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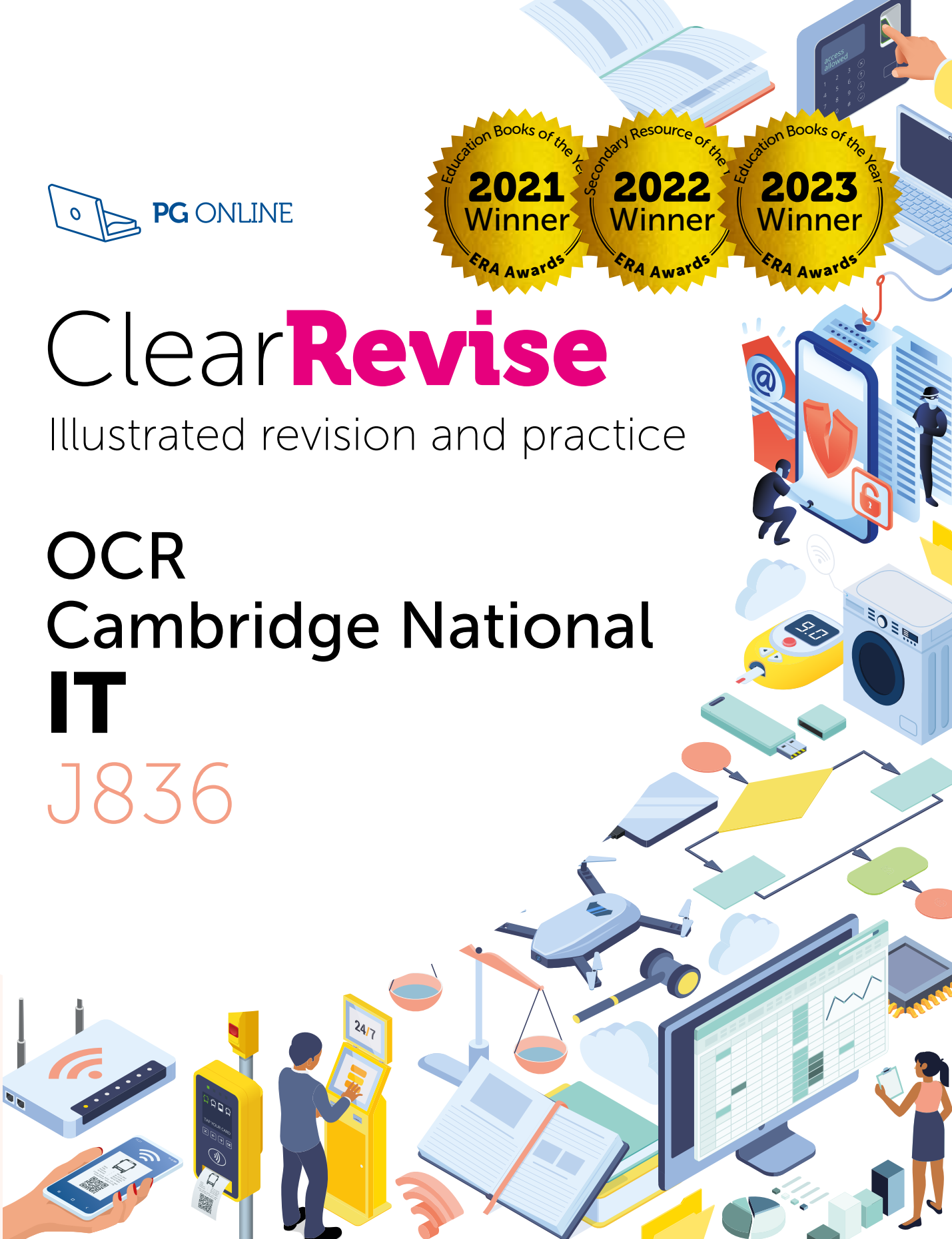

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PREFACE

Absolute clarity! That's the aim.

This is everything you need to ace the examined component in this course and beam with pride. Each topic is laid out in a beautifully illustrated format that is clear, approachable and as concise and simple as possible.

