

Syllabus

Cambridge International AS & A Level Information Technology 9626

Use this syllabus for exams in 2025, 2026 and 2027.

Exams are available in the June and November series.

Also available for examination in March 2025, 2026 and 2027 for India.



Why choose Cambridge International?

Cambridge International prepares school students for life, helping them develop an informed curiosity and a lasting passion for learning. We are part of Cambridge University Press & Assessment, which is a department of the University of Cambridge.

Our Cambridge Pathway gives students a clear path for educational success from age 5 to 19. Schools can shape the curriculum around how they want students to learn – with a wide range of subjects and flexible ways to offer them. It helps students discover new abilities and a wider world, and gives them the skills they need for life, so they can achieve at school, university and work.

Our programmes and qualifications set the global standard for international education. They are created by subject experts, rooted in academic rigour and reflect the latest educational research. They provide a strong platform for students to progress from one stage to the next, and are well supported by teaching and learning resources.

We review all our syllabuses regularly, so they reflect the latest research evidence and professional teaching practice – and take account of the different national contexts in which they are taught.

We consult with teachers to help us design each syllabus around the needs of their learners. Consulting with leading universities has helped us make sure our syllabuses encourage students to master the key concepts in the subject and develop the skills necessary for success in higher education.

Our mission is to provide educational benefit through provision of international programmes and qualifications for school education and to be the world leader in this field. Together with schools, we develop Cambridge learners who are confident, responsible, reflective, innovative and engaged – equipped for success in the modern world.

Every year, nearly a million Cambridge students from 10 000 schools in 160 countries prepare for their future with the Cambridge Pathway.

School feedback: ‘We think the Cambridge curriculum is superb preparation for university.’

Feedback from: Christoph Guttentag, Dean of Undergraduate Admissions, Duke University, USA

Quality management



Cambridge International is committed to providing exceptional quality. In line with this commitment, our quality management system for the provision of international qualifications and education programmes for students aged 5 to 19 is independently certified as meeting the internationally recognised standard, ISO 9001:2015. Learn more at www.cambridgeinternational.org/ISO9001

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Important: Changes to this syllabus

For information about changes to this syllabus for 2025, 2026 and 2027, go to page 72.

The latest syllabus is version 2, published January 2023.



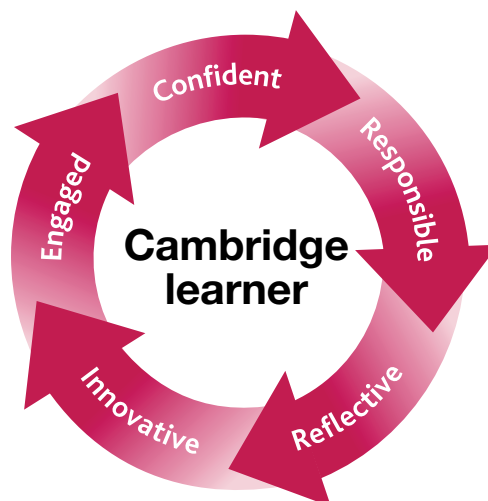
1 Why choose this syllabus?

Key benefits

The best motivation for a student is a real passion for the subject they're learning. By offering students a variety of Cambridge International AS & A Levels, you can give them the greatest chance of finding the path of education they most want to follow. With over 50 subjects to choose from, students can select the ones they love and that they're best at, which helps motivate them throughout their studies.

Following a Cambridge International AS & A Level programme helps students develop abilities which universities value highly, including:

- a deep understanding of their subjects
- higher order thinking skills – analysis, critical thinking, problem solving
- presenting ordered and coherent arguments
- independent learning and research.



Cambridge International AS & A Level Information Technology encourages learners to become effective and discerning users of IT. Learners develop a broad range of knowledge, skills and understanding, essential for progression on to higher education courses in Information Technology or employment.

Our approach in Cambridge International AS & A Level Information Technology encourages learners to be:

confident, using a range of software

responsible, using technology ethically

reflective, as learners, developing their knowledge and understanding of IT to solve problems

innovative, creating efficient solutions to problems

engaged, in technology, how it is built and how software solutions are developed.

School feedback: 'Cambridge students develop a deep understanding of subjects and independent thinking skills.'

Feedback from: Principal, Rockledge High School, USA

Key concepts

Key concepts are essential ideas that help students develop a deep understanding of their subject and make links between different aspects. Key concepts may open up new ways of thinking about, understanding or interpreting the important things to be learned.

Good teaching and learning will incorporate and reinforce a subject's key concepts to help students gain:

- a greater depth as well as breadth of subject knowledge
- confidence, especially in applying knowledge and skills in new situations
- the vocabulary to discuss their subject conceptually and show how different aspects link together
- a level of mastery of their subject to help them enter higher education.

The key concepts identified below, carefully introduced and developed, will help to underpin the course you will teach. You may identify additional key concepts which will also enrich teaching and learning.

The key concepts for Cambridge International AS & A Level Information Technology are:

- **Hardware and software**
Hardware and software interact with each other in an IT system. It is important to understand how these work and how they work together with each other, and with us in our environment.
- **Networks**
Computer systems can be connected together to form networks, allowing them to share data and resources. The central role networks play in the internet, mobile and wireless applications and cloud computing has rapidly increased the demand for network capacity and performance.
- **The internet**
The internet is a global communications network. It uses standardised communications protocols to allow computers worldwide to connect and share information in many different forms. The impact of the internet on our lives is profound. While the services the internet supports can provide huge benefits to society, they have also introduced issues, for example security of data.
- **System life cycle**
Information systems are developed within a planned cycle of stages. They cover the initial development of the system, through to its scheduled updating or redevelopment.
- **New technologies**
As the information industry changes so rapidly, it is important to keep track of new and emerging technologies and consider how they might affect everyday life.

International recognition and acceptance

Our expertise in curriculum, teaching and learning, and assessment is the basis for the recognition of our programmes and qualifications around the world. Every year thousands of students with Cambridge International AS & A Levels gain places at leading universities worldwide. Our programmes and qualifications are valued by top universities around the world including those in the UK, US (including Ivy League universities), Europe, Australia, Canada and New Zealand.

UK NARIC*, the national agency in the UK for the recognition and comparison of international qualifications and skills, has carried out an independent benchmarking study of Cambridge International AS & A Level and found it to be comparable to the standard of AS & A Level in the UK. This means students can be confident that their Cambridge International AS & A Level qualifications are accepted as equivalent, grade for grade, to UK AS & A Levels by leading universities worldwide.

Cambridge International AS Level Information Technology makes up the first half of the Cambridge International A Level course in Information Technology and provides a foundation for the study of Information Technology at Cambridge International A Level. The AS Level can also be delivered as a standalone qualification. Depending on local university entrance requirements, students may be able to use it to progress directly to university courses in Information Technology or some other subjects. It is also suitable as part of a course of general education.

