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# Secondary Storage Revision – Solid State Drives

**Secondary storage** is any **non-volatile** storage that can not be directly accessed by the CPU. This includes hard drives, CDs and DVDs and memory sticks. These can be inside the computer (such as a hard drive) or they can be removable.

**Non-volatile** means that the data remains stored when the computer is turned off.

A NAND gate is a NOT AND logic gate – the reverse of an AND gate

Solid State memory includes solid state disk drives (SDDs), SD cards and USB pen drives. Each of these use "Flash" data that is stored using electrical charge.

## Q. Explain how a solid state disk drive (SDD) operates (4 marks):

- use electrical circuits to persistently store data;
- non-mechanical – nothing spins;
- contain a controller circuit board and lots of electrical circuits wired together into a grid. The grid is organised into "pages";
- hold data using microscopic electronic switches (floating gate transistors) - these can be charged as + or –turned in to 1s and 0s;
- the transistors create NAND gates that trap electron flow within them. This continues when the power in the system is turned off;
- SSD are random access – so data transfer is quicker;
- if data is updated, the section of the SSD can't just be over-written. Data must be copied to main memory, written to a new area and the original section then erased.

### A little more detail:

- to save data, an electrical charge (from the computer) is used to create a binary string which is sent to the SSD.
- to erase data, a high voltage removes electrons from the pools.
- SSDs become slower as they fill up due to the copying of data
- SSD have a limited lifespan. The number of times that an SSD can be written to is limited, and memory cell 'leakage' can be a problem if devices are not powered up from time to time.

## Advantages of Solid State Disks:

This understanding might come into a question where they provide two different computer setups and ask you to compare them

- no moving parts, so less likely to fail;
- quicker data read/write speeds in general;
- small and light – so good for portable devices;
- lower energy requirements;
- create less heat – less need for fans etc…;
- pen drives and backup drives can be very portable.

## Disadvantages of Solid State Disks:

Generally we're comparing HDD with SSD here

- smaller capacity than HDDs;
- more expensive;
- read/write speed slows down when they get full;
- data can be lost is stored for a long time without being powered up – not suitable for long term archiving of data;
- portability can lead to problems with drives being lost (data protection issues) and spread of malware.