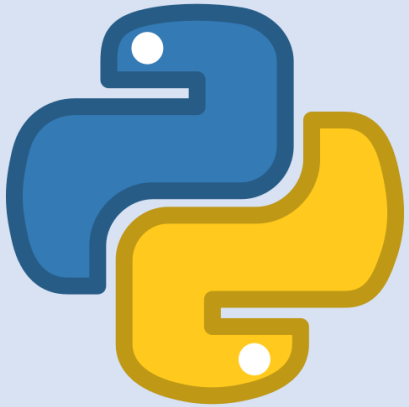
Introduction to Python Programming



Year 8 Unit 1 – Introduction to Python Programming

Your Keywords

Algorithm	A set of step-by-step instructions that tell a computer how to do something. *Example: A recipe for making a cake is an algorithm*
Program	A programming language that lets you write instructions for a computer in a way that is easy to understand. *Example: print("Hello, world!") is a simple Python program that displays a message.*
Python	A way to store information in a program that can be used and changed as the program runs. *Example: age = 12 stores the number 12 in a variable called age.*
Variable	Events in computer science are the 'triggers' for making actions happen. They are the yellow 'hat' blocks found at the top of the script.
Input	Information that you give to a computer program, often by typing on a keyboard. *Example: Typing your name into a program when it asks for it is giving input.*
Output	Information that a computer program gives back to you, usually by displaying it on the screen. *Example: When a program shows "Game Over" on the screen, that's output.*
Syntax Error	A mistake in the code that makes it impossible for the computer to understand and run the program. *Example: Forgetting a quotation mark in print("Hello, world!) causes a syntax error.*
Selection	A way for a program to make decisions using "if" statements to choose different paths based on conditions. *Example: if score > 10: print("You win!") checks if your score is greater than 10 and then prints a message.*

Key Questions

What are algorithms and programs?

Can you give an example of an 'IF' statement?

How do you correct a syntax error in a Python program?

Can you explain the flow of a program that takes an input and prints whether it is odd or even?

How can "<, <=, ==, => and >" be used in a Python program?

"For me, electronic music is like cooking: it's an organic activity where you can mix ingredients"
Jean-Michel Jarre

Year 8 – Python

Web Development: Python is used to build websites and web apps. Big websites like Instagram and YouTube use Python to run smoothly and manage all their users.
Game Development: You can create simple games using Python. Games like "Pygame" let you build your own fun games by writing Python code.
Data Science: Scientists and researchers use Python to analyze large amounts of data. It helps them find patterns and make important discoveries, like predicting weather or studying space.
Artificial Intelligence (AI): Python is used to create smart programs that can learn and make decisions, like virtual assistants (Siri or Alexa) or self-driving cars.
Automation: Python can automate boring or repetitive tasks. For example, it can help send automatic emails, organize files, or even control robots.

At the end of this unit you will know how to:
- Create programs using Python that use inputs and outputs
- Use randomness, selection, and iteration create a variety of programs

Skills you will be practicing from previous units:
- Y7 Scratch Essentials I
- Y7 Scratch Essentials II

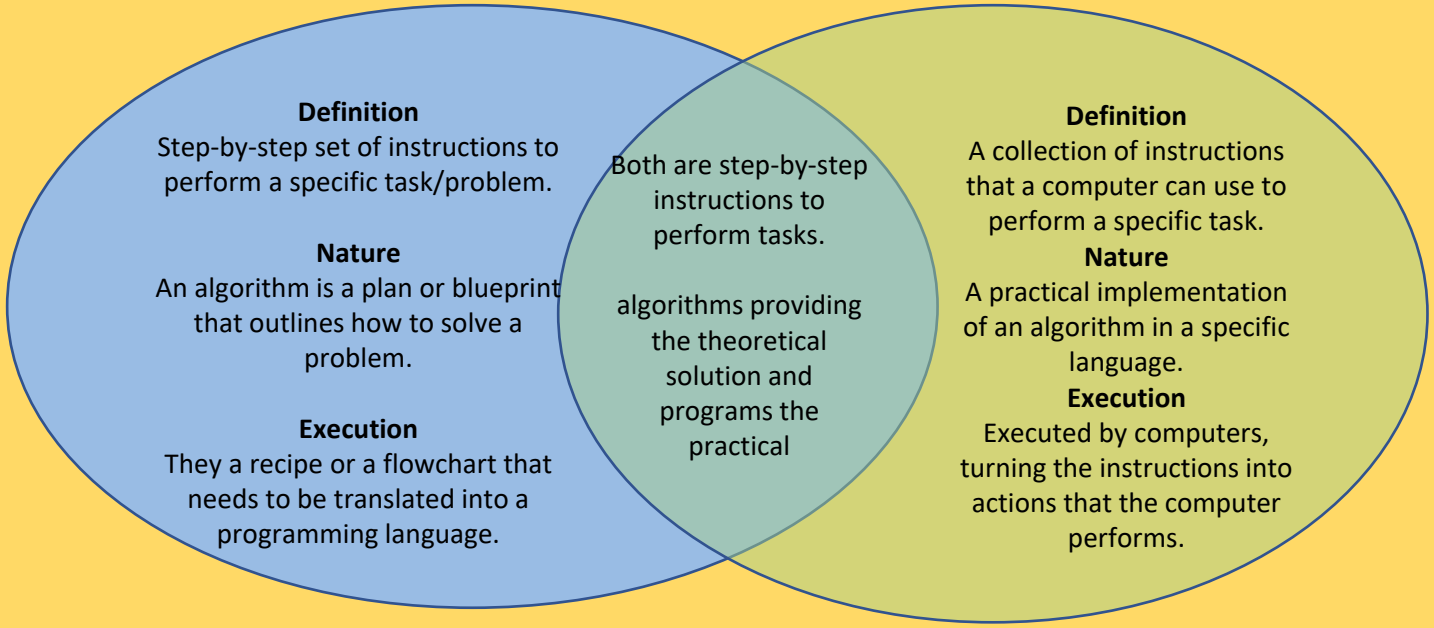
Examples of what you will produce by the end of the unit

```
from random import randint
questions = 0
while questions < 3:
  a = randint(2,12)
  b = randint(2,12)
  print(a, "times", b, "=")
  answer = int(input())
  product = a * b
  if answer == product:
    print("That is correct")
  else:
    print("I am sorry")
    print(a, "times", b, "is", product)
  questions = questions + 1
```

```
lucky = 13
guessed = False
while guessed == False:
  print("Can you guess my lucky number?")
  guess = int(input())
  if guess != lucky:
    print("Sorry, it's not", guess)
  else:
    print("Amazing, you guessed it")
print("Nice playing with you")from random import randint
```

Key Knowledge

“Describe what algorithms and programs are and how they differ.”



Locate and correct common syntax errors.

Read the Error Message:

Missing a Parenthesis (Bracket)

```
# Incorrect
print("Hello, world!"

# Correct
print("Hello, world!")
```

Improper Use of Tabs and Spaces

```
# Incorrect
if True:
   print("Correct")
 print("Well done!")

# Correct
if True:
   print("Correct")
   print("Well done!")
```

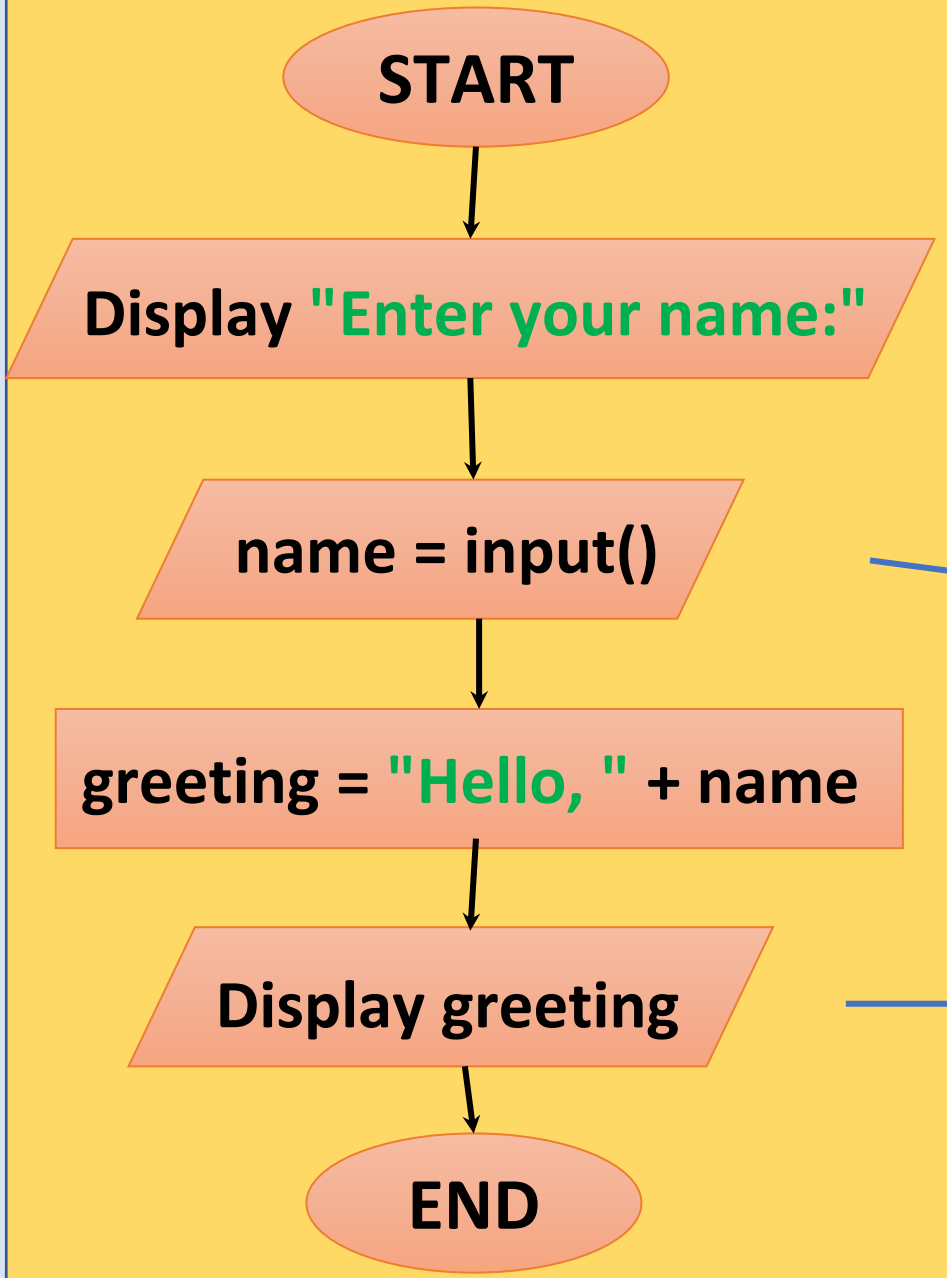
Variable Name Starts with a Number

```
# Incorrect
1st_place = "John"

# Correct
first_place = "John"
```

Missing Quotation Marks

```
# Incorrect
message = Hello, world!

# Correct
message = "Hello, world!"
```

Key Knowledge



Write simple Python programs that display messages, assign values to variables, and receive keyboard input.