Cambridge International A Level Information Technology provides a foundation for the study of Information Technology or related courses in higher education. Equally it is suitable as part of a course of general education.

For more information about the relationship between the Cambridge International AS Level and Cambridge International A Level see the 'Assessment overview' section of the Syllabus overview.

We recommend learners check the Cambridge recognition database and university websites to find the most up-to-date entry requirements for courses they wish to study.

* Due to the United Kingdom leaving the European Union, the UK NARIC national recognition agency function was re-titled as UK ENIC on 1 March 2021, operated and managed by Ecctis Limited. From 1 March 2021, international benchmarking findings are published under the Ecctis name.

Learn more at www.cambridgeinternational.org/recognition

Supporting teachers

We provide a wide range of resources, detailed guidance, innovative training and professional development so that you can give your students the best possible preparation for Cambridge International AS & A Level. To find out which resources are available for each syllabus go to **www.cambridgeinternational.org/support**

The School Support Hub is our secure online site for Cambridge teachers where you can find the resources you need to deliver our programmes. You can also keep up to date with your subject and the global Cambridge community through our online discussion forums.

Find out more at **www.cambridgeinternational.org/support**

Support for Cambridge International AS & A Level			
Planning and preparation <ul style="list-style-type: none"> Schemes of work Specimen papers Syllabuses Teacher guides 	Teaching and assessment <ul style="list-style-type: none"> Endorsed resources Online forums Support for coursework and speaking tests 	Learning and revision <ul style="list-style-type: none"> Example candidate responses Past papers and mark schemes Specimen paper answers 	Results <ul style="list-style-type: none"> Candidate Results Service Principal examiner reports for teachers

Sign up for email notifications about changes to syllabuses, including new and revised products and services at **www.cambridgeinternational.org/syllabusupdates**

Professional development

We support teachers through:

- Introductory Training – face-to-face or online
- Extension Training – face-to-face or online
- Enrichment Professional Development – face-to-face or online

Find out more at **www.cambridgeinternational.org/events**

- Cambridge Professional Development Qualifications

Find out more at **www.cambridgeinternational.org/profdev**



Supporting exams officers

We provide comprehensive support and guidance for all Cambridge exams officers.

Find out more at: **www.cambridgeinternational.org/eoguide**

2 Syllabus overview

Aims

The aims describe the purposes of a course based on this syllabus.

The aims are to enable students to:

- develop a broad range of IT skills
- develop an understanding of the parts, use and applications of IT systems within a range of organisations, including the use of networking technology
- develop an understanding of how IT systems affect society in general
- develop a broad knowledge of the use of IT in workplace situations and the potential risks
- develop an understanding of the system life cycle and apply this understanding to workplace situations
- develop an understanding of project management skills
- be aware of new and emerging technologies
- apply their knowledge and understanding of IT to solve problems.

Cambridge Assessment International Education is an education organisation and politically neutral. The contents of this syllabus, examination papers and associated materials do not endorse any political view. We endeavour to treat all aspects of the exam process neutrally.



Content overview

AS Level candidates study topics 1–11.

- 1 Data processing and information
- 2 Hardware and software
- 3 Monitoring and control
- 4 Algorithms and flowcharts
- 5 eSecurity
- 6 The digital divide
- 7 Expert systems
- 8 Spreadsheets
- 9 Modelling
- 10 Database and file concepts
- 11 Video and audio editing

A Level candidates study topics 1–11 and topics 12–21.

- 12 IT in society
- 13 New and emerging technologies
- 14 Communications technology
- 15 Project management
- 16 System life cycle
- 17 Data analysis and visualisation
- 18 Mail merge
- 19 Graphics creation
- 20 Animation
- 21 Programming for the web

Cambridge International does **not** specify hardware requirements or suppliers for the different software applications. Teachers may choose which software to use for practical tasks. The software used must fully support the practical requirements of the syllabus. This should include the use of file conversion software to ensure files are saved in the required formats.

School feedback: ‘Cambridge International AS & A Levels prepare students well for university because they’ve learnt to go into a subject in considerable depth. There’s that ability to really understand the depth and richness and the detail of a subject. It’s a wonderful preparation for what they are going to face at university.’

Feedback from: US Higher Education Advisory Council

Assessment overview

Paper 1

Theory 1 hour 45 minutes
70 marks
Candidates answer all questions. Questions will be based on sections 1–11 of the subject content.
Externally assessed
50% of the AS Level
25% of the A Level

Paper 3

Advanced Theory 1 hour 45 minutes
70 marks
Candidates answer all questions. Questions will be based on sections 12–21 of the subject content.
Externally assessed
25% of the A Level

Paper 2

Practical 2 hours 30 minutes
90 marks
Candidates answer all questions. Tasks will be based on sections 8–11 of the subject content. Candidates apply knowledge and understanding from sections 1–7 of the subject content.
Externally assessed
50% of the AS Level
25% of the A Level

Paper 4

Advanced Practical 2 hours 30 minutes
90 marks
Candidates answer all questions. Tasks will be based on sections 17–21 of the subject content. Candidates apply knowledge and understanding of all subject content. The exam may also include practical tasks from sections 8–10 within a problem-solving context.
Externally assessed
25% of the A Level

Information on availability is in the **Before you start** section.

Check the timetable at www.cambridgeinternational.org/timetables for the one-day window to conduct the practical tests, Papers 2 and 4.

Check the samples database at www.cambridgeinternational.org/samples for submission information, forms and deadlines for Papers 2 and 4.

There are three routes for Cambridge International AS & A Level Information Technology:

Route	Paper 1	Paper 2	Paper 3	Paper 4
1 AS Level only (Candidates take all AS components in the same exam series)	yes	yes	no	no
2 A Level (staged over two years) Year 1 AS Level*	yes	yes	no	no
Year 2 Complete the A Level			yes	yes
3 A Level (Candidates take all components in the same exam series)	yes	yes	yes	yes

* Candidates carry forward their AS Level result subject to the rules and time limits described in the *Cambridge Handbook*. See **Making entries** for more information on carry forward of results.

Candidates following an AS Level route are eligible for grades a–e. Candidates following an A Level route are eligible for grades A*–E.

Assessment objectives

The assessment objectives (AOs) are:

AO1

Recall, select and communicate knowledge and understanding of IT.

AO2

Apply knowledge, understanding, skills and judgement to produce IT-based solutions.

AO3

Analyse, evaluate, and present reasoned conclusions.

Weighting for assessment objectives

The approximate weightings allocated to each of the assessment objectives (AOs) are summarised below.

