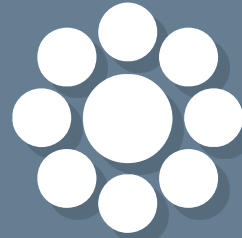


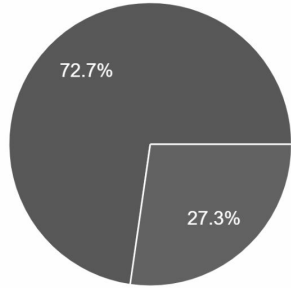
Waste is a Design Flaw

ENGR 1501 FALL 2023 - Week 2

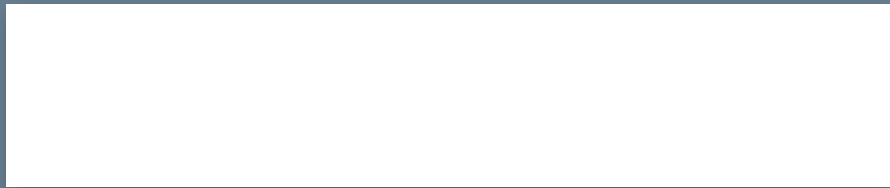


Is a hotdog a sandwich?

11 responses



A



SCAN ME

Today's Agenda



0

PROJECT OVERVIEW

1

WHAT IS E-WASTE

2

HOW MUCH E-WASTE IS THERE

3

E-WASTE BRAINSTORM

4

HOW IS E-WASTE MADE

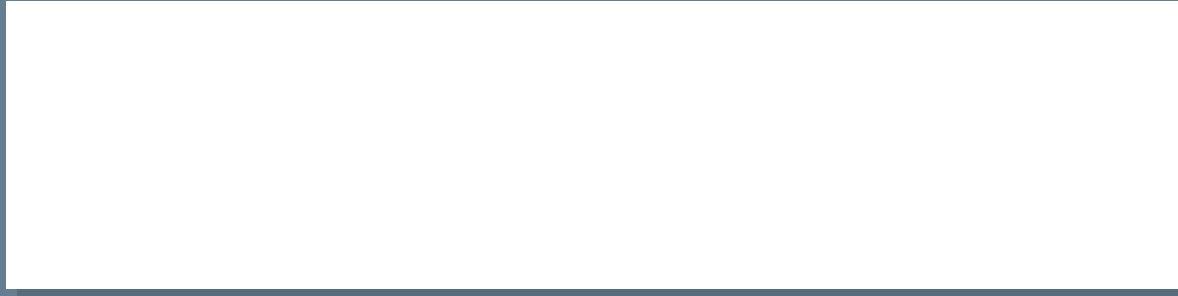


Course Objectives

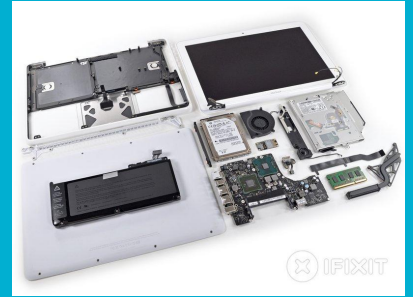


- **Learn how waste creation is designed into our linear economy**
- **Understand engineering frameworks for designing “out” waste and designing with waste**
- **Explore what main components make up electronics and how to work them**
- **Create a Circular Engineering outline for an E-waste product**

0) Project/Course Recap



Disassembly Guide



[Teardown for Apple's MacBook Unibody Model A1342 Mid 2010](#)

Skill level for disassembly: minimal (must have access to specific Apple screwdrivers but teardown is mostly just de-attaching parts)

Estimated Time for teardown: 1-2 hours

Safety: do not mutilate individual parts, especially parts containing potentially hazardous chemicals (ex. battery)

- Unplug device and power off for several days/weeks before teardown

LIGHTBULBS AND THEIR DESIGN FOR WASTE



- Hardware –
 - Main electronics reside in glued or “welded” plastic base – Blackbox system
 - A Hacksaw is the main way to disassemble, but this also raises risk for breaking the fluorescent bulb
 - Limited repairability since design is a vacuum and operates at high temperatures
 - Can’t restore evaporated metal internally
 - Electrolytic capacitors not optimized in high temperature environment
- Software is not very complex, so waste is not designed around phasing out previous processors
- System –
 - Long-lasting products make it difficult for businesses to profit
 - Has caused companies to diversify products in a similar fashion to Apple based around appearance of lights, thus flooding the market (See Cree Lighting)

How each component can be used

I believe I could use almost everything already included in the phone. Extra wires or circuit boards could be donated to schools for robotics classes or companies for parts. Unneeded keypads could be used for art projects or simply recycled as needed, as they are often just plastic buttons.