Each section of the IT specification is clearly indicated to help you cross-reference your revision. The checklist on the contents pages will help you keep track of what you have already worked through and what's left before the big day.

We have included worked exam-style questions with answers for every topic. This helps you understand where marks are coming from and to see the theory at work for yourself in an exam situation. There is also a set of exam-style questions at the end of each section for you to practise writing answers for. You can check your answers against those given at the end of the book.

LEVELS OF LEARNING

Based on the degree to which you are able to truly understand a new topic, we recommend that you work in stages. Start by reading a short explanation of something, then try and recall what you've just read. This has limited effect if you stop there but it aids the next stage. Question everything. Write down your own summary and then complete and mark a related exam-style question. Cover up the answers if necessary but learn from them once you've seen them. Lastly, teach someone else. Explain the topic in a way that they can understand. Have a go at the different practice questions – they offer an insight into how and where marks are awarded.

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THE SCIENCE OF REVISION

Illustrations and words

Research has shown that revising with words and pictures doubles the quality of responses by students.[1] This is known as 'dual-coding' because it provides two ways of fetching the information from our brain. The improvement in responses is particularly apparent in students when they are asked to apply their knowledge to different problems. Recall, application and judgement are all specifically and carefully assessed in public examination questions.

Retrieval of information

Retrieval practice encourages students to come up with answers to questions.[2] The closer the question is to one you might see in a real examination, the better. Also, the closer the environment in which a student revises is to the 'examination environment', the better. Students who had a test 2–7 days away did 30% better using retrieval practice than students who simply read, or repeatedly reread material. Students who were expected to teach the content to someone else after their revision period did better still.[3] What was found to be most interesting in other studies is that students using retrieval methods and testing for revision were also more resilient to the introduction of stress.[4]

Ebbinghaus' forgetting curve and spaced learning

Ebbinghaus' 140-year-old study examined the rate at which we forget things over time. The findings still hold true. However, the act of forgetting facts and techniques and relearning them is what cements them into the brain.[5] Spacing out revision is more effective than cramming – we know that, but students should also know that the space between revisiting material should vary depending on how far away the examination is. A cyclical approach is required. An examination 12 months away necessitates revisiting covered material about once a month. A test in 30 days should have topics revisited every 3 days – intervals of roughly a tenth of the time available.[6]

Summary

Students: the more tests and past questions you do, in an environment as close to examination conditions as possible, the better you are likely to perform on the day. If you prefer to listen to music while you revise, tunes without lyrics will be far less detrimental to your memory and retention. Silence is most effective.[5] If you choose to study with friends, choose carefully – effort is contagious.[7]

1. Mayer, R. E., & Anderson, R. B. (1991). Animations need narrations: An experimental test of dual-coding hypothesis. *Journal of Education Psychology*, (83)4, 484–490.
2. Roediger III, H. L., & Karpicke, J.D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, 17(3), 249–255.
3. Nestojko, J., Bui, D., Kornell, N. & Bjork, E. (2014). Expecting to teach enhances learning and organisation of knowledge in free recall of text passages. *Memory and Cognition*, 42(7), 1038–1048.
4. Smith, A. M., Floerke, V. A., & Thomas, A. K. (2016) Retrieval practice protects memory against acute stress. *Science*, 354(6315), 1046–1048.
5. Perham, N., & Currie, H. (2014). Does listening to preferred music improve comprehension performance? *Applied Cognitive Psychology*, 28(2), 279–284.
6. Cepeda, N. J., Vul, E., Rohrer, D., Wixted, J. T. & Pashler, H. (2008). Spacing effects in learning a temporal ridgeline of optimal retention. *Psychological Science*, 19(11), 1095–1102.
7. Busch, B. & Watson, E. (2019), *The Science of Learning*, 1st ed. Routledge.