Assessment objectives as a percentage of each qualification

Assessment objective	Weighting in AS Level %	Weighting in A Level %
AO1 Recall, select and communicate knowledge and understanding of IT	40	35
AO2 Apply knowledge, understanding, skills and judgement to produce IT-based solutions.	50	50
AO3 Analyse, evaluate, and present reasoned conclusions.	10	15
Total	100	100

Assessment objectives as a percentage of each component

Assessment objective	Weighting in components %			
	Paper 1	Paper 2	Paper 3	Paper 4
AO1 Recall, select and communicate knowledge and understanding of IT	75	0	70	0
AO2 Apply knowledge, understanding, skills and judgement to produce IT-based solutions.	0	100	0	100
AO3 Analyse, evaluate, and present reasoned conclusions.	25	0	30	0
Total	100	100	100	100

3 Subject content

This syllabus gives you the flexibility to design a course that will interest, challenge and engage your learners. Where appropriate you are responsible for selecting subject contexts, resources and examples to support your learners' study. These should be appropriate for the learners' age, cultural background and learning context as well as complying with your school policies and local legal requirements.

Annual technical updates

Technical updates will be published each year to take account of emerging technologies relevant to the syllabus content. Please refer to the AS & A Level Information Technology page on our website www.cambridgeinternational.org/alevel

Topics

Candidates should be able to demonstrate and apply their knowledge and understanding of all content within each topic in the theory and practical assessments.

Where the term 'including' or 'for example' is used, everything listed must be studied. 'Including' refers to content which is being considered as part of that topic point. 'For example' illustrates a typical case. The lists are not exhaustive and other relevant and related aspects should also be studied.

AS Level candidates study topics 1–11.

A Level candidates study all topics 1–21.

The A Level components (Papers 3 and 4) assume candidates have knowledge and understanding of the content in the AS Level topics 1–11.

AS Level topics

Candidates should be able to demonstrate and apply their knowledge and understanding of all content within each topic in the theory and practical assessments.

1 Data processing and information

1.1 Data and information

- Differences between data and information, including:
 - identifying that data becomes information through context and meaning
- Uses of direct and indirect data and their suitability for given purposes
- Sources of direct data, for example:
 - questionnaires
 - interviews
 - data logging
 - observation
- Sources of indirect data, for example:
 - weather data
 - census data
 - electoral register
 - businesses collecting personal information when used by third parties
 - research from textbooks, journals and websites
- Advantages and disadvantages of direct and indirect data

1.2 Quality of information

- Factors that affect the quality of information, for example:
 - accuracy
 - relevance
 - age
 - level of detail
 - completeness of information

1 Data processing and information (continued)

1.3 Encryption

- The need for encryption
- Methods of encryption, including:
 - symmetric (using private key only)
 - asymmetric (using private and public keys)
- Encryption protocols, including:
 - the purpose of Transport Layer Security (TLS)/Secure Socket Layer (SSL) and Internet Protocol Security (IPsec)
 - the use of TLS/SSL and IPsec in client server communication
- Uses of encryption, including:
 - protection of data
 - systems encryption
- Advantages and disadvantages of different protocols and methods of encryption

1.4 Checking the accuracy of data

- Methods and uses of validation and verification, including:
 - validation:
 - presence check
 - range check
 - type check
 - length check
 - format check
 - check digit
 - lookup check
 - consistency check
 - limit check
 - verification:
 - visual checking and double data entry
 - parity check
 - checksum
 - hash total
 - control total
- The difference between validation and verification
- The need for both validation and verification
- Advantages and disadvantages of validation and verification

1 Data processing and information (continued)

1.5 Data processing

- Methods and uses of batch processing, including:
 - utility bills
 - credit card and debit card accounts
 - customer accounts
 - master and transaction files and their use in payroll and customer orders
 - the steps involved in sequentially updating a master file using a transaction file
- Methods and uses of online processing, including the steps involved in carrying out:
 - electronic funds transfer
 - automatic stock control
 - electronic data interchange (exchange)
 - business-to-business buying and selling
 - online shopping
- Methods and uses of real-time processing systems where the output affects the input, including:
 - microprocessor-controlled/computer-controlled systems, including:
 - greenhouses
 - central heating systems
 - air conditioning systems
 - burglar alarms
 - control of traffic/pedestrian flow/smart motorways
 - car park barriers
 - traffic lights
 - wireless sensor and actuator networks, including:
 - smart homes
 - guidance systems (for space rockets, etc.)
 - autonomous vehicles (including aircraft, cars/automobiles, drones and ships)
- Write an algorithm to show the steps involved in different methods of processing (see 4.1)
- Advantages and disadvantages of different methods of data processing

2 Hardware and software

2.1 Mainframe computers and supercomputers

- Characteristics of mainframe computers and supercomputers, including:
 - longevity
 - reliability, availability and serviceability (RAS)
 - security
 - performance metrics (MIPS and FLOPS)
 - volume of input, output and throughput
 - fault tolerance
 - operating system
 - number of processors
 - heat maintenance
- Uses of mainframe computers, including:
 - census
 - transaction processing
 - industry statistics
 - consumer statistics
- Uses of supercomputers, including:
 - weather forecasting
 - climate research
 - quantum mechanics
- Advantages and disadvantages of mainframe computers and supercomputers

2.2 System software

- Types and functions of system software, including:
 - compilers
 - interpreters
 - linkers
 - device drivers
 - operating systems
 - utilities
- Uses of system software, including:
 - how a high-level language is translated to run on different computer systems using:
 - interpreters
 - cross compilers
- Advantages and disadvantages of different types of system software

2 Hardware and software (continued)

2.3 Utility software

- The need for utility software, including:
 - anti-virus
 - back-up
 - data compression
 - disk defragmentation (including understanding the structure of hard disk storage)
 - formatting (including low-level, partitioning and high-level)
 - file copying
 - deleting files
- Types of utility software, including:
 - file management systems
 - disk management systems
 - data compression utilities
- Uses of the different types of utility software
- Advantages and disadvantages of different types of utility software

2.4 Custom-written software and off-the-shelf software

- Custom-written software
 - uses by individuals and organisations
- Off-the-shelf software
 - uses by individuals and organisations
- Advantages and disadvantages of different types of custom-written and off-the-shelf software, including:
 - degree of testing
 - level of support
 - cost
 - adaptability
- Proprietary and open-source software

2.5 User interfaces

- Types of user interfaces, including:
 - command line interface
 - graphical user interface
 - dialogue interface
 - gesture-based interface
- Uses of the different types of user interfaces
- Advantages and disadvantages of different types of user interfaces

3 Monitoring and control

3.1 Monitoring and measurement technologies

- Sensors, including:
 - light/UV
 - temperature
 - pressure
 - humidity
 - pH
 - gas sensors (including oxygen, carbon dioxide, carbon monoxide and oxides of nitrogen)
 - sound
 - infrared
 - touch sensors
 - (electro)magnetic field sensors
 - proximity sensors
- Uses of monitoring and measurement technologies, including:
 - environmental monitoring
 - monitoring water pollution
 - weather stations, including the use of sensors by weather stations
 - temperature sensors to measure ambient temperature
 - pressure sensors to measure atmospheric pressure
 - humidity sensors to measure absolute and relative humidity
 - light sensors to measure sunlight
 - monitoring patients
- Calibration, including:
 - the importance of calibration
 - the various methods used to calibrate devices, including when to use:
 - one-point calibration
 - two-point calibration
 - multipoint calibration
 - methods of calibrating readings from sensors, for example, temperature sensors

