

# Output Devices

## **Printers**

# Printers

A printer is an output device used to transfer text and graphics from a computer onto paper.

The printed copy is called a hardcopy.

Two types of printers are:

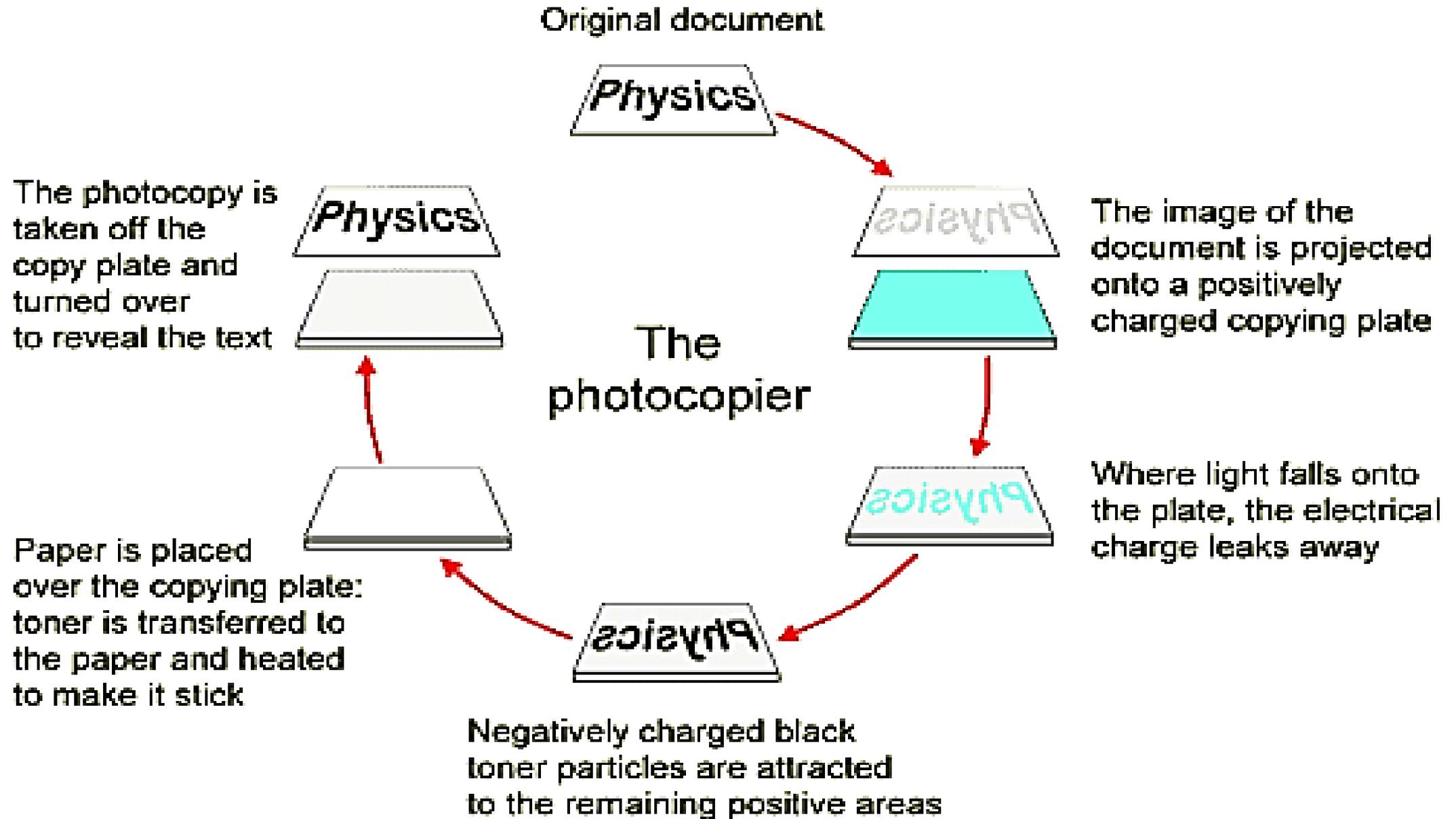
1. Laser printers
2. Inkjet printers.