CONTENTS

R050: IT in the digital world

Topic Area 1: Design tools

Topic Area 2: Human Computer Interface (HCI) in everyday life

Topic Area 3: Data and testing

Topic Area 4: Cyber-security and legislation

Topic Area 5: Digital communications

Topic Area 6: Internet of Everything (IoE)

MARK ALLOCATIONS

Green mark allocations[1] on answers to in-text questions throughout this guide help to indicate where marks are gained within the answers. A bracketed '1' e.g. [1] = one valid point worthy of a mark. In longer answer questions, a mark is given based on the whole response. In these answers, a tick mark [✓] indicates that a valid point has been made. For a mark, a judgement should be made using the levels-based mark scheme on **page 76**. There are often many more points to make than there are marks available so you have more opportunity to max out your answers than you may think.

ACKNOWLEDGMENTS

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TOPICS FOR EXAM

Unit R050 IT in the digital world

Information about the externally assessed exam

Written exam: 1 hour and 30 minutes
70 marks
Section A: 15 marks
Section B: 55 marks

Specification coverage

Knowledge of IT in the digital world, topic areas 1-6.

Topic Area 1: Design tools

Topic Area 2: Human Computer Interface (HCI) in everyday life

Topic Area 3: Data and testing

Topic Area 4: Cyber-security and legislation

Topic Area 5: Digital communications

Topic Area 6: Internet of Everything (IoE)

Questions

Section A: A range of closed response, multiple choice and short answer questions.

Section B: Scenario based questions which require knowledge and understanding from all the topic areas in R050. A hand-drawn/sketch question worth 8 marks, such as mind maps, flow charts or visualisation diagrams, will be given. An extended response question worth 9 marks will also be given.

FLOW CHARTS

A **flow chart** uses symbols and connecting lines to show the steps in a **process**.

Flow chart uses

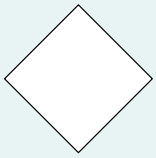
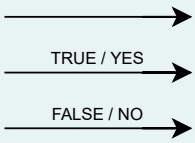
There are many uses for flow charts. For example, they could show a process that happens when a form is submitted on a website.

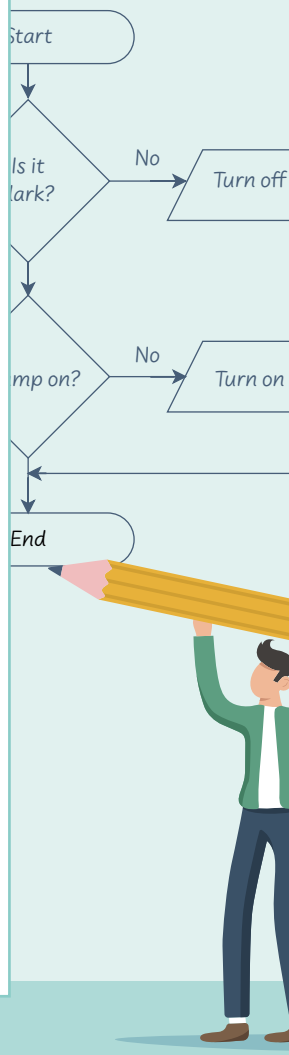
You need to know four design tools:

- Flow charts
- Mind maps
- Visualisation diagrams
- Wireframes

Flow chart components

Flow charts use common symbols so that they are easily understood. The symbols are connected via flow lines. This shows the direction of flow through the flow chart.

Symbol	Meaning
Start / End 	A **start/end symbol** is used at the **start** of the flow chart and the **end** of the flow chart. A flow chart should only have one start and one end symbol. The end symbol is also called a **terminator**.
Process 	A **process box** shows that some processing will happen such as a calculation being performed.
Decision 	A **decision symbol** is used when a choice of direction needs to be taken. For example, "Is the switch on?". Decision boxes usually have two outputs – **True** or **False**. However, sometimes they can have more than this.
Input / Output 	**Input/Output symbols** show where a user enters data or the results of processing are displayed. *Input examples*: PRESS BUTTON, INPUT age *Output examples*: OUTPUT age, DISPLAY RESULTS.
Flow lines 	**Flow lines** show the direction of travel through a flow chart. The arrow on the end shows the direction. Flow lines are usually given a label of **Yes**/**No** or **True**/**False** when they come out of a decision symbol. Some decision boxes have more than two arrows that come out from them - for example, a different direction for each of the days of the week.