3 Monitoring and control (continued)

3.2 Control technologies

- Sensors and their uses, including:
 - touch sensors incorporated within detection devices used to measure fluid levels (for example, cooling water level in nuclear power plants)
 - temperature sensors
 - light sensors to measure light level
 - light sensors to detect light source, for example, in a car park barrier system
 - moisture sensors to measure water content of soil
 - pH sensors to measure the acidity of soil
 - gas sensors
 - infrared sensors to detect movement of human bodies which emit heat, for example, in burglar alarm systems
 - (electro)magnetic field sensors
 - ultrasonic sensors
 - the use of induction (inductive) loops in car parking and car park barrier systems
 - sound sensors in burglar alarm systems
 - proximity sensor in smartphones to switch off screen display when phone is held near to the ear
- Actuators and their uses, including:
 - carrying out an action/movement, including:
 - linear
 - rotary
 - soft
 - hydraulic
 - pneumatic
 - electric
 - thermal
 - magnetic
 - mechanic
- Microprocessor-controlled/computer-controlled technology, including:
 - greenhouses
 - central heating systems
 - air conditioning systems
 - burglar alarms
 - control of traffic/pedestrian flow (including smart motorways)
 - car park barriers
 - traffic lights
 - Wireless Sensor and Actuator Networks
 - smart homes
- Advantages and disadvantages of different control technologies
- Write an algorithm or draw a flowchart to represent the processing involved in the control technologies listed above (see 4.1)

4 Algorithms and flowcharts

4.1 Algorithms

- Writing and editing a given algorithm that demonstrates a decision-making process, including:
 - conditional branching
 - looping
 - nested loops
 - procedures/subroutines
- Writing an algorithm using pseudocode to solve a given problem, including:
 - INPUT/READ
 - WRITE/PRINT
 - FOR...NEXT
 - FOR...NEXT...STEP
 - IF...ELSE...ENDIF
 - WHILE...ENDWHILE
 - REPEAT...UNTIL
 - CASE...ENDCASE
 - Comparison operators >, <, =
 - Arithmetic operators +, -, *, /

4.2 Flowcharts

- Drawing a basic program flowchart to solve a given problem
- Drawing a basic program flowchart that demonstrates a decision-making process (see symbols at the end of the 'Subject content' section), including:
 - input/output
 - decision (using comparison operators)
 - terminator (start, stop)
 - process boxes (using arithmetic operators)
 - subroutine
 - connector
 - flowline
- Editing a given basic program flowchart that demonstrates a decision-making process
- Identifying errors in an algorithm/program flowchart for a given scenario

5 eSecurity

5.1 Personal data

- What personal data is
- Keeping personal data secure and confidential, including:
 - why personal data should be kept confidential
 - how personal data can be kept confidential, including the removal of geotags from photos/videos, anonymising and aggregating information and duty of confidence measures
- Preventing misuse of personal data, including:
 - how personal data can be kept secure, including network security measures
 - how personal data can be gathered by unauthorised persons (smishing, vishing, phishing and pharming) and how this might be prevented, including firewalls (hardware and software)
- Advantages and disadvantages of the different methods of preventing misuse of personal data

5.2 Malware

- Types of malware, including:
 - trojan
 - worms
 - spyware
 - adware
 - rootkit
 - malicious bots
 - ransomware
- Uses of malware, including:
 - fraud
 - theft
 - industrial espionage
 - sabotage
- Consequences of malware for organisations and individuals
- Malware prevention software and physical malware prevention methods
- Advantages and disadvantages of the methods of malware prevention

6 The digital divide

6.1 The digital divide

- What the digital divide is, including:
 - between people and regions that have access to modern technology and information (for example, smart phones, television, personal computers, tablet computers, laptop computers and internet access) and those with restricted or no access
- Causes of the digital divide, including:
 - the availability of high and low performance computers
 - wireless connections
- Effects of the digital divide, including:
 - inequality of access to all types of internet services and technology
 - reducing the effects, including digital literacy teaching
- Groups affected by the digital divide, including:
 - people in different age groups
 - people in cities and people in rural areas
 - people with differing levels of education
 - people in different socioeconomic groups
 - people with accessibility barriers due to learning difficulties or physical or sensory impairments
 - people in more and less industrially developed nations, with different levels of technological awareness/infrastructure

7 Expert systems

7.1 Expert systems

- How expert systems are used to produce possible solutions for different scenarios
- Components, including:
 - user interface
 - inference engine
 - knowledge base (as a database of facts and rules base)
 - explanation system
 - knowledge base editor
- Scenarios, including:
 - mineral prospecting
 - investment analysis
 - financial planning
 - insurance planning
 - car engine fault diagnosis
 - medical diagnosis
 - route scheduling for delivery vehicles
 - plant and animal identification
- The concepts of backward chaining and forward chaining, including the use of the IF...THEN constructs
- The terms data driven and goal driven, including their use in:
 - diagnoses
 - gaming
 - artificial intelligence (for use in manipulating social media)
- Advantages and disadvantages of expert systems

8 Spreadsheets

8.1 Creating a spreadsheet

- Creating page/screen structures to meet the requirements of an audience and/or task specification/ house style, including:
 - page orientation
 - page size
 - fit to page
 - margins
 - header and footer
- Creating/editing spreadsheet structures, including:
 - insert rows and columns
 - delete rows and columns
 - hide rows and columns
 - resize rows and columns
 - merge cells
- Controlling data input using validation techniques, for example, drop-down menu
- Protecting cells and their content, including:
 - cells
 - rows
 - columns
 - worksheets
 - workbooks
- Freezing and unfreezing panes and windows
- Creating and using formulas that include/contain:
 - addition
 - subtraction
 - multiplication
 - division
 - indices
- Using absolute, relative and mixed referencing to replicate formulas, including:
 - named cells (across several worksheets or workbooks)
 - named ranges (across several worksheets or workbooks)
- Understanding why absolute, relative and mixed referencing are used
- Using functions that:
 - perform calculations, for example: SUM, AVERAGE, MIN, MAX, MAXA, INT, ROUND, SUBTOTAL
 - count the number of cells that meet a criterion, for example: COUNT, COUNTIF, COUNTIFS, COUNTA, COUNTBLANK
 - look up data, for example: LOOKUP, VLOOKUP, HLOOKUP, XLOOKUP, INDEX, MATCH
 - make decisions based on certain criteria, for example: IF, IFS, nested IF, AND, OR
 - insert, extract and calculate with date and time, for example: DATE, TIME, WEEKDAY, DAY, MONTH, YEAR

8 Spreadsheets (continued)

8.1 Creating a spreadsheet (continued)

- extract numeric values from strings, concatenate strings, test cell contents, including text values, numeric values, blank cells
- extract characters from strings, for example: LEFT, RIGHT, MID, FIND
- apply conditional formulas, for example: SUMIF, SUMIFS, COUNTIF, COUNTIFS, AVERAGEIF, AVERAGEIFS, MAXIF, MAXIFS and MINIF, MINIFS
- perform error trapping, for example: ISERROR, IFERROR
- insert nested functions
- rotate data from columns to rows or vice versa, for example: TRANSPOSE

The **functions** listed above are examples **only**. Candidates must be familiar with functions to apply all of the **skills** listed above. If candidates are asked to perform a task and the skill required is **not** listed above, the question paper will specify the function candidates should use to complete the task. For example, 'Use the DEC2BIN function to ... '.

