Batteries and Bulbs: EMF, Current, Potential difference/drop & Intensity

Universiti Teknologi MARA
Fakulti Sains Gunaan

A Physical Science Activity

Name:_____ HP: _____ :

Course Learning Outcome:

Students will be able to explain basic concepts and principles pertaining to electric current, electromotive-force (EMF), potential difference, brightness of a light bulb, power consumed by the bulb and resistance of the bulb for a simple circuit and for a complex circuit which are connected in series, in parallel and a series-parallel combination. [Other outcomes can be investigate skills, skills of using devices and work cooperatively in a team]

Course Learning Outcome	**Performance Criteria [How do we know learners have achieved the LO?]**	**Learning & Teaching Learning Activities**	**Assessment Tasks [how much & how well]**
Students will be able to explain basic concepts and principles pertaining to electric current, electromotive-force (EMF), potential difference, brightness of a light bulb, power consumed by the bulb and resistance of the bulb for a simple circuit and for a complex circuit which are connected in series, in parallel and a series-parallel combination	Define EMF, electric current, electric potential, potential drop, electric resistance and electric power.	Read aloud to peers in a cooperative learning session	• Selected Response (MCQ) Formative Quiz & Summative Test
	Draw schematic diagrams representing electrical devices which are connected in series, in parallel and a combination of both.	Interactive lecture Cooperative Learning Individual classroom learning task	• Short constructed response formative quiz & Summative Test
	Explain the relationship between EMF, current, potential difference across a bulb, brightness of a bulb, power consumed by a bulb, for a simple circuit and for bulbs which are connected in series, in parallel and a combination of both.	4E+A Learning Cycle (**Engage, Explore, Explain, Elaborate, Assess**). **EXPLORATION** & **ELABORATION** stage will involve the use of PHeT simulation. You may google PHeT and choose to run simulations “one at a time”. Download the Circuit Construction Kit (DC only) to your computer. **ENGAGEMENT & EXPLANATION** stage will be done via interactive engagement	• Pre diagnostic test • Post summative test • Formative classroom conceptual test • Formative constructed response quizzes • Summative constructed response Test

Objective:

Today's activity explores and investigates concepts such as EMF, current, potential difference/drop and the brightness of light bulbs when batteries or bulbs are connected in series, parallel and series-parallel combination.

At the end of the activity, you will be able to:

- Connect a simple circuit and light up a light bulb using an EMF source, wires and a switch.
- Connect a voltmeter to measure potential difference/drop across a bulb/device and an ammeter in a circuit to measure current flowing through the bulb/device.
- Connect a more complex circuit and construct a relationship between brightness of bulbs, current and potential drops when bulbs are connected in series.
- Connect a more complex circuit, construct a relationship between brightness of bulbs, current and potential drops when bulbs are connected in parallel.
- Connect a more complex circuit and construct a relationship between brightness of bulbs, current and potential drops when bulbs are connected in series-parallel combination.

Sample of Investigative/Exploration Questions

1. How will changes in EMF affect the brightness of the bulb for a simple circuit?
2. How does the change in EMF influence the current in a simple circuit?
3. How does the change in EMF affect the potential difference across the bulb?
4. How is the EMF, current and brightness of the bulb related?

STOP EXPLORING. You are now at Stage 3 of the 4E+A cycle.

The remainder of this exploration is stage 4 of the cycle, the ELABORATE stage

5. How will adding another identical bulb in series with the original bulb in the simple circuit affect the brightness of the original bulb?
6. How will adding another identical bulb in parallel with the original bulb in the simple circuit affect the brightness of the original bulb?
7. How does the brightness of the two bulbs compare?
8. How will the current in the circuit and through each bulb change for the situations described in questions 5 and 6?
9. How will the potential difference across the original bulb change for the situation described in questions 5 and 6?
10. What if I were to repeat the process by having a total of 3 bulbs in the circuit, all in series, all in parallel, a series-parallel combination?
11. What then will happen if I change the resistance of one of the bulbs by a half?

Before you proceed to answer each question through your exploration, make a prediction based on your prior experience or existing knowledge. Write down your prediction (its like a hypothesis but not quite since these phenomenon and relationship had already been discovered and explained by scientists). Start exploring after you make your prediction. STOP exploring after you complete answering question 4. We will get groups to EXPLAIN their discoveries.

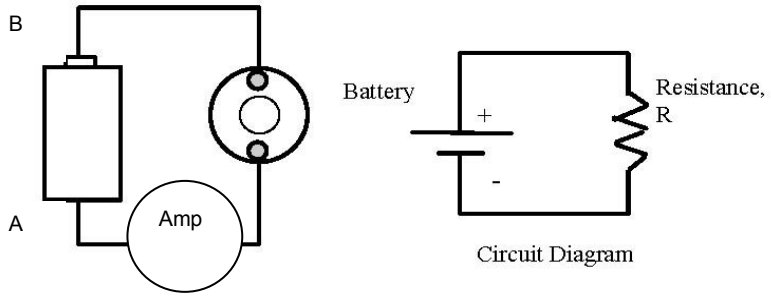
So, **Predict, Explore, Accept/Reject, Conclude (PEAC)**

Appendix: Circuit connections

A Simple Circuit

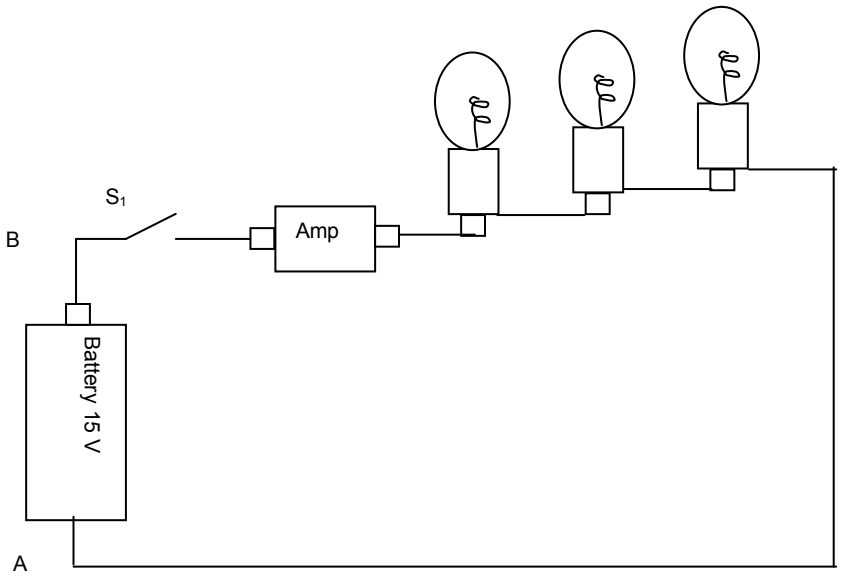
When performing the PHeT simulation,

- ✓ drag and drop the devices onto the working area.
- ✓ Simply right-click on each device to see more options such as changing values or even removing the device from the working area.
- ✓ Note that there two contact points for each device, the inlet and exit contact point.
- ✓ When using a voltmeter to measure potential difference <u>across a device/bulb</u>, simply place the voltmeter's probes at each contact point respectively.



A Complex Circuit with Bulbs Connected in Series.

"S" in the diagram represents toggle switches and the rectangular box labeled "Amp" represents the ammeter.



A complex Circuit with Bulbs Connected in Parallel.

"S" in the diagram represents toggle switches and the rectangular box labeled "Amp" represents the ammeter.