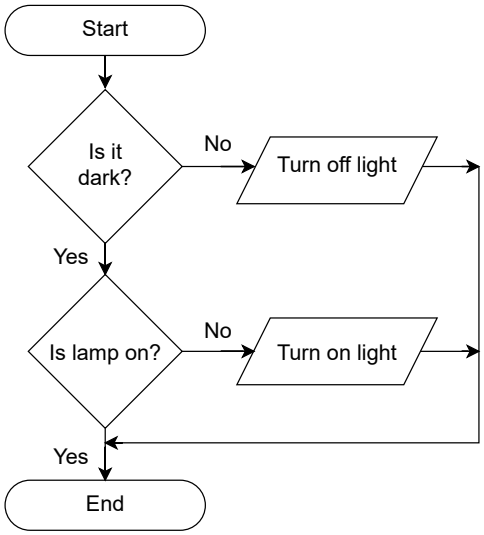


Creating flow charts

Flow charts can represent any process. This flow chart shows the process for turning a security light on or off. It uses two decision symbols and two input/output symbols.

Flow charts are easy to draw by hand. You can also draw them in software programs.

Some software programs are specifically designed to draw flow charts. These include **Microsoft Visio** or **draw.io**. **Word processing** and **presentation software** usually allows flow charts to be created by inserting relevant symbols and arrows.



Advantages and disadvantages of flow charts

Advantages	Disadvantages
• Flow charts are quick to draw by hand. • Digital flow charts are quick and easy to create and edit. With good software, flow lines will automatically update. • Processes and steps are clearly shown.	• Specialist software may be needed to create digital flow charts. • Hand drawn flow charts are hard to change if a mistake is made. • Can be complex and difficult to read if a process is very complex. • Specific symbols need to be known to create or understand a flow chart.

1. Flow charts use arrows to show the direction of flow.
   State **three** other components that may be used in a flow chart. [3]
2. The flow chart shown at the top of this page is used to turn a security light on and off. It only checks whether the light needs to be turned on or off once.
   Describe how the flow chart could be altered so that it constantly checks whether the light needs to be turned on or off. [2]
3. One disadvantage of using flow charts is that they become complex and difficult to read for large problems. State **two** other disadvantages of using flow charts. [1]

1. *Decision,[1] Input,[1] Output,[1] Process,[1] Start,[1] End.[1]*
2. *The end symbol needs to be removed[1] and the Yes arrow (from the 'is lamp on?' decision symbol) will go into the 'Is it dark' decision symbol[1] to form a loop.[1]*
3. *Specialist software may be required to create one.[1] Hand drawn flow charts are hard to change if a mistake is noticed.[1] Specific symbols need to be understood to create or understand a flow chart.[1]*

PREVENTION MEASURES

There are many ways that help to prevent cybersecurity threats from being successful. These fall into three broad categories, **physical prevention measures**, **logical prevention measures** and **secure destruction of data**.

Physical prevention measures

Physical prevention measures are physical hardware or devices which prevent access to computer systems or data. The following are the devices you need to be aware of.

Biometric devices

Biometric devices work on a person's physical characteristics. **Fingerprints**, **facial recognition** and **eye scans** (of the iris or retina) are commonly used. Biometrics are also often used to gain access to portable devices such as smartphones.

Radio-frequency identification (RFID)

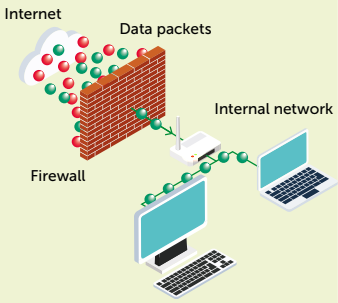
RFID is used in door entry cards and fobs. The card is held close to the device causing a door to be unlocked.

Keypads

Keypads are often used to secure doors or safes. They are also used on smartphones and cash registers. A code is entered to unlock the room or device.

