Cambridge IGCSE

Computer Science

Section 1

The USB interface

Unit 2:
Data Transmission

Objectives

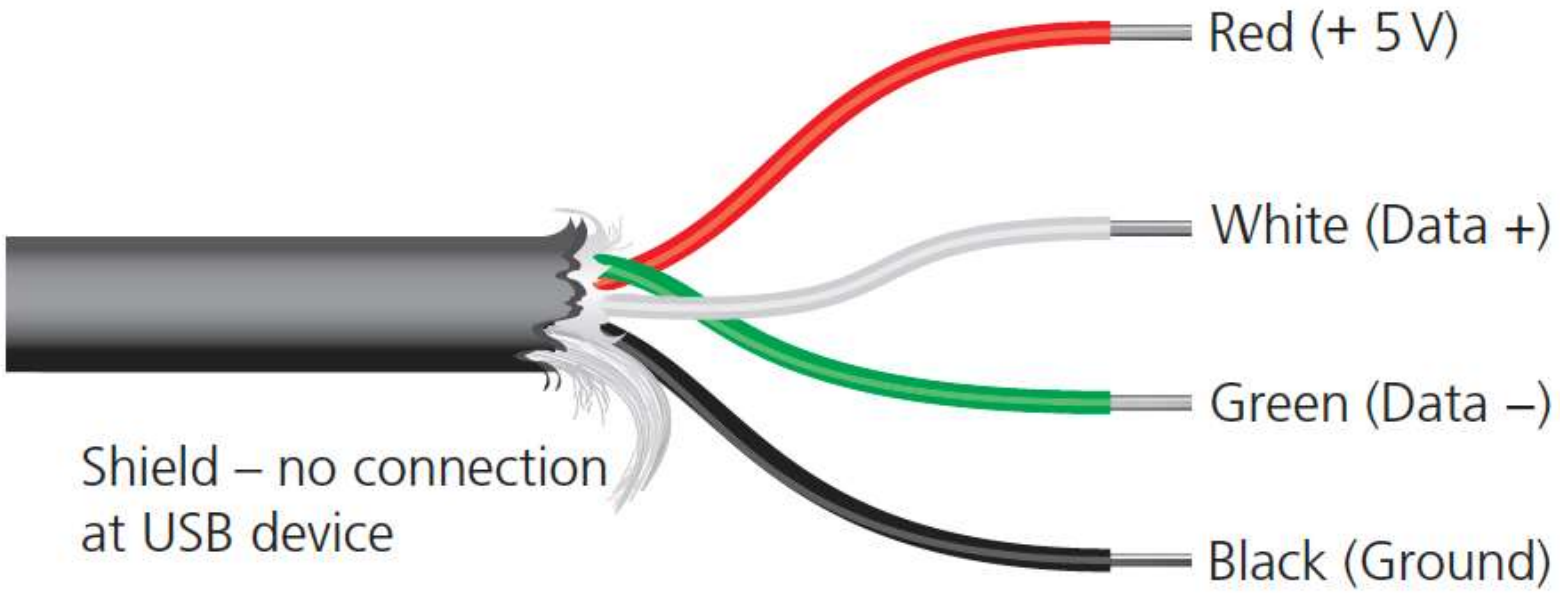
- Understand the universal serial bus (USB) interface
- Explain how USB is used to transmit data

Universal Serial Bus (USB)

- The Universal Serial Bus (USB) is a form of serial data transmission and is now the most common type of input and output port found on digital devices.
- It has set standards (cables, connectors and transmission protocols - rules) for the transfer of data between devices.
- It allows both half-duplex and full-duplex data transmission.

Universal Serial Bus

- A USB cable is a four-wire shielded cable.
- Two wires are responsible for connecting power - the red and black carry the power and ground connection.
- The two other wires (white and green), that transmit data.



Connecting USB device to a computer

When a device is plugged into the USB port of a computer:

- the computer automatically detects that a device (e.g. printer) has been connected because of a small change in the voltage on the data signal wires in the USB cable
- the device is automatically recognised with the appropriate device driver loaded up so that the computer and device can communicate properly
- if the computer does **not** have the matching device driver, the user will be asked to download the appropriate device driver software

Advantages of USB

- Once the device is plugged in, the device is automatically detected and drivers are automatically installed. A USB interface is self-configuring.
- USB Type A and B connectors can only be connected in one way which stops the user from plugging in a device incorrectly.
- Several data transmission rates are supported
  - 1.5Mbps to 5 Gbps
- Newer USB connectors are compatible with the older USB standards - backward compatible 相容 - 适用于旧设备