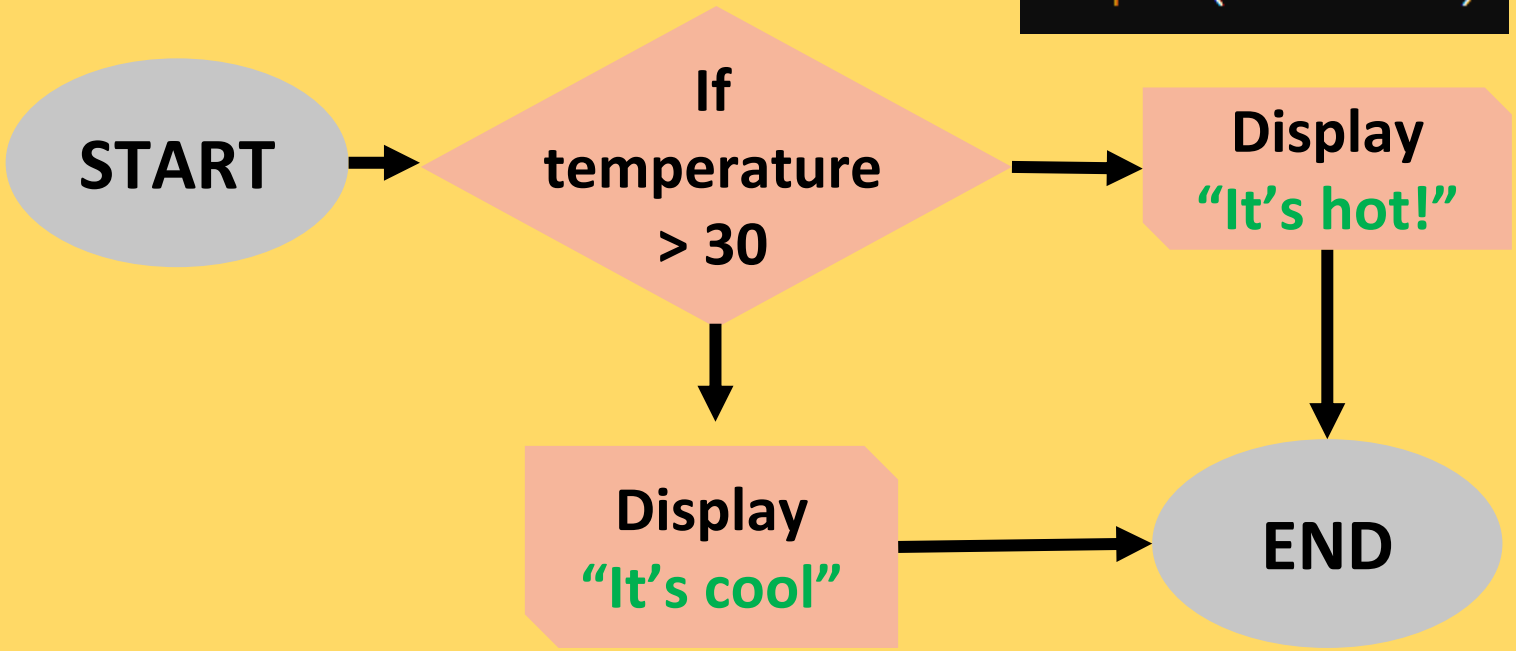
```
print ("Enter your name:")

name = input ()

greeting = "Hello, " + name

print (greeting)
```

Iteration: A loop that repeats a set of instructions until a condition is met.

Selection: Using if statements to choose different actions based on conditions.

```
for i in range(5):
    print(i)
```

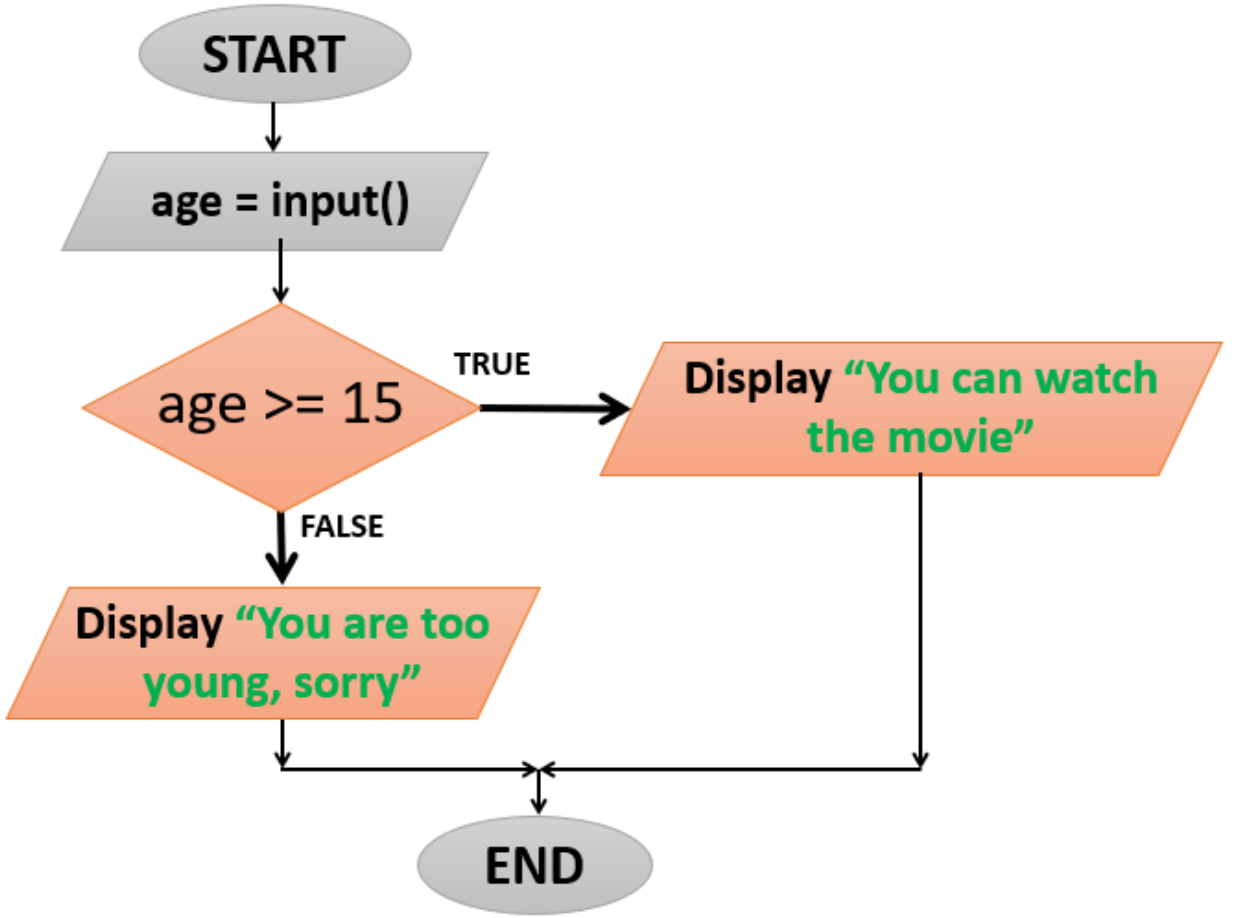
```
if temperature > 30:
    print("It's hot!")
else:
    print("It's cool.")
```



Combine iteration and selection to control the flow of program execution

Key Knowledge

Use **selection** (if-else statements) to control the flow of program execution.



Make and populate **lists.**

Populate a List:
Iteration and selection use loops to repeat actions (iteration) and if statements to make decisions (selection) to determine what the program does step by step

List with Different Data Types:
Python lists can hold elements of different data types (e.g., integers, floats, strings, etc.) in the same list.

```
mixed_list = [1, 2.5, "apple", True]
```

Make an empty List:
You can also create an empty list by simply using empty square brackets `**[ ]**`.

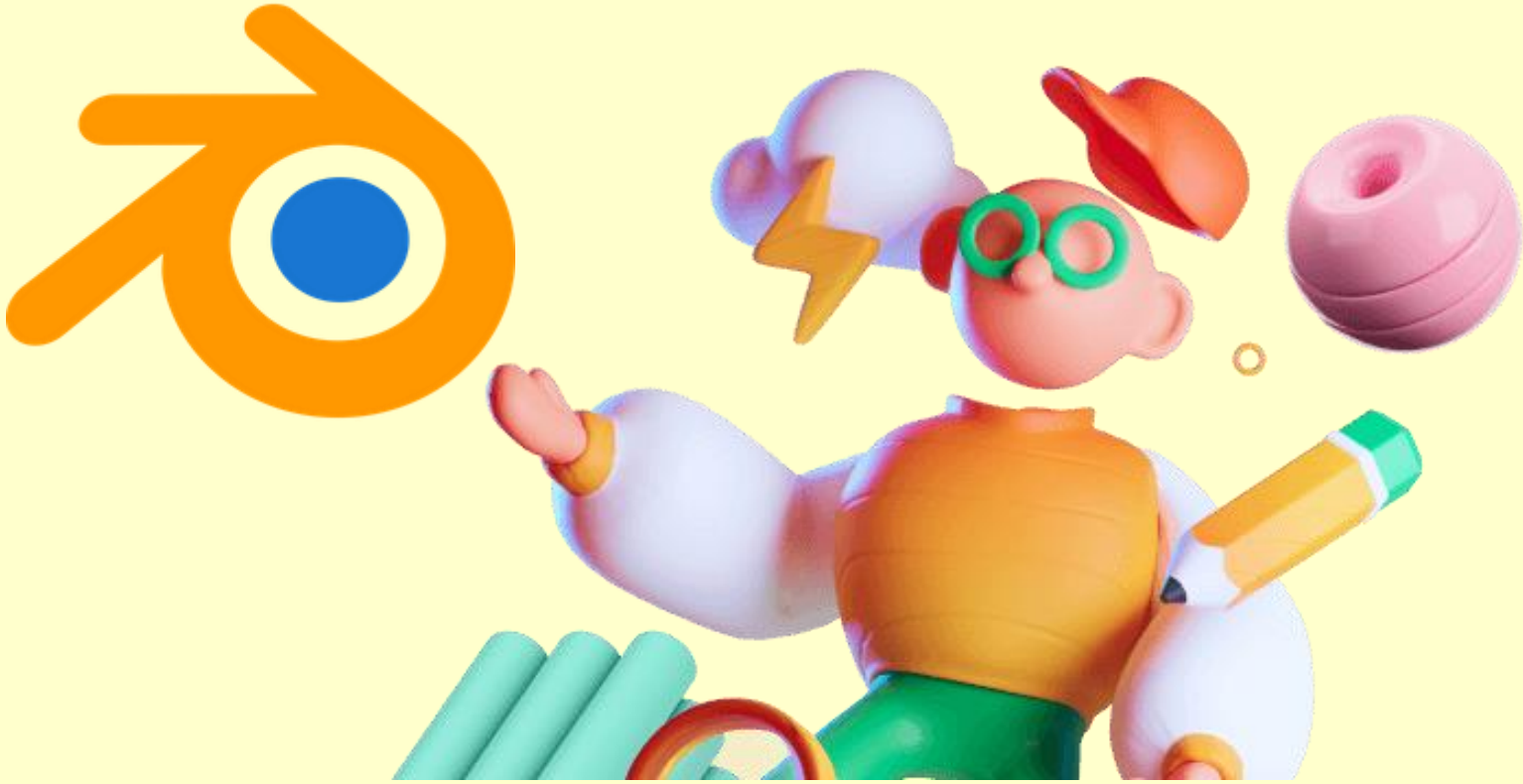
```
empty_list = []
```

Please screenshot your multiple choice quiz results

Please screenshot your program's code

Please screenshot your program running

Animations




INQUISITIVE


PERSISTENT


COLLABORATIVE


IMAGINATIVE


DISCIPLINED

Year 8 Unit 2 – Animation

From the first Fantascopes people have been fascinated by animation, pictures that are seemingly *living*.

Animation has been used throughout the world to attract attention and engage audiences and users. It is used in user interfaces and it has been used to help indicate progress and options to users, e.g. a progress animation helps users understand that a process is happening and / or how far along the process they may be. Animation may be used within films or TV programmes to explain complex topics.

