



GCSE Computer Science Knowledge Organiser

SLR 1.6 Ethical, legal, cultural and environmental concerns: *Investigating and discussing computer science technologies*

Key Terminology	BCS Definition
Ethical issues	"Ethical issues introduced by the increasing use of computer science and its related technologies – e.g., job losses, AI/machine learning, digital divide, privacy, responsibility for web content."

What is ethics?

- Ethics is not about whether something is legal or illegal but more so whether it is morally right or wrong.
- For example, jumping a queue is not illegal, but it is deemed morally unacceptable.

Investigating computer science technologies

The internet presents many legal, cultural and ethical issues.

It offers many **benefits**:

- Vast repository of knowledge
- Communication
- Education
- Research
- E-commerce

It also has its **drawbacks**:

- Increase in piracy
- Distribution of illegal images
- Offensive content
- Fraud
- Hate speech
- Dissemination of fake news

Consider the following example:

Should the internet be regulated?

Consider the arguments for and against the topic of the question and write a paragraph for each:

Arguments for:

- The internet is no different to other media – radio, TV, newspapers, etc.
- The internet contains harmful, offensive and illegal content.
- Children should be better protected online.
- Profit-making organisations on the internet should share responsibility for policing it.

Arguments against:

- Freedom of expression is an absolute right.
- The internet is different to other media because anyone can author content online.
- The internet grows too quickly for filtering to be effective.
- Censorship is bad for democracy.
- Parents should take more responsibility for their children's safety.

Complete the question by writing up a conclusion.

Exam Tip:

- It is common to find this section used for the "essay style questions" worth about 8 marks.
- These questions use the exam Command Word "**Discuss**".
- Discuss questions require you to: "Give an account that addresses a range of ideas and arguments" – **OCR**

How to Answer

Marks are given based on your understanding of the subject content. You need to give a full and balanced answer in proper English.

- Read the question carefully.
- Read the question carefully and re-read the question to make sure you are providing an answer to that question.
- Underline any key words in the question.

You will need to organise your answer so that it is structured in a way that makes sense.

For example, if you are exploring the advantages and disadvantages of something then you would look to group all the advantages together in a paragraph and then group all the disadvantages together in the next paragraph.

Practice this skill by discussing the follow example topics:

- Should the government be able to decrypt data?
- Is social media and mobile technology having a negative impact on teenage mental health?
- Are video games bad for children?
- Is the digital divide unavoidable?
- Should the DNA of every living person be recorded in a database?
- Should employees receive emails outside working hours?
- Is trolling ever acceptable?



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SLR 1.6 Ethical, legal, cultural and environmental concerns: Privacy Issues

Key Terminology	BCS Definition
Privacy issues	"Privacy issues introduced by the increasing use of computer science and its related technologies – e.g., always-on, voice-activated devices; CCTV; social media; GPS tracking."

Privacy Issues

- Today, there are a vast array of surveillance systems in place in our towns and cities. Furthermore, modern technology has perfected number plate and face recognition.
- Surveillance systems are hugely beneficial for both the police and the general public, helping to solve crimes or prevent them from being carried out in the first place.
- However, the resulting loss of personal privacy is a cause of concern for many.



Examples of Privacy issues

GPS tracking can be used for:

- Tracking criminals wearing electronic tags.
- Navigation apps.
- Automatically tagging photos with the date, time and location.
- Find-my-device apps on supported smartphones, tablets and laptops.
- Schools often monitor internet, email and general computer activity.
- Companies often monitor their workforce's browser use and record their business calls.
- Data is an incredibly valuable commodity.

Digital technologies that impact on our privacy

- Number plate recognition
- Face recognition
- Electronic tagging
- Smartphone location and GPS technology
- Recording internet activities
- Digital retention of personal data
- Smart listening devices

Should smart devices be allowed to record our activities?

The range of smart devices in our homes is increasing every day. These devices are voice-activated and can listen in to our daily activities.

Who can hear the recordings?

And for what purpose?

Arguments for

- Encryption ensures the privacy of individual users.
- Voice input is convenient – the next step in the modernisation of user interfaces.
- Processing sound data provides additional functionality.
- Assistance for disabled users.
- Artificial intelligence may save lives.
- If you have nothing to hide, privacy should not be an issue for you.
- Data is only recorded for a specific purpose.

Arguments against

- Invasion of personal privacy.
- Some Smart TVs may also be capturing video footage.
- Data is sent over the internet for processing.
- Data may be used for other purposes.