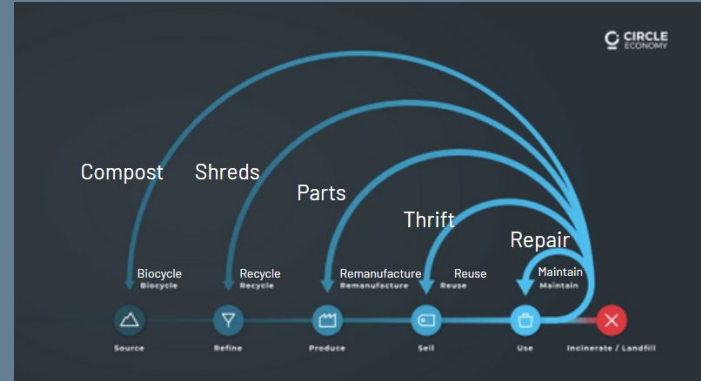
Assembly Components

- Plastic casing
- Battery Pack
- Phillips-head or Torx Screws
- Circuit Board
- Motors
- LED lights
- Extra plastic
- Microprocessor
- LCD Screen
- Front bezel

I will most likely remove the number keypad and replace it with another screen, or even just plastic, but it may be a good resource to keep and help give the phone more features. Maybe if there are questions for the servers or even the manager, then the users could call from the phones they've been given (but that could just as easily be done with the simple push of one button).

Class Summary: Foundations

- Class 1: Introduction to Class and Syllabus
- Class 2: E-waste
- Class 3: Waste is a Design Flaw
- Class 4: Life of Waste
- Class 5: Sustainable Design
- Class 6: Sustainable Psychology: Guest Speakers



Review: Framework's latest modular laptop is one I could stick with for years

Devin Coldewey @techcrunch / 11:31 AM EDT • July 23, 2022

Comment



Image Credits: Framework

Class Summary: Workshops

- Class 7: Disassembly Workshop
- Class 8: Identification, Extraction, Use Workshop
- Class 9: Creativity Workshop
- Class 10: Creativity Workshop 2
- Class 11: 3D Modeling Workshop
- Class 12: Design Workshop
- Class 13: Review



Workshop	Category	Participant	Activity
Creativity Workshop	Toys	Zack	Build a robot
		Reed	Build a robot
		Chris	Build a robot
		Blair	Build a robot
		Kate	Build a robot
		Jeffrey	Build a robot
		Reed	Build a robot
		Chris	Build a robot
	Restaurants	Zack	Build a robot
		Reed	Build a robot
		Chris	Build a robot
		Blair	Build a robot
		Kate	Build a robot
		Jeffrey	Build a robot
		Reed	Build a robot
		Chris	Build a robot
	STEAM kits	Zack	Build a robot
		Reed	Build a robot
		Chris	Build a robot
		Blair	Build a robot
		Kate	Build a robot
		Jeffrey	Build a robot
		Reed	Build a robot
		Chris	Build a robot



Presentation Goals

- **Easy to digest content**
 - Succinct slide text
 - Visuals
 - Aesthetic! (slidesgo.com)
- **Storyline**
 - **Decide what your goal is for the project, build around that!**
 - Online guide for DIY
 - Research into the design
 - Portfolio work for your showcasing
 - For entrepreneurship! For a contest!
 - Class assignment!



Competitions (inspiration for project)



A screenshot of the Make:able website. The header features the "PrintLab" and "AUTODESK" logos on the left, and navigation links for "home", "toolkit", "news", and "learn 3d printing" on the right. The main content area has a heading: "Make:able is a 3D printing and assistive technology design challenge, brought to you by PrintLab, Autodesk & partners." Below this is a "Register for Free" button. At the bottom, there is a collage of images including a 3D printed brass nozzle, a woman in a wheelchair, and two people looking at a document.



Presentation Goals

What initial ideas do you have?

- **For a piece of e-waste**
- **For a design goal**

What questions do you have about the project?