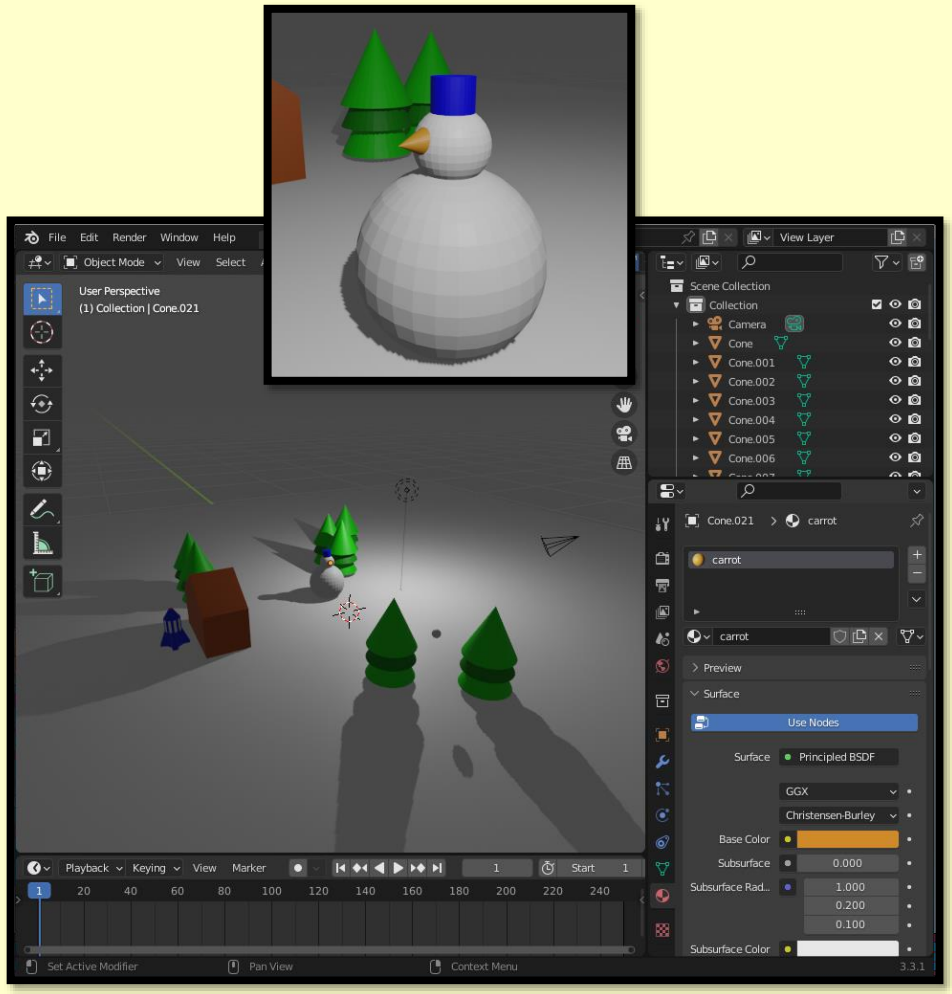
Films, television, computer games, advertising, and architecture have been revolutionised by **computer-based 3D modelling** and **animation**. In this unit you will discover how professionals create 3D animations using the industry-standard software package, **Blender**.

At the end of this unit you will know how to use **Blender** to create and manipulate **3D objects**. You will be able to control your objects by moving them through time, using **frames** of the **timeline** in order to create a 3D animation.

Skills you will be practicing from previous units:

- Y7 Graphics – creating and manipulating vectors;

Examples of what you will produce by the end of the unit



"Animation is about creating the illusion of life. And you can't create it if you don't have one."
— Brad Bird

Key Words / Skills	Definition and Example
Blender	Blender is a software used to create 3D models and animations for movies, games, and other digital media.
3D visualisations	3D modelling is the process of creating a three-dimensional digital representation of objects using special software.
Advertising leaflets	Flyers or papers that promote something, made by combining photos, designs, and information.
Texturing	Texturing is the technique of adding colour, patterns, and details to a 3D model to make it look realistic.
Rendering	An online collection of your work, like pictures and projects, to show what you can do.
Parenting	The specific group of people you want to reach with your work or message.
Proportional Editing	Proportional editing is a tool in 3D modelling that allows you to make smooth changes to a model by affecting nearby points around the one you're editing.
Subdivision:	Subdivision is a technique used to add more detail to a 3D model by breaking down its surfaces into smaller parts.

Key Questions

How do you add and move objects within an animation project?

What are key frames?

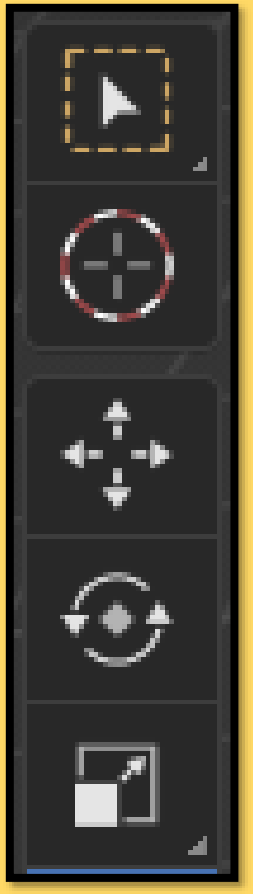
How do you scale and rotate objects?

How can you apply different colours to different parts of the same model?

How do you render an animation?

Add, delete, scale, rotate and move objects

Key Knowledge



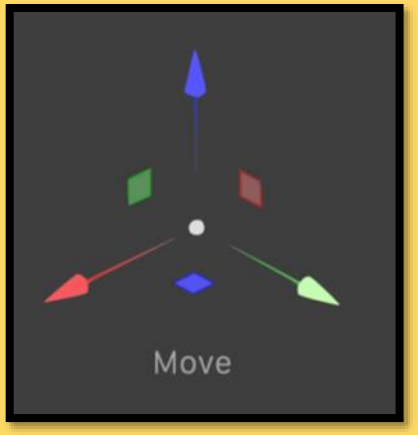
Select Box: used to select objects

Curser: put the curser where you want new objects to go

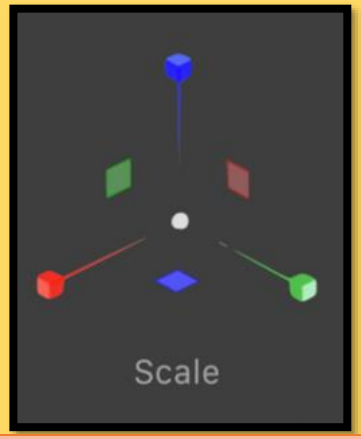
Move: select this to move the selected object

Rotate: select this to rotate the selected object

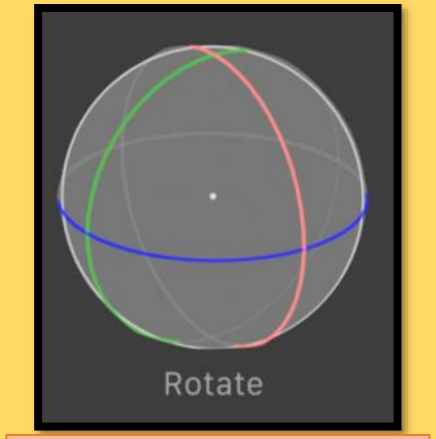
Scale: select this to scale the selected object



Pull these to move the object in the direction of the coloured arrow

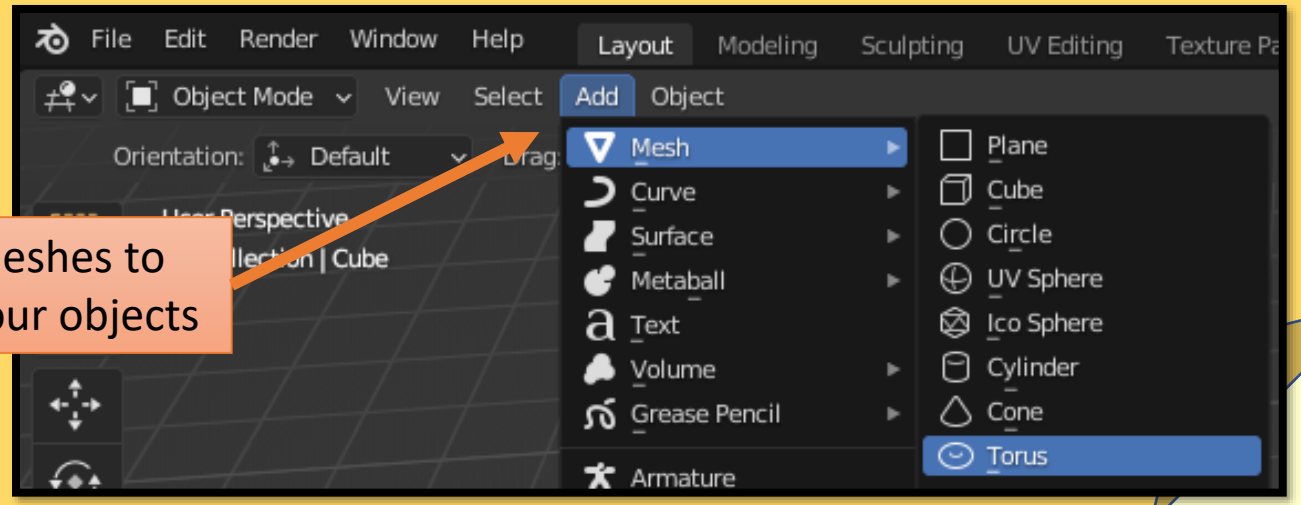


Pull these to scale the object in the direction of the coloured arrow



Pull these to rotate the object in the direction of the coloured line

Add meshes to make your objects



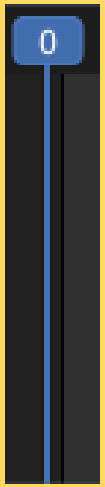
[Click here for LOOM Blender Basics: The Asset Collection, Adding and Removing Meshes and Move, Rotate and Scale]

Explain keyframes

A keyframe is an important point in an animation or video that shows the starting or ending position of an object.

1. Select the object you want to move
2. Move the marker to the frame you want the animation to begin
3. Press “I” on the keyboard to set the open the **keyframe** menu.
4. Choose the type of movement you want to capture e.g. location.
5. Move the keyframe to when you want the action to end.
6. Make the change e.g. move the object.
7. Add another **keyframe** using the **keyframe** menu using **I**.

2.



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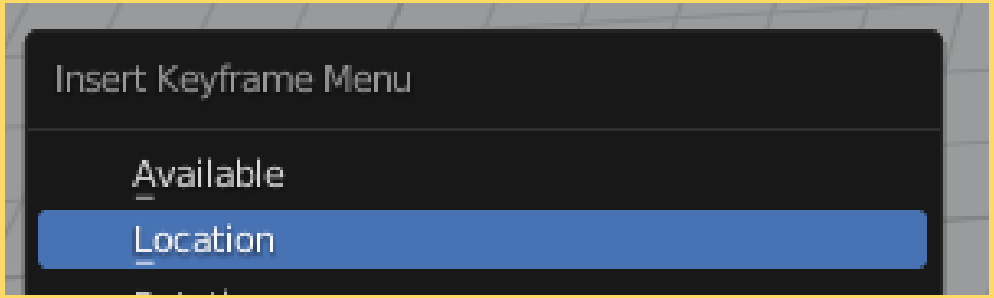

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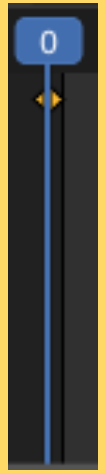
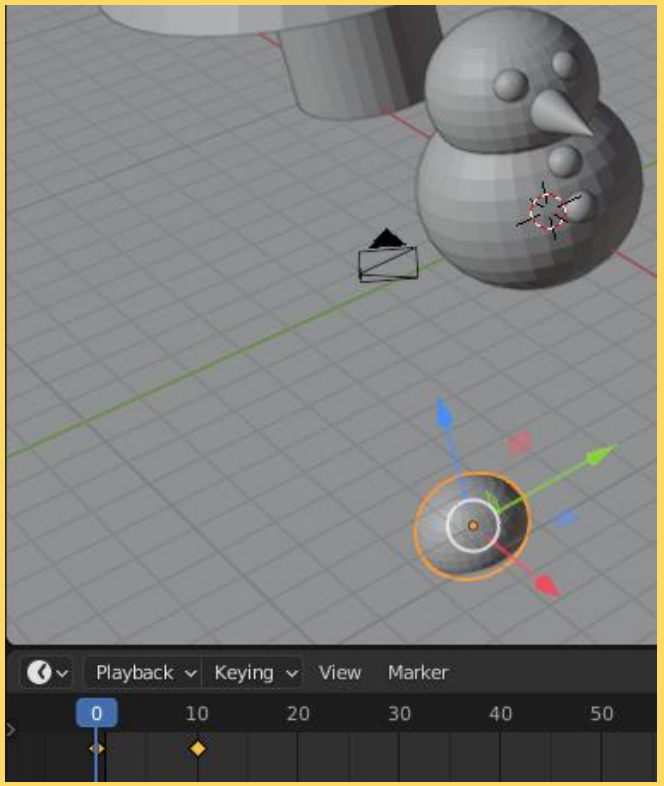
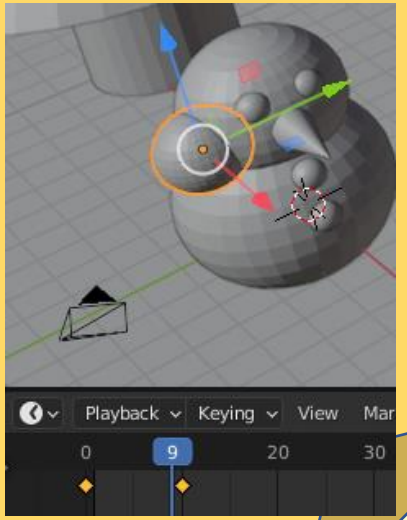


