Worksheet 3 – Data Transmission & USB – Detailed Answer Key

Section A: Multiple Choice Questions (10 marks)

1. Which type of data transmission sends one bit at a time over a single wire?

Answer: b) Serial
Explanation:

- **Serial transmission** sends data **one bit at a time** sequentially over a single channel (e.g., USB, Ethernet).
- **Parallel transmission** sends multiple bits simultaneously over multiple wires (e.g., internal computer buses).

---

2. What is the main advantage of USB-C over older USB types?

Answer: b) Symmetrical, reversible design
Explanation:

- USB-C's **reversible plug** eliminates the frustration of inserting it the wrong way (unlike USB-A/Micro-USB).
- Additional advantages:
  - Higher data speeds (up to 40 Gbps with USB4).
  - Supports **power delivery (up to 240W)** and **4K video**.

---

3. In half-duplex transmission, data can be sent:

Answer: c) In both directions but not at the same time
Explanation:

- **Half-duplex** allows **two-way communication**, but only **one direction at a time** (e.g., walkie-talkies).
- **Full-duplex** allows simultaneous two-way communication (e.g., phone calls).

---

4. Which part of a USB cable is responsible for data transmission?

Answer: b) White and green wires
Explanation:

- A standard USB cable has **4 wires**:

- **Red (+5V power)** and **Black (Ground)** for power.
- **White (Data-)** and **Green (Data+)** for **data transmission**.

---

5. What happens first when a USB device is plugged into a computer?

Answer: b) The computer detects a voltage change
Explanation:

1. **Detection**: Voltage change on data lines signals a new device.
2. **Recognition**: OS identifies the device (e.g., flash drive, keyboard).
3. **Driver Handling**: Loads drivers automatically or prompts the user.

---

6. Parallel transmission is most suitable for:

Answer: b) High-speed internal computer components
Explanation:

- **Parallel transmission** is **fast but short-range** (e.g., RAM-to-CPU communication).
- **Serial transmission** is better for long distances (e.g., USB, Ethernet) due to **no skewing issues**.

---

7. Which USB feature ensures backward compatibility with older devices?

Answer: b) Adapters for USB 2.0/3.0
Explanation:

- USB-C **physically differs** from USB-A/Micro-USB, but **adapters** allow connection to older ports.
- Software protocols (e.g., USB 2.0 mode) ensure compatibility.

---

8. Full-duplex transmission is used in:

Answer: c) Telephone calls
Explanation:

- **Full-duplex** enables **simultaneous two-way communication** (e.g., phone calls, video chats).
- **Half-duplex**: Walkie-talkies, some network protocols.
- **Simplex**: Keyboards, printers (one-way only).

---

9. What problem does skewing cause in parallel transmission?

Answer: a) Data corruption over long distances
Explanation:

- **Skewing**: Bits arrive **out of sync** due to varying wire lengths/interference.
- **Solution**: Use **serial transmission** for long distances (avoids skewing).

---

10. USB-C can deliver power up to:

Answer: d) 240 watts
Explanation:

- USB-C **Power Delivery (PD) 3.1** supports **up to 240W** (48V/5A).
- Older USB types max out at **7.5W (USB 2.0)** or **100W (USB 3.2)**.

Section B: Short Answer Questions (12 marks)

11. Define simplex, half-duplex, and full-duplex transmission with one example each.

Answer:

- **Simplex**: One-way communication (e.g., **keyboard to computer**).
- **Half-duplex**: Two-way, but **not simultaneously** (e.g., **walkie-talkies**).
- **Full-duplex**: Two-way **simultaneously** (e.g., **phone calls**).

---

12. Explain why serial transmission is preferred over parallel for long-distance communication.

Answer:

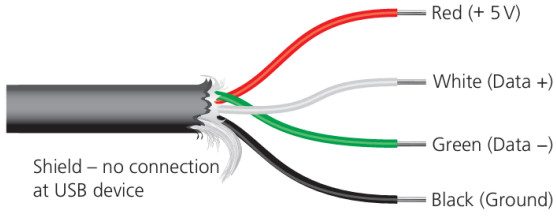
- **Serial avoids skewing** (bits stay synchronized over long cables).
- **Fewer wires** = cheaper, less interference, and easier maintenance.

---

13. Label the four wires in a standard USB cable and state their purposes.

Answer:

1. **Red**: +5V Power
2. **Black**: Ground
3. **White**: Data- (D−)
4. **Green**: Data+ (D+)



▲ **Figure 2.12** Typical USB cable

---

14. Describe the steps a computer takes when a USB device is plugged in.

Answer:

1. **Detection**: Voltage change on data lines.
2. **Recognition**: OS checks device ID (e.g., USB flash drive).
3. **Driver Handling**: Loads drivers or prompts user.

---

15. List two advantages and two drawbacks of USB-C compared to older USB types.

Answer:

- **Advantages**:
    1. **Reversible plug** (no wrong way to insert).
    2. **Higher power/speed** (up to 240W, 40 Gbps).
- **Drawbacks**:
    1. **Adapters needed** for older devices.
    2. **Costlier** to manufacture.

Section C: Structured Questions (8 marks)

16. USB-C Flash Drive Not Recognized

a) Possible Causes:

- **Faulty cable/port** (physical damage).
- **Driver issues** (OS fails to load correct driver).

b) Normal Detection Process:

1. **Voltage detection** on data pins.
2. **Handshake protocol** (device identifies itself).
3. **Driver installation** (automatic or manual).

---

17. Compare Serial vs. Parallel Transmission

Answer:

Criteria	Serial	Parallel
Speed	Slower (one bit at a time)	Faster (multiple bits at once)

Criteria	Serial	Parallel
Long Distance	Better (no skewing)	Poor (skewing issues)
Use Cases	USB, Ethernet, SATA	RAM, internal buses

---

18. USB Packet Structure

a) Trailer Purpose:

- Contains **CRC (error-checking)** and **end marker**.

b) CRC Function:

- Sender calculates a checksum, receiver verifies it. **Mismatch = request retransmission**.