

Exploring Products— Computer Hard Drives

How do hard drives store information?



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Try this!

1. Place a ring magnet on one of the ring stands.
2. Take the magnet off, flip it over, and put it back on the stand. What happens?
3. Use a row of 8 magnets to make a code! Choose a letter of the alphabet and look it up on the Binary Code sheet.
4. In this code, a magnet that sticks to the stand represents a 0 and a magnet that floats represents a 1.



What's going on?

You're using the ring magnets as a model for how computer hard drives store information! The ring magnets either float or stick to the magnet in the base of the stand, depending on which magnetic pole is facing down.

Computers use *binary code* to store information. Binary code is a series of 1s and 0s. In computer documents like text files, each letter is represented by a particular combination of 1s and 0s. The letter z, for example, is usually stored in computers as 01111010. Each of these 1s and 0s is called a "bit," so the code for the letter z has eight bits.

Hard drives use magnetic regions on the hard disk surface to represent these 1s and 0s. If the region is magnetized with the north pole facing up, it represents a 1. If the south pole is facing up, it represents a 0.

Hard drives made today store bits in tiny magnetic regions that are about 50 nanometers wide and only a few nanometers thick. (A nanometer is a billionth of a meter.) The smaller the magnetic regions, the more information a hard drive can hold. That's why some new hard drives are the same size as older models but can hold much more.

When we talk about the capacity of hard drives in gigabytes or terabytes we're actually counting the number of magnetic regions they contain. *Byte* is a word that means "8 bits." *Giga-* means a billion. *Tera-* means a trillion. So a hard drive with a terabyte of storage space uses around 8 trillion magnetic regions!



Now try...

1. Look at the "Data Storage" sheet to compare how much information magnets of different sizes can store in the same amount of space.
2. Make your own binary code! Use a pencil to fill in the circles on the "My Name in Binary Code" sheet.

How is this nano?



Computer hard drives are one the most common applications of

nanotechnology. Hard drives use tiny, nano-sized magnetic regions on their disks to make the binary code that holds information. The smaller the regions, the more information a hard drive can hold in the same amount of space.

Nanotechnology takes advantage of different material properties at the nanoscale to make new materials and tiny devices smaller than 100 nanometers in size. (A nanometer is a billionth of a meter.)