# Laser printer

## How it works:

- A drum is charged up with electrostatic charge
- A laser beam transfers the image to be printed onto the drum, discharging the bits where it shines but leaving the remainder still charged
- Toner is then put on the drum. It sticks where the charge remains, but falls off where the laser has discharged it
- Heat and pressure is applied to transfer toner to the paper and fuse it on.

# How Laser printers work



# Features of Laser printer

- Uses powdered ink stored in toner cartridges
- Uses a (charged) printing drum and fuser to melt and fix ink onto the paper
- Can print very fast
- Produces high quality printouts
- Useful when printing a large number of high quality output, e.g. leaflets, brochures

# Laser printer Exam Question - NOV 2015 P12 Q 8

The steps to print a document using a laser printer are shown in the table below. Put each step in the correct order. The first step has been done for you. Work out the question, then check the answers on the next page.

Step	Order
As the printing drum rotates, a laser scans across it; this removes the positive charge in certain areas	
The printing drum is coated in positively-charged toner; this then sticks to the negatively-charged parts of the printing drum	
The paper goes through a fuser which melts the toner so it fixes permanently to the paper	
The printer driver ensures that the data is in a format that the laser printer can understand	1
A negatively-charged sheet of paper is then rolled over the printing drum	
Data is then sent to the laser printer and stored temporarily in the printer buffer	
The toner on the printing drum is now transferred to the paper to reproduce the required text and images	
The printing drum is given a positive charge	
Negatively-charged areas are then produced on the printing drum; these match exactly with the text and images to be printed	

# Steps to print a document using a laser printer.

- 1 The data from the document is sent to a printer driver
- 2 The printer driver ensures that the data is in a format that the laser printer can understand
- 3 Data is then sent to the laser printer and stored temporarily in the printer buffer
- 4 The printing drum is given a positive charge
- 5 As the printing drum rotates, a laser scans across it; this removes the positive charge in certain areas
- 6 Negatively-charged areas are then produced on the printing drum; these match exactly with the text and images to be printed
- 7 The printing drum is coated in positively-charged toner; this then sticks to the negatively-charged parts of the printing drum
- 8 A negatively-charged sheet of paper is then rolled over the printing drum
- 9 The toner on the printing drum is now transferred to the paper to reproduce the required text and images
- 10 The paper goes through a fuser which melts the toner so it fixes permanently to the paper

# 8 Laser printers - Benefits and drawbacks

## **Advantages:**

- Quiet and fast
- Long lasting
- Produce high quality printouts
- Cost per page is lower than other printers

## **Disadvantages:**

- Initial cost of printer is high
- Toner is expensive
- Heat emanating while printing may cause inconvenience