- Using appropriate input and error messages
- Formatting cells, including:
 - date and time
 - text
 - numeric
 - currency
 - percentage
 - fractions
 - text orientation
 - alignment
- Formatting cell emphasis, including:
 - size
 - style
 - colour
 - shading
 - merge
 - borders
 - comments
 - conditional formatting
- Appreciation of the spreadsheet requirements, purpose and use for a variety of audiences, including people from different age groups and with different specialisms, for example, scientists, administrators, artists

8 Spreadsheets (continued)

8.2 Testing a spreadsheet

- Testing a spreadsheet structure
 - creating and applying a test plan to test spreadsheet elements, including:
 - functions
 - validation rules
 - conditional formatting
- Testing data
 - the need to choose appropriate test data
 - select appropriate test data to use in the test plan, including using:
 - normal data
 - extreme data
 - abnormal data

8.3 Using a spreadsheet

- Extracting data, including searching using:
 - text
 - numeric
 - date and time
 - Boolean operators (AND, OR, NOT)
 - >, <, =, >=, <=
 - contains
 - starts with, ends with
- Sorting data, including:
 - ascending and descending
 - applied to single or multiple columns
- Summarising and displaying data using:
 - pivot tables
 - pivot charts
 - subtotals
 - groups
- Importing and exporting data, including:
 - csv
 - txt
 - pdf
 - graphs and charts

8 Spreadsheets (continued)

8.4 Graphs and charts

- Creating a graph or chart appropriate to a specific purpose, including:
 - appropriate data series
 - from contiguous data
 - from non-contiguous data
 - specified range(s)
 - bar chart
 - pie chart
 - line graph
 - comparative bar chart
 - comparative line graph
 - combination chart
- Apply chart formatting, including:
 - title
 - legend
 - segment labels
 - segment values
 - percentages
 - category axis labels
 - series labels
 - field selection buttons
 - value axis labels
 - scales
 - axis scale (maximum and minimum)
 - data intervals
 - add secondary axis
 - extract pie chart sector

9 Modelling

9.1 Modelling and simulations

- What-if analysis, including:
 - predict the result of changing data
 - change data to model different scenarios
 - goal seek
 - uses, including:
 - financial forecasting
 - population growth
 - climate change
 - weather systems
 - queue management
 - traffic flow
 - construction
- The characteristics of modelling software
- The need for computer models
- The effectiveness of spreadsheet models
- The use of a model to create and run simulations, including:
 - natural disaster planning
 - pilot training
 - learning to drive a car
 - nuclear science research

10 Database and file concepts

10.1 Creating a database

- Assigning a data type and an appropriate field size to a field, including:
 - text
 - alphanumeric
 - numeric (integer, decimal)
 - date
 - time
 - Boolean
- The three relationships: one-to-one, one-to-many and many-to-many
- The function of key fields, including:
 - primary key
 - compound key
 - foreign key
 - composite key
- Referential integrity and its importance
- The difference between a flat file and a relational database and why one might be more appropriate in certain situations
- Creating and using relationships, including:
 - one-to-one
 - one-to-many
- Creating and interpreting an Entity Relationship Diagram (ERD), including:
 - conceptual entity relationship diagrams
 - logical entity relationship diagrams
 - physical entity relationship diagrams
- Creating a relational database
- Setting key fields
- Validate and verify data entry:
 - using validation rules
 - testing validation applied to a database
 - verifying data entry
- Selecting appropriate query types, including:
 - when static and dynamic parameters should be used
 - when simple, complex, nested and summary queries (including cross-tab queries/pivot tables) should be used
- Performing searches, including:
 - simple query on a single criterion
 - complex queries using multiple criteria
 - static parameter queries
 - dynamic parameter queries
 - nested queries
 - using queries to find and remove duplicate records

10 Database and file concepts (continued)

10.1 Creating a database (continued)

- using queries to create new tables, append records to tables, delete records in tables and update data in tables
- summarising data (including using cross-tab queries)
- using text, numeric, date, time, wildcard, Boolean operators (AND, OR, NOT), >, <, =, >=, <=
- Performing calculations with arithmetic operations and numeric and logical functions, including:
 - calculated controls and calculated fields
- Sorting data, including:
 - ascending, descending, sorting on more than one criteria
- Designing and creating an appropriate data entry form, including appropriate:
 - font styles and sizes
 - spacing between fields
 - object width and height to display data
 - use of white space
 - radio buttons
 - drop-down menus
 - highlighting key fields
 - form controls
 - linked subforms
- Designing, creating and editing a database report, including:
 - grouped report
 - controls
 - calculated controls
- Designing and creating a switchboard/menu within a database
- Importing data, including:
 - csv
 - txt
- Exporting data, including:
 - table
 - query
 - report
 - csv
 - txt
 - rtf

10 Database and file concepts (continued)

10.2 Normalisation to third normal form (3NF)

- The characteristics of data in:
 - unnormalised form (UNF)
 - first normal form (1NF)
 - second normal form (2NF)
 - third normal form (3NF)
- The normalisation of data including the advantages and disadvantages
- Normalise a database to:
 - first normal form (1NF)
 - second normal form (2NF)
 - third normal form (3NF)

10.3 Data dictionary

- Identifying different data types, including:
 - text, alphanumeric
 - numeric (integer, decimal, currency)
 - percentage
 - date and time
 - Boolean/logical (yes/no, true/false)
- Components of a data dictionary
- Creating a data dictionary and selecting appropriate data types for a given set of data and a given situation

10.4 File and data management

- Different file types and their use
- Why generic file formats are needed
- Proprietary and open-source file formats, including why open-source file formats are needed
- Using indexed sequential access
- Using direct file access
- Using database management systems, including:
 - hierarchical
 - network
 - object-oriented
 - relational
- The features of a management information system (MIS)
- How a management information system (MIS) can be used by organisations
- Advantages and disadvantages of the different types of database management systems

