Extraction to E-Waste ~ The Secret Life of Rechargeable Batteries

*This Learning Experience seeks to educate Honors Biology students on the way that lithium-ion batteries are obtained, how that impacts the environment, and how we can be responsible about our own use using the **Extraction to E-Waste** pathway.*

Instructional Phases	ENGAGE	EXPLORE	EXPLORE	EXPLAIN & ELABORATE	
Visual Storyline					
Objectives	Connect personal technology use to global resource systems. Ask questions about the long-term impacts of lithium-ion battery use.	Explain how lithium-ion batteries function and what materials they are made of.	Use models to investigate how resource extraction alters natural systems.	Analyze real-world data to identify patterns in resource extraction. Construct evidence-based explanations about human impacts on ecosystems.	Apply scientific understanding to propose solutions that reduce environmental harm. Communicate scientific ideas to inform and influence community decision-making.
Standards	NGSS.HS-LS2-6: Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms, but changing conditions may result in a new ecosystem. NGSS.HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. NGSS.HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate				

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Timing	1 class period	1 class period	2-3 class periods	1-2 class periods	Minimum 1 class period (extended for up to 2 weeks)
Overview	Students complete a survey about how many items in their daily lives contain Li+ batteries to reflect on how often they use them, and begin connecting personal habits to global systems. The short *Tomorrowland* clip frames the tension between environmental harm and hope for change, prompting students to question: *Can our choices make a difference?* After compiling survey data, students will engage in the **Postcards from the Future activity**, writing about Li+ batteries and their prevalence in the future.	Students investigate how lithium-ion batteries function and what materials they're composed of. The focus is on observation and guided inquiry using the *"How Do Lithium-Ion Batteries Work?"* video to establish a foundational understanding of chemistry and structure before addressing environmental context.	Students engage in a two-part exploration of lithium extraction, first through a "cookie mining" model to visualize environmental degradation; and second, using the Xplorlabs *Modeling Mining Processes* investigation to simulate real-world reclamation efforts. This phase emphasizes systems thinking and human-environment interactions.	The class connects prior activities to ecological consequences of resource extraction. Students will analyze a dataset that represents the prevalence of mining operations in Maricopa county. Then, they will conduct a mini-investigation on ecosystem disruption, selecting a subtopic (e.g., battery disposal, pollution, mining impacts, environmental disruption) for deeper inquiry while the teacher facilitates connection-making and evidence-based reasoning.	Students transition from learning to advocacy through a project. Working individually or in teams, they research a focus issue and design a school-wide awareness campaign (e.g., a PSA, video, poster, or announcement series). The teacher's role shifts to coach and mentor—guiding students to apply science to civic action.
Supporting Documents	"Tomorrowland – "Can We Fix It?" [video] Postcards from the Future [writing activity]	How do lithium-ion batteries work? [video] Xplorlabs.org's Inside a lithium-ion battery pathway	Modeling Mining Processes [investigation]	CODAP [tool] to support the exploration of coordinates and Arizona mining data	Battery Supply Chain: Disposal [information] Be Nice to your Device [video] Broken Phone Fast Facts [information]
	Extraction to E-Waste Student Guide: https://xplorlabs.org/wp-content/uploads/2023/01/Extraction-to-Ewaste-Student-Guide.pdf Extraction to E-Waste Teacher Guide: https://xplorlabs.org/wp-content/uploads/2023/01/Extraction-to-Ewaste-Teacher-Guide.pdf				