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SLR 1.6 Ethical, legal, cultural and environmental concerns:

Cultural Issues

Key Terminology	BCS Definition
Cultural issues	"Cultural issues introduced by the increasing use of computer science and its related technologies – e.g., censorship, network restrictions, cyberbullying."

The impact of technology on our daily lives

Technology is changing how people live – we are depending on it more and more every day.

The Digital Divide

The degree of access to technology and the internet is not the same across the world.

As people around the world become more exposed to technology, it is impacting on their values and expectations.

Computer technology has completely changed our lives.

Imagine life without:

- Mobile phones
- Social networking
- Sat-nav
- Video games
- Online shopping
- Digital TV/streaming
- YouTube



Positive cultural effects of technology

- In the developing world, the rapid spread of technology – fuelled by the internet – has led to positive cultural changes in developing countries.
- Easier, faster communication has contributed to the rise of democracy and the alleviation of poverty.
- Globalisation can also help increase cultural awareness and promote diversity.



Negative cultural effects of technology

- The distribution of technology must be carefully controlled to prevent negative cultural consequences.
- Developing countries risk losing their cultural identities and assimilating themselves into an increasingly westernised world.
- There are also inequality challenges stemming from the uneven distribution of technology in developing countries.
- Traditionally, most computer applications are designed by North American developers who often apply their cultural values and systems of thought to their products – albeit unintentionally.



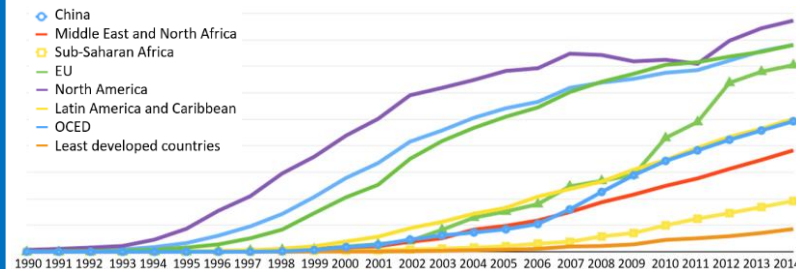
Restricting internet access

Countries may restrict internet access for several reasons:

- Limiting public exposure to content that may ignite social or political unrest.
- Preventing criticism of a ruler, government or religion.
- Preventing violations of national laws.
- Preventing violations of ethical or moral laws.



The digital divide – internet users by region



Cultural Issues:

- The pace of technological change and its effect on society – e.g., mobile phones, social networks, the world wide web, digital TV and streaming, increased automation, video games, sat-nav and online shopping.
- The digital divide and unequal access to technology.
- Censorship and the internet.
- Cultural influences in software development.



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SLR 1.6 Ethical, legal, cultural and environmental concerns:

Environmental impact of computer science

Key Terminology	BCS Definition
Environmental issues	"Environmental issues introduced by the increasing use of computer science and its related technologies – e.g., fossil fuels, energy usage, hazardous materials."

Disposal of computing technologies

Old computing equipment is often shipped to countries with lower safety standards for disposal.

Here, we can see people sifting through computer parts for raw materials, exposing themselves to dangerous chemicals.



