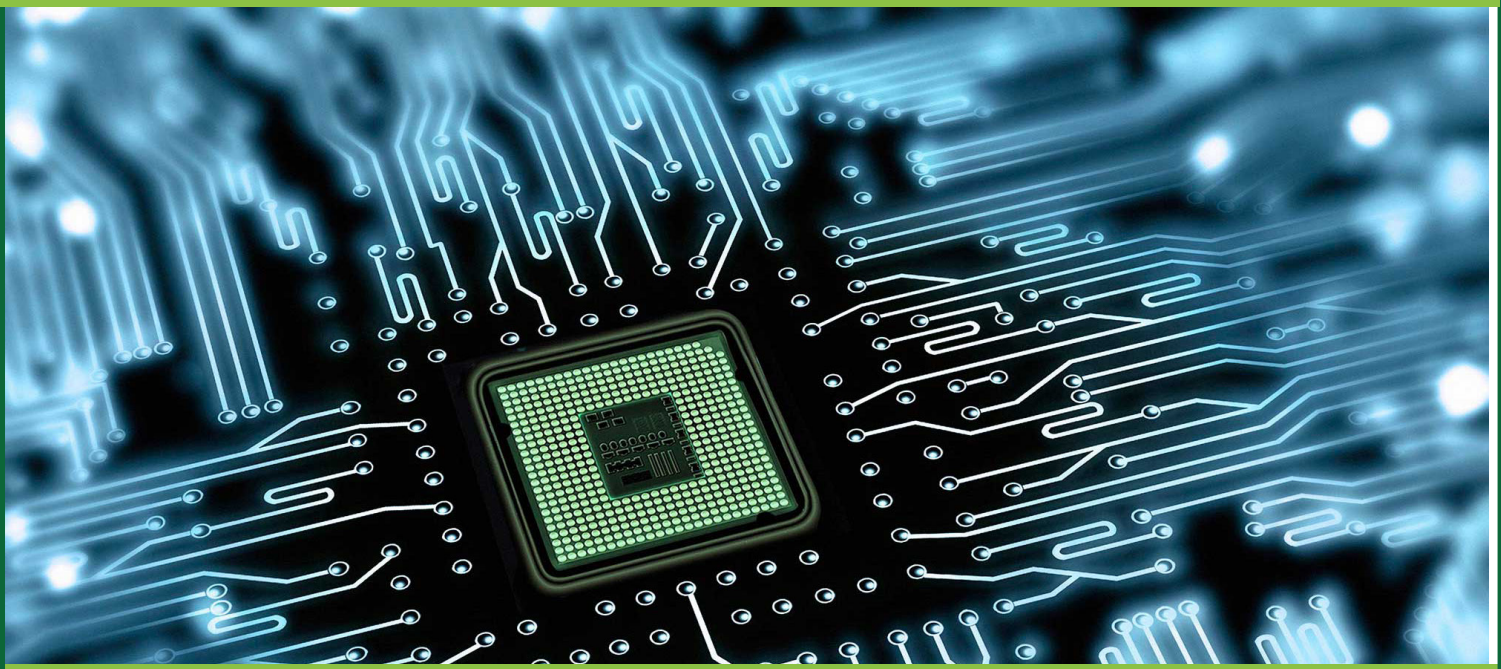




# Computer Science Bridging Work

Year 10 into 11 for 2024/25



Name: \_\_\_\_\_

Tutor Group: \_\_\_\_\_

Teacher: \_\_\_\_\_



## Aims of the bridging work

- The topic of Computer Science is at the heart of the modern world
- Studying it can make you extremely sought after in today's job market
- You would have noticed that the transition from Key Stage 3 to GCSE is significant, this includes:
  - An increased emphasis on technical content
  - An increased emphasis independent research

This pack is designed to allow you to practice some of the skills you learnt in year 10 and to develop new ones. Programming, like any other discipline needs to be practiced; little and often.