Firewalls

Firewalls sit between an external and internal network. A physical firewall is a hardware device that sits between the two networks. Data is sent between networks in **packets**. The firewall **blocks** harmful packets coming from the Internet so they don't enter the internal network.



Secure backups

Backups of data are important as they allow data to be **restored** if it is damaged or deleted.

It is important that backups are stored securely, such as in a locked room with other security features in a remote location.

DISTRIBUTION CHANNEL CONNECTIVITY

The types of distribution channel given on **pages 49-50** all need an underlying method of **connectivity**. There are different characteristics, advantages and disadvantages for each connection method. The different characteristics affect which connection method is most suitable for a given scenario.

Wired

Computers and servers are usually connected to networks with **wired connections**.

Wired connections are cheap to run, fast and reliable. However, there is often a significant cost to installing wired networks and computers cannot be easily moved. Wired connections are not suitable for mobile devices.

Ethernet cables

The most common type of connection for home and business computers is a copper twisted pair **Ethernet cable**. Connections are made directly from a computer to a switch or hub up to 100m away.

Fibre optic cables

Fibre optic cables are commonly used to connect homes and businesses to the Internet. Fibre optic cables have extremely high **bandwidth** (the amount of data transmitted per second) and connections can be many miles apart.

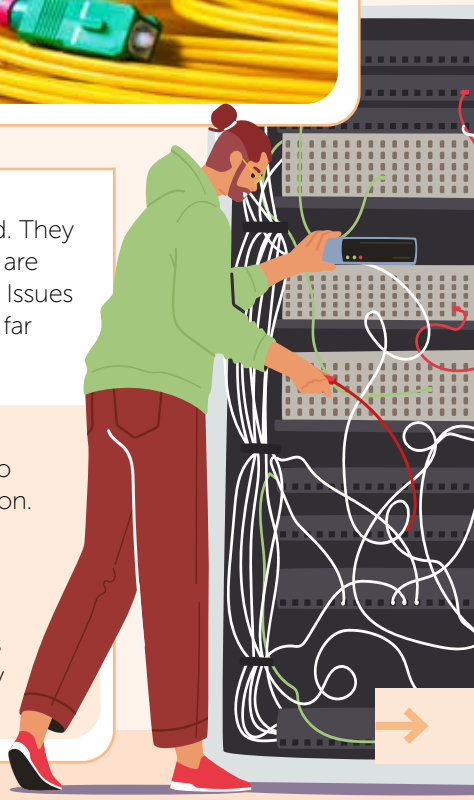
Wireless

Wireless connections are easy to install as no cables need to be used. They usually make use of radio waves or microwaves to transmit data. They are particularly important for mobile devices to allow them to be portable. Issues with wireless connections include **signal quality** if moving or located far away from a **wireless transmitter**.

4G and 5G

4G and **5G** are technologies to connect mobile phones and tablets to **mobile phone networks** and the Internet. The G stands for generation. 4G networks are usually fast enough for web browsing and video, however they are not as fast as Ethernet and fibre optic connections.

5G connections are comparable to the speeds used in most homes and businesses for Ethernet and Fibre optic connections. This allows 5G to replace many wired home connections and also makes it easy to connect IoT (Internet of Things) devices.



APPLICATIONS OF IOE IN EVERYDAY LIFE

IoE is used in a range of areas of everyday life. The following are those that need to be known for the exam. Remember that many devices in IoE are called 'smart', such as smartphones, smartwatches, smart meters. A huge number of other devices and processes also exist.

Energy management

Households and other organisations are able to use **smart meters** to improve their energy usage. Traditional meters have a display that must be manually read by a company or user. Smart meters are able to take frequent readings, usually hourly. These are then automatically reported back to the electric or gas company.

A small display in a house is able to show users their current, daily and weekly usage. These allow users to monitor their usage. Some homes and businesses may be charged different amounts for energy used at different times of the day.

Advantages	Disadvantages
• Users no longer need to take meter readings and send them to the energy providers. • Users are able to constantly monitor usage which helps to reduce energy consumption and costs. • Reduced energy consumption has environmental benefits.	• It needs a network connection. • There is a cost to upgrading old meters. • There is a risk of data theft and hacking. • There are privacy issues as more personal data is given with regular hourly readings rather than monthly ones.