Energy consumption of computing technology

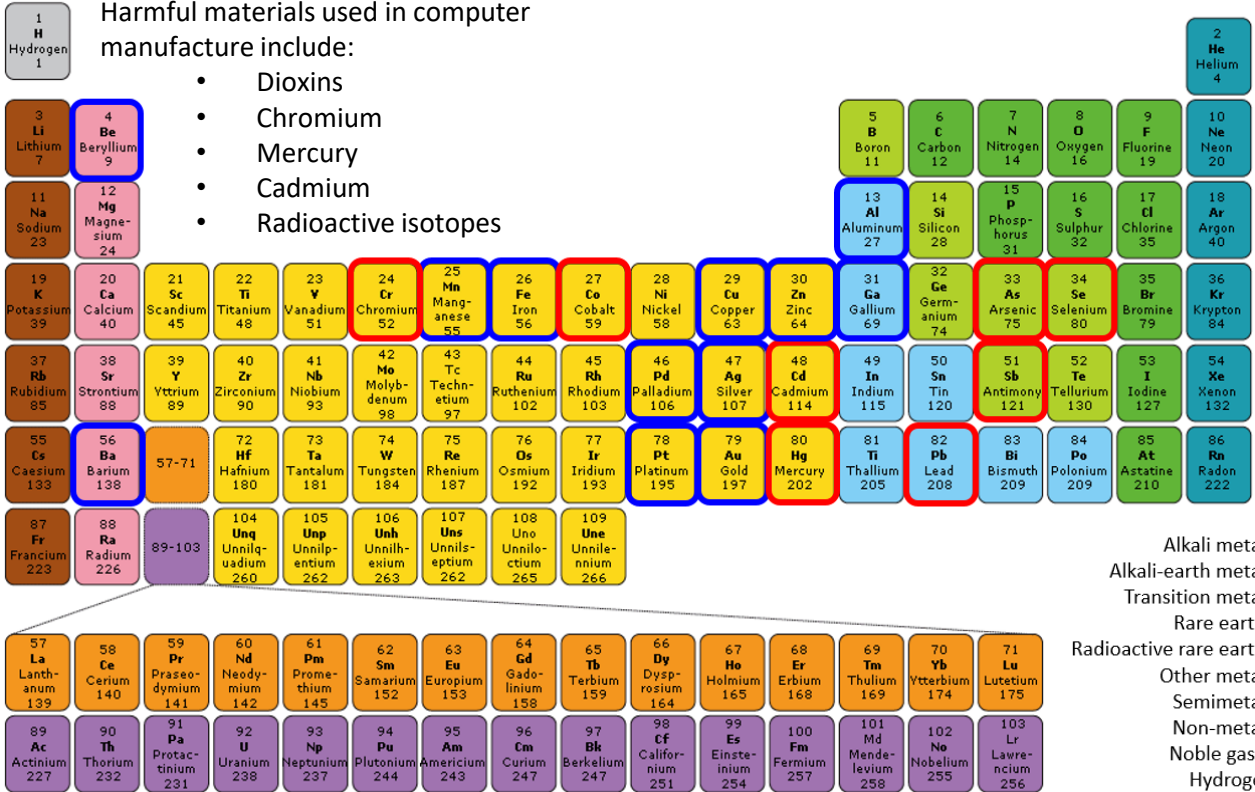
Two percent of global energy consumption is used by data centres.



Elements found in computers production.

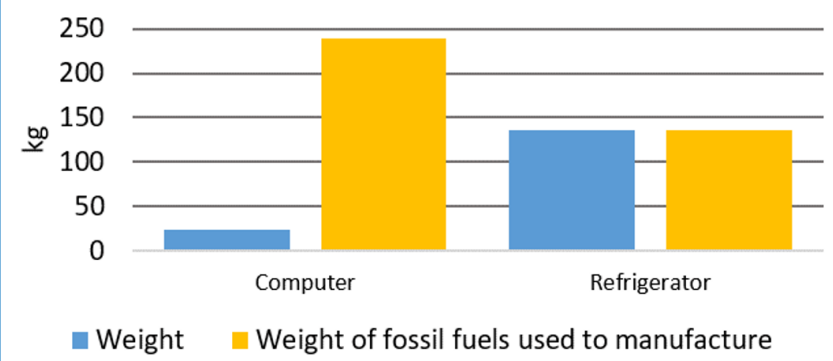
Harmful materials used in computer manufacture include:

- Dioxins
- Chromium
- Mercury
- Cadmium
- Radioactive isotopes



Manufacturing computing technologies

Fossil fuel used to manufacture a device compared to the product weight



Manufacturing computing technologies

Statistics for technology sold by the year 2016:

- Nintendo DS: 154 million
- Xbox: 160 million
- PlayStation 1-4: 448 million
- Smartphones: 1.5 billion

Our appetite for technology puts a huge demand on our natural resources – which are finite.





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SLR 1.6 Ethical, legal, cultural and environmental concerns:

Legislation relevant to computer science

Key Terminology	BCS Definition
Legal issues	"Legal issues introduced by the increasing use of computer science and its related technologies – e.g., digital content ownership, hacking, piracy."
The Data Protection Act 2018	"Legislation that protects individuals from the unreasonable use of their personal data. Updated in 2018 to cover the requirements of the General Data Protection Regulation (GDPR)."
Computer Misuse Act 1990	"Legislation that defines electronic vandalism, unauthorised access to computer systems and theft of information."
Copyright Design and Patents Act 1998	"Legislation that gives creators of literary, dramatic, musical and artistic works the right to control how their material can be used."

