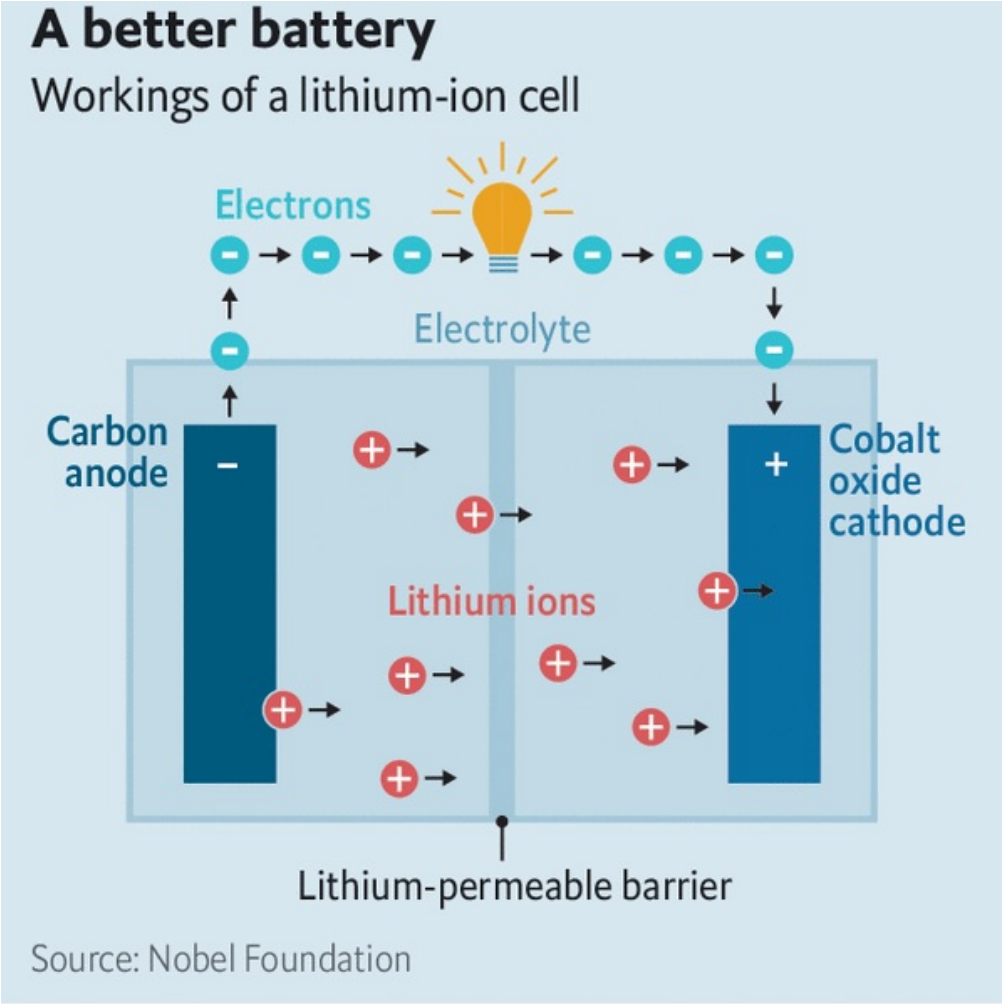
Challenges of Lithium ion Batteries

What is the issue?

Safety and sustainability continue to pose impediments in the growth envisaged in Lithium Ion Batteries (LIBs) usage.

What are Lithium ion batteries?

- Every Li-ion battery consists of three active components - anode, cathode and electrolyte.
- The anode and cathode is where the lithium is stored while the electrolyte carries positively charged Li-ions from the anode to the cathode and vice versa through the separator.
- The movement of the Li-ions creates free electrons in the anode, which creates a charge at the positive current collector.
- **Features**
    - Small size
    - Light weight
    - High energy density
    - Ability to recharge
    - Longer lifespan compared to a lead acid battery
    - More efficiency
    - Greater driving range
    - Affordable



What are the impediments in the growth of Li-ion batteries?

> *By 2025, the global demand for LIBs is likely to cross about $100 billion with the automobile sector leading as the fastest growing consumer.*

- **Fires**- In India, reports of fatality and material loss due to fire from LIBs are on the rise.
- **Sustainability-** There are concerns around sustainability and lifecycle management of LIBs.

How to overcome the challenges?

- **Safety -** Both range and fast charging aspects require thorough understanding from the metal chemistries to the overall LIB system level.
- The quality of raw materials and components must be ensured for high fidelity manufacturing practices.
- Electric vehicle designs need highly efficient thermal management systems and fault-detection mechanisms to avoid thermal runaways.
- EVs need an accelerated go-to-market approach to cater to the sustainability goals driven by organisations and nations across the world.
- **Environmental sustainability**- As the long-term sustainability of depending on primary mineral sources (mines) is in question, recycling is key.

- Most recycling processes practise partial recovery wherein only high-margin metals are recovered from waste and the rest is discarded.
- The current recycling rate is around 5-9%.
- **The Battery Waste Management Rules 2022** was notified by the government to accelerate the development of infrastructure for waste collection and improve recycling rates.
- The Extended Producer Responsibility increases the accountability battery manufacturers need to assume towards collection, refurbishment/recycle of batteries.
- The need of the hour is to accelerate the development of circular economy solutions that recycle all the metals and facilitate a cradle-to-cradle (infinite loop) approach.
- A strong collaboration among technologists, policy-makers and governments is required to help manage the EV revolution.

References

1. The Hindu Businessline | Many challenges of lithium ion batteries
2. PIB | Government notifies Battery Waste Management Rules, 2022

Quick facts

Battery Waste Management Rules, 2022

- **Ministry of Environment, Forest and Climate Change** published the Battery Waste Management Rules to ensure environmentally sound management of waste batteries.
- The new rules will replace Batteries (Management and Handling) Rules, 2001.
- **Coverage** - The rules cover all types of batteries, viz. Electric Vehicle batteries, portable batteries, automotive batteries and industrial batteries.
- **EPR -** The rules function based on Extended Producer Responsibility (EPR) which mandates the producers (including importers) of batteries to collect and recycle/refurbish waste batteries.
- **Online portal** - The rules will enable setting up a centralized online portal for exchange of EPR certificates between producers and recyclers/refurbishers to fulfil the obligations of producers.
- **Recovery** - It mandates minimum percentage of recovery of materials from waste batteries.
- It also prescribes the use of certain amount of recycled materials in making of new batteries.
- **Polluter Pays Principle** - Environmental compensation will be imposed for non-fulfilment of EPR targets and obligations set out in the rules.

IAS PARLIAMENT

Information is Empowering

A Shankar IAS Academy Initiative