The bridging work is organized into three sections:

- Practical programming challenges
- Theory – research-based task
- Algorithms and programming

## Useful Resources

- ✚ <https://www.csnewbs.com/python>
  - ✚ <https://wiki.python.org/moin/BeginnersGuide/Programmers>
  - ✚ *Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming Paperback – 9 May 2019*
  - ✚ <https://www.learnpython.org/>
-

# Contents

Useful Resources.....	2
Introduction .....	<b>Error! Bookmark not defined.</b>
Challenge 1 .....	4
Challenge 2 .....	5
Challenge 3 .....	6
Challenge 4 .....	7
Challenge 5 .....	8
Challenge 6 .....	9
Section 2.....	10

## Section 1

The following programming challenges below range in difficulty from 1 to 10. With 10 being the most difficult. To successfully complete the challenges, you must create an algorithm for each task using either a flowchart or pseudocode. You must also program the task and provide print screen evidence of the program and the output.

## Difficulty 1 Challenges

Difficulty Level									
1	2	3	4	5	6	7	8	9	10
✓									

### Challenge 1

Design a program which asks the user to **input** their name, age and favourite colour.

You may need the following...			
<b>Arithmetic</b>	<b>Operations</b>	<b>Decisions</b>	<b>Iteration</b>
-	<b>BEGIN / END INPUT</b>	-	-

Algorithm	
Program	
Output	

## Challenge 2

The program asks the user to **input** their first name. The program then **outputs** the users first name.

<b>Suggested Pseudocode Statements</b>			
<b>Arithmetic</b>	<b>Operations</b>	<b>Decisions</b>	<b>Repetition</b>
-	<b>BEGIN / END</b> <b>INPUT</b> <b>OUTPUT</b>	-	-

Algorithm	
Program	
Output	

### Challenge 3

The program asks the user to **input** their surname and then their first name. The program then **outputs** the user's first name and then their surname **separately**.

Suggested Pseudocode Statements			
<b>Arithmetic</b>	<b>Operations</b>	<b>Decisions</b>	<b>Repetition</b>
-	<b>BEGIN / END</b> <b>INPUT</b> <b>OUTPUT</b>	-	-

Algorithm	
Program	
Output	

#### Challenge 4

The program asks the user to **input** their first name and then their surname. The program then **outputs** the user's first name and then their surname on the same line.

Suggested Pseudocode Statements			
<b>Arithmetic</b>	<b>Operations</b>	<b>Decisions</b>	<b>Repetition</b>
-	<b>BEGIN / END</b> <b>INPUT</b> <b>OUTPUT</b>	-	-

Algorithm	
Program	
Output	



## Challenge 5

Difficulty Level									
1	2	3	4	5	6	7	8	9	10
					✓				

A primary school teacher wants a computer program to test the basic arithmetic skills of her students. The program should generate a quiz consisting of a series of random questions, using in each case any two numbers and addition, subtraction and multiplication. The system should ask student's name, then ask 10 questions, output if the answer to each question is correct or not and produce a final score out of 10.

Scores from the quiz should be stored and added to when a student takes a new quiz.

Write an **algorithm** and **program** for the process described above.