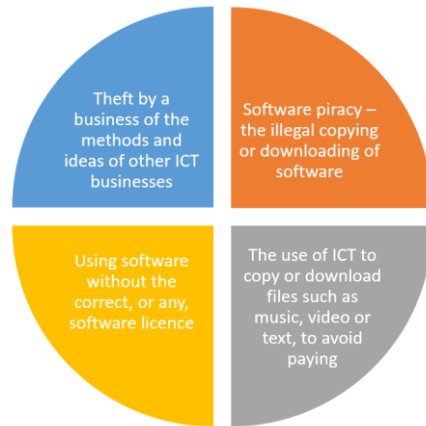
Data Protection Act 2018:

- Data must be processed lawfully, fairly and in a transparent manner.
- Data must only be collected for specified, explicit and legitimate.
- Data must be adequate, relevant and limited to what is necessary.
- Data you collect must be accurate and, where necessary, kept up to date.
- Data you hold must be kept for no longer than is necessary.
- Data you hold must be processed in a manner that ensures appropriate security of the personal data.
- Data controllers must be able to prove that their data protection measures are sufficient.



Copyright Designs and Patents Act 1988:

- An example of a piece of legislation which has had to evolve in order keep up with technology.
- This act makes it illegal to copy any work without the owners or copyright holders permission.
- In terms of technology this relates to work such as a digital file, image or piece of software.
- Owning the copyright does not stop others from copying it, but it does allow only the owner to bring action in the courts.
- It is illegal to copy, modify or distribute software, music, videos or other intellectual property without permission from the author.



Computer Misuse Act 1990:

An example of a piece of legislation which has had to be created in order keep up with technology.

It is illegal to:

- Make any unauthorised access to data...
- ...with the intent to commit further offences
- ...with the intent to modify data, e.g. viruses



Preparing for exams

While being asked to state specific points from the Acts of Parliament, you are also likely to be given a scenario and asked to apply the Acts in context.

For example:

"Fred has a small farm that provides fresh produce to local customers. He intends to set up a new website featuring his produce and allowing customers to sign up for a weekly delivery to their home. What are the legal issues Fred should consider."



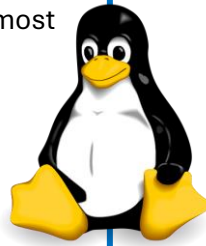


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SLR 1.6 Ethical, legal, cultural and environmental concerns: *Open-source vs proprietary software*

Open-Source software is given away with its **Source Code**

- Open-Source software is software where the source code is made freely available.
- Users may legally modify the source code to create their own spin-off software, which can be shared under the same licence and terms as the original software
- Well-known examples include Apache HTTP Server (runs web servers), GIMP (image editing), Mozilla Firefox (web browser) and VLC media player.
- Linux is a hugely successful open-source OS released in 1991. Hundreds of Linux-based OSs have been developed and shared over the years. The most popular include UBUNTU, Debian and Android
- Popular open-source software is always supported by a strong online community (forums of users sharing ideas and solving problems).
- Users actively help to improve the software – anyone can play with the source code and suggest bug fixes and improvements to the original developers.



Proprietary Software is closed sourced software

- Proprietary software is software, usually paid for, where only the compiled code is released. The source code is usually a closely guarded secret. Proprietary software licences restrict the modification, copying and redistribution of the software
- Businesses often use proprietary software instead of open-source as it tends to have better customer support options.
- Companies producing proprietary software include Microsoft (Office, Windows, Outlook, etc.) and Adobe (Photoshop, Illustrator, etc.).



Key Terminology	BCS Definition
Software licences	"A set of binding legal terms that often come with a commercial software application and dictate how you can use it – e.g., personal use, company use, etc."
Open source	"Users can modify and distribute the software. Can be installed on any number of computers. Support provided by the community. Users have access to the source code. May not be fully tested."
Proprietary	"Users cannot modify the software. Copyright protected. Usually paid for. Licensed per user or per computer. Support provided by developers. Users do not have access to the source code. Fully tested and supported by developers."

Advantages of Open Source

- It is usually free
- Made for the greater good, not profit – it benefits everyone, encourages collaboration, sharing of ideas.
- Software can be adapted by users to fit their needs.
- Wide pool of collaborators can be more creative and innovative than the programmers
- Popular software is very reliable and secure – any problems are quickly solved by the community

Disadvantages of Open Source

- Small projects may not get regular updates and so could be buggy or have unpatched security holes.
- There may be limited user documentation
- No warranties if something goes wrong.
- No customer support (although community forums make up for this)
- Companies using open-source code to make custom software may not want their competitors to see their source code, but they have no choice

Advantages of Proprietary Software

- Comes with warranties, documentation, and customer support.
- Should be well-tested and reliable as the company's reputation depends on this. Fixes and updates will come regularly (open-source will vary more).
- Usually cheaper for companies than developing their own custom-built software.

Disadvantages of Proprietary Software

- Can be expensive.
- Software may not exactly fit a user's needs.
- Software companies may not maintain older software after warranties expire – they'll want people to buy their latest products.