NAME: _____

Activity Sheet: Making Memory

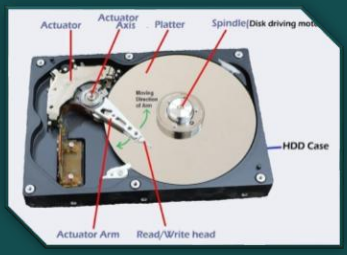
CHIP KIDS

Micron | STEM

SSD vs. HDD

- **SSD: Solid State Drive** – Uses flash memory to store data, which means no moving parts. SSDs are more expensive, but use less power, are faster and smaller than HDDs. The first SSDs were used starting in the early 2000s and became more common in laptops around 2010.

- **HDD: Hard Disk Drive** – Controls the electromagnetic disk (a metal platter with a magnetic coating) that provides data storage for a computer. Data is stored on the disk with an 'arm' that accesses the data while the disk is spinning. In 1956, the first HDD was 24 inches wide with 3.75MB of memory. Today's HDD size is 2.5 inches with Terabytes of memory.



SSD Memory Components Defined:

- **NAND:** A Boolean operator that gives the value zero if and only if all the operands have a value of one, and otherwise has a value of one (equivalent to NOT AND). NAND can be a circuit that produces an output signal until there are signals on all of its inputs.

- **FLASH MEMORY:** A kind of memory that retains data in the absence of power.

- **NAND MEMORY:** Is FLASH memory, a type of nonvolatile storage technology that does not require power to retain data. It is typically used in CompactFlash cards, USB Flash drives, etc. NAND flash development has been focused on reducing the cost per bit and to increase maximum chip capacity so that flash memory can compete with magnetic storage devices, such as hard disks.

- **RAM – Random Access Memory:** A type of computer memory that can be accessed randomly; that is, information is accessed in any order instead of sequentially like it is on a CD or hard drive, so the computer can access the data much faster. More RAM usually means a faster computer.

- **DRAM – Dynamic RAM:** A type of random access semiconductor memory that stores each bit of data in a separate tiny capacitor within an integrated circuit. The capacitor can either be charged or discharged; these two states are taken to represent the two values of a bit, conventionally called 0 and 1. Data stored in this memory is lost in the absence of power.

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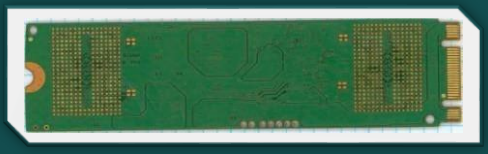
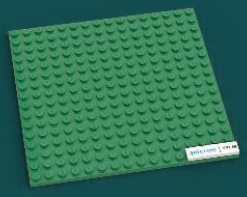
Printed Circuit Board (PCB): The foundation on which the SSD is built.



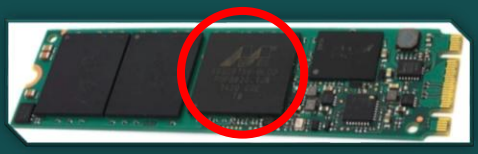
GREEN Baseplate = $5



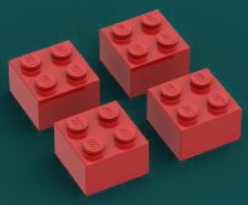
Connector: This is the Interface between the SSD and the outside world. A single connector is slower & works for older PCs; multiple connectors are faster.

GOLD Tile = $2 per Tile

Controller: The brains of the SSD – Manages the information in and out of the memory (NAND or DRAM).

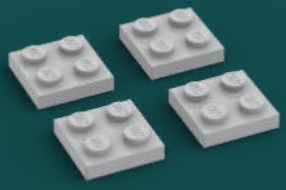


RED Brick = $5 per Brick

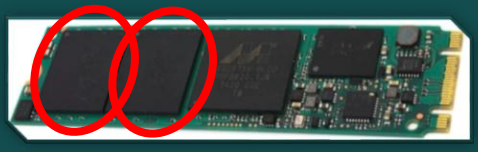


Power Management: Manages amount of power SSD uses & how fast the SSD wakes up. A single brick is minimally effective – multiple bricks provide more effective power management functionality.