Security

Newer smart meters take regular readings and also turn a meter on or off. If a hacker were able to alter a reading, then they could increase or decrease an energy bill. Alternatively, they could turn the electricity off or view personal data on energy usage. A cyber attack on smart meters could lead to disruptions and blackouts across the country. As the potential damage could be very large, smart meters make use of **authentication** and **encryption** when sending and receiving data. A lot of consideration is made to prevent security vulnerabilities.

EXAMINATION PRACTICE

Section A style questions

1 There are four pillars of the Internet of Everything (IoE). One pillar is named Things or Devices. Name **two** of the other pillars. [2]

2 IoE digital interactivity occurs as device to device (D2D) and human to device (H2D).

A user makes use of their smartphone to control their home lighting.

(a) Describe **one** digital interactivity which occurs from device to device. [1]

(b) Describe **one** digital interactivity which occurs from human to device. [1]

3 Identify **one** drawback of the Internet of Everything. [1]

4 Give **two** examples where the IoE may be used in a gym. [2]

Section B style questions

A delivery company decides that they want to install a new 'smart office' at their head office.

As part of the smart office, they want to provide a better working environment for employees by installing an automated heating system.

5 Identify **two** smart devices that may be used in the office as part of the heating system and describe how each one may be used within the system. [4]

6 The office will make use of CCTV cameras which connect to the IoE.

(a) Give **two** advantages of connecting these cameras to the IoE. [2]

(b) Give **two** disadvantages of connecting these cameras to the IoE. [2]

The delivery company has approximately 1000 drivers making deliveries each day.

7 Sometimes delivery drivers are involved in accidents.

Describe how the IoE could be used to improve the response time for an ambulance or the police to arrive. [4]

8 Some delivery drivers travel long distances before making a stop.

Describe how an in car entertainment system could make use of the IoE to make the journey more pleasant for the driver. [4]

9 Many customers would like to have up to date tracking information about products as they are being transported and delivered.

Discuss how the Internet of Everything (IoE) could be used when tracking products.

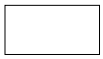
In your answer, you must consider:

- How different devices (IoE Things) could be used;
- The advantages and disadvantages of using the IoE for tracking products. [9]

EXAMINATION PRACTICE ANSWERS

Topic area 1: Types of design tools

1.

Flow chart symbol	Meaning
	Input/output symbol.[1]
	Decision symbol.[1]
	Start/stop symbol / Terminator.[1]
	Process box/symbol.[1]

[4]

2. **C** One or more arrows indicating direction of flow.[1] [1]

3. Library mind map,[1] presentation mind map.[1] [1]

4. Branches/linking lines/arrows,[1] nodes,[1] sub-nodes,[1] keywords,[1] images,[1] colour,[1] shapes/bubbles.[1] [2]

5. (a) It looks like the finished product[1] so feedback can be given before the product is designed.[1]
Annotations are included[1] to give more information / help justify design choices.[1]

(b) Advantages of wireframes (compared to visualisation diagrams):
Wireframes are quick to create[1] as they are usually black and white / can be made with pen/paper / use simple symbols[1] this saves the designer time[1] and allows for quick alterations.[1]
Disadvantages of wireframes (compared to visualisation diagrams):
Visualisation diagrams have more detail / colour / detailed sketches / annotation[1] which helps people get a better idea of the finished product[1] and also helps a designer/developer to understand exactly what they will need to create.[1] [4]

LEVELS-BASED MARK SCHEME FOR EXTENDED RESPONSE QUESTIONS

Example level descriptors

Each exam paper will have an extended response question, such as a discuss question, which is marked by the following levels.

