effect, and others, creating curiosity.
How to teach using the IQ asset?	You may use the questions to connect with the students, encourage exploration to engage them in the learning process. You may allow multiple responses and instead of rejecting any of the responses, ask why, before revealing the suggested answer or hints.
What is a 'Day to day Relevance' (DD) Asset?	The Day to Day Relevance asset helps students understand the practical relevance of every topic, making them eager participants in the classroom. If students connect the concepts to their environment, they would learn meaningfully without dislike or simply memorizing for exams.

How to teach using the DD asset?	You may use the asset by asking questions about their experience and use it to establish why they are learning the topic. If necessary you may substitute with a recent or local example.
What is an 'Interesting Aside' (IA) asset?	The Interesting Aside asset uses attention grabbing titbits or anecdotes to bring joy and satisfy the child's hunger to know more. This is a quick/short asset intended to bring attention back to the main concept being taught.
How to teach using the IA asset?	You may use this asset to give a piece of interesting information relevant to the topic, without prolonged explanation/discussion. You may suggest appropriate books for further reading.
What is a 'Suggested Activity' (SA) Asset?	The Suggested Activity asset provides a detailed step by step procedure for the teacher to conduct a hands-on activity. This promotes Activity Based Learning.
How to teach using the SA asset?	You may use this asset to energise your students to learn by doing simple, fun-filled activities based on the topic. The asset includes - preparation, activity, and follow-up. You may engage the students in the preparation and follow-up stages to develop collaboration and responsibility. You could try it once, yourself, before the actual delivery to be more comfortable with it. Note: The duration mentioned in the asset is usually for the activity part only.
What is a 'Value Content' (VC) Asset?	The Value Content asset integrates Universal Human Values (such as empathy, inclusivity, respect for nature that translates into responsible behaviour) seamlessly into the curriculum, as the "End of education is character".
How to teach using the VC asset?	You may use this asset to engage with the students to bring out their innate values and connect with the intrinsic values in the topic/concept. The asset includes pointers on the specific pedagogical technique followed.
What is a 'Questions to Assess' (QA) asset?	The Questions to Assess asset uses an interactive approach to check learning of different types of learners, and provides feedback to the teacher for appropriate action. The questions cater to all the levels of Bloom's Taxonomy. Questions from 'Apply' level and above enable students to reflect on their learning.
How to teach using the QA asset?	You may go through the slides to understand its flow and know when to click for the answer (slides include suggested answers). While presenting in the class, you may display the question and encourage multiple responses, before revealing the answer. In some cases, this asset may include extra questions/worksheet that can be given as homework.