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BESE 31-C

Applied Physics Assignment 1

LAB REPORT

Extraction of Precious Metals and Materials from Discarded Computer Devices

Executive Summary

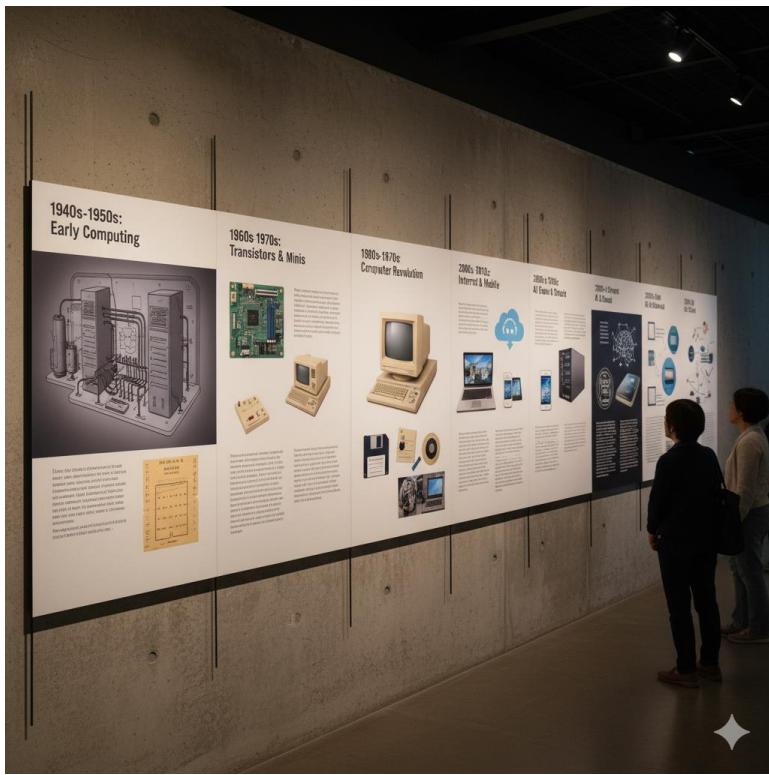
- This report examines the extraction of precious metals (e.g., gold, silver, palladium) and materials (e.g., copper, rare earths) from discarded computer devices.
- E-waste is a growing issue, with 50+ million tons generated annually; extraction conserves resources and reduces pollution.
- Methods include mechanical, chemical, pyrometallurgical, and hydrometallurgical processes.
- Benefits: Economic gains (\$57 billion market by 2027), environmental savings (95% less energy than mining).
- Challenges: Health risks, regulations, scalability.
- Recommendations: Adopt sustainable practices for a circular economy.



[Image 1: Pile of discarded computers in a landfill.]

Introduction

- E-waste from computers includes desktops, laptops, and servers, rich in recoverable metals.
- Global production: 53.6 million tons in 2019, rising to 74 million by 2030.
- Key materials: Gold (0.2-0.5g per device), silver, palladium, copper, rare earths.
- Importance: Prevents pollution, conserves resources, creates jobs.
- Report structure: 15 sections with data and visuals.



[Image 2: Timeline of computer evolution.]

Overview of E-Waste Generation

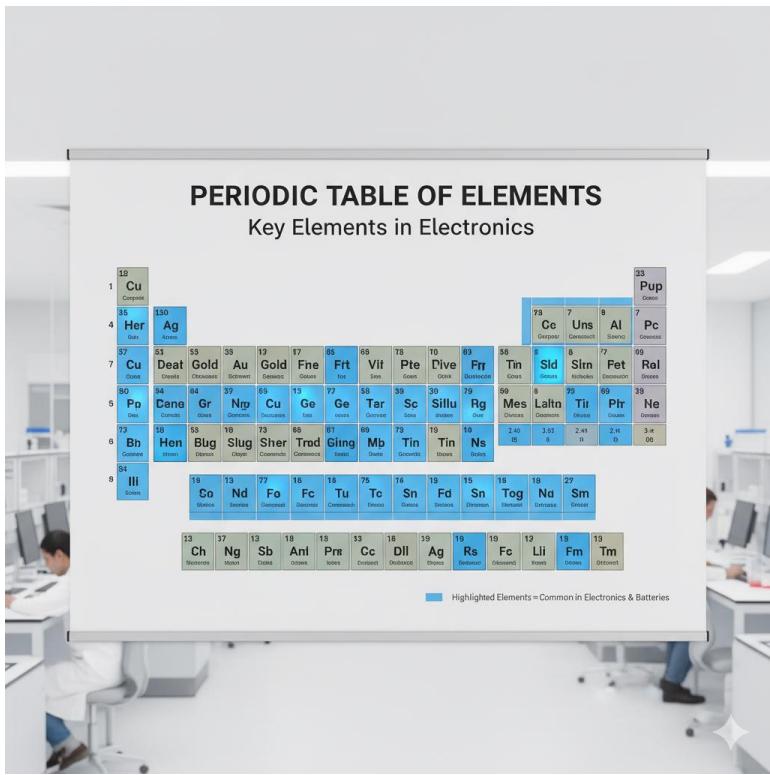
- Driven by rapid tech advancements and short device lifespans (3-5 years).
- Regional stats: Asia (24.9M tons), Americas (13.1M), Europe (12M).
- Only 20% recycled formally; rest in landfills or informal sectors.
- Issues: Toxic leaching, health risks.
- Solutions: Regulations like Basel Convention.



[Image 3: Bar graph of e-waste by region.]