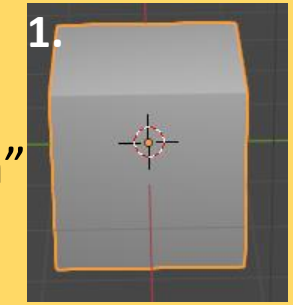


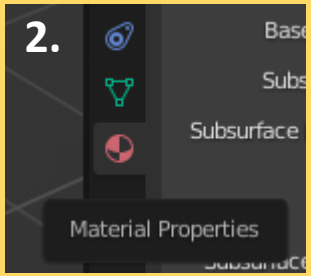


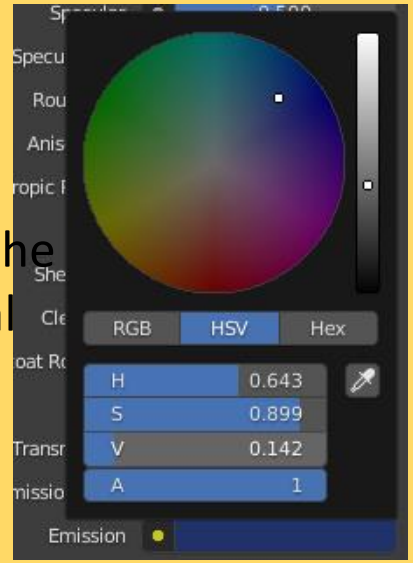
Apply different colours to a model

Changing the colour

1. Select the object
2. Click on the “material icon”
3. Select the first material
4. Click on the base colour
5. The colour can be changed using the colour wheel and the brightness with the vertical slider.



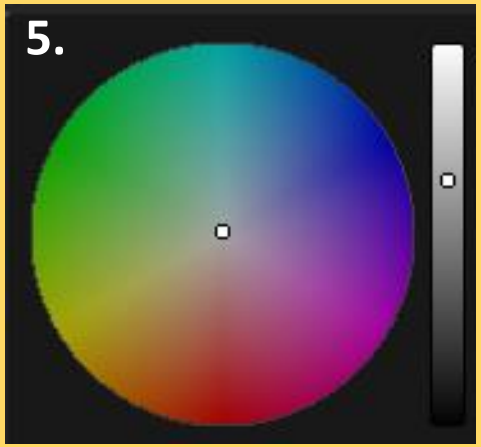


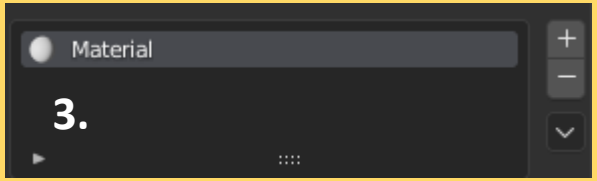


Want to make it glow?

1. Click emission

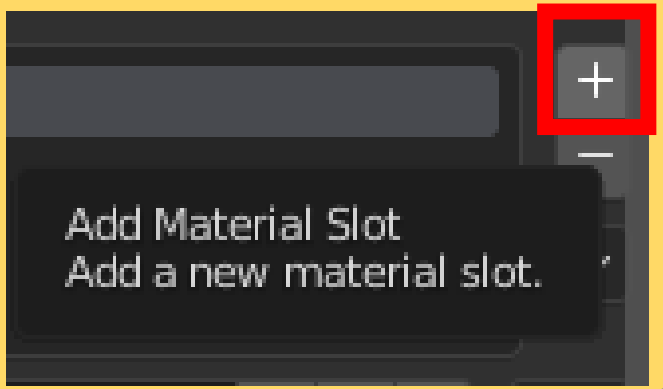
Change the colour change the brightness using the vertical slider





Need a new colour?

1. Click on the Material Properties tab (2)
2. Click on the **+** button to add a new material slot.



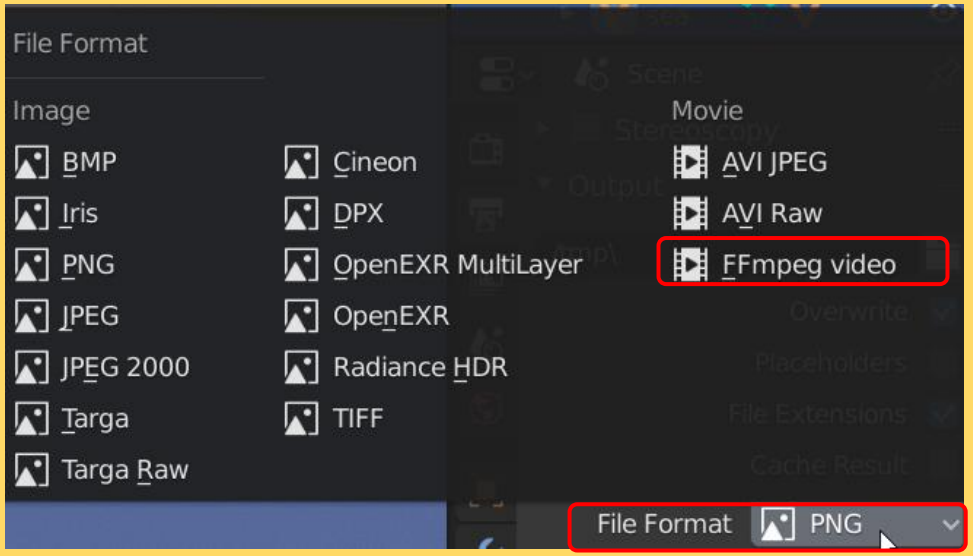
Can’t see colour?

Check that the *Viewport rendering* is *Rendered*

Render an animation

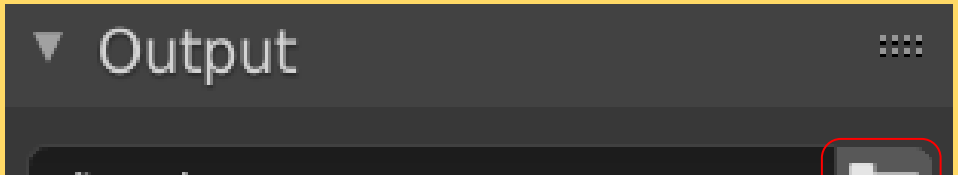
1. Switch in the **Output Properties tab**

Under **File Format**, select **FFmpeg** video:



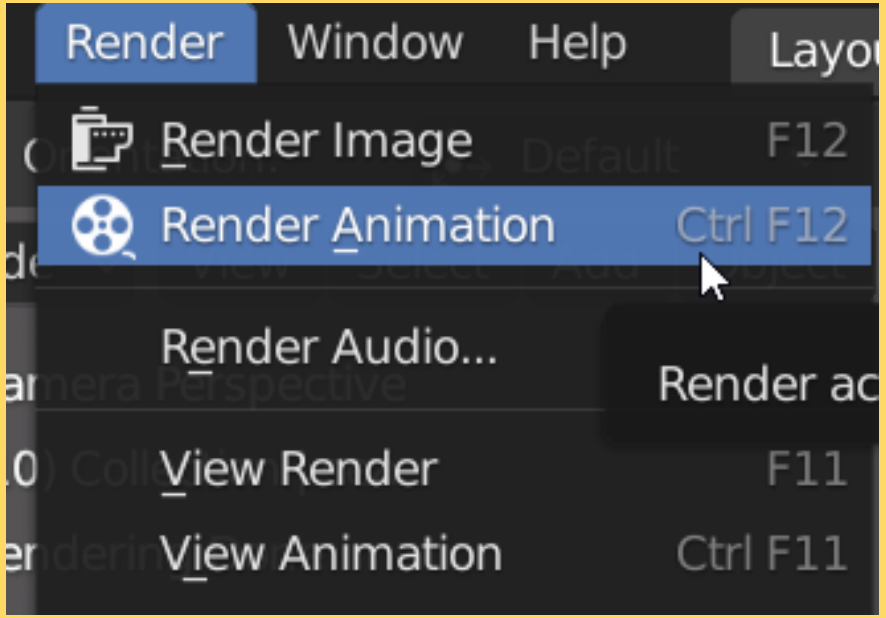
2. In the **Output Properties tab**

Find the output destination and click on the file image to choose where you want to save your video.

