Secondary storage

1.2.2 · Computer systems (Paper 1) · revision notes

Secondary storage keeps programs and data permanently. You need to know the three types (magnetic, optical and solid state), examples of each, and how they compare on capacity, speed, portability, durability, reliability and cost, so that you can recommend a suitable device for a situation. 'Recommend and justify' questions are very common.

Key facts

- Secondary storage: non-volatile, keeps data when the power is off
- Optical (CD, DVD, Blu-ray): cheap, light, low capacity, slow, scratches easily
- Six characteristics: capacity, speed, portability, durability, reliability, cost
- Rough capacities: CD 700 MB, DVD 4.7 GB, Blu-ray 25 GB, HDDs and SSDs hundreds of GB to several TB
- Magnetic (HDD, tape): high capacity, cheapest per GB, moving parts
- Solid state (SSD, USB flash drive, SD card): fast, durable, no moving parts, higher cost per GB
- Durability = resists physical damage; reliability = keeps working correctly over time

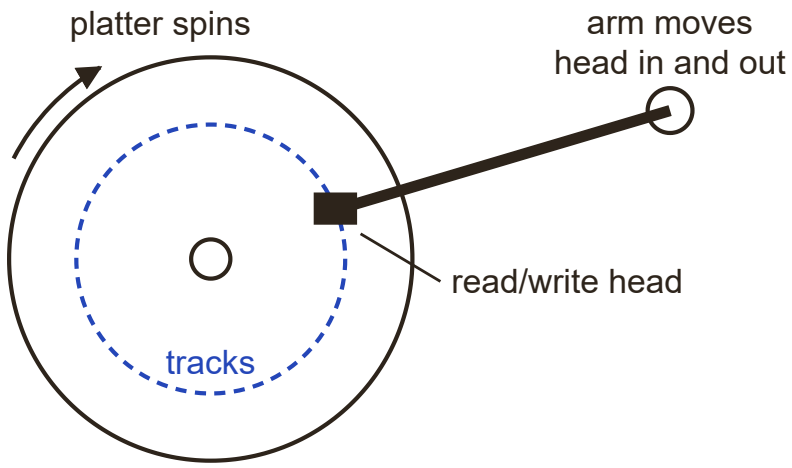
Notes

Why secondary storage is needed

- RAM is volatile and fairly small, so the operating system, programs and users' files need **non-volatile** storage that keeps them when the power is off.
- The CPU does not access secondary storage directly: data is copied into RAM first.
- Secondary storage has a much larger capacity and a lower cost per GB than RAM.

The three types

- **Magnetic**: hard disk drives (HDDs) and magnetic tape. An HDD stores data magnetically on spinning disks, read by a moving read/write head. Very high capacity and cheap per GB, but the moving parts make it slower and less durable than solid state. Tape is used for large backups and archives.



Inside an HDD: the moving parts (spinning platter and moving arm) make it slower and less durable than solid state

- **Optical**: CDs (about 700 MB), DVDs (about 4.7 GB) and Blu-ray discs (about 25 GB per layer), read by a laser in an optical drive. Very cheap per disc and light to post, but low capacity, slow, and easily scratched.
- **Solid state**: SSDs, USB flash drives and SD cards, which use flash memory with **no moving parts**. Fast, durable, light and low power, but more expensive per GB. Each memory cell can only be rewritten a limited number of times.

The six characteristics

- **Capacity**: how much data it can hold.
- **Speed**: how quickly data can be read and written.
- **Portability**: how easy it is to carry around (size and weight).
- **Durability**: how well it resists physical damage, e.g. being dropped, knocked or heated.
- **Reliability**: how consistently it keeps working and storing data correctly, over a long time or many uses.
- **Cost**: usually compared as cost per GB, not just the price of one device.

Choosing storage

- Laptops, phones and cameras: solid state (fast, survives being dropped, light, and low power so the battery lasts longer).
- Large backups and archives: magnetic HDDs or tape (huge capacity at the lowest cost per GB; speed matters less).
- Giving copies of films, music or software to lots of people: optical discs (very cheap to mass-produce and light to post).

How to answer each type of question

State why secondary storage is needed and identify storage types

1 mark each | Grade 3

1. For 'why', use the word non-volatile or say the data is kept when the power is off.
2. Learn two examples of each type: magnetic, optical, solid state.

Example. (a) State **one** reason why a computer needs secondary storage. [1]
(b) State the type of storage used by a DVD. [1]
(c) State the type of storage used by an SD card. [1]

Model answer.