Advantages of USB

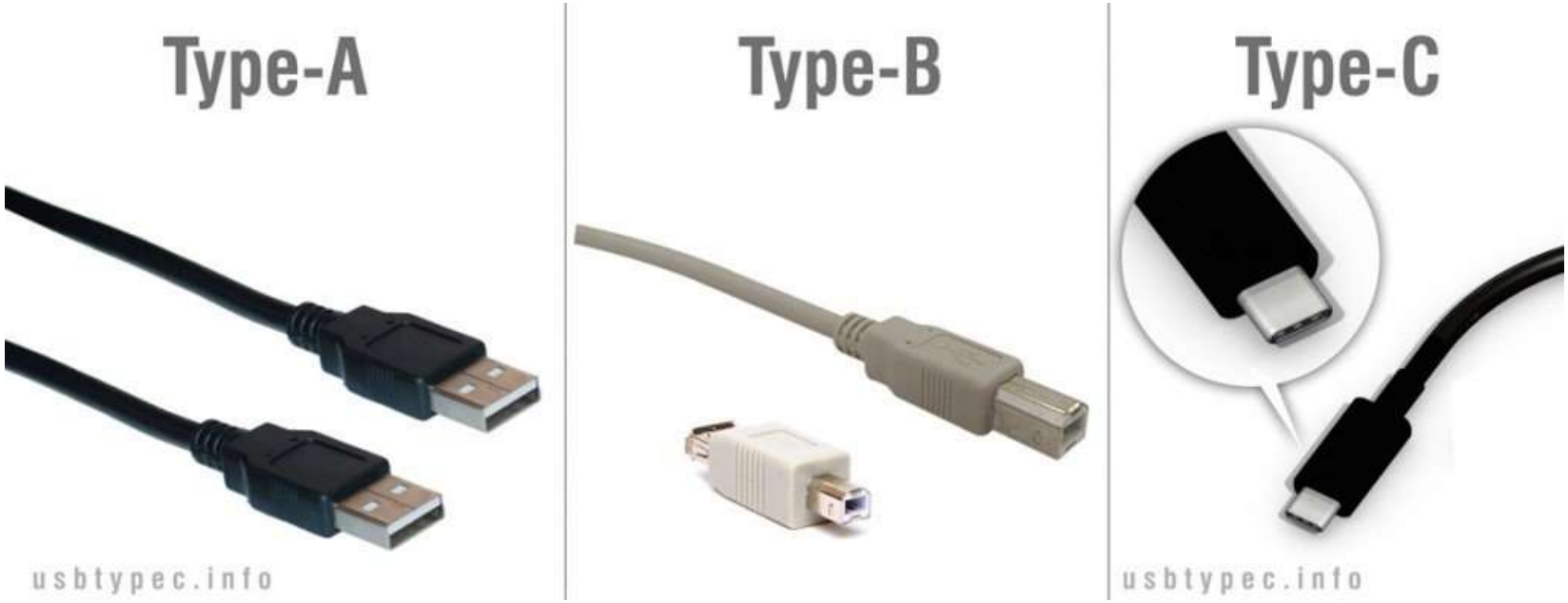
- As the cable supplies +20V of power, there is no need for external power source, and the USB connectors can be used to charge the batteries of portable devices.
- If there are any errors in the transmission, the USB protocol allows for the re-transmitting of the data. This can produce error-free data transmission.
- If required, it is fairly easy to add more USB ports through the use of USB hubs.
- As it has now become an industry standard, there is lots of support available - nearly all devices have a USB interface

Disadvantages of USB

- Standard USB only supports a maximum cable length of 5m, after that, a hub is required to extend the distance
- Older USB standards are not supported by some newer computers
- Data transfer rate can be slow compared to some other methods e.g. ethernet

USB Type A and B

USB Type A and B and C



USB Type C

USB Type C

- USB-C is now commonly used in new computers.
- It has a 24-pin symmetrical connector, which means it will fit into a USB-C port either way around.
- It is much smaller and thinner than older types and carries 100 watts (20 volt) of power, meaning full-sized devices can be charged.
- It can carry data at 10 Gbps, meaning it supports 4K video.
- It is backward compatible with older USB formats through the use of a suitable adaptor.

Activity

Statement	True	False
Packets have a header which contains the IP address of the sender and the receiver		
Packets don't require any form of error checking		
USBs use a protocol that allows for error-free data transmission between device and computer		
Serial data transmission suffers from data skewing		
The longest cable length supported by USB is 5 metres or less		
Simplex data transmission occurs when data is transmitted one bit at a time		
Full-duplex data transmission involves sending 8 bits of data at a time		
USB uses serial data transfer		
Packet switching prevents loss of any data packets		
USB connections can transfer data using half-duplex or full-duplex		

Vocabulary

- **serial**
- **transmission**
- **device**
- **standard**
- **protocol**
- **input device**
- **output device**
- **port**
- **device driver**
- **compatible**

Plenary

For your exam you need to be able to:

- describe the USB interface
- explain how it is used to transmit data

Past paper question examples ...

6 Nadia purchases a printer to print out her homework.

She connects the printer to her computer using USB.

(a) Explain what is meant by USB.

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..... [3]

Past paper question examples ...

3 Carla's computer has a USB port.

Carla uses the USB port to connect her mobile device to her computer, to transfer her photos.

(a) Give **three** benefits of using a USB port to connect the mobile device to the computer.

Benefit 1 .....

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Benefit 2 .....

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Benefit 3 .....

.....

[3]

(b) State the type of data transmission used when transferring data using a USB port.

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[1]