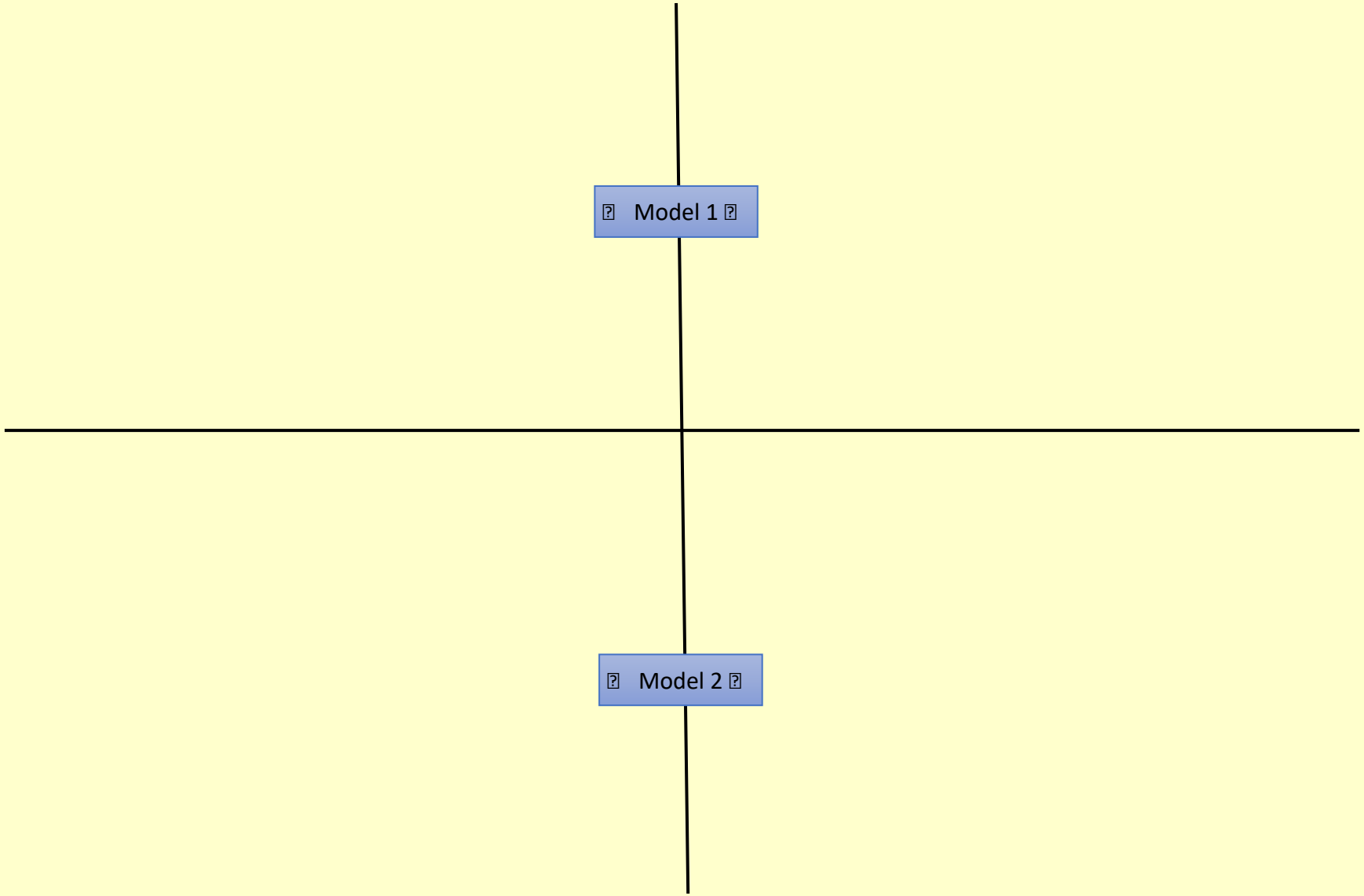


3. In the top left of the Blender interface, find the Render menu:

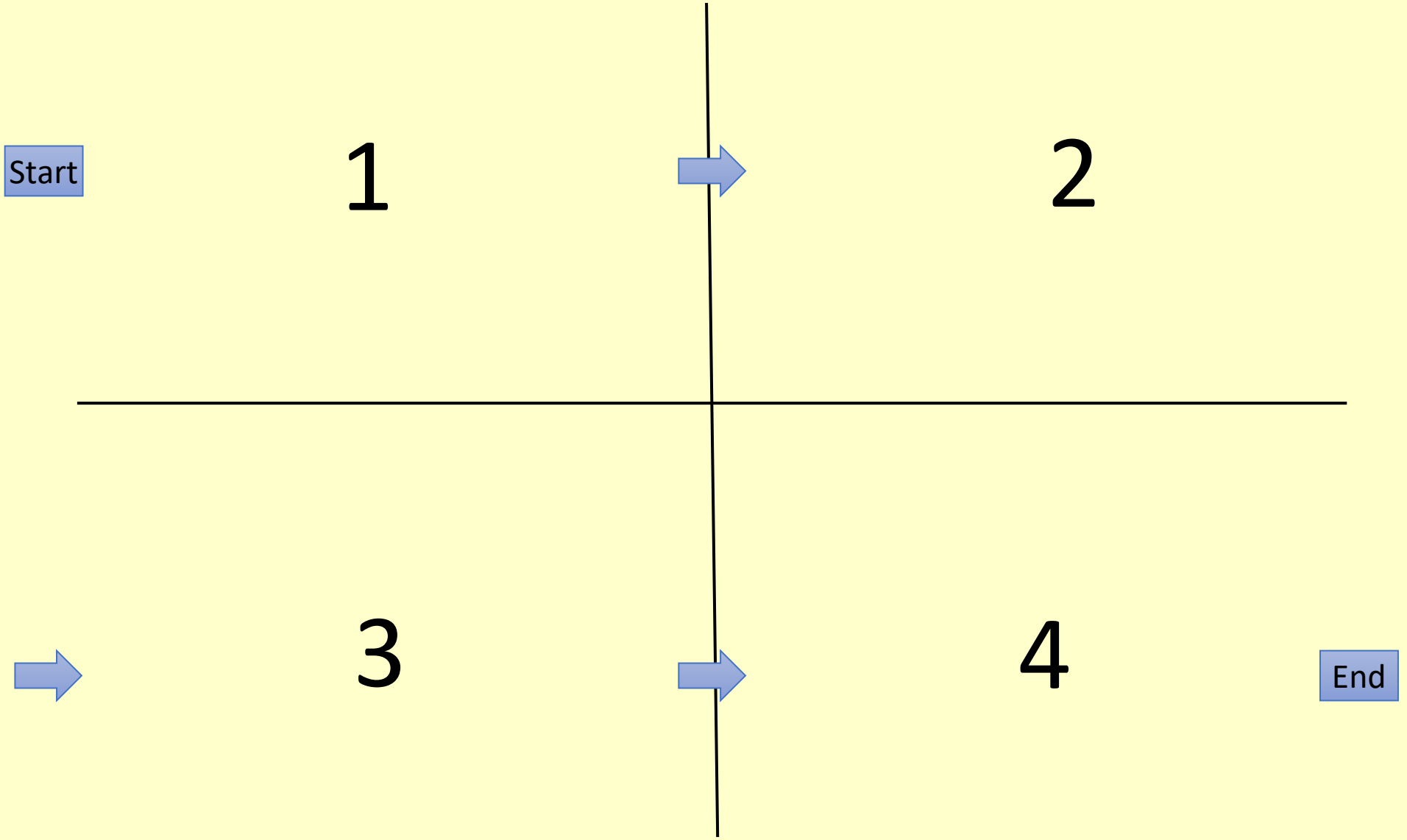
Render ▷ Render Animation



Take two screenshots of each model

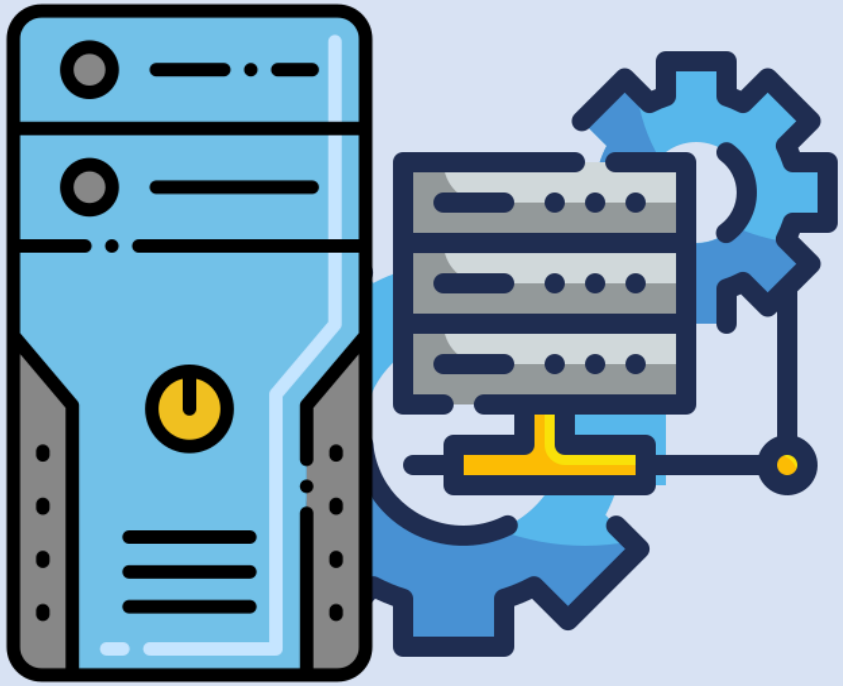


Take screenshots of your animation

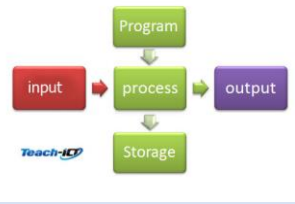


Please screenshot the results of your second attempt of the Animation quiz here

Computer Systems



Year 8 Unit 3 – Layers of Computer Systems



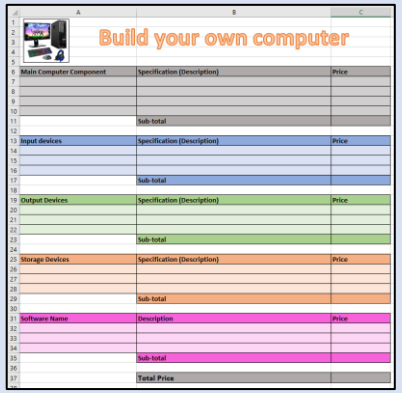
This unit takes learners on a **tour through** the different layers of computing systems: from programs and the operating system, to the physical components that store and execute these programs, to the fundamental binary building blocks that these components consist of. The aim is to provide a concise overview of how computing systems operate, conveying the essentials and abstracting away the technical details that might confuse or put off learners.

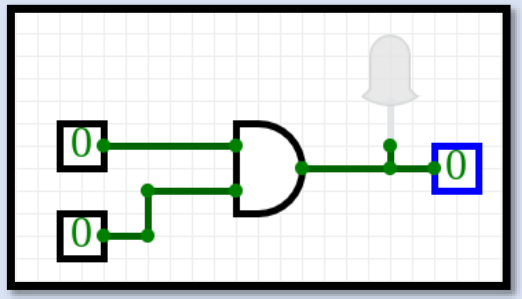
The last lessons cover two interesting contemporary topics: artificial intelligence and open source software. These are linked back to the content of the unit, helping learners to both broaden their knowledge and focus on the topics addressed in the unit. The unit assumes no prior knowledge.

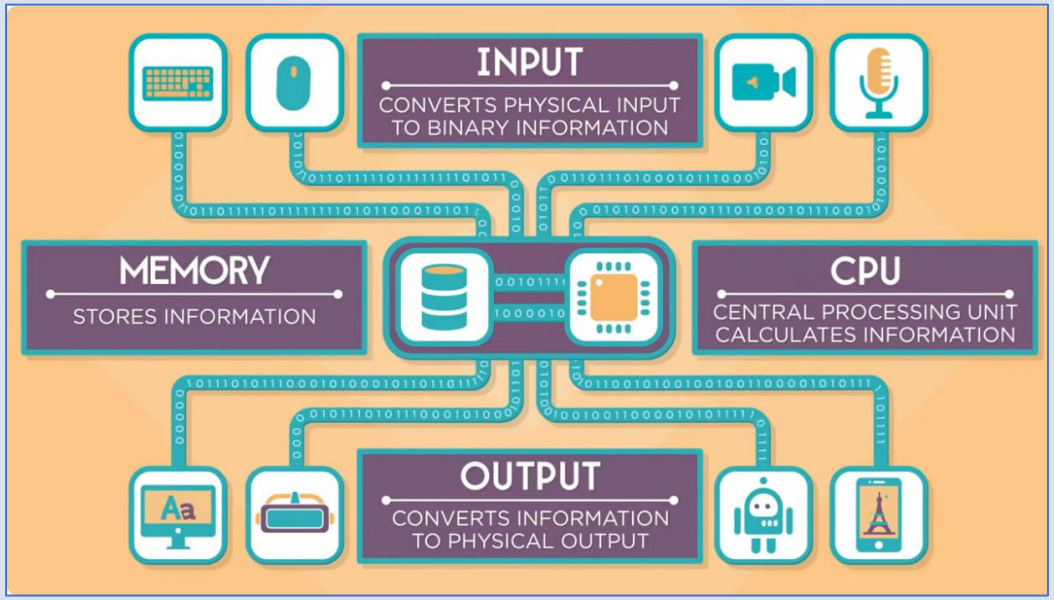
At the end of this unit you will understand what a **computer** is, you will be able to shop for selected computer components to build a computer system for your needs. You will also understands how the CPU that is found inside all computer systems work.

Skills you will be practicing from previous units:
Links to the 'Representations' units taught in Years 8 and 9, the Year 7 unit 'Networks from semaphores to the Internet' and Year 8 unit 'Developing for the web

Examples of what you will produce / learn by the end of the unit







"Unlocking the layers of computer systems reveals the symphony of hardware and software innovation." — ChatGPT

Year 8 – Layers of Computer Systems

Mobile App Development Keywords	
CPU Central Processing Unit	Free Computer Aided Design (CAD) software used for creating professional quality 3D animations and scenes
Motherboard	A point where one or more edges meet
RAM	A surface made up of three or more sides
ROM	A point where one or more edges meet
Peripheral	A line connecting two vertices
Input	A collection of faces, vertices and edges that create a single 3D object
Output	Transforms are operations that alter the position (move), size (scale) or orientation (rotate) of an object.
Process	A frame is a single image in a sequence to pictures. In general, one second of video is made up of 24 or 30 frames per second, also known as FPS
Logic Gate	A key frame is the frame that defines the starting and/or ending point of any smooth transition.

What is the CPU?

What is RAM?

