REAL Science – **M**UD **B**ATTERY **P**ROJECT

BC CURRICULUM **C**ONNECTIONS

COMPETENCIES

Questioning and Predicting

- Demonstrate a sustained intellectual curiosity about a scientific topic or problem of interest
- Formulate multiple hypotheses and predict multiple outcomes.

Planning and conducting

- Collaboratively and individually plan, select, and use appropriate methods to collect reliable data (qualitative and quantitative)

Processing and analyzing data and information

- Seek and analyze patterns, trends, and connections in data, including describing relationships between variables (dependent and independent) and identifying inconsistencies.
- Use knowledge of scientific concepts to draw conclusions that are consistent with evidence.

Evaluating

- Describe specific ways to improve their investigation methods and the quality of data.

Applying and Innovating

- Transfer and apply learning to new situations
- Generate and introduce new or refined ideas when problem solving

Communicating

- Communicate scientific ideas, claims, information, and perhaps a suggested course of action.

CONTENT

Circuits

- Basic components of a circuit

Voltage, current and resistance

- Ohm's Law (V=IR)

Matter cycles

- Water, nitrogen, carbon, phosphorus within biotic and abiotic components of ecosystems.

REAL Science – **M**UD **B**ATTERY **P**ROJECT

PROJECT: The Mud Battery

GOAL: Develop a mud battery that produces the highest voltage

BIG QUESTIONS:

1. What conditions provide an optimal environment for bacterial growth?
2. What conditions allow for the optimal collection and transfer of electric charge?

DATES, DETAILS & RESPONSIBILITES

DATE: _____

[GROUP] Initial Research and sketches due. Each group should submit:

- Research at least 3 mud batter designs. In your search, you must include: (1) the link(s) where you found the design (2) a picture of the design, and (3) a written paragraph explaining what elements of the design you like.
- Provide a sketch of the mud battery you plan on constructing. You must (1) have at least 2 views, (2) include all important features, (3) make it neat, and (4) label your sketch. This sketch will serve as a blueprint for your first mud battery.
- A 1 page report explaining the advantages of the features you've included in your design.

DATE: _____

[GROUP] Mud Battery Test #1

DATE: _____

[INDIVIDUAL] Post-Lab report due. Post-lab guidelines are as follows:

- Each student must **submit their own** 1-2 page post-lab report.
- Include at least 5 Pictures from different views of your mud battery
- Provide a list of materials for the mud battery you constructed. Also, write 1-2 paragraphs re: what you made (include key features), what improvements you made since last time (if applicable), and some possible sources of error during this test that affected the performance of your mud battery.
- Provide qualitative and quantitative observations from your test. Include a data table with initial and final temperatures of both your prototype and the control.
- A paragraph written in CER format explaining what you will do next time to improve your result. Include a hypothesis.

DATE: _____

[GROUP] Mud Battery Test 2.

DATE: _____

[INDIVIDUAL] Post-Lab report due. Follow previous guidelines.

DATE: _____

[GROUP] Mud Battery Final.

DATE: _____

[INDIVIDUAL] Post-lab report due. Follow previous guidelines.

MARK DISTRIBUTION

[20 marks]	Initial Research and Sketches
[10 marks] x 3	Post lab reports
[5 marks] x 2	Mud Battery Test 1 and 2.
[5 mark]	Bonus Performance mark – dependent on Mud Batter Final results
[60 marks]	Total Marks Possible

SUBMISSION PROCEDURE

Initial Research and Sketches will be submitted to the teacher as a **physical copy**

Post lab reports will be submitted to the teacher **digitally**. This will be done on **Freshgrade.com**.

MUD **B**ATTERY – **D**ESIGN **I**NSTRUCTIONS

GOAL: To build a mud battery produces the highest voltage.

RULES & RESTRICTIONS

- Must be homemade. It cannot be a mud battery kit that has been store bought.
- All building materials must be biodegradable, reusable, or recyclable.
- With the exception of adhesive tape, duct tape, and masking tape, only reusable or recyclable plastics can be used (ie. No Styrofoam).
- Mud battery must be able to safely fit on top of a lab bench.
- Mud battery must work without any supervision (ie. It must be "hands free"). Students will not be allowed to hold, manipulate, or move the battery or parts of the battery when it is being tested.
- Mud Battery cannot be powered by anything else (ex. You cannot use connect solar cells or other batteries or energy sources to the mud battery).
- Mud Battery cannot harm itself or its environment.

ONLINE RESOURCES

VIDEO: https://youtu.be/RPnJ0OGjCDM

"MudWatt Assembly Tutorial" – this video shows how the MudWatt kit is assembled. Even though you are not allowed to use the MudWatt in this lab, it is useful to see the basic set up of a mud battery.

VIDEO: https://youtu.be/RdIV_UZFK9A

"MudWatt Microbial Fuel Cell - How It Works" – this video also shows the individual parts of the MudWatt and how they work to produce a voltage.

https://makezine.com/projects/microbial-fuel-cell/

"Generate Electricity from Bacteria in Mud" – Make magazine has another design for a mud battery that utilizes 2 containers and a salt bridge (which differs from the MudWatt, which uses 1 container)

http://www.kidsciencechallenge.com/pdfs/2010activities/Mud_Battery_Magical_Microbes_2010.pdf

A handout that features yet another design for a mud battery that also utilizes 2 containers.

MARKING **C**RITERIA – **C**URRICULAR **C**OMPETENCIES

Science competencies will be evaluated on a Pass/Fail basis.

Questioning and Predicting		
Demonstrate a sustained intellectual curiosity about a scientific topic or problem of interest	F	P
Formulate multiple hypotheses and predict multiple outcomes	F	P
Planning and Conducting		
Collaboratively and individually plan, select, and use appropriate investigation methods to collect reliable data (qualitative and quantitative)	F	P
Ensure safety and ethical guidelines are followed in their investigations	F	P
Processing and analyzing data and information		
Construct and use a range of methods to represent patterns or relationships in data, including tables, graphs, keys, models, and digital technologies as appropriate	F	P
Seek and analyze patterns, trends, and connections in data, including describing relationships between variables (dependent and independent) and identifying inconsistencies.	F	P
Use knowledge of scientific understandings to draw conclusions that are consistent with evidence	F	P
Evaluating		
Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions.	F	P
Describe specific ways to improve their investigation methods and the quality of the data.	F	P
Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and secondary sources	F	P
Applying and innovating		
Transfer and apply learning to new situations	F	P
Generate and introduce new or refined ideas when problem solving	F	P
Contribute to finding solutions to problems at a local and/or global level through inquiry.	F	P
Communicating		
Communicate ideas, claims, information and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions and representation.	F	P