Anyone have any fun inspiration they are building off of? (tiktok, diy, article, etc.)





Course Assignments

Presentation & Slides

- **Start of every class, the slide from the previous week is due**
- **The goal is to build out the guide and presentation as the semester goes**





First slide: Select and describe your electronic waste

(1) E-waste Stats



History of your e-waste product

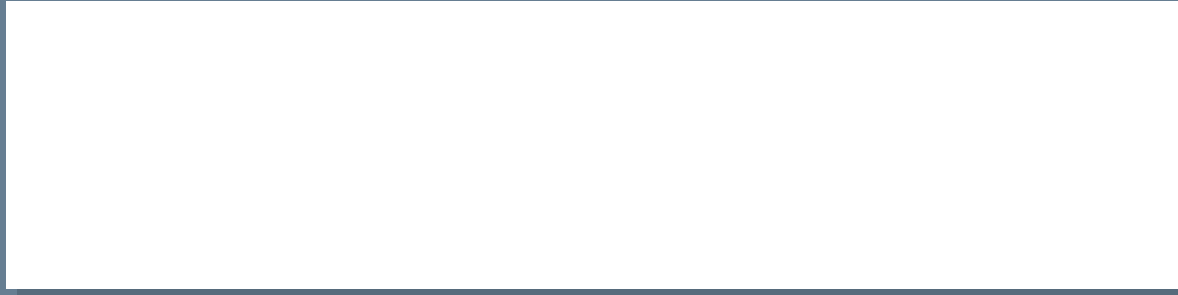
What stats can you find on its particular pounds created every year?

When was the device first invented?

Does it create toxic waste?

This is a numbers slide to bring focus to the waste, pollution, loss of value, etc caused by your selected e-waste product. Build a case for why you selected this product.

1) What is E-waste?





Electronic Waste: Gold Mine





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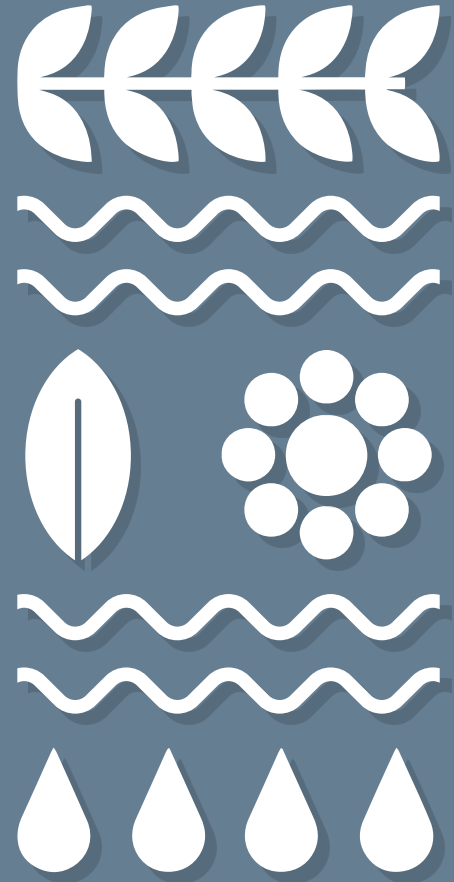
Article

E-waste: Turning a challenge into business advantage

What is E-waste? (week 1)

How is E-waste Made? (week 2)

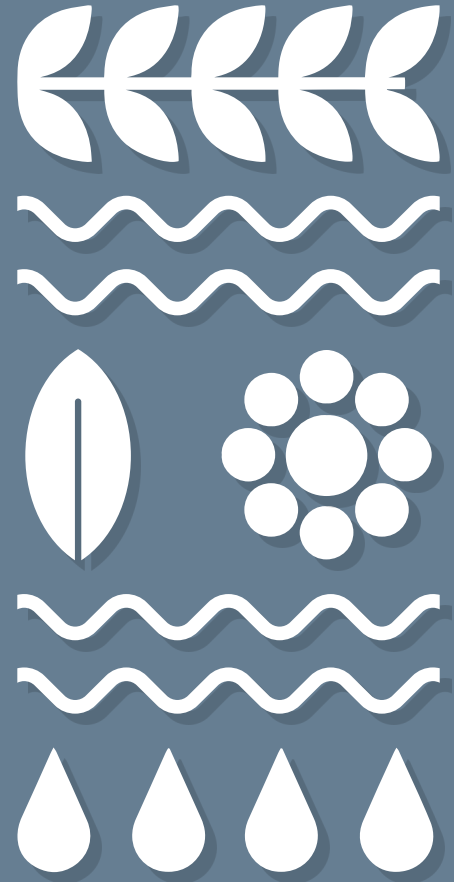
What happens to E-waste? (week 3)



What is E-waste?