Can you give an example of a general purpose and an embedded device?

Can you name three logic gates?

Can you name three operating systems?

Can you give an example of AI in the real world?

Can you give an example of a general purpose and an embedded device?

Embedded System

Not very **flexible.** They're **programmed** to do **one thing** and usually **can't be changed easily.**

Don't need much **interaction** from the user. Once you set a microwave, it does its job **without** needing more **input.**

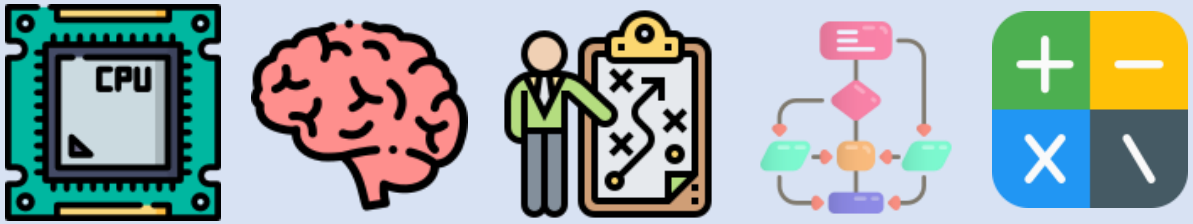
General System

Very flexible. You can install **different programs** and use the computer for **many different tasks.**

General Purpose Systems: Often need a lot of interaction. You use a keyboard and mouse to tell it what to do.

Embedded systems are like specialists that are very good at one job, while general-purpose systems are like jacks-of-all-trades that can handle many different tasks.

What is RAM?

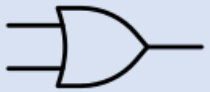


1. **Brain of the Computer**: Controls everything the computer does.
2. **Follows Instructions**: Runs programs by following instructions.
3. **Processes Information**: Handles input and output.
4. **Performs Calculations**: Does math quickly to run programs.

1. **Short-term Memory**: computer's short-term memory.
2. **Stores Data**: holds data and instructions that the CPU needs
3. **Temporary Storage**: Gets erased when the computer is turned off.
4. **Multitasking**: Allows the computer to run multiple programs at once

Name 3 logic gates

- **AND Gate**: Outputs 1 only if all inputs are 1.



- **OR Gate**: Outputs 1 if at least one input is 1.

- **NOT Gate**: Inverts its input (0 becomes 1 and 1 becomes 0).

- **NAND Gate**: Outputs 0 if all inputs are 1; otherwise, outputs 1.

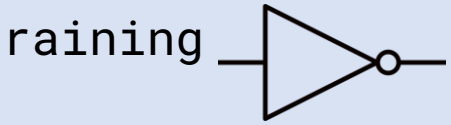
- **NOR Gate**: Outputs 0 if at least one input is 1; otherwise, outputs 1.

- **XOR Gate**: Outputs 1 if the number of 1 inputs is odd; otherwise, outputs 0.

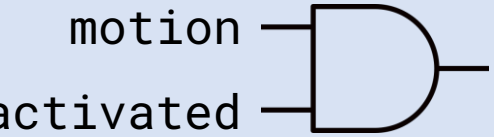
How are logic gates used to construct logic circuits? Provide an example.

0 

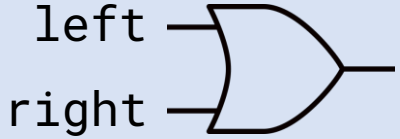
1



go out **not** raining



open motion **and** activated

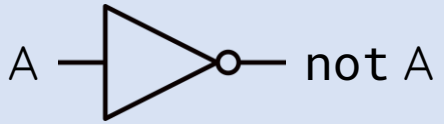


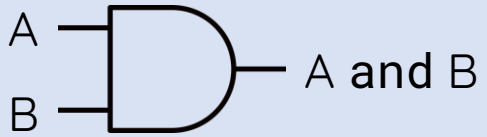
open left **or** right

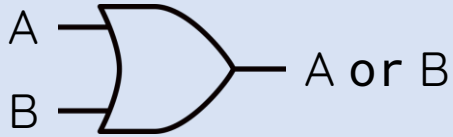
NAND Gate: Outputs 0 if all inputs are 1; otherwise, outputs 1.

NOT Gate: Inverts its input (0 becomes 1 and 1 becomes 0).

OR Gate: Outputs 1 if at least one input is 1.







Please screenshot the results of your multiple choice quiz here

Networks


INQUISITIVE


PERSISTENT


COLLABORATIVE


IMAGINATIVE


DISCIPLINED

Year 8 – Networking

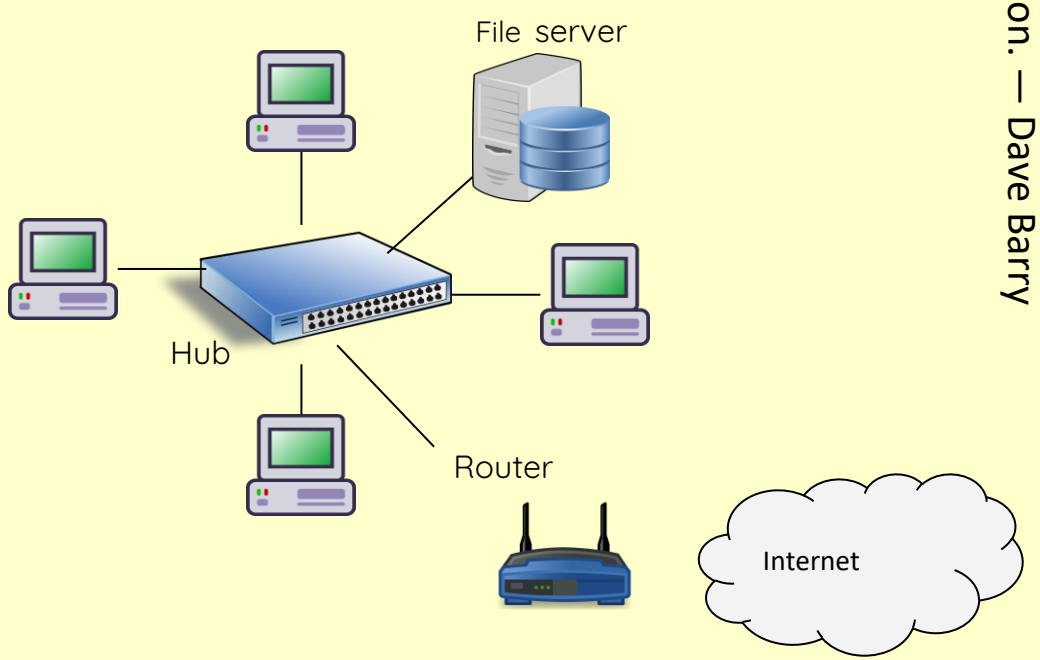
Imagine a world without computer networks: no YouTube, Google, instant messaging, online gaming, Netflix, or iTunes. Online shopping and instant directions wouldn't exist, nor would file sharing or central backups. Networks revolutionized learning, work, play, and communication.

This unit defines networks, their benefits, data transmission protocols, necessary hardware, and wired vs. wireless transmission. Learners will understand the internet, World Wide Web, and key services and protocols, with practical exercises enhancing comprehension.

By the end of this unit, students will understand the basics of computer networks, including key hardware components, data transmission methods, and the differences between the internet and the World Wide Web. They will be able to explain protocols, bandwidth, and internet services, as well as discuss the implications of internet-connected devices and the Internet of Things (IoT).

Examples of what you will produce by the end of the unit

Example of a simple network



The internet is one of the most important inventions in history because it has completely changed how we communicate and share information. — Dave Barry

Year 8 Unit – Networking

Mobile App Development Keywords	
Network	A group of interconnected computers and devices that can communicate and share resources with each other.
Protocol	A set of rules and standards used to communicate between computers and devices in a network.
Bandwidth	The maximum rate of data transfer across a network, measured in bits per second (bps).
Router	A device that forwards data packets between computer networks, directing traffic on the internet.
IP Address	A unique string of numbers separated by periods that identifies each computer using the Internet Protocol to communicate over a network.
Packet	A small segment of data that is sent over a network, containing both the data being sent and control information.
Internet	A global network of interconnected computers that communicate freely and share and exchange information.
World Wide Web (WWW)	A system of interlinked hypertext documents and multimedia content accessed via the internet using web browsers.
Wi-Fi	A wireless networking technology that allows devices to connect to the internet and communicate with each other over a wireless signal.
Internet of Things (IoT)	The network of physical objects embedded with sensors and software that connect and exchange data with other devices and systems over the internet.

What is a computer network?

Can you define the term 'protocol' ?

Can you name three pieces of network hardware?

Explain how data travels across the internet?

What is the difference between the internet and the World Wide Web?

Can you define the term 'protocol' ?

All methods of **communication** need **rules** in place in order to **pass on** the message **successfully**.

These sets of rules are called **protocols**.

In email an '@' symbol must be used.

The email address must be unique.

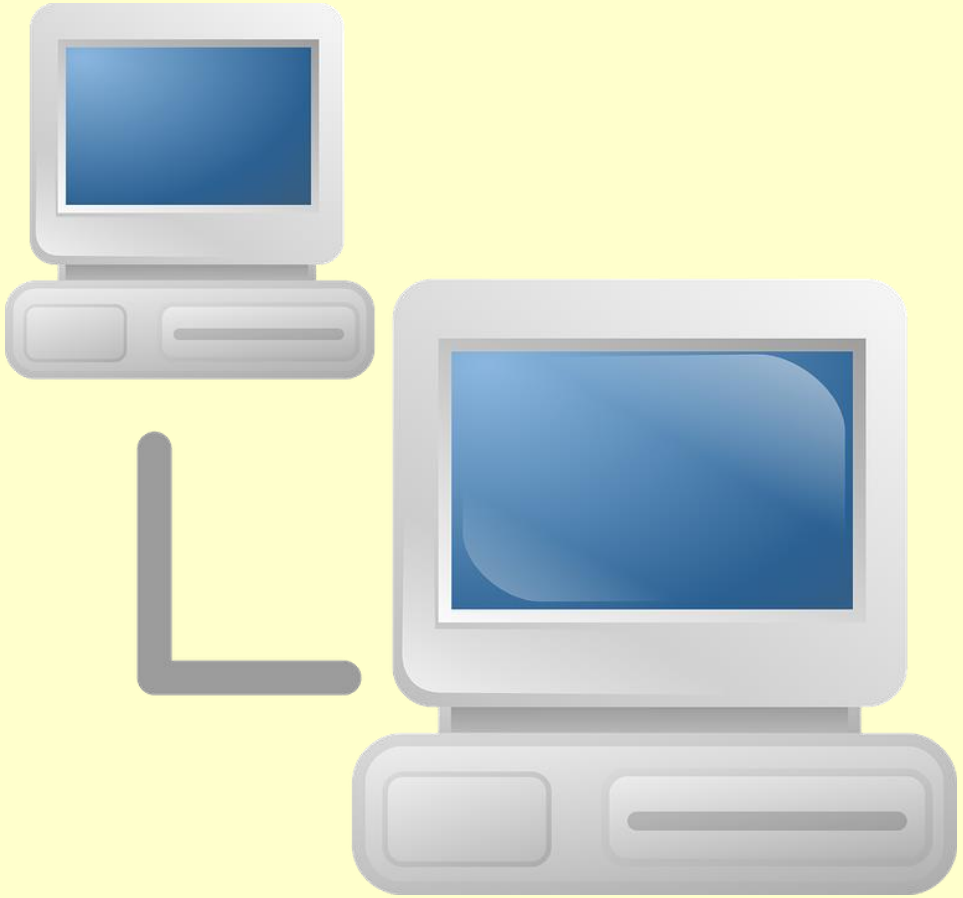
All **website addresses** start with **'http://'** followed by 'www'.

All **website addresses** are **unique.**

They use **dots** to **separate** each part of the **address**.

What is a computer network?

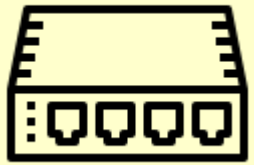
A **computer network** is when two or more **computers** are **connected together** to **allow** them to **communicate**.