(a) To store programs and data permanently / because it is non-volatile, so data is kept when the power is off (1)
(b) Optical (1)
(c) Solid state (1)

Compare two storage devices

3 to 4 marks | Grade 5

1. Pick different characteristics for each point (speed, durability, capacity, cost, power).
2. Make each point a comparison, e.g. 'the SSD is faster than the HDD'.
3. Link it to the use in the question where you can.

Example. Compare a hard disk drive (HDD) with a solid state drive (SSD) for use in a laptop. [4]

Model answer. The SSD reads and writes data faster, so the laptop starts up and loads programs more quickly (1). The SSD has no moving parts, so it is more durable if the laptop is dropped (1). The HDD is cheaper per GB, so more capacity can be bought for the same price (1). The SSD uses less power, so the laptop's battery lasts longer (1).

Recommend a storage device for a scenario and justify

3 to 4 marks | Grade 6

1. Name one type or device clearly (usually 1 mark).
2. Choose the characteristics that matter in this scenario.
3. Link each characteristic to the scenario with 'so…'. 'It is durable' on its own rarely scores.

Example. A mountain guide takes photos on a camera while hiking. Recommend a suitable type of storage for the camera. Justify your recommendation. [3]

Model answer. Solid state, e.g. an SD card (1). It has no moving parts, so it is durable and will not be damaged if the camera is knocked or dropped on the hike (1). It is small and light, so it fits inside the camera and is easy to carry (1). Also accept: low power, so the camera's battery lasts longer; fast write speed, so photos are saved quickly.

Evaluate options from given data

4 to 6 marks **Grade 8**

1. Check whether each option has enough capacity (a quick calculation).
2. Compare the total cost, not just the price of one device.
3. Consider speed, durability and convenience for the use described.
4. Recommend one option and say why each other option is less suitable.

Example. A photographer needs to back up 3 TB of photos and keep the backup in a cupboard for several years. Use 1 TB = 1000 GB.

Option	Device	Capacity	Price
P	USB flash drive	512 GB	£40 each
Q	External HDD	4 TB	£90 each
R	Blu-ray disc	25 GB	£1 each

Recommend the most suitable option. Justify your answer, explaining why the other options are less suitable. [4]

Model answer. Q, the external HDD (1). 4 TB is enough to hold the 3 TB backup on a single device, at the lowest total cost (£90) (1). P would need 6 drives (5 × 512 GB = 2560 GB is not enough), costing £240 (1). R would need 3000 ÷ 25 = 120 discs, costing £120, and writing and storing that many discs is slow and awkward, and they scratch easily (1).

Don’t lose marks

- Confusing durability (survives knocks and drops) with reliability (keeps working correctly over time).
- Writing 'it's faster' or 'it's cheaper' without saying what it is being compared with and why that matters in the scenario.
- Saying SSDs are cheaper than HDDs. They cost more per GB.
- Calling RAM secondary storage, or saying secondary storage is volatile.
- Recommending optical discs for very large backups: their capacity is far too small.

More tips

Memory tricks

- 'Moving parts' is the key idea: an HDD has them (slower, less durable); an SSD does not.
- Cost per GB = price ÷ capacity in GB: a quick way to compare value.
- Match the use: carried around → solid state; huge and cheap → magnetic; cheap copies to give away → optical.
- The six characteristics: 'Can Some People Drive Really Carefully?' = capacity, speed, portability, durability, reliability, cost.

Exam technique

- In 'recommend' questions, the justification marks often depend on a sensible recommendation, so pick one device and stick to it.
- Use details from the scenario (dropped, carried, huge amount of data, rarely accessed, low budget) to decide which characteristics to write about.
- When a table gives figures, use them: show a quick calculation that the data fits, or compare costs.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **Explain why secondary storage is needed**
It is non-volatile, so programs and files are kept when the power is off.

Grade 3 — **Give examples of each type of storage**
Magnetic: HDD, tape; optical: CD, DVD, Blu-ray; solid state: SSD, USB flash drive, SD card.

Grade 4 — **Define the six storage characteristics**
Capacity, speed, portability, durability, reliability and cost, and what each one means.

Grade 5 — **Compare HDDs and SSDs**
SSDs are faster, more durable and use less power; HDDs are cheaper per GB and available with larger capacities.

Grade 6 — **Recommend storage for a given scenario**
Choose a device and justify it with characteristics that are linked to how it will be used.

Grade 7 — **Evaluate storage options using given data**
Use capacities, speeds and costs from a table, including checking by calculation whether the data will fit.

Grade 8 — **Justify why alternatives are less suitable**
Explain why the other options would not work as well, not just why your choice does.

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