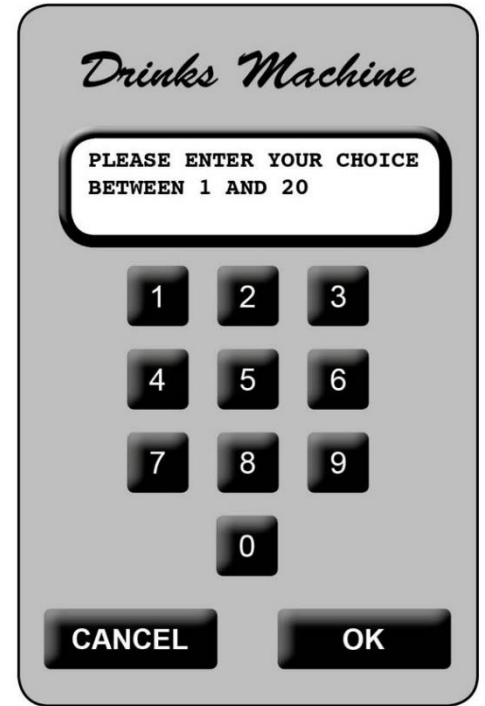
Algorithm	
Program	
Output	

## Challenge 6

Difficulty Level									
1	2	3	4	5	6	7	8	9	10
							✓		

A free drinks machine in an office provides 20 different drinks. The machine has a small keypad with keys 0 to 9, OK and CANCEL. It also has a small LCD screen, which can display a short message. To get a drink, users select an item number between 1 and 20 with the keypad and confirm their choice by pressing OK. If they make a mistake, they can press the CANCEL button and start again. If the selection is valid and the drink is available it dispenses the drink. The display screen is used to show suitable short messages throughout the process.

Write an **algorithm** and **program** of the process described above.



Algorithm	
Program	

## Section 2

### Truth tables to circuit diagrams

An important area of computer science is understanding the logic gates and diagrams which are used to represent the physical circuitry of computer systems.

Carry out some research into the following areas:

- Logic gates:
  - AND
  - NOT
  - OR
- Truth tables
- Boolean expressions
- Circuit diagrams

#### Additional help:

For additional help and support in structuring your answer you might like to watch some of the videos from the following Craig 'n' Dave playlists:

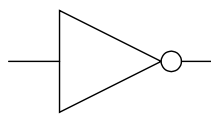
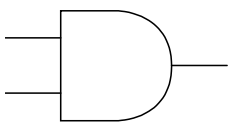
**OCR:** SLR2.4 – Boolean logic

<https://student.craigndave.org/videos/slr2-4-boolean-logic>

## Computational Logic task

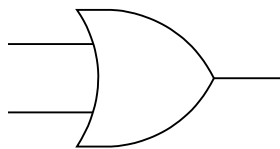
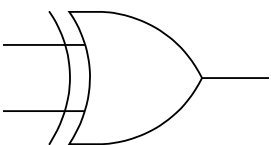
### Truth tables to circuit diagrams

1. Drag the labels into their correct place on the following diagram:



OR

AND

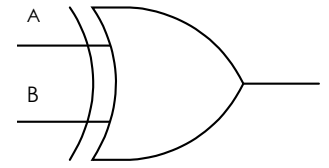
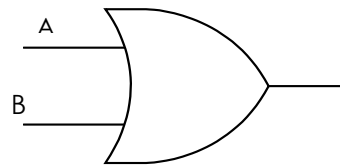
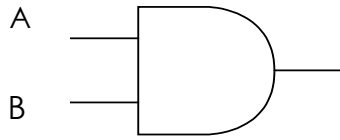
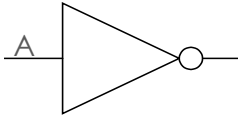


NOT

XOR

# Truth tables to circuit diagrams

2. Complete the truth tables for the following logic gates:



A	
0	
1	

A	B	
0	0	
0	1	
1	0	
1	1	

A	B	
0	0	
0	1	
1	0	
1	1	

A	B	
0	0	
0	1	
1	0	
1	1	

*Emerging computer technology*

In this task you get to investigate any area of emerging computer technology which interests you.

You can pick any area which interests you, but examples could be:

- Cyber security
- Autonomous self-drive cars
- Augmented reality
- Computer games
- Computer based implants

In no more than ONE side of A4 summarise the area you have chosen under the following four headings:

1. What is it?
2. What are the possible Ethical, Legal and Environmental impacts of this technology on society
3. What are the possible Ethical, Legal and Environmental risks of this technology on society
4. My conclusion on this technology and what it will mean for our world 10 years from now

Answer here:

---



## **Aims of the bridging work**

The bridging work is organised into three sections, each aimed at solidifying your understanding and honing your skills in Computer Science:

- **Practical Programming Challenges:**

These challenges aim to strengthen your programming skills from year 10 and introduce new concepts. By working on practical exercises, you'll solve real-world problems, use algorithms, and create effective solutions. Regular practise, even in small amounts, is essential for mastering and being creative in programming.

