

Solutions

Each answer shows the steps, then the **result**.

2.1

- the parts, from the outside in: **platters** spin; a surface has **tracks**; a track has **sectors**
- the head is on an **arm**
- a bit is an area **magnetised** in one of two directions

2.2

- laser, pits and lands → **optical disc**
- trapped electrons on a floating gate → **solid state**
- a head on an arm → **magnetic hard disk**
- one spiral track → **optical disc** (a hard disk has many circular tracks)
- no moving parts → **solid state**

2.3 any two of:

- RAM is volatile, so programs and files must be kept somewhere when the power is off
- secondary storage has a much larger capacity than primary memory
- it costs much less per GB than RAM

2.4 any two of:

- to move files from one computer to another
- to keep a backup copy in a different place
- to give software or films to other people

2.5

- the disc must spin and the laser must shine on the track before anything can be detected, so C then D come first
- then the sensor detects the reflection, and the changes are read as bits: **C, D, A, B**

2.6

- a hard disk must wait while the arm moves to the track and the platter turns to the sector
- a solid state drive has **no moving parts**: any cell is reached electronically, with almost no delay

3.1

(a) any five of:

- it has one or more platters with a surface that can be magnetised
- the platters are on a spindle and spin at high speed
- each surface is divided into tracks and sectors
- a read/write head on an actuator arm moves across the surface to the correct track

- to write, a current in the head creates a magnetic field that magnetises an area in one of two directions, for 1 and 0
- to read, the magnetised areas passing under the head produce a changing current in it

(b) the head moves very close to the surface of a platter that is spinning at high speed

- a knock can make the head touch the surface and scratch it, or damage the moving parts, so the data can no longer be read

3.2

(a) any four of:

- it is made of transistors arranged in a grid, using NAND (or NOR) flash technology
- each cell has a control gate and a floating gate
- a voltage moves electrons onto the floating gate, where they are trapped by an insulating layer
- trapped electrons represent 0, and no trapped electrons represent 1
- the electrons stay without power, so the data is kept
- data is erased and rewritten in blocks

(b) any three of:

- no moving parts, so it is not damaged when the phone is dropped or shaken
- it uses less power, so the battery lasts longer
- it is smaller and lighter
- faster access, so apps open quickly
- it produces less heat and no noise

3.3

(a) any four of:

- a motor spins the disc
- a laser beam is focused on the disc's single spiral track
- the track is made of pits and lands, which reflect the light differently
- a light sensor detects the reflected light
- a change between a pit and a land is read as 1, and no change as 0

(b) a **higher-powered** laser heats spots on the dye (recording) layer

- the heated spots reflect light differently from the rest, so they are read like pits and lands

3.4

(a) **magnetic hard disk**

- 900 TB is a very large amount of data, and magnetic storage has the lowest cost per GB and very large capacities

- the images are opened only occasionally and the servers never move, so its slower access and lower robustness do not matter

(b) **solid state drive**

- the laptop is carried around, and a solid state drive has no moving parts, so it is not damaged by knocks
- it gives fast access to large files, and it uses less power, so the battery lasts longer

(c) it is a **backup**: if the servers fail, or are damaged by fire or stolen, the images are not lost

- removable storage can be kept in a **different place** from the servers

(d) any **two** of:

- RAM is volatile, so every image would be lost when the power went off
- 900 TB of RAM would cost far too much
- a computer cannot hold that much RAM