

# Cambridge International AS and A Level Computer Science

## 9608

For examination from 2017

### Topic 1.3.1 Input, output and storage devices

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## Introduction

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### How to use this guide

The aim of this guide is to facilitate your teaching of Cambridge International AS and A Level Computer Science, syllabus topic 1.3.1, Input, output and storage devices. This is an introductory topic that is part of topic 1.3 Hardware. The devices covered can be used as an introduction to discussions on buffering and interrupts to explain how operating systems (syllabus topic 3.4.1) deal with devices that operate at different speeds. The guidance and activities in this resource are designed to help teachers devise programmes of study which provide teaching time devoted to theory work as well as activities that consolidate learning.

Section 1 lists some key terms used in this topic and their definitions. Section 2 explains what input, output and storage devices are, and Section 3 provides links to online resources for each of the hardware devices. Section 4 gives ideas for class and homework activities.

### Learning objectives

Using this document should help you guide learners in the following syllabus learning objectives:

- identify hardware devices used for input, output, secondary storage
- show understanding of the basic internal operation of the following specific types of device:
  - keyboard
  - trackerball mouse
  - optical mouse
  - scanner
  - inkjet printer
  - laser printer
  - 3D printer
  - speakers
  - hard disk
  - solid state (flash) memory
  - optical discs
  - microphone
  - touchscreen
- show understanding of the need for secondary (including removable) storage

### Prior knowledge

This topic is an introductory one in the syllabus, so you do not need to have covered any other topics in order to understand it. However, you can make links in your teaching to the following aspects of syllabus topic 1.1 Information representation, when different devices in this topic are covered:

- ASCII/Unicode representation of characters
- the relationship between the number of bits used to store the colour of a pixel (colour depth) and the number of colours that can be represented
- the range of values that can be stored by a given number of bits when performing analogue to digital conversion / converting from denary to binary.

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## 1. Key terms

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Word/phrase	Meaning
<b>3D printer</b>	An output device that can generate a three-dimensional (3D) physical object
<b>hard disk</b>	A magnetic secondary storage device
<b>inkjet printer</b>	An output device for printing pages using ink cartridges
<b>keyboard</b>	An input device that allows text characters and symbols to be entered into a computer system
<b>laser printer</b>	An output device for printing pages that uses toner cartridges
<b>microphone</b>	An input device that allows sound to be entered into a computer system
<b>optical discs</b>	Secondary storage devices
<b>optical mouse</b>	An input device that is used to move a pointer on a screen
<b>scanner</b>	An input device that takes physical printed information and converts it into a digitised format
<b>speakers</b>	Output devices that produce sound
<b>solid state (flash) memory</b>	A secondary storage device that has no moving parts
<b>touchscreen</b>	Both an input and an output device: the display outputs an image; it can receive inputs by being touched by either a finger or a stylus
<b>trackerball</b>	An input device that moves a pointer on a screen when a ball on the device is rolled or moved

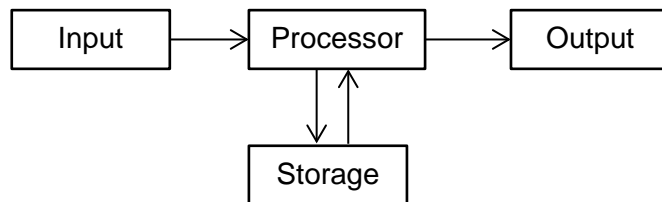
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## 2. Theory

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### 2.1. What are input, output and storage devices?

All computing systems can be broken down into a basic input, processing, output and storage model:



Hardware input devices such as keyboards, scanners or microphones, are used to input data that is processed by software programs (such as editing applications); hardware output devices such as printers or screens are used to output the processed data. External storage devices are used to provide additional memory, backup, or security for the long-term storage of data such as files, photos, videos.

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## 3. Online resources

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The following resources will give you and your learners information on how each of the hardware devices listed in the syllabus work.

The content of websites is dynamic and constantly changing. Schools are strongly advised to check each site for content and accessibility prior to using it with learners. Cambridge International Examinations is not responsible for the accuracy or content of information contained in these sites. The inclusion of a link to an external website should not be understood to be an endorsement of that website or the site's owners (or their products/services).