Can you name three pieces of network hardware?

Router - Guides packet to next destination

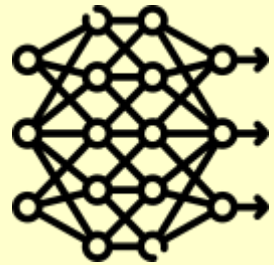
Hub – Takes physical cables from devices and enables packets to be sent to other connected devices



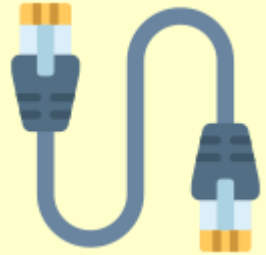
Access Point – uses radio waves to create connections between devices.

Explain how data travels across the internet?

- The internet is a worldwide network of computers



- It is the physical hardware, i.e. the cables, the routers, and other pieces of hardware used to connect devices together.



- Any device connected to the internet is part of this network

What is the difference between the internet and the World Wide Web?

The Internet:
Imagine the Internet as a huge network of connected computers all over the world.

These computers communicate with each other using special languages called protocols.

The Internet includes everything from websites and email to online games and video streaming.

The World Wide Web (WWW):
The World Wide Web is a part of the Internet.

Think of it like a giant library filled with billions of books. Each "book" is a website.

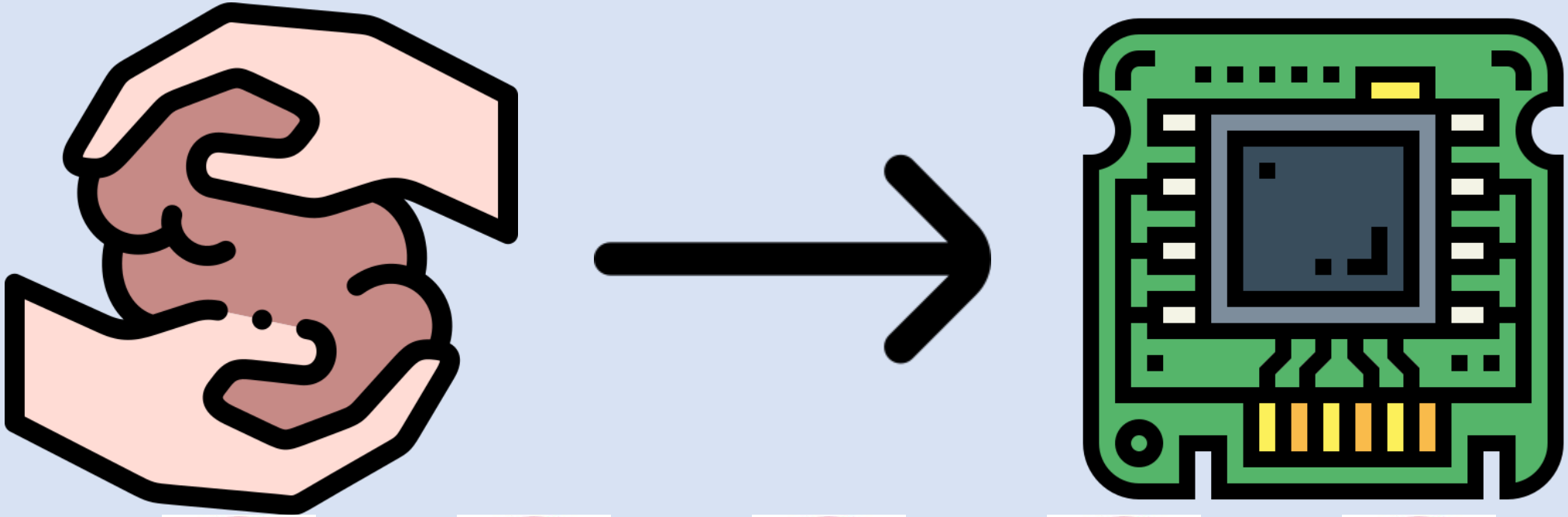
You access these websites using a browser (like Chrome, Safari, or Firefox).

Websites are made up of pages that contain text, images, videos, and links to other pages.

Please screenshot the results of your multiple choice quiz here

Representations

From Clay to Silicon



Year 8 – Representations

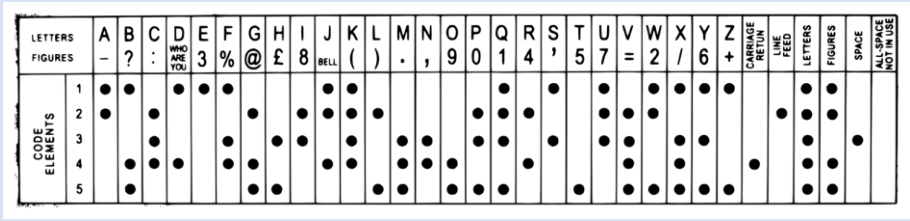
In this unit, "Representations: From Clay to Silicon," we'll learn about binary representations and how they're used in computing. We'll start by looking at old and familiar examples of representations to understand their use. Then, we'll do fun activities like encoding and decoding messages with different symbols and media, helping us see how text can be represented.

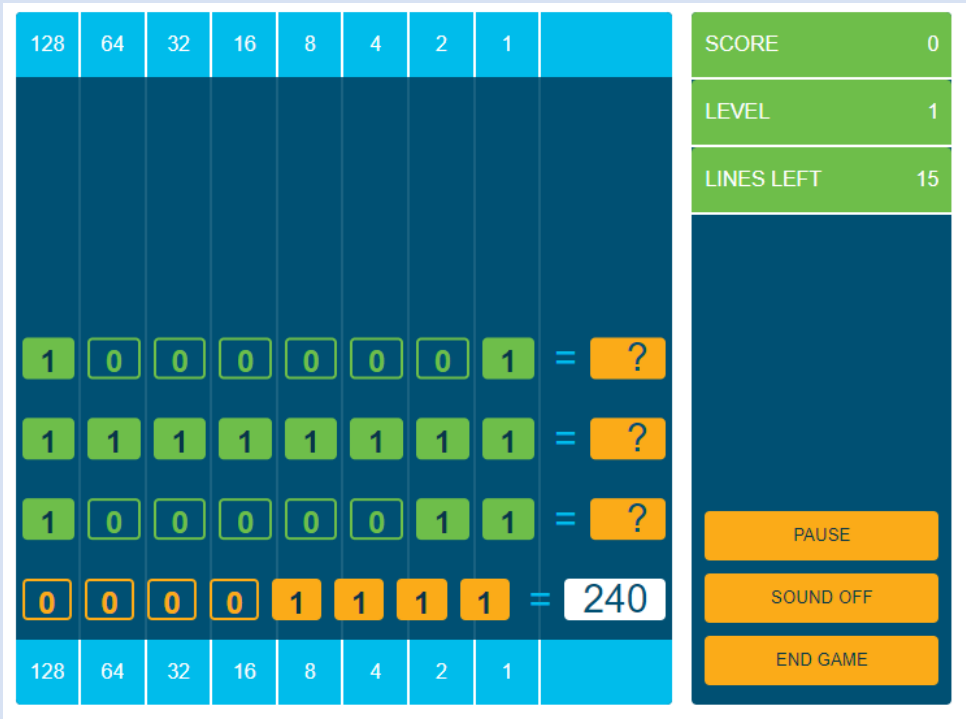
We'll also learn about binary digits, or bits, and how they relate to letters and numbers we know. We'll practice converting numbers between binary and decimal systems. We'll look at bytes and units like kilobytes and megabytes to understand how data size is measured. Finally, we'll wrap up with a quiz and a puzzle to test everything we've learned. By the end, you'll know how data is represented and manipulated using binary digits.

You'll work in groups to send messages using light, sounds, and other fun methods to learn how symbols can represent text. Then, we'll explore how computers use binary numbers and learn about data sizes like kilobytes and gigabytes

Skills you will be practicing from previous units:
Links to the 'Representations' units taught in Years 8 and 9, the Year 7 unit 'Networks from semaphores to the Internet' and Year 8 unit 'Developing for the web

Examples of what you will produce / learn by the end of the unit





"Binary is the language of computers, and understanding it helps unlock the mysteries of technology we use every day"
— Dan McCreary

Year 8 Unit 3 – Layers of Computer Systems

Keywords	
Representation	A way to display or describe information
Binary	A base-2 numeral system using only 0 and 1 to represent data
Digit	A single numerical symbol used to represent numbers.
Bit	The smallest unit of data in computing, representing a binary digit (0 or 1).
Byte	A line connecting two vertices
Encoding	The process of converting information into a different form or code.
Decimal:	A base-10 numeral system using digits 0-9
Decoding	The process of converting encoded data back into its original form.
Symbol	A character or mark used to represent something else.
Prefix	A unit of measurement indicating multiples of bytes (e.g., kilo-, mega-, giga-).

How do you convert a decimal number to binary and vice versa?

What are binary digits (bits)?

How are bits used on digital devices?

How are bits used on digital devices?

Why are representations important?

Electronic devices are built using circuits of interconnected **switches** that control the flow of **electricity**.

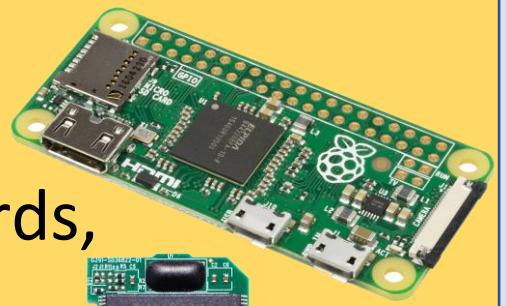
Why use just 2 symbols?
Why not 10, or 26, like humans?

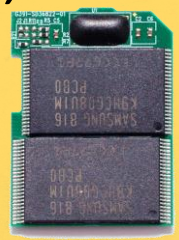
Building binary systems is **simpler**.

You can build a binary system using circuits of interconnected **switches**.

Each switch is binary:
it has two possible states.

processors (CPU, GPU)
main memory (RAM)
storage devices (SD cards, SSDs)
and any electronic component





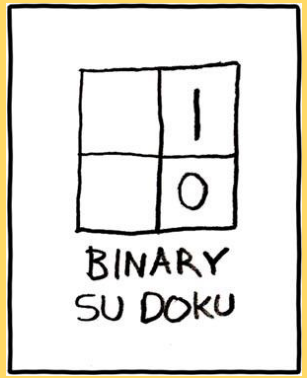
What are binary digits (bits) and how are they used in digital devices?

0 1

We call these symbols **binary digits**.
There are only 2 of them.

Common abbreviation:

binary digi**t** = **bit**



The bits behind the tweets

First message posted (in 2006) was:

`just setting up my twttr`

Twitter's coding scheme represents English characters as 8-bit sequences.

Binary digits are the symbols that digital devices use to do their 'writing'.

24 characters in the message
8 bits for each character

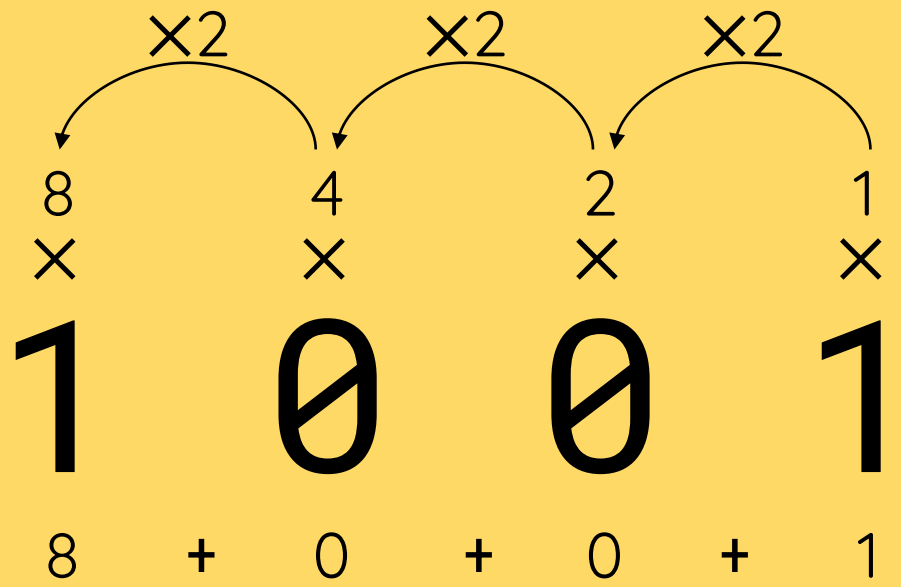
24 × 8 = **192 bits**

**Binary digits are symbols,
just like letters and words.**

j	01101010
u	01110101
s	01110011
t	01110100
	00100000
s	01110011 …

How do you convert a decimal number to binary?