Level	Marks	Level descriptors
HIGH 3	7–9	• A **thorough** discussion with detailed understanding. • A detailed knowledge. • **More than** one advantage **and** one disadvantage are **explained**. • Relevant and appropriate examples are given. • Terminology is consistently used.
MID 2	4–6	• An **adequate discussion** showing sound understanding. • At least **one** advantage and/or **one** disadvantage are **described**. • Some relevant examples are provided although these may not always be appropriate. • Some use of appropriate terminology.
LOW 1	1–3	• A brief discussion showing limited understanding. • Few advantage(s) and/or disadvantage(s) are identified. • Little or no use of appropriate terminology.
0	0	• No response worthy of credit.

Create/draw questions

Each exam paper will have a question that requires a hand-drawn visual solution, such as a mind map, flow chart or visualisation diagram. These questions will be marked with up to 4 marks for layout and up to 4 marks for content. The marks are added giving up to 8 marks.

Marks for layout	Marks for content
• Wholly relevant layout (4 marks) • Mostly suitable layout (3 marks) • Simplistic layout (2 marks) • Minimal layout for the scenario (1 mark)	• All relevant content (4 marks) • Mostly relevant content (3 marks) • Some relevance (2 marks) • Limited relevance (1 mark)

0 marks – no answer worthy of credit

INDEX

EXAMINATION TIPS

With your examination practice, use a boundary approximation using the following table. Be aware that boundaries are usually a few percentage points either side of this.

Level	**Level 2**			**Level 1**			
Grade	Distinction*	Distinction	Merit	Pass	Distinction	Merit	Pass
Code	2*	D2	M2	P2	D1	M1	P1
Boundary	80%	70%	60%	50%	40%	30%	25%

1. Be prepared with a black pen and a ruler.
2. Always read each question carefully. Make sure you understand what the question is asking and follow the instructions. You cannot get marks for giving an answer to a question you think is appearing rather than the actual question.
3. Section B is based around a scenario. Remember to link your answers to this scenario if required.
4. Avoid simply rewriting the question or repeating examples that are already given in the question.
5. It is better to use generic terms such as heart rate monitor or smart watch, rather than brand names such as FitBit.
6. Remember that explain questions have two marks. You need to make a point for the first mark, and then expand this point with a linked development for the second mark. To help you develop your responses, aim to include words such as 'because' or 'therefore'.
7. On describe or explain questions remember to construct your answer in a logical manner.
8. There is one long answer question on the exam paper which is worth 9 marks and could use the command words analyse, discuss, or evaluate. Remember that the answers to these questions need both advantages and disadvantages, and an 'evaluate' question also needs a conclusion.
9. Answer questions in the spaces provided. If this is not possible e.g. due to deleting a wrong answer, indicate the location of the corrected answer on the paper (e.g. 'see next page' or 'my answer is on the last blank page').
10. Cross out any errors neatly.
11. Don't spend too much time on one question or leave any questions unanswered.
12. Make sure your handwriting is clear and legible.
13. Don't let your nerves get the better of you. Remember that you have prepared well, and you can do this.
14. Lastly, try to relax, breathe deeply, and focus on the task at hand. Don't compare yourself to others or worry about what they are doing.

Good luck!

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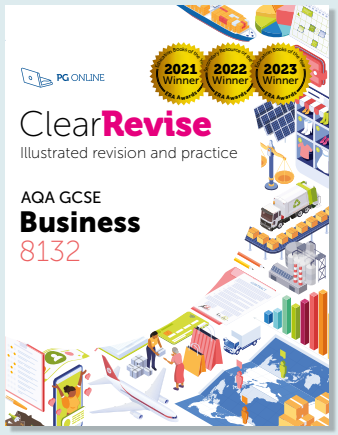

