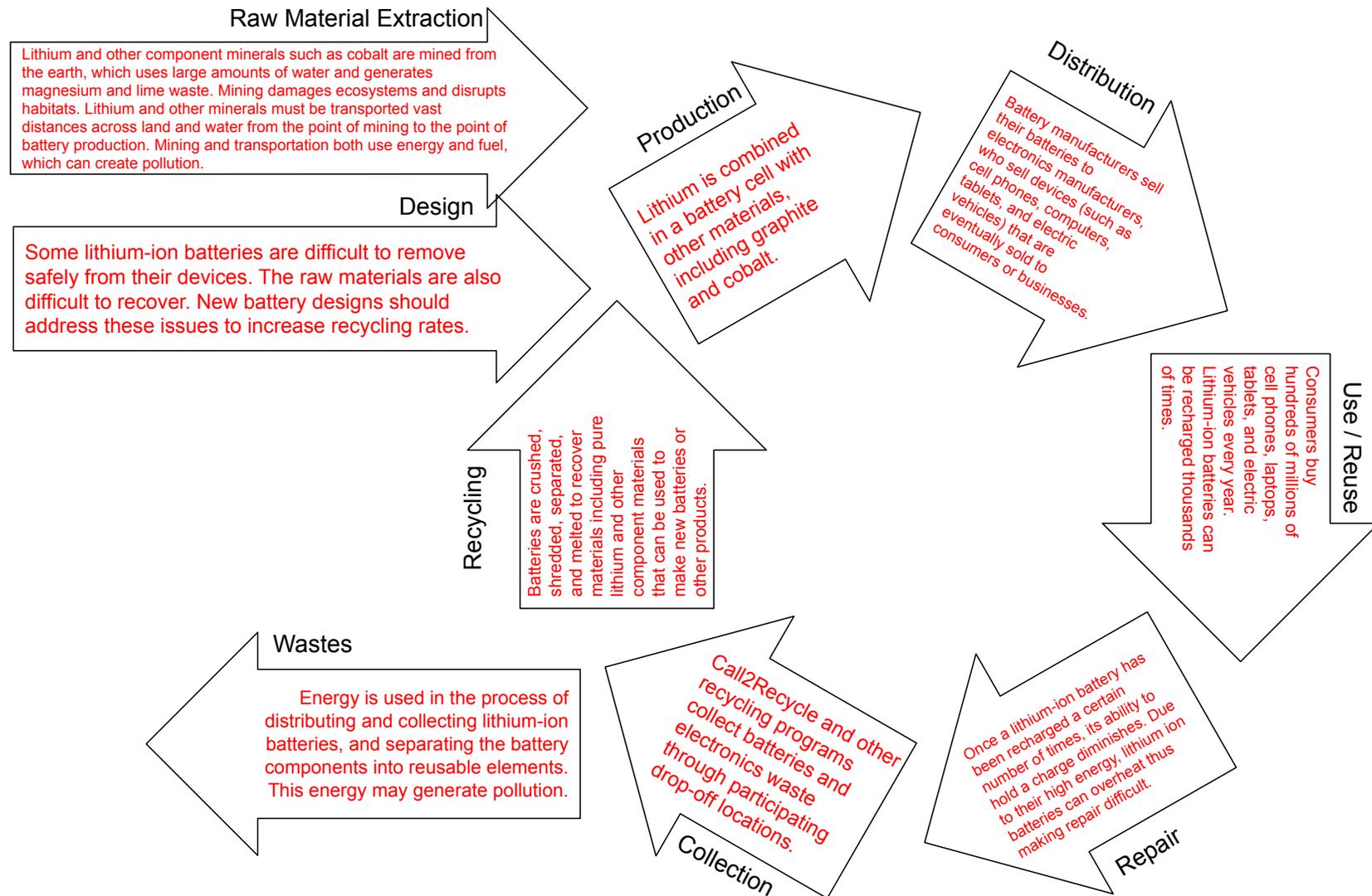


# Circular Economy Analyzer: Li-Ion Batteries Answer Key

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## Circular Economy Analysis: Lithium-Ion Batteries

1. What would a linear economy normally look like for this product? Draw a picture and/or describe in words.  
Lithium and other component minerals are extracted as described above lithium-ion batteries are created with other component materials batteries are used in consumer devices and recharged over time devices and batteries are thrown away to landfills when they no longer work or are able to recharge

2. What makes this circular economy different from the linear economy you described in Question 1?  
It is different from a linear economy because instead of throwing lithium-ion batteries away, they are collected and recycled to reclaim valuable materials for use in new products, including more lithium-ion batteries. These batteries can be recharged and reused until it is time to recycle them again.

3. How does the circular economy for this product help to reduce impacts on the environment, human health, and local community compared to a linear economy?

Mining lithium, the raw material from which lithium-ion batteries are made, can be damaging to the environment by creating magnesium and lime waste and using precious water in desert environments that would otherwise be used to irrigate crops. This circular process allows lithium to be reused and recycled, which means less lithium mining needs to occur. Lithium and other component minerals are also a non-renewable resource, so there is a finite supply of minerals that must be preserved for future generations to use. Lithium-ion batteries can explode if disposed of improperly. A circular economy for devices containing lithium-ion batteries will also ensure that safe and appropriate disposal methods are used.

4. What kinds of rethinking and redesigning were necessary to move from the linear economy to the circular economy?

Lithium-ion batteries must be collected from consumers before they can be recycled. Many consumers do not know about proper battery and e-waste recycling practices, and most devices containing lithium-ion batteries are not recycled. A lot of education is necessary to ensure that electronic devices are not simply thrown away to landfill. Systems of collection and transportation must also be arranged, such as Call2Recycle's collection centers. Finally, the process of extracting usable lithium and other component minerals from a spent battery is chemically complex and requires a lot of research and development.

5. Which steps in this circular economy are the strongest? For each step, identify why you think it is strong, and how it helps to minimize impacts on the environment or human health.

The strengths of this system are distribution, use/reuse, and recycling. Many people and industries use lithium-ion batteries because they are reliable, rechargeable, light, and long-lasting. There are good systems already in place to distribute, use, and recycle the batteries.

6. Which steps in this circular economy are the weakest? For each step, identify why you think it is weak, and how it could be improved to help minimize impacts on the environment or human health.

The weaknesses in this system are in collection, repair, waste, and design. Cell phones are not often recycled by consumers, which points to a problem in collection. Once lithium batteries stop holding a charge, they cannot be repaired by consumers and must be recycled. Design is a weakness because batteries, and the devices that contain them, should be redesigned to make repair, collection, and recycling easier. Waste is an issue because this process uses a lot of energy, and that energy should come from renewables instead of fossil fuels.