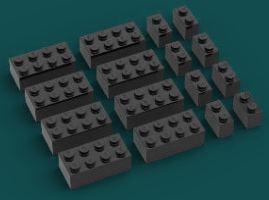
GREY Plate = $3 per Plate



NAND Memory: Permanent storage – Data can be stored in NAND for years.

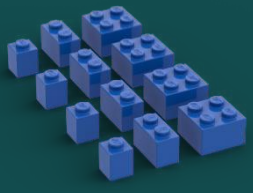


BLACK Brick, Each DOT = 32GB, $3 per 32GB



DRAM: Temporary storage - faster than NAND - buffer between controller and NAND to increase speed.

BLUE Brick, Each DOT = 1 GB, $1 per 1 GB



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Phase 1: Marketing (Know Your Customer)

Goal: Think about what gamers care about most.

- What do gamers usually complain about when their computer or console lags?
- If you're playing Fortnite/Minecraft/Roblox, what would make your experience better?
- Would you rather have more space for games or faster speed? Why?
- How much do you think reliability matters to gamers who play all night?

Phase 2: Architecture (Design the Blueprint)

Goal: Translate customer needs into components.

- If speed is your #1 priority, what component(s) should you buy more of?
- If storage is most important, what would you have to give up to stay on budget?
- How do you balance what your customer wants with the budget limit?

Phase 3: Procurement (Shopping with a Budget)

Goal: Consider trade-offs and budget constraints.

- What's the first thing you're putting in your cart? Why?
- Which component costs the most? Is it worth paying extra for it?
- If you spend big on DRAM, what do you have to cut back on?
- How are you making sure you don't go over budget?

Phase 4: Build (Hands-On Assembly)

Goal: Connect abstract choices to physical builds.

- Does your SSD look like the blueprint you planned in Phase 2?
- Which piece do you think is the "most important" to your design? Why?
- Did you have to make any last-minute changes while building?
- If you had $20 extra in your budget, what would you add right now?

Phase 5: Quality Check (Testing the Build)

Goal: Evaluate design against customer needs.

- Does your SSD really solve the problems gamers care about?
- Did your final design stick to your original priorities?
- If you could go back to Phase 1, would you change your priorities after seeing the cost/build?
- How would you convince a gamer to buy your SSD instead of someone else's?

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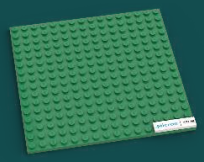
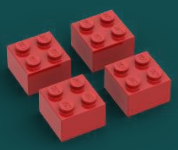
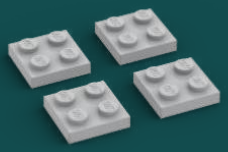
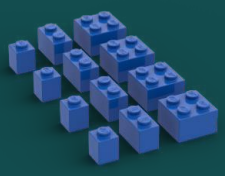
BLUEPRINT (PHASE 2):

NAME:

PROCUREMENT (PHASE 3):

Component	LEGO	Cost	x	Quantity	=	Total
Printed Circuit Board	 GREEN Plate	$5.00	X	1	=	$5
Connector	 GOLD Tiles	$2.00	X	*# TILES*	=	
Controller	 RED Bricks	$5.00	X	*# BRICKS*	=	
Power Management	 GREY Plates	$3.00	X	*# PLATES*	=	
NAND Memory	 BLACK Dots (1 dot = 32 GB)	$3.00	X	*# DOTS*	=	
DRAM Memory	 BLUE Dots (1 dot = 1 GB)	$1.00	X	*# DOTS*	=	
	TOTAL SSD COST:				=	

*Making Memory is adapted from https://www.micron.com/educatorhub/courses/build-a-solid-state-drive-ssd