Multipliers are **powers of 2**



The **sum of the products** is the number

8 + 0 + 0 + 1

9

in decimal

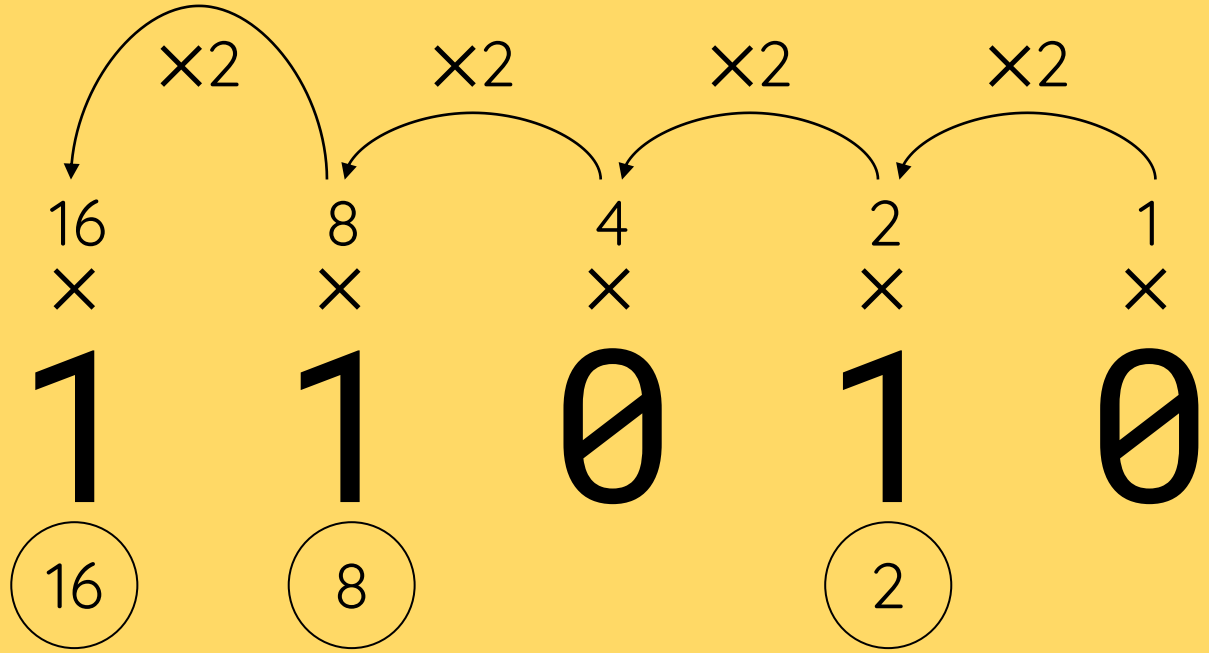
How do you convert a decimal number to binary?

Write multipliers over the bits:

Start with 1 on the right, and double as you go from right to left.

For each bit set to 1, select its corresponding multiplier.

Add up the selected multipliers: the sum is the decimal number.



26 in decimal

Why are representations important?



Computers need to store, process, and communicate information.

To **store** it (across time)
To **communicate** (across distance)
To **process** it




Sequences of symbols can represent any piece of information.

Computers use sequences of symbols to represent information.

Please screenshot the results of your multiple choice quiz here

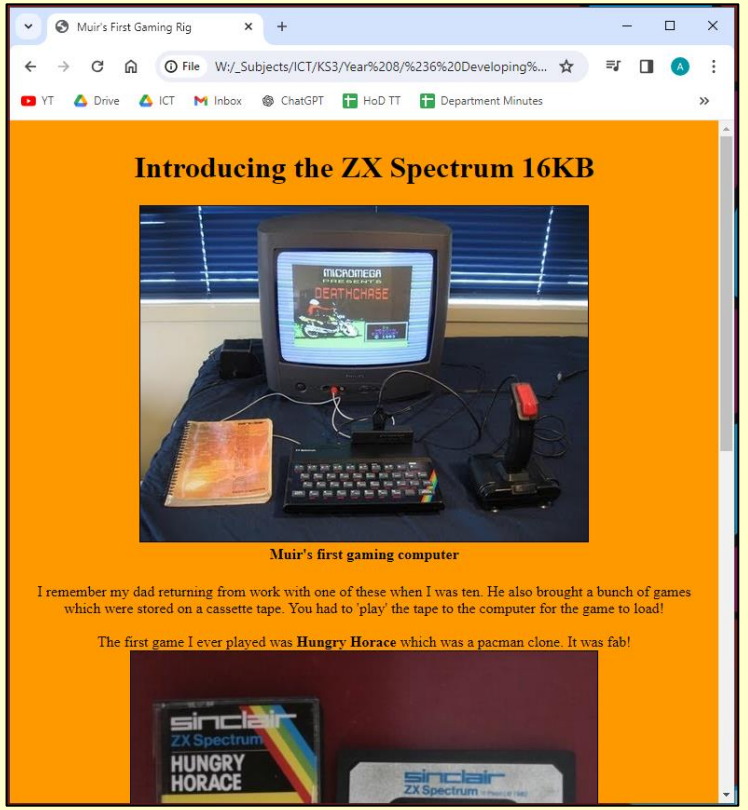
Developing for the web

Developing for the web

Learning HTML might sound a bit techy, but trust me, it's like having a **superpower for the internet**. HTML is like the skeleton of a webpage – it tells the computer where to put things like text, images, and links.

Once you get the hang of HTML, it's like **opening a door to a whole new world of tech skills**. These languages are like the building blocks for other coding adventures. It's not just about making awesome web pages now; it's about **setting yourself up for even cooler tech stuff in the future**.

Examples of what you will produce by the end of the unit



"The original idea of the web was that it should be a collaborative space where you can communicate through sharing information."
- Tim Berners-Lee, the inventor of the World Wide Web

Developing for the web

Keywords	
HTML (HyperText Markup Language)	The basic language used to create web pages. It tells the browser how to display text, images, and other content.
Web Page	A single page on the internet that can include text, images, videos, and links. It's like a page in a book but online.
World Wide Web (WWW)	The part of the internet where web pages live. It's like a giant library of web pages that you can visit using a browser.
Search Engine	A website like Google or Bing that helps you find other web pages by typing in keywords. It shows a list of results that match what you're looking for.
Hyperlink	A clickable word or image that takes you to another web page or a different part of the same page. It's like a digital shortcut.
Inline Styling	A way to change how a single part of a web page looks by adding style directly to HTML tags. It's quick but can get messy if used too much.
Element	A part of an HTML document, such as a heading, paragraph, or image. Each element has a specific purpose and is defined by HTML tags.
Attribute	A piece of extra information added to an HTML tag to change how an element looks or behaves. For example, the "**src**" attribute in an image tag tells the browser where to find the picture.

Key questions

What is HTML and how is it used to structure web pages?

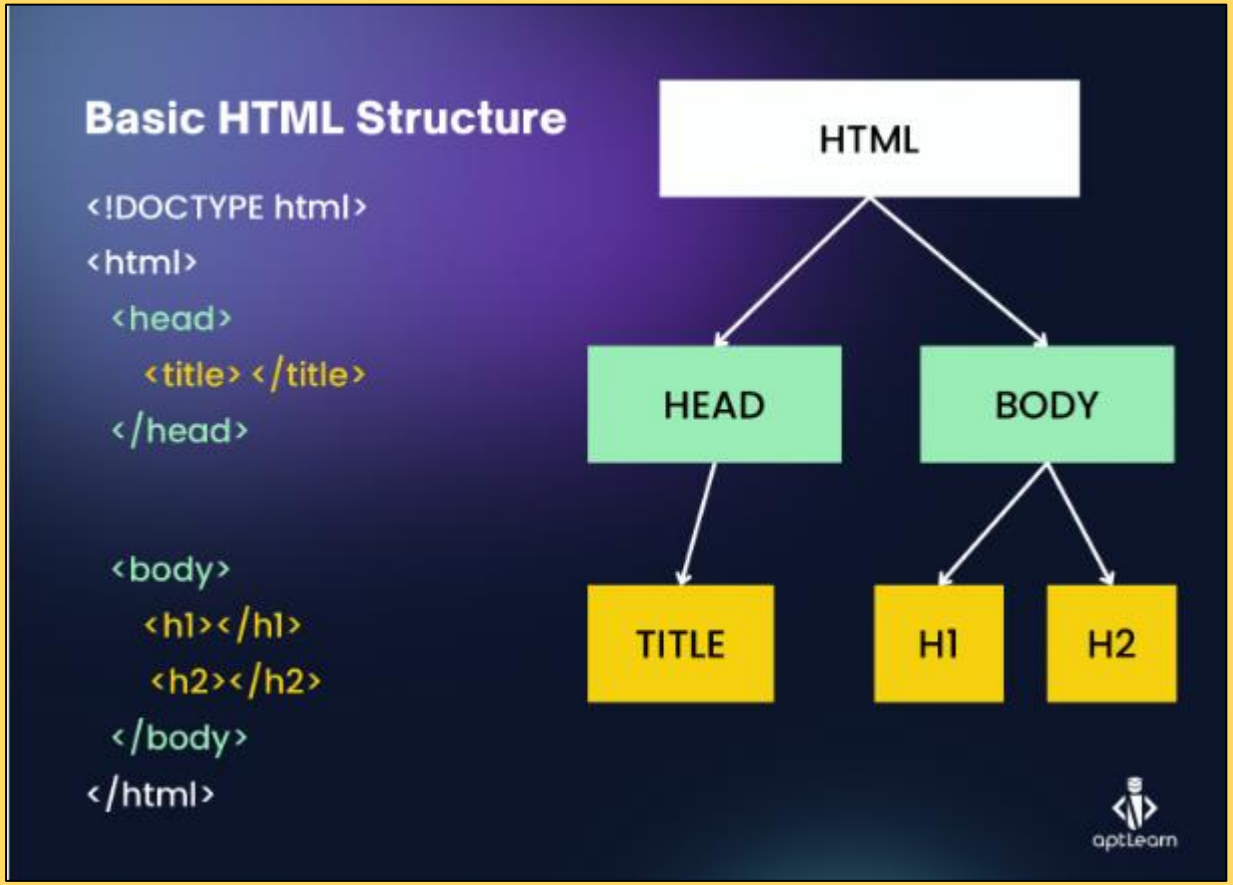
How do you create a simple HTML page with an image and a hyperlink?

How do search engines crawl through the World Wide Web and rank results?

Explain the impact of search technologies on web users and the issues that arise from their use.

Key Knowledge

Use HTML to Structure Web Pages




```
<html>
  ├── <head>
  │     ├── <title> (The house's title)
  └── <body> (The main content of the house)
        ├── <h1> (The main heading)
        ├── <p> (A paragraph of text)
        └── <div> (A section of content)
```

Click me for an online HTML tutorial

Key Knowledge

Modify HTML tags using inline styling to improve the appearance of web pages.

```
Before:
<p>This is a paragraph.</p>

After:
<p style="color: blue; font-size: 16px;">This is a styled paragraph.</p>
```

Create hyperlinks to allow users to navigate between multiple web pages.

```
HTML:
<a href="page2.html">Go to Page 2</a>
<a href="page3.html">Go to Page 3</a>

Flowchart:
[Home Page] ---> [Page 2]
                \
                 ---> [Page 3]
```

Please screenshot your multiple choice quiz results

Name:

Paste your website here

Paste your code here