

Solutions

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

2.1

- primary memory holds the programs and data the processor is using now, and the processor can access it directly and quickly
- secondary storage keeps programs and data when the power is off (non-volatile), and it holds much more

2.2 any **three** of:

- the platter spins on the spindle
- the actuator arm moves the read-write head to the correct track
- the head waits for the correct sector to pass under it
- the head detects the direction of magnetisation of each area, which gives the 1s and 0s

2.3 any **two** of:

- faster access to data, because there are no moving parts
- more robust if the laptop is dropped
- uses less power, so the battery lasts longer
- lighter and thinner

2.4

- the glass has a conductive layer with an electrostatic field
- a finger draws a little charge, so the current changes at the point of touch
- sensors at the corners measure the change, and the microprocessor calculates the position

2.5

- the download rate over the internet can change, but the video must play at a steady rate
- the buffer holds data downloaded ahead of playback, so the video does not stop and wait

2.6

- (a) an **infra-red** (motion) sensor
- (b) a **pressure** sensor
- (c) a **sound** sensor

3.1

(a) any **three** of:

- sound waves make the diaphragm vibrate
- the diaphragm moves a coil backwards and forwards near a permanent magnet

- this produces a varying electric current
- the analogue signal is converted to digital by an ADC

(b) any **three** of:

- a DAC converts the digital sound into a varying current
- the current flows through a coil, which becomes an electromagnet
- the coil is attracted to and repelled by the permanent magnet as the current changes
- so the cone vibrates and produces sound waves

3.2

(a) any **three** of:

- the disc spins, and a laser shines on its surface
- the surface has pits and lands along a spiral track
- a light sensor detects the reflected light
- the change in reflection at the edge of a pit is read as binary data

(b) any **two** of:

- films are large files, and magnetic storage has a lower cost per GB
- very large capacities are available
- the archive computer does not move, so being less robust does not matter
- fast access is not needed for an archive

3.3 any **four** of:

- two screens, or one split screen, show a slightly different image to each eye
- so the brain sees the scene in 3D
- lenses focus the images for the eyes
- sensors such as a gyroscope and an accelerometer detect the movement of the head
- the processor updates the images so the view changes as the head moves

3.4

(a) each key press is stored in the buffer, in RAM, in the order it was typed

- the processor takes the key presses from the buffer when it is ready
- first in, first out, so the characters are processed in order and none is lost while the processor is busy

(b) DRAM is cheaper and holds more data per chip, so a large main memory is affordable

3.5

(a) it is a microprocessor-based system inside a larger device

- it has one dedicated task: controlling the heating

(b) benefit, e.g. small, cheap, low power or reliable

- drawback, e.g. hard to upgrade or repair, limited to one task, or can be hacked if it is not updated

(c) PROM can be written only once, so the program could never be changed

- EEPROM can be erased and rewritten electrically while it is in the thermostat, so the program can be updated

(d) the processor switches the boiler on or off through the relay (an actuator), so it changes the conditions instead of only recording them

- the sensor measures the temperature again after each change
- the processor compares the new reading with the target and decides whether to switch again, which keeps the temperature near the target

(e) e.g. the current temperature reading, or the target temperature set by the user