- **Theory – Research-based Task:**

This section focuses on independent research, essential for success in academic and professional settings. You'll explore theoretical aspects of computer science, such as data structures, computational theory, or new technologies. Through thorough research and critical analysis, you'll deepen your understanding and broaden your perspective in the field.

- **Algorithms and Programming:**

Here, the emphasis is on improving your skills in algorithms and honing your programming techniques. You'll learn about algorithm design principles, analyse their efficiency, and practise implementing them in code. Understanding algorithms enhances your problem-solving abilities and equips you to create efficient solutions for challenging problems.

By engaging with these sections, you will not only strengthen your foundational knowledge but also prepare yourself for the increased technical rigour and independent study demanded as you progress from Key Stage 3 to GCSE. Computer Science lies at the heart of the modern world, and mastering its concepts and skills will make you highly sought after in today's competitive job market.



# Useful Resources

Below is a list of resources to support you during your final GCSE year. These resources are accessible on your Team Page and can be used throughout your summer break.

## GCSE Computer Science Specification Tracker:

Paper 1: Computer systems:		😊	😐	😞
<b>Knowledge</b>				
<b>1.1 Systems architecture</b>				
<b>1.1.1 Architecture of the CPU</b>				
<ul style="list-style-type: none"> <li>The purpose of the CPU</li> <li>Von Newman architecture                             <ul style="list-style-type: none"> <li>MAR (Memory Address Register)</li> <li>MDR (Memory Data Register)</li> <li>Program counter</li> <li>Accumulator</li> </ul> </li> <li>Common CPU components and their function:                             <ul style="list-style-type: none"> <li>ALU (Arithmetic Logic Unit)</li> <li>CU (Control Unit)</li> <li>Cache</li> </ul> </li> <li>The function of the CPU as fetch and execute instructions stored in memory</li> </ul>				
<b>1.1.2 CPU Performance</b>				
<ul style="list-style-type: none"> <li>How common characteristics of CPUs affect their performance:                             <ul style="list-style-type: none"> <li>Clock speed</li> <li>Cache size</li> <li>Number of cores</li> </ul> </li> </ul>				
<b>1.1.3 Embedded Systems</b>				
<ul style="list-style-type: none"> <li>Embedded systems                             <ul style="list-style-type: none"> <li>Purpose of embedded systems</li> <li>Examples of embedded systems</li> </ul> </li> </ul>				

Paper 2: Computational thinking, Algorithms, and programming		😊	😐	😞
<b>Knowledge</b>				
<b>2.1 Algorithms</b>				
<b>2.1.1 Computational Thinking</b>				
<ul style="list-style-type: none"> <li>Principles of Computational thinking:                             <ul style="list-style-type: none"> <li>Abstraction</li> <li>Decomposition</li> <li>Algorithmic thinking</li> </ul> </li> </ul>				
<b>2.1.2 Designing, creating, and refining algorithms</b>				
<ul style="list-style-type: none"> <li>Identify the inputs, processes, and outputs for a problem.</li> <li>Structure diagrams</li> <li>Create, interpret, correct, complete, and refine algorithms using:                             <ul style="list-style-type: none"> <li>Pseudocode</li> <li>Flowcharts</li> <li>Reference language/ high-level programming language</li> </ul> </li> <li>Identify common errors.</li> <li>Trace Tables</li> </ul>				
<b>2.1.3 Searching and sorting algorithms</b>				
<ul style="list-style-type: none"> <li>Standard searching algorithms:                             <ul style="list-style-type: none"> <li>Binary search</li> <li>Linear search</li> </ul> </li> <li>Standard sorting algorithms:                             <ul style="list-style-type: none"> <li>Bubble sort</li> <li>Merge sort</li> <li>Insertion sort</li> </ul> </li> </ul>				