Precious Metals and Materials in Computers

- Gold: In connectors and chips.
- Silver: In solders.
- Palladium: In capacitors.
- Copper: 10-20% by weight.
- Rare earths: In magnets.
- Value: Higher than ores; gold at \$50-60/g.



[Image 4: Periodic table with highlighted elements.]

Methods of Extraction: Mechanical Processing

- Involves dismantling, shredding, sorting.
- Uses magnets, eddy currents, optical sensors.
- Recovers 80% bulk metals; eco-friendly but labor-intensive.
- Challenges: Dust, safety.

[Image 5: Mechanical processing diagram.]

Methods of Extraction: Chemical Leaching

- Uses aqua regia for gold, cyanide for silver.
- Bioleaching as eco-alternative.

- Recovery: Up to 95%; generates wastewater.
- Safety protocols needed.



[Image 6: Leaching tank photo.]

Methods of Extraction: Pyrometallurgical Processes

- High-heat smelting to melt metals.
- Recovers 90% metals; energy-intensive.
- Emissions controlled in advanced facilities.

[Image 7: Furnace cross-section.]

Methods of Extraction: Hydrometallurgical Techniques

- Acid leaching and solvent extraction.
- Precise for rare earths; low emissions.
- Recovery: 98% for neodymium.

[Image 8: Hydrometallurgical flowchart.]

Environmental Impact of Extraction

- Varies by method: Mechanical low impact; chemical risks spills.
- Recycling saves 95% energy vs. mining.
- Regulations promote sustainability.

[Image 9: Impact comparison pie charts.]

Economic Aspects and Market Value

- Market: \$41B in 2020, growing.

- Revenues from metals offset costs.
- Jobs in recycling sectors.

[Image 10: Market growth line graph.]

Challenges in Extraction

- Tech barriers, regulations, health risks.
- Solutions: AI sorting, standards.

Case Studies: Successful Implementations

- Switzerland: 80% recycling via laws.
- India: Informal gold extraction.
- U.S.: Robotic efficiency.



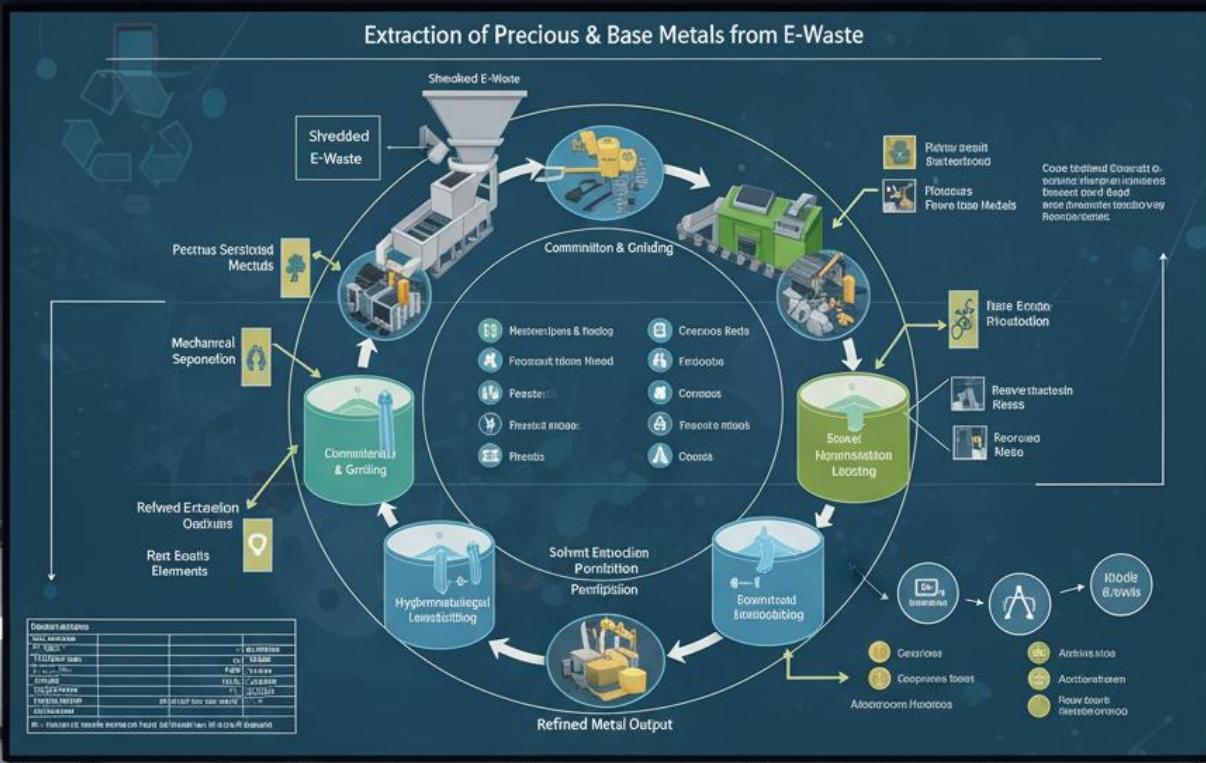
[Image 12: Recycling site photos.]

Future Trends and Innovations

- AI, nanotechnology, blockchain.
- Urban mining by 2030.

Legal and Ethical Considerations

- WEEE Directive, Basel Convention.
- Ethics: Fair labor, data security.



[Image 14: Regulations map.]

Conclusion

- Extraction key to sustainability.
- Collaborate for circular economy.

[Image 15: Summary infographic.]

References and Appendices

- *UN reports, EPA data.*
- *Appendices: Cost analysis, diagrams.*