



# J276 1.3 Storage



## Primary Storage

Primary storage is used to store programs and data currently used by the computer. When a user needs to run a program, it is loaded from disk to primary storage.

## The Need for Secondary Storage

Data and programs are stored permanently on secondary storage devices but the CPU cannot access them directly and so they be transferred to the main memory.

Secondary storage devices can also be used to transfer stored data between computers.

## Comparison of Secondary Storage devices

	Optical	Magnetic (HDD)	Solid state (SSD)
<b>Capacity</b>	650MB - 50GB	Up to 16 TB	Up to 4 TB for an SSD or 256 for a USB stick
<b>Speed</b>	Up to 50 MB/s	Up to 200 MB/s	Up to 3.5 GB/s
<b>Portability</b>	Highly portable and lightweight	Internal drives are not portable. External drives are.	Highly portable. Internal SSD are not intended to be portable
<b>Durability</b>	Susceptible to scratches	Affected by magnetic fields & heat. Moving parts	Extremely durable – no moving parts
<b>Reliability</b>	Good in the medium term	Very reliable	Extremely reliable
<b>Cost</b>	50GB for 45p	8 TB for £120	4 TB for £400

## Magnetic

Magnetic storage is used in hard disc drives (HDDs) and digital tape drives which are often used for backing up large computer systems. **Magnetic discs** consist of stacks of non-removable discs coated with magnetic materials.

Data is encoded as opposing magnetic polarities on the surface of the disc. Electromagnets in the read/write heads read and write the data.

The cost of magnetic storage is very low. HDDs in budget laptops have capacities of at least 1 terabyte.

## Optical

Optical storage includes:

- Compact discs (CDs) that store 700MB
- Digital versatile discs (DVDs) that store 4.7 GB
- Blu-ray discs that store up to 50GB

Optical discs use a laser to read and write data. The data is encoded as a series of pits in a spiral track running from the inside to the outside of the disc.

CD, DVD and Blu-ray drives write and read data onto discs using light from lasers.

## Solid state

Solid state memory is made of flash memory. Flash memory is non-volatile storage that can be electrically erased and reprogrammed. Flash memory uses arrays of transistors (switches). Transistors can operate in two state, 0 and 1, and are switched from one to the other using electrical signals. Data is encoded as sets of binary digits, 8 GB of solid state storage require 32 billion transistors.

**Uses of solid-state memory:** solid state drives (SSD), secure digital (SD) cards, USB flash drives.

# J276 1.3 Storage - Example Exam Questions and Answers

A small business backs up the data on its computer system every day. Compare backing up the data to a magnetic hard disc with backing up to an optical disc.

(4 marks)

*Data is written to and read from a magnetic hard disc more quickly than to/from an optical disc, so backing up and restoring would be quicker. Hard discs are permanently located within a hard disc drive so are less portable than optical discs, such as DVDs, which can be removed from the drive when not in use. Portable hard drives are very light and compact so could be stored off-site. Optical media tends to be more durable than magnetic media. DVDs offer unlimited storage because the business can use as many as needed. HDDs can store several terabytes of data which would probably be enough for the business*

A school has a number of different data storage requirements. State which type of secondary storage is most suitable for each of the purposes listed below. Give a reason for your choice.

(6 marks)

- **Hand-held data-logging devices for fieldwork.**  
*Solid state. Very fast access speed for taking readings and not sensitive to being moved around.*
- **Storage drives on the school's file server to save all of the student's work.**  
*Magnetic. Very large capacity, reliable and low cost.*
- **Copies of a video of a school production to be given to parents.**  
*Optical. Discs are cheap and portable and most home computers can access them.*

Explain how each of these secondary storage devices physically records data.

- **Magnetic hard drive**
- **Flash memory USB stick**
- **Optical disc drive**

(3 marks)

*Hard disc drives use electromagnetism to store data magnetically on metal discs.*

*Data is stored in flash memory by using electricity to change the state of the transistors it is made of.*

*DVDs use light produced by a laser to store data on the disc by changing its surface.*

Anna is buying a new laptop computer. She has the choice between a magnetic hard disc drive and a SSD for file storage.

Discuss the benefits and drawbacks of these alternative secondary storage devices.

(6 marks)

*At present, the storage capacity of hard disc drives is greater than for SSDs so Anna would be able to store more files.*

*Also, at present, the cost of hard disc drive storage is cheaper than for SSDs although the cost is falling.*

*SSD data access speeds are far greater than for hard disc drives.*

*SSDs have no moving parts so they are ideal for laptops as they will not be damaged if they are dropped.*

*As data becomes fragmented, access is slower on hard disc drives as the read/write heads have to move to different platters to access different parts of the same file. Fragmentation does not slow data access in SSDs as there are no moving read/write heads.*