## GCSE Computer Science Knowledge Organiser:

Knowledge Organiser - 1.2 Memory & Storage			CS																											
<table border="1"> <thead> <tr> <th>Unit</th> <th>Abbreviation</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Petabyte</td> <td>PB</td> <td>1000<sup>3</sup> bytes</td> </tr> <tr> <td>Terabyte</td> <td>TB</td> <td>1000<sup>2</sup> bytes</td> </tr> <tr> <td>Gigabyte</td> <td>GB</td> <td>1000<sup>1</sup> bytes</td> </tr> <tr> <td>Megabyte</td> <td>MB</td> <td>1000<sup>0</sup> bytes</td> </tr> <tr> <td>Kilobyte</td> <td>KB</td> <td>1000 bytes</td> </tr> <tr> <td>Byte</td> <td>B</td> <td>8 bits</td> </tr> <tr> <td>Nibble</td> <td>N</td> <td>4 bits</td> </tr> <tr> <td>Bit</td> <td>b</td> <td>0 or 1</td> </tr> </tbody> </table>			Unit	Abbreviation	Value	Petabyte	PB	1000 <sup>3</sup> bytes	Terabyte	TB	1000 <sup>2</sup> bytes	Gigabyte	GB	1000 <sup>1</sup> bytes	Megabyte	MB	1000 <sup>0</sup> bytes	Kilobyte	KB	1000 bytes	Byte	B	8 bits	Nibble	N	4 bits	Bit	b	0 or 1	
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## Online Links:

- CS Newbs Paper 1 & 2 Content
  - <https://www.csnewbs.com/ocr-gcse>
- CS Newbs Python
  - <https://www.csnewbs.com/python>
- Python Beginner's Guide
  - <https://wiki.python.org/moin/BeginnersGuide/Programmers>
- GCSE Computer Science – Paper 1 Walkthrough
  - <https://www.youtube.com/watch?v=Rkc50S-tj4A&t=52s>
- GCSE Computer Science – Paper 2 Walkthrough
  - <https://www.youtube.com/watch?v=KhUpmxnF8o>

To support you on the course, or you have any questions, please contact your teachers for the course next academic year:

Mr. N Khan	<a href="mailto:Nkhan@bentleywood.harrow.sch.uk">Nkhan@bentleywood.harrow.sch.uk</a>
Mr. T Toolan	<a href="mailto:TToolan@bentleywood.harrow.sch.uk">TToolan@bentleywood.harrow.sch.uk</a>
Miss. L North	<a href="mailto:LNorth2@bentleywood.harrow.sch.uk">LNorth2@bentleywood.harrow.sch.uk</a>

## Section 1

The following programming challenges below range in difficulty from 1 to 10. With 10 being the most difficult. To successfully complete the challenges, you must create an algorithm for each task using either a flowchart or pseudocode. You must also program the task and provide print screen evidence of the program and the output.

### Difficulty 1 Challenges

Difficulty Level									
1	2	3	4	5	6	7	8	9	10
✓									

#### Challenge 1

Design a program which asks the user to **input** their name, age and favourite colour.

You may need the following...			
Arithmetic	Operations	Decisions	Iteration
-	<b>BEGIN / END INPUT</b>	-	-

Algorithm  <b>Flowchart or Pseudocode</b>	
Program	
Output	

## Challenge 2

The program asks the user to **input** their first name. The program then **outputs** the users first name.

<b>Suggested Pseudocode Statements</b>			
<b>Arithmetic</b>	<b>Operations</b>	<b>Decisions</b>	<b>Repetition</b>
-	<b>BEGIN / END</b> <b>INPUT</b> <b>OUTPUT</b>	-	-

Algorithm	
<b>Flowchart or Pseudocode</b>	
Program	
Output	

### Challenge 3

The program asks the user to **input** their surname and then their first name. The program then **outputs** the user's first name and then their surname **separately**.