The term “e-waste” is loosely applied to consumer and business electronic equipment that is near or at the end of its useful life. There is no clear definition for e-waste.

Why do we care about E-waste?



Unwanted Treasure Trove: E-waste

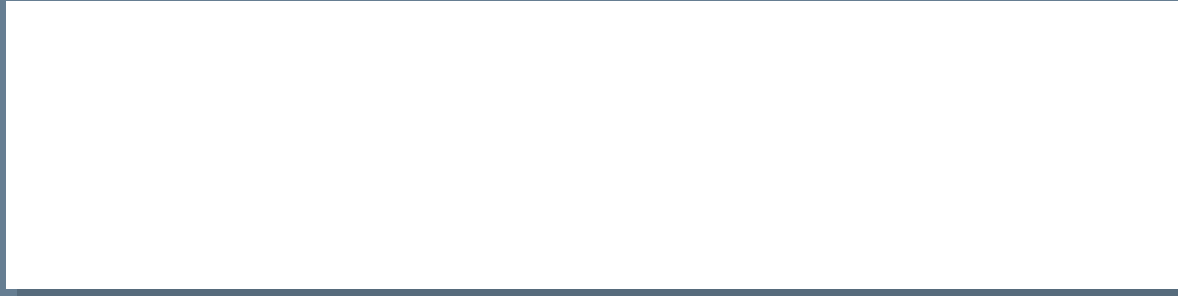
- Global E-waste was recorded at **53.6 million** metric tons recorded in 2019
- But, it is the fastest growing municipal waste stream worldwide
- **Only 12.5% of e-waste** is currently recycled
- E-waste has 10 times the concentration of gold compared to gold ore



1. <https://globalewaste.org/news/surge-global-waste/>

2. <https://www.sciencedirect.com/science/article/abs/pii/B9780444643216000161#:~:text=E%2Dwaste%20contains%20significant%20concentration,13.5%20g%20of%20gold%2Fton.>

1) How Much E-waste is there?



The Global E-waste Monitor 2020 – Quantities, flows, and the circular economy potential

The Global E-waste Monitor 2020 (www.globalewaste.org) is a collaborative product of the Global E-waste Statistics Partnership (GESP), formed by UN University (UNU), the International Telecommunication Union (ITU), and the International Solid Waste Association (ISWA), in close collaboration with the UN Environment Programme (UNEP). The World Health Organization (WHO) and the German Ministry of Economic Cooperation and Development (BMZ) also substantially contributed to this year's Global E-waste Monitor 2020.

A record 53.6 million metric tonnes (Mt) of electronic waste was generated worldwide in 2019, up 21 per cent in just five years, according to the UN's Global E-waste Monitor 2020, released today. The new report also predicts global e-waste – discarded products with a battery or plug – will reach 74 Mt by 2030, almost a doubling of e-waste in just 16 years. This makes e-