11 Video and audio editing

11.1 Video editing

- Editing a video clip to meet the requirements of its intended application and audience, including:
 - setting an aspect ratio
 - trimming a video clip to remove unwanted footage
 - splicing/joining together video clips
 - adding titles, subtitles and captions
 - adding credits with appropriate source information
 - using scrolling credits with appropriate blank lines
 - ensuring readability of text
 - adding fading effects
 - adding pan and zoom effects
 - adding transitions
 - extracting a still image from a video clip
 - resizing and cropping a still image to match a video's aspect ratio
 - inserting a still image
 - adding audio to a video clip
 - editing audio within a video clip
 - removing audio from a video clip
 - altering the speed of a video clip
 - using filters and colour correction
 - exporting a video clip in different file formats (including: MP4, AVI, MOV, WMV)
 - compressing a video to different resolutions to suit different media (including: DVD, internet, mobile devices)
- The effects of different methods of compression on video, including:
 - how the different compression methods affect video quality
- Why typical features found in video editing software are used, including:
 - trimming and cropping a video clip
 - creating text-based slides
 - creating credits
 - adding captions and subtitles
 - adding fading effects
 - extracting a still image from a video clip
 - inserting a still image
 - editing audio within a video clip
 - exporting a video clip in different file formats
 - compressing a video to different resolutions
- Advantages and disadvantages of export file formats

11 Video and audio editing (continued)

11.2 Audio editing

- Editing an audio clip to meet the requirements of its intended application and audience, including:
 - importing new tracks
 - adding a track to an existing audio clip
 - normalising an audio clip, including removing any DC offset
 - trimming an audio clip to remove unwanted material
 - splicing/joining together two audio clips
 - fading in and fading out
 - altering the clip speed
 - changing the pitch
 - adding or adjusting delay/echo
 - adding or adjusting reverberation
 - changing an audio clip from stereo to mono
 - applying equalisation, high and low pass filters
 - applying noise reduction
 - overdubbing an audio clip, including voiceover
 - compressing an audio file to different sample rates to suit different media
 - exporting an audio clip in different file formats, including: MP3, MP4a, WAV, AAC
- How and why typical features found in audio editing software are used, including:
 - trimming
 - splicing/joining together two audio clips
 - fading in and fading out
 - normalising audio
 - applying noise reduction
 - overdubbing an audio clip, including voiceover
 - exporting an audio clip in different file formats
 - compressing an audio file
- Advantages and disadvantages of export file formats
- Why file sizes depend on sampling rate and sampling resolution, including:
 - describing sampling rate and sampling resolution
- The effects of different methods of compression on audio, including:
 - how the different compression methods affect the audio quality
 - saving in files v containers
 - lossy and lossless

A Level topics

Candidates should be able to demonstrate and apply their knowledge and understanding of all content within each topic in the theory and practical assessments.

12 IT in society

12.1 Digital currencies

- Types, characteristics and uses of digital currencies, including:
 - digital/electronic currency, virtual currency, cryptocurrency, central bank digital base money, stored value cards
 - centralised systems (debit, credit cards, electronic point of sale)
 - decentralised systems (Bitcoin, Litecoin, peer-to-peer electronic monetary systems, mobile electronic wallets)
- Use of blockchains as distributed ledgers for cryptocurrencies
- Impact and risks of digital currencies, including on:
 - individuals
 - businesses
 - governments
 - the global economy
- Advantages and disadvantages of different types of digital currency

12.2 Data mining

- Process of data mining
- Stages in the data mining process
 - 1 Business understanding
 - 2 Data understanding
 - 3 Data preparation
 - 4 Data modelling
 - 5 Evaluation
 - 6 Deployment
- How and why data mining is used, including in:
 - national security
 - surveillance
 - businesses
 - scientific research
 - healthcare
 - the analysis of social and economic trends
- Advantages and disadvantages of data mining to individuals and organisations, including:
 - all information is in one place
 - ethical and privacy concerns

12 IT in society (continued)

12.3 Social networking services/platforms

- Types of social networking services/platforms, including:
 - chat rooms
 - instant messaging
 - email
 - social media such as forums, blogs, microblogs
- Uses of social networking services/platforms, including:
 - by individuals, businesses, organisations, governments
 - for education, finance, healthcare, news sources
- The impact of social networking services/platforms, including:
 - on individuals – for example, meeting new people, keeping in contact with family and friends, common interest groups, exchanging ideas, intellectual isolation, physical and mental health of different age groups, ideological polarisation, stereotyping, cognitive issues
 - on businesses – for example, advertising, product information, safety information about products, customer feedback
 - on organisations – for example, to disseminate information, weather warnings
 - on governments – for example, distribution of useful information, updating of regulations, advice and discussions on current issues, government news, feedback from citizens, censorship, false/distorted information
- Advantages and disadvantages of different types of social networking services/platforms

12.4 The impact of IT

- The impact of IT on society, including on:
 - sport
 - manufacturing
 - healthcare
 - education
 - banking
 - e-business and finance
 - news
 - entertainment and media
 - family and home
 - government
 - politics
 - individuals and organisations
- The impact of IT on monitoring and surveillance in society, including on:
 - individuals
 - organisations
 - security and policing

12 IT in society (continued)

12.5 Technology enhanced learning

- Methods of delivery of technology enhanced learning, including:
 - computer-based training
 - online tutorials
 - networked courses
 - massive open online courses (MOOC)
 - video-conferencing
- Impact of technology enhanced learning, including on:
 - student and teacher motivation
 - achievement
 - autonomy
- Advantages and disadvantages of different methods of delivery

13 New and emerging technologies

13.1 New and emerging technologies

- Types of new and emerging technologies, including:
 - artificial intelligence
 - augmented reality
 - virtual reality
 - robotics
 - computer-assisted translation
 - holographic imaging
 - holographic and 4th generation optical data storage
 - 3D printing
 - vision enhancement
 - wearable computing
 - blockchain technology
 - Internet of Things (IoT)
 - molecular data storage
 - autonomous transport systems
- Impact of new and emerging technologies, including on:
 - individuals
 - organisations
 - medicine and healthcare, including patient care and monitoring, development of prosthetics and medical products, tissue engineering, artificial blood vessels, the design of medical tools and equipment
 - scientific research
 - the environment, including e-waste, recycling, power consumption, manufacturing processes, energy from wireless signals
- Advantages and disadvantages of different types of new and emerging technologies

14 Communications technology

14.1 Networks

- Types of networks, including:
 - local area network (LAN)
 - wide area network (WAN)
 - client-server
 - peer-to-peer
 - virtual private network (VPN)
 - mobile networks
- Characteristics of each type of network, including:
 - topologies (physical and logical)
 - architecture
 - protocols
- Uses of each type of network, including:
 - sharing and storage of resources
 - sharing of peripherals
 - exchange of data
 - BitTorrent for transferring large files
 - access to internet services
 - tunneling
 - access to telephony services
 - access to content delivery services such as those used, for example, for streaming videos and to download software
- Advantages and disadvantages of each type of network