<b>Suggested Pseudocode Statements</b>			
<b>Arithmetic</b>	<b>Operations</b>	<b>Decisions</b>	<b>Repetition</b>
-	<b>BEGIN / END</b> <b>INPUT</b> <b>OUTPUT</b>	-	-

Algorithm  <b>Flowchart or Pseudocode</b>	
Program	
Output	

#### Challenge 4

The program asks the user to **input** their first name and then their surname. The program then **outputs** the user's first name and then their surname **on the same line**.

<b>Suggested Pseudocode Statements</b>			
<b>Arithmetic</b> -	<b>Operations</b> <b>BEGIN / END</b> <b>INPUT</b> <b>OUTPUT</b>	<b>Decisions</b> -	<b>Repetition</b> -

Algorithm  <b>Flowchart or Pseudocode</b>	
Program	
Output	

## Challenge 5

Difficulty Level									
1	2	3	4	5	6	7	8	9	10
					✓				

A primary school teacher wants a computer program to test the basic arithmetic skills of her students. The program should generate a quiz consisting of a series of random questions, using in each case any two numbers and addition, subtraction and multiplication. The system should ask student's name, then ask 10 questions, output if the answer to each question is correct or not and produce a final score out of 10.

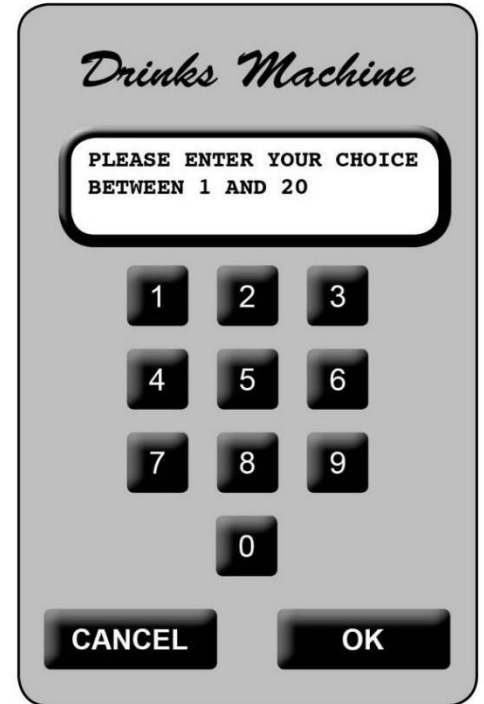
Scores from the quiz should be stored and added to when a student takes a new quiz.

Write an **algorithm** and **program** for the process described above.

Algorithm  <b>Flowchart or Pseudocode</b>	
Program	
Output	

## Challenge 6

Difficulty Level									
1	2	3	4	5	6	7	8	9	10
							✓		



A free drinks machine in an office provides 20 different drinks. The machine has a small keypad with keys 0 to 9, OK and CANCEL. It also has a small LCD screen, which can display a short message. To get a drink, users select an item number between 1 and 20 with the keypad and confirm their choice by pressing OK. If they make a mistake, they can press the CANCEL button and start again. If the selection is valid and the drink is available it dispenses the drink. The display screen is used to show suitable short messages throughout the process.

Write an **algorithm** and **program** of the process described above.

Algorithm  <b>Flowchart or Pseudocode</b>	
Program	



## Section 2

### Truth tables to circuit diagrams

An important area of computer science is understanding the logic gates and diagrams which are used to represent the physical circuitry of computer systems.

Carry out some research into the following areas:

- **Logic gates:**
  - **AND**
  - **NOT**
  - **OR**
- **Truth tables**
- **Boolean expressions**
- **Circuit diagrams**

#### Additional help:

For additional help and support in structuring your answer you might like to watch some of the videos from the following Craig 'n' Dave playlists:

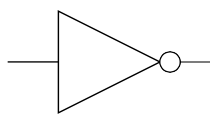
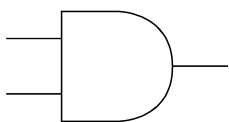
**OCR:** SLR2.4 – Boolean logic