# Laser printers

## Uses:

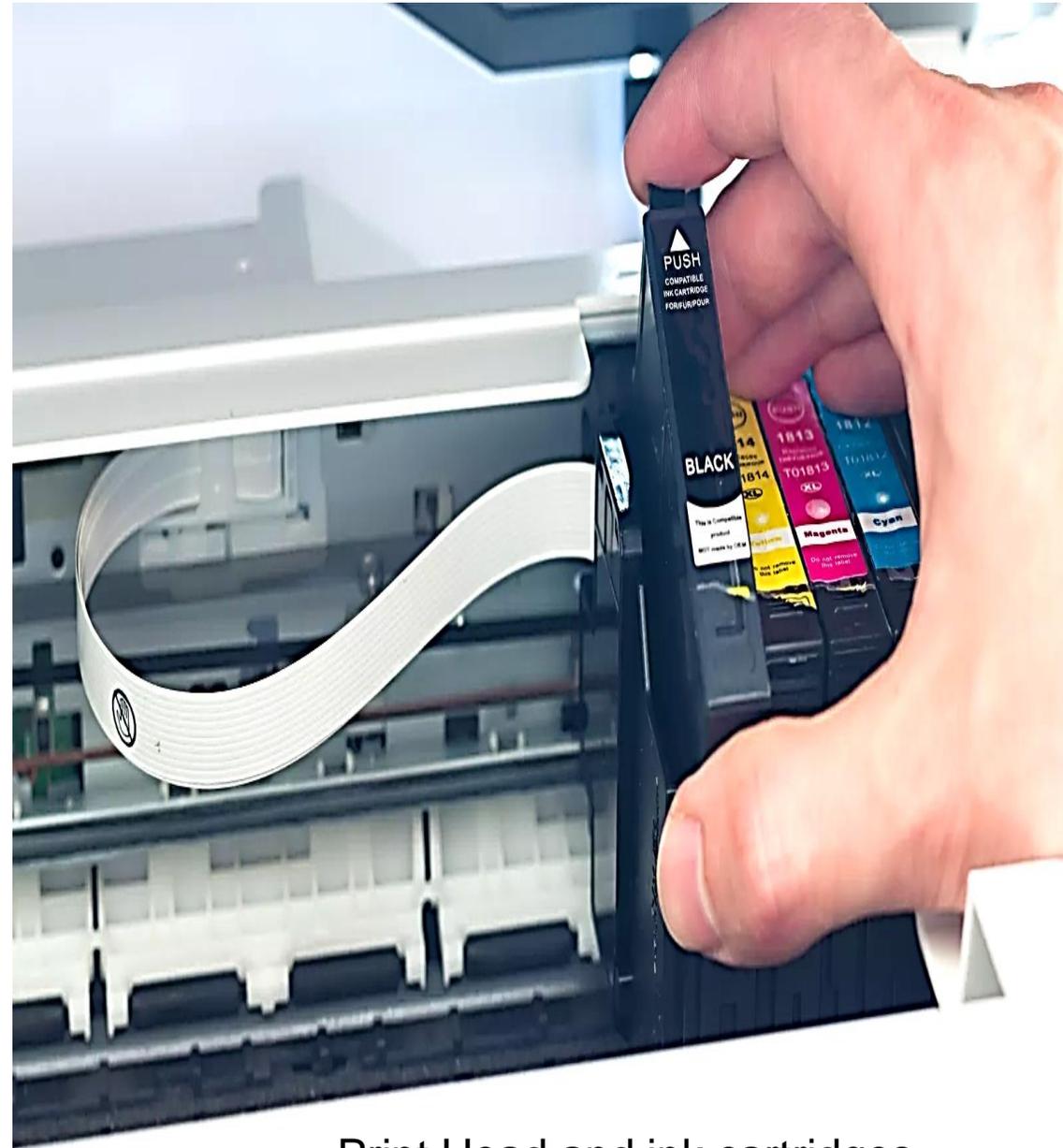
- Anywhere where large amount and high quality printout is required e.g.
  - Printing company stationery
  - Making labels
  - Creating company leaflets
  - Brochures

# Inkjet printers

- An inkjet printer is an output device.
- Characters and graphics are formed by spraying tiny drops of liquid ink on paper
- Inkjet printers are the most popular choice for home printing needs.

# Inkjet printers principles of operation

- uses cartridges of liquid ink
- ink droplets are produced using two different technologies:
  - thermal bubble
  - piezoelectric
- ink in droplets are sprayed on the paper using a moving print head
- a stepper motor and belt moves the print head across the page from side to side
- a paper feed automatically feeds the printer with pages as they are required