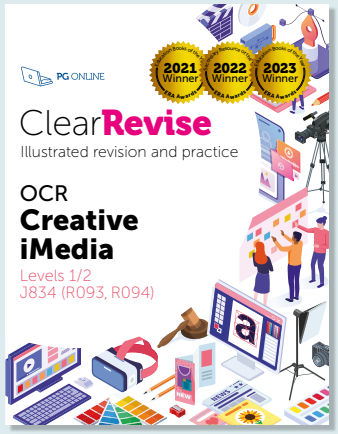

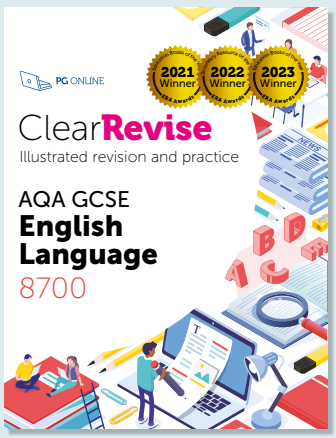

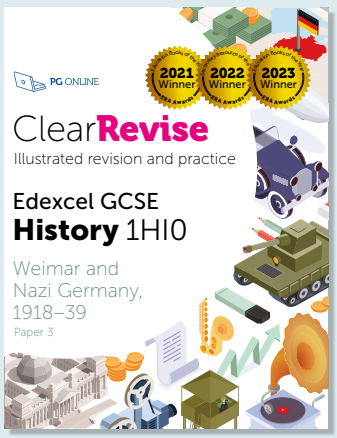

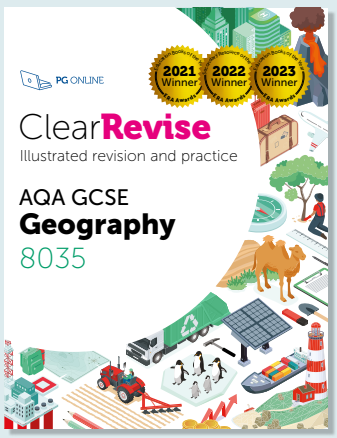

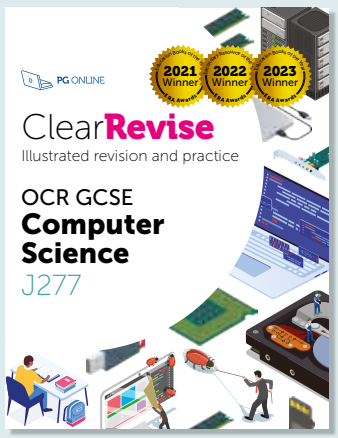

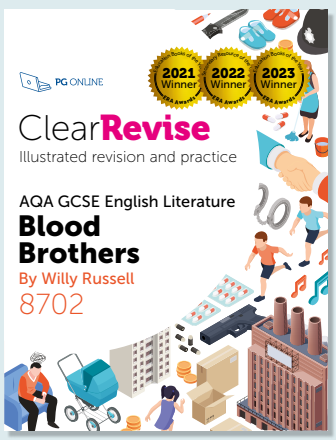

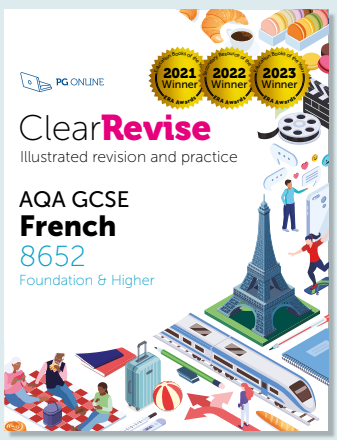

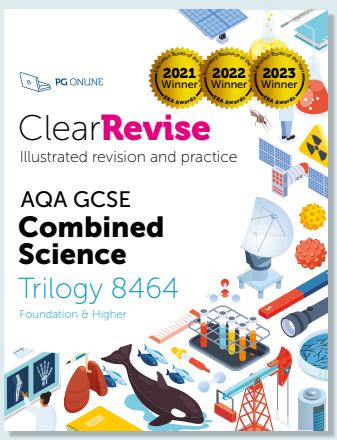

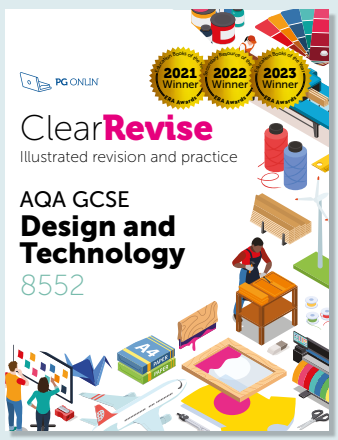

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