<https://student.craigndave.org/videos/slr2-4-boolean-logic>

## Computational Logic task

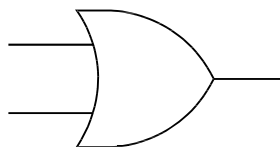
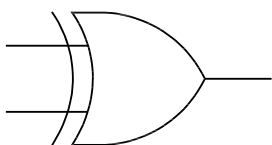
### Truth tables to circuit diagrams

1. Drag the labels into their correct place on the following diagram:



OR

AND

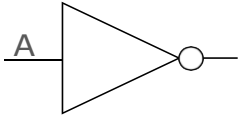


NOT

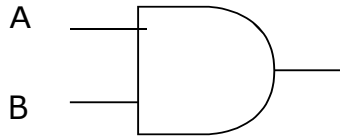
XOR

# Truth tables to circuit diagrams

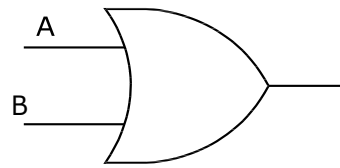
2. Complete the truth tables for the following logic gates:



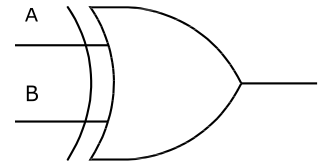
A	
0	
1	



A	B	
0	0	
0	1	
1	0	
1	1	



A	B	
0	0	
0	1	
1	0	
1	1	



A	B	
0	0	
0	1	
1	0	
1	1	

*Emerging computer technology*

In this task you get to investigate any area of emerging computer technology which interests you.

You can pick any area which interests you, but examples could be:

- Cyber security
- Autonomous self-drive cars
- Augmented reality
- Computer games
- Computer based implants

In no more than ONE side of A4 summarise the area you have chosen under the following four headings:

1. What is it?
2. What are the possible Ethical, Legal and Environmental **impacts** of this technology on society
3. What are the possible Ethical, Legal and Environmental **risks** of this technology on society
4. My conclusion on this technology and what it will mean for our world 10 years from now

Answer here:

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# Reading for Pleasure

1. A Brief History of Artificial Intelligence: What It Is, Where We Are, and Where We Are Going  
[https://books.google.co.uk/books?id=hjctEAAAQBAJ&newbks=0&hl=en&redir\\_esc=y](https://books.google.co.uk/books?id=hjctEAAAQBAJ&newbks=0&hl=en&redir_esc=y)
2. A Citizen's Guide to Artificial Intelligence  
[https://books.google.co.uk/books?id=myAXEAAAQBAJ&newbks=0&hl=en&redir\\_esc=y](https://books.google.co.uk/books?id=myAXEAAAQBAJ&newbks=0&hl=en&redir_esc=y)
3. Artificial You: AI and the Future of Your Mind  
[https://books.google.co.uk/books?id=pDwDEAAAQBAJ&newbks=0&hl=en&redir\\_esc=y](https://books.google.co.uk/books?id=pDwDEAAAQBAJ&newbks=0&hl=en&redir_esc=y)
4. The Alignment Problem: How Can Machines Learn Human Values?  
[https://books.google.co.uk/books?id=TdL2DwAAQBAJ&newbks=0&hl=en&redir\\_esc=y](https://books.google.co.uk/books?id=TdL2DwAAQBAJ&newbks=0&hl=en&redir_esc=y)
5. The Atlas of AI  
[https://books.google.co.uk/books?id=KfodEAAAQBAJ&newbks=0&hl=en&redir\\_esc=y](https://books.google.co.uk/books?id=KfodEAAAQBAJ&newbks=0&hl=en&redir_esc=y)
6. Understanding the Digital World: What You Need to Know about Computers, the Internet, Privacy, and Security, Second Edition  
[https://books.google.co.uk/books?id=BWUGEAAAQBAJ&newbks=0&hl=en&redir\\_esc=y](https://books.google.co.uk/books?id=BWUGEAAAQBAJ&newbks=0&hl=en&redir_esc=y)