Print Head and ink cartridges

# Steps in the printing process using Inkjet printers

1	The data from the document is sent to a printer driver
2	The printer driver ensures that the data is in a format that the chosen printer can understand
3	A check is made by the printer driver to ensure that the chosen printer is available to print (e.g. is it busy, is it off line, is it out of ink, and so on)
4	The data is then sent to the printer and it is stored in a temporary memory known as a printer buffer
5	A sheet of paper is then fed into the main body of the printer; a sensor detects whether paper is available in the paper feed tray. if it is out of paper (or the paper is jammed) then an error message is sent back to the computer
6	As the sheet of paper is fed through the printer, the print head moves from side to side across the paper printing the text or image; the four ink colours are sprayed in their exact amounts to produce the desired final colour
7	At the end of each full pass of the print head, the paper is advanced very slightly to allow the next line to be printed; this continues until the whole page has been printed
8	If there is more data in the printer buffer, then the whole process from stage 5 is repeated until the buffer is finally empty
9	Once the printer buffer is empty, the printer sends an interrupt to the processor in the computer; this is a request for more data to be sent to the printer; the whole process continues until the whole of the document has been printed

# Inkjet printers – Uses/Advantages/Disadvantages

## ■ Uses

- It is a printer, capable of printing high-quality documents.
- It is suitable for small quantity but high quality photographs at home

## ■ Advantages:

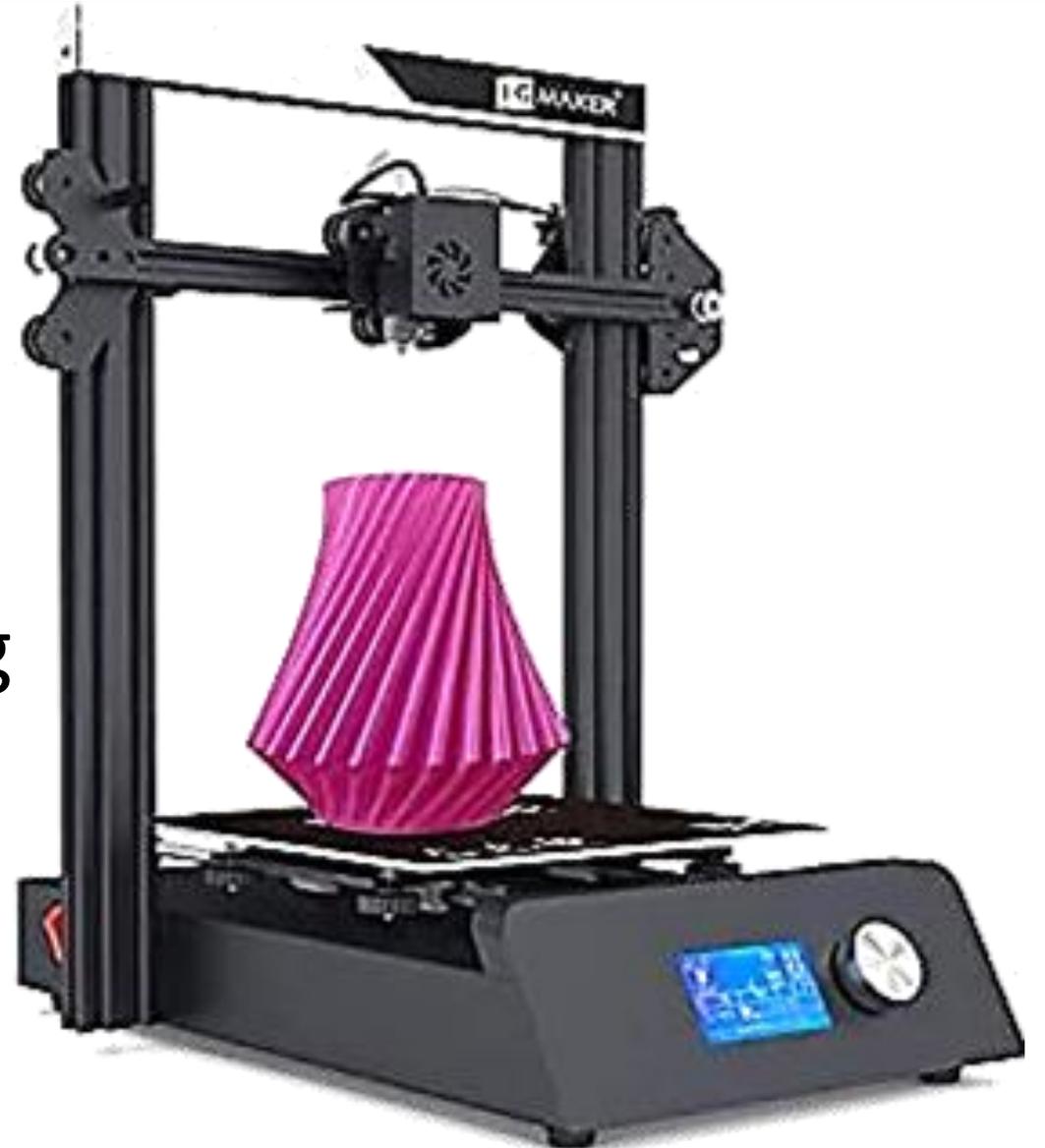
- Can print high quality colour printouts
- Inkjet printers are not expensive to buy