Growth of 9.2 Mt since 2014



Growth of 1.8 Mt since 2014

Global e-waste documented to be collected and properly recycled⁽¹⁾

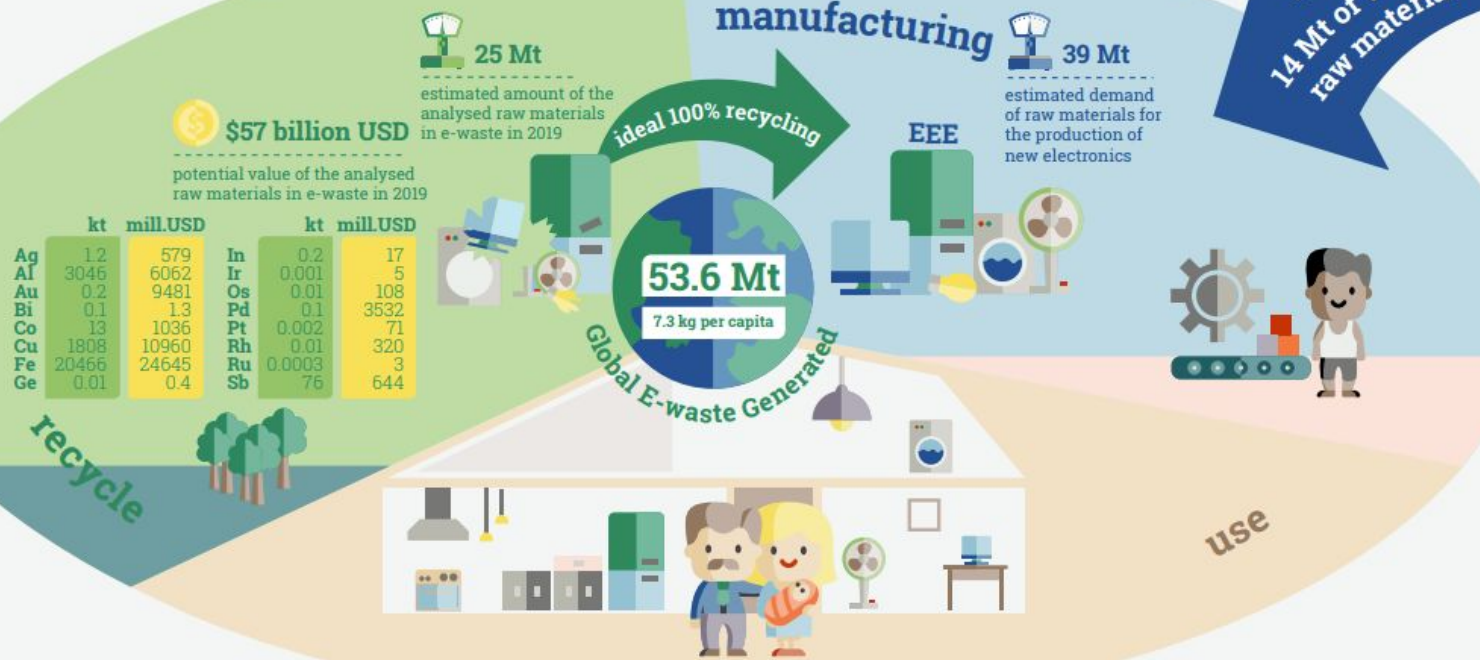
Global e-waste flows that are not documented



of e-waste is unknown; this e-waste is likely dumped, traded, or recycled in a non-environmentally sound way



is estimated to end up in waste bins in EU countries



	kt	millUSD	kt	millUSD
Ag	1.2	579	In	0.2
Al	3046	6062	Ir	0.001
Au	0.2	9481	Os	0.01
Bi	0.1	1.3	Pd	0.1
Co	13	1036	Pt	0.002
Cu	1808	10960	Rh	0.01
Fe	20466	24645	Ru	0.0003
Ge	0.01	0.4	Sb	76



25 Mt

estimated amount of the analysed raw materials in e-waste in 2019



\$57 billion USD

potential value of the analysed raw materials in e-waste in 2019

	kt	mill.USD		kt	mill.USD
Ag	1.2	579	In	0.2	17
Al	3046	6062	Ir	0.001	5
Au	0.2	9481	Os	0.01	108
Bi	0.1	1.3	Pd	0.1	3532
Co	13	1036	Pt	0.002	71
Cu	1808	10960	Rh	0.01	320
Fe	20466	24645	Ru	0.0003	3
Ge	0.01	0.4	Sb	76	644

ideal 100% recycled

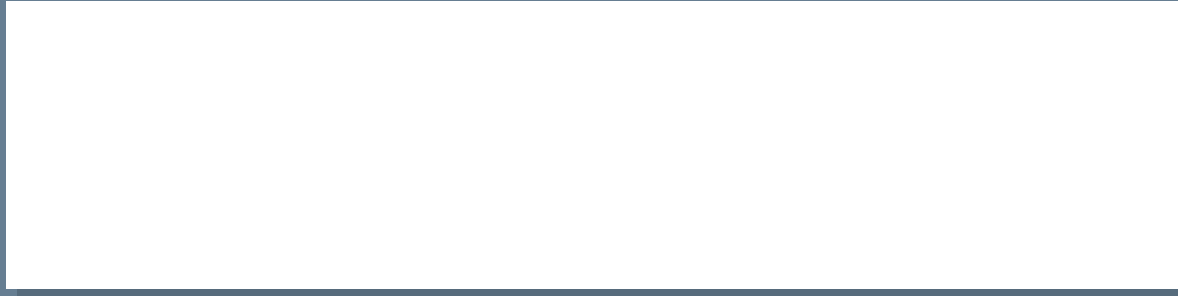


53.6 Mt

7.3 kg per capita

Global E-waste Generation

3) E-waste Brainstorm



Creativity is a learned skill!