14.2 Components in a network

- The role of components in a network, including:
 - network interface cards
 - wireless network interface cards
 - repeaters
 - hubs
 - switches
 - wireless access points
 - gateways
 - bridges
 - routers
- The operations of networking components, including:
 - how each component carries out its role
 - how each component works with the others in a network

14 Communications technology (continued)

14.3 Network servers

- Types of network servers, including:
 - file server
 - web server
 - mail server
 - applications server
 - print server
 - FTP server
 - proxy server
 - virtual server
- The role of servers in a network, including:
 - the function of servers in a network
- The operations of servers in a network, including:
 - the 'request and response' method of communication between servers and clients
 - within server farms
- Advantages and disadvantages of each type of server for a given scenario

14.4 Cloud computing

- Characteristics of cloud computing, including:
 - sharing computing resources
- Uses of cloud computing, including:
 - by individuals and organisations
- Advantages and disadvantages of cloud computing for individuals and organisations

14 Communications technology (continued)

14.5 Data transmission across networks

- Speed of transmission, including:
 - how bandwidth is defined
 - how bit rates are defined
 - the bandwidths made available by different transmission media and different internet access technologies, for example, ethernet, fibre optic, wireless, mobile communications
- Data streaming, including:
 - real time and on demand media streams
 - the impact of bit rate and bandwidth on the streaming of audio and video data
- The properties, features and characteristics of different transmission methods, including:
 - fibre optic
 - copper cables (coaxial and twisted pair)
 - lasers
- Typical applications of each method of data transmission across networks
- The effect of the medium on the available bandwidth for:
 - data transmission
 - audio and video streaming services
 - ultra-high definition television systems
- Advantages and disadvantages of each method of data transmission across networks

14 Communications technology (continued)

14.6 Network protocols

- The definition of a protocol
- Explain the term protocol, as used in networking, and why protocols are necessary
- The purposes and uses of protocols in the preparation, addressing, sending and receiving of data across networks, including:
 - Transmission Control Protocol (TCP)
 - Internet Protocol (IP)
 - Internet Control Message Protocol (ICMP)
 - Address Resolution Protocol (ARP) and inverse address
 - Resolution Protocol (InARP)
 - Dynamic Host Configuration Protocol (DHCP)
 - User Datagram Protocol (UDP)
 - Hypertext Transfer Protocols (HTTP and HTTPS)
 - File Transfer Protocol (FTP)
 - tunneling protocol, for example, L2TP
 - Simple Mail Transfer Protocol (SMTP)
 - Post Office Protocols, for example, POP3
 - Internet Message Access Protocol (IMAP)
 - Telnet
 - SSH
 - Internet Protocol Security (IPsec)
 - TLS/SSL
- Methods of sending data over a network, including:
 - packet switching
 - the structure of packets, including what is contained in the packets
 - the modes of connection – how and why they are used, including:
 - connection mode, for example, frame relay, Transmission Control Protocol (TCP)
 - connectionless (datagram) mode, for example, ethernet, Internet Protocol (IP), User Datagram Protocol (UDP)
 - circuit switching, including:
 - the use of communication channels in circuit switching
 - message switching, including:
 - the store of and forward method of sending messages across networks
- The purpose and use of network addressing systems, including:
 - Media Access Control (MAC) addressing
 - IP addressing (IP4 and IP6)
- Static and dynamic routing, including:
 - the selection of paths for network traffic and the use of routing tables
 - advantages and disadvantages of static and dynamic routing

14 Communications technology (continued)

14.6 Network protocols (continued)

- Function of routing protocols, including:
 - interior gateway protocols
 - exterior gateway protocols
 - border gateway protocols
- Use of protocol layering, including:
 - TCP/IP and Open Systems Interconnection model (OSI model)
 - the function of each layer in the TCP/IP suite
 - the function of each layer in the OSI model
 - comparison of the schemes
- Firewalls, including:
 - their use and configuration in controlling access to networks

14.7 Wireless technology

- Methods of wireless transmission of data, including:
 - Wi-Fi
 - Bluetooth
 - infrared
 - microwave
 - radio
 - NFC (Near Field Communication)
- The operation of wireless transmission methods, including:
 - methods of data transfer
 - wireless protocols
 - wireless power transfer
- Uses of wireless transmission methods, including:
 - data exchange
 - mobile communications
 - the Internet of Things (IoT)
- Security issues associated with wireless transmission, including:
 - methods of prevention
 - the use of wireless security protocols, for example, WEP, WPA and their variants
- Advantages and disadvantages of wireless transmission methods

14 Communications technology (continued)

14.8 Mobile communication systems

- Cellular networks, including:
 - structure of a cellular network
 - use of 3G, 4G and 5G systems for mobile communications
- How satellite communication systems are used for transferring data, including:
 - how communications data is prepared, sent and received by satellite communication systems
 - global positioning systems (GPS)
 - global mapping systems
 - surveillance, telecommunications (for example, television and radio broadcasting, telephones)
 - ultra-high definition television systems

14.9 Network security

- Network security threats, including:
 - brute force
 - denial of service (DoS)
 - botnets
 - malware
 - malicious actors (perpetrators)
 - Structured Query Language (SQL) injection
 - (poor) network policies
- Impact of network security threats on individuals and organisations, including:
 - data destruction
 - manipulation and modification and theft by unauthorised users
 - identity theft
- Methods of preventing network security issues, including:
 - use of barriers, locks, surveillance, alarm systems, security guards
 - how software methods can prevent unauthorised access, including:
 - biometric methods
 - anti-malware
 - anti-virus and anti-spyware software for protecting data, files and systems
 - encryption
 - access rights/permissions for protecting data and files
 - how firewalls can be configured to control access to networks
- Advantages and disadvantages of the various methods of network security for preventing networking security threats

14 Communications technology (continued)

14.10 Disaster recovery management

- Identification of threats and risks, including:
 - types of disaster that cause data loss and business disruption, including:
 - natural disasters
 - equipment and power failures
 - cybercrime
 - malware
 - criminal activity
 - accidental disruptive events
 - risk analysis
 - perpetrator analysis
 - risk testing
 - quantifying the risk
- Control of threats, including:
 - how to detect threats and prevent a disaster
 - how to restore after a disaster
- Strategies to minimise risks, including:
 - use of protection for power supplies
 - use of password and access controls for data and file protection
 - protection of data and software from malware, unauthorised access
 - use of back-up strategies

15 Project management

15.1 The stages of the project life cycle

- Project initiation, including:
 - identifying objectives
 - resources required
 - success criteria
 - stakeholders and their needs
 - project scope and developing high-level schedules
- Project planning, including:
 - detailed planning of resources
 - scheduling of tasks
- Project execution and monitoring, including:
 - implementing the plan
 - monitoring progress against time
 - cost and quality
 - reporting to stakeholders
- Project close, including:
 - project completion and review
 - why project reviews are conducted