### 3.1. Websites

#### 3.1.1 General

Accessible and clear slide presentation that covers most of this topic at an introductory level

[https://docs.google.com/presentation/d/1RQpksRuBW8sYW0Vlfk1z39\\_ - ueQHEd4ahaln0xgmnVY/embed#slide=id.i132](https://docs.google.com/presentation/d/1RQpksRuBW8sYW0Vlfk1z39_ - ueQHEd4ahaln0xgmnVY/embed#slide=id.i132)

#### 3.1.2 Input devices

##### Keyboard

Page 3 explains the key matrix, page 6 how keyboards connect to the computer

<http://computer.howstuffworks.com/keyboard2.htm>

Readable description of keyboard principles under 'Input' heading

<http://digitalhumanities.org/companion/view?docId=blackwell/9781405103213/9781405103213.xml&chunk.id=ss1-3-1>

##### Microphone

A BBC Bitesize GCSE revision guide to how sound is sampled, including an overview diagram

<http://www.bbc.co.uk/education/guides/z7vc7ty/revision>

How microphones convert sound into an electrical signal

<http://www.mediacollege.com/audio/microphones/how-microphones-work.html>

##### Trackerball

How a trackerball works

<http://www.ask.com/technology/trackball-work-4f12b9f60ba6990>

##### Optical mouse

Description of the optical mouse, including the advantages of this type of mouse

<http://computer.howstuffworks.com/question631.htm>

## Online resources

### **Scanner**

Description of the principles of scanners, including diagram

<https://www.pctechguide.com/scanners/scanner-operation>

A more detailed article on how scanners work

<http://computer.howstuffworks.com/scanner1.htm>

### **Touchscreen**

Describes resistive, capacitive and surface acoustic wave touchscreens

<http://computer.howstuffworks.com/question716.htm>

Resistive and capacitive touchscreens with diagrams

<https://techexplainer.wordpress.com/2012/04/02/resistive-vs-capacitive-touchscreen/>

## **3.1.3 Output devices**

### **Inkjet printer**

How an inkjet printer works, based on a labelled diagram

<http://www.computershopper.com/feature/how-it-works-inkjet-printer>

Describes the components of an inkjet printer

<http://computer.howstuffworks.com/inkjet-printer2.htm>

### **Laser printer**

How a laser printer works, based on a labelled diagram

<http://www.computershopper.com/feature/how-it-works-laser-printer>

Labelled diagram and explanation of laser printers

<http://www.explainthatstuff.com/laserprinters.html>

### **3D printer**

Short article in the Independent newspaper explaining 3D printing

<http://www.independent.co.uk/life-style/gadgets-and-tech/features/3d-printing-for-dummies-how-do-3d-printers-work-8668937.html>

### **Speakers**

Explains sound signals, how the voice coil produces sound, and differences between computer speakers and other speakers

[http://www.ehow.com/how-does\\_4963948\\_how-computer-speakers-work.html](http://www.ehow.com/how-does_4963948_how-computer-speakers-work.html)



### 3.1.4 Storage devices

#### Hard disk

Description and labelled diagram of the parts in a hard disk

<http://www.explainthatstuff.com/harddrive.html>

Page 5 onwards: a more detailed explanation of the parts of a hard disk

<http://computer.howstuffworks.com/hard-disk4.htm>

#### Optical discs

Basic description of the operation of optical discs in BBC Bitesize Higher Computing Science

<http://www.bbc.co.uk/education/guides/zws3gk7/revision/3>

#### Solid state (flash) memory

An accessible simple description of flash memory, followed by a more detailed explanation

<http://www.explainthatstuff.com/flashmemory.html>

## 3.2. Videos

The following are all very brief videos that explain the principles of the devices:

How the internals of a keyboard work

<https://www.youtube.com/watch?v=chSzoovWtzU>

How an optical mouse works

[https://www.youtube.com/watch?v=i6WRuwJ0\\_PM](https://www.youtube.com/watch?v=i6WRuwJ0_PM)

How a touchscreen works

<https://www.youtube.com/watch?v=euCewYGHZB0>

How a scanner works

<https://www.youtube.com/watch?v=shnYljG20i4>

How an inkjet printer works

<https://www.youtube.com/watch?v=CFuNd3Lqslc>

How a laser printer works

<https://www.youtube.com/watch?v=WB0HnXcW8gQ>

How a 3D printer works

<https://www.youtube.com/watch?v=Vx0Z6LplaMU>

How a hard disk works

<https://www.youtube.com/watch?v=4iaxOUYaJJU>

## Online resources

How an optical drive works

<https://www.youtube.com/watch?v=bRDuAa6nhpw>

How solid state memory works

<https://www.youtube.com/watch?v=TFoOyPXYJ-E&feature=youtu.be>

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## 4. Class and homework activities

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### 4.1. Research questions

The following are examples of questions that can be adapted as necessary. Encourage learners to research the questions independently.

1. Complete the following table:

Type of secondary storage device	Magnetic	Optical	Solid state
Example			
Key features of the way it operates			

2. Compare and contrast the operation of an optical mouse and a trackerball.