Quantity over Quality (at first)

5 minutes: come up with as many ideas of electronic waste as you can

Roundtable

Each person find an e-waste idea someone else came up with and elaborate on it (what model, why is there so much of that waste, what could be a challenge?)

Quantity Round 2:

3 minutes: Follow up with more ideas. If you hit a wall go for crazy ideas (or ones you may think are stupid)



What makes up landfill waste?

1. Temperature exchange equipment:

more commonly referred to as cooling and freezing equipment. Typical equipment includes refrigerators, freezers, air conditioners, and heat pumps.



2. Screens and monitors:

typical equipment includes televisions, monitors, laptops, notebooks, and tablets.



3. Lamps:

typical equipment includes fluorescent lamps, high intensity discharge lamps, and LED lamps.



4. Large equipment:

typical equipment includes washing machines, clothes dryers, dishwashing machines, electric stoves, large printing machines, copying equipment, and photovoltaic panels.



5. Small equipment:

typical equipment includes vacuum cleaners, microwaves, ventilation equipment, toasters, electric kettles, electric shavers, scales, calculators, radio sets, video cameras, electrical and electronic toys, small electrical and electronic tools, small medical devices, small monitoring, and control instruments.

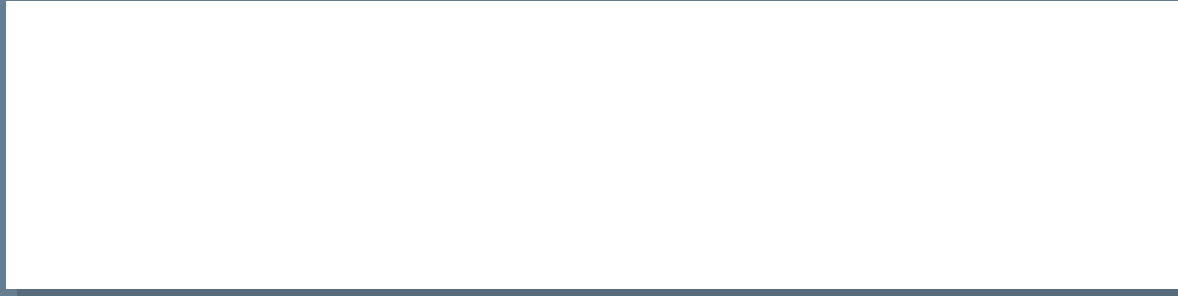


6. Small IT and Telecommunication equipment:

typical equipment includes mobile phones, Global Positioning System (GPS) devices, pocket calculators, routers, personal computers, printers, and telephones.



4) How is E-waste made?



Next Class: **When does an electronic device become waste?**

- Hardware
- Software
- Societal/behavioral

Attendance

Again at the end in case a student missed it



SCAN ME

Thought for the class:

“Joining any collective effort and embracing feelings of awe can help us unlock our potential to lead a meaningful life and to leave a meaningful mark on the world.” - Reality is Broken by Jane McGonigal

Recommended Media:

[What Are The Most Common Types Of Electronic Waste? - hummingbirdinternational.net](https://www.hummingbirdinternational.net)

<https://www.instructables.com/How-to-Salvage-Useful-Parts-From-Old-Printers/>



Example of Disassembly Guides



Nintendo 3DS Teardown

Written By: Walter Galan (and 11 other contributors)

Published: March 3, 2011

Comments: 38 Favorites: 167 Views: 453k

Introduction [Go to step 1 ↓](#)

Although not released in the United States until the 27th of March, Nintendo's 3DS was released in Japan on the 26th of February. We pulled some strings to acquire this Japanese model, and cannot wait to see what makes the 3DS tick. Join us today as we tear down Nintendo's newest and most radical handheld device yet.

What you need

Tools

	Heat Gun \$24.99	Buy
--	---------------------	---------------------