## ■ Disadvantages

- Ink cartridges can be expensive
- Printing speed slower compared to laser printer.

# 3D printers

- A 3D printer takes 3D computer model and turns it into a real object that may really work.
- The digital model is created using a 3D scanner (Recall 3D Scanners from chapter : Input devices).



A 3D printer used to print a vase

# 3D printer – How it works

- Uses additive manufacturing i.e. it
  - Creates a 3D object applying layer by layer of material such as:
    - Plastic
    - Resin
    - Clay
    - Ceramic
    - Powdered Metal
- until the whole object is complete.

# 16 How to create a solid object using a 3D printer

Read textbook chapter 5 figure 5.30

A design is made using computer-aided design (CAD) software

The finalised drawing is imported into some special software that prepares it in a format which is understood by the 3D printer

The 3D printer is set up to allow the solid object to be made

The solid object is built up layer by layer (often only 0.1 mm thick); this can take several hours, depending on the thickness of the layers, the material used and the size of the final object

The object is removed from the printer and is then prepared; for example, some use a jelly-like support which needs to be washed away by immersion in water, some require the removal of excess plastic powder and others require the cutting away of unused material; in many cases, the object has to be left to 'cure' for a few hours

# Uses of 3D printers

- Create decorative objects for home use
- Buy a digital image and print your own object e.g. shoes
- Replicate toys, jewellery, weapons
- Health : to create artificial organs for transplant
- Industry: to create prototype/ machine parts
- Visit <http://3dprinting.com> for many other uses

# 3D printers

## Advantages:

- Economical – cost less than real thing
- Nearly anything can be printed
- Can print movable parts
- Consumers will be able to do their own manufacturing rather than buying products from other people.

# 3D printers

## Disadvantages:

- Expensive to buy a 3D printer, not everybody can afford
- No laws and regulations to prevent people from making illegal copies of anything e.g weapons , knives , guns
  - Could provide advantage to criminals, frauds.

# Homework 1

## Computer Science Workbook:

Page 35 Q 5(a) Read textbook before answering

Page 35 Q 5(b) + (c)

Page 34 Q 6 (a), (b) , (c)

# Homework 2

## Question from Past Exam Papers:

**1.(a)** Inkjet printers and laser printers are two common types of printer. Describe the features and principles of operation of each type of printer.

**(i)** Inkjet printer

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**(ii)** Laser printer

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**(b)** Another type of printer is the 3D printer.

**(i)** Describe 3D printing.

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**(i)** State one suitable application for a 3D printer

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# Homework 3

## Question from Past Exam Papers:

2. Nadia purchases a printer to print out her homework. The printer uses powdered toner rather than liquid ink.

(i) State the type of printer Nadia has purchased.

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(ii) Give **two** benefits of using this type of printer.

Benefit 1

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Benefit 2

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• (iii) Give **one** drawback of using this type of printer.

• Drawback 1

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