15.2 Project management software

- Types of project management software, including:
 - desktop, web-based, mobile
 - personal, single-user, collaborative
- Uses for supporting projects, including:
 - supporting planning
 - scheduling of tasks
 - allocation of resources
 - costings
 - communication
 - collaborative working and decisions
- Advantages and disadvantages of:
 - the types of project management software
 - the use of project management software for supporting projects

15 Project management (continued)

15.3 Tools and techniques for project management tasks

- Gantt charts, including:
 - creating Gantt charts
 - using and interpreting Gantt charts
- Performance Evaluation and Review Technique (PERT) and Critical Path Method (CPM), including:
 - creating PERT charts
 - using and interpreting PERT charts for the analysis and management of projects
 - components such as:
 - activities/tasks/work breakdown structures (WBS)
 - timings
 - float
 - end points
 - milestones
 - dependencies
 - deliverables
 - critical path calculations and determinations to identify the longest path of dependent activities
 - the use of critical path analysis for, for example, work flow control such as authorising work, costings, allocating resources
- Advantages and disadvantages of Gantt charts, PERT charts and CPM

16 System life cycle

16.1 The stages in the system life cycle

- The definition of a system, i.e. a collection of components to form a whole system, including:
 - a hardware system
 - a software system
 - a combination of hardware and software
- The different stages of developing a system
- The relationship between the different stages of the system life cycle

16 System life cycle (continued)

16.2 Analysis

- Methods of researching for a given situation, including:
 - questionnaires
 - interviews
 - observation
 - document analysis
- Content and purpose of specifications, including:
 - user requirements specification
 - system specification
 - design specification
- Advantages and disadvantages of the different methods of researching a given situation

16.3 Design

- System processing and flow of data through a system, including:
 - Data flow diagrams (DFD), level 0 (context-level), level 1 and level 2 diagrams
 - construct a system flowchart and a data flow diagram (DFD) using correct symbols (see symbols at the end of the 'Subject content' section)
- Data storage, including:
 - databases
 - files (input and output)
- Input forms, including:
 - features and elements of forms
 - appropriate use of forms for data collection
 - validation and checking of data collected by forms
 - input screen layouts
- Output reports, including:
 - output screen layouts
 - printed copy layouts

16 System life cycle (continued)

16.4 Development and testing

- Test plans, including:
 - the need for testing and the purpose of a test plan
 - contents of a test plan
 - create a test plan for a given situation
- Test data, including:
 - the types and purpose of test data
- Alpha and beta testing, including:
 - differences between alpha and beta testing
- White box and black box testing, including:
 - differences between white box and black box testing
- Advantages and disadvantages of the different types of testing

16.5 Implementation

- Methods of implementing a system, including:
 - parallel running
 - direct changeover
 - phased implementation
 - pilot implementation
- Advantages and disadvantages of each implementation method for a given situation, including:
 - how each method is implemented in a given situation
 - the suitability of an implementation method for a given situation

16.6 Documentation

- Types of documentation and why each is needed, including:
 - requirements and design documentation
 - technical documentation
 - user and marketing documentation
- Contents of the different types of documentation
- Advantages and disadvantages of the different types of documentation

16.7 Evaluation

- Evaluating a new system, including the efficiency, ease of use and appropriateness for intended use
- Evaluation techniques, including:
 - checking against specifications
 - meeting user requirements
 - feedback from users

16 System life cycle (continued)

16.8 Methods of software development

- Stages and processes of each method, including:
 - agile
 - iterative
 - incremental
 - rapid application development (RAD)
 - waterfall
- Advantages and disadvantages of each method

16.9 Prototyping

- Types of prototyping and why each is needed, including:
 - evolutionary
 - incremental
 - throwaway
 - rapid
- Advantages and disadvantages of each type of prototyping

16.10 Maintenance

- Types of maintenance and why each is needed, including:
 - perfective
 - adaptive
 - preventive
 - corrective maintenance
- How each type of maintenance is carried out
- Advantages and disadvantages of different types of maintenance

17 Data Analysis and Visualisation

17.1 Data Analysis and Visualisation

Using skills, knowledge and understanding described in sections 8 Spreadsheets, 9 Modelling and 10 Database and file concepts of the AS Level subject content to analyse, interpret and display data to visually communicate information to users in a clear and efficient manner.

- Transforming and cleaning data to extract meaningful information
- Getting data from different sources, including:
 - comparing and consolidating data from two data sources
 - splitting data into discrete fields
 - merging and combining data into required fields
- Displaying data to communicate information, including:
 - pivot table reports
 - pivot charts

18 Mail merge

18.1 Mail merge

- When and why mail merge is used
- The need for data sources and master documents
- Creating/editing and using source data using appropriate software
- Creating a master document for:
 - letters
 - labels (including custom labels)
 - a directory
- Link a master document to a source file, including:
 - identifying and using correct field names
 - embedding a chart/table
- Inserting:
 - specified merge fields
 - document properties
 - document fields
 - date/time fields
- Setting up fields:
 - for manual completion, including:
 - using Fill-in and Ask fields
 - creating appropriate prompts to the user for manual completion
 - for automatic completion calculations, including inserting formulas
 - when and why fields need to be set up
- Specifying rules:
 - for selecting recipients, including:
 - editing
 - sorting
 - filtering
 - for excluding recipients
 - for excluding recipients by inserting conditional fields, including the use of:
 - If Then Else
 - Skip Record If
 - Next Record If
 - when and why rules need to be specified

19 Graphics creation

19.1 Common graphics skills

- Using software tools for the creation and editing of digital graphics, including:
 - graphics tools, including:
 - add layers
 - remove layers
 - select active layer
 - order
 - toggle visibility
 - lock/unlock layers
 - change opacity/transparency
 - blend/flatten/merge layers
 - transform tools, including:
 - resize
 - skew
 - reflect
 - rotate
 - move
 - scale
 - shear
 - apply envelope and perspective
 - grouping or merging tools, including:
 - group
 - ungroup
 - combine/join
 - add/subtract
 - intersect
 - alignment and distribution tools, including:
 - left
 - right
 - top
 - bottom
 - centre alignment
 - vertical and horizontal distribution
 - order
 - raise
 - lower
 - bring to front
 - send to back

19 Graphics creation (continued)

19.1 Common graphics skills (continued)

- layout tools, including:
 - rulers
 - grids
 - guidelines
 - snapping
- colour picker tools, including select a colour or colour range within an image or from other sources
- crop tools, including crop/clip to objects
- colour systems, including:
 - RGB
 - HSL
 - CMYK
 - CMS
 - how each produces colour
 - their properties, purpose and uses
- the need for different image resolutions, including the impact of having too low/high resolution for an image on screen or in print
- different bitmap and vector file formats, including their suitability and selection for use in a given scenario
- exporting an image in different file formats, including:
 - svg
 - bmp
 - jpg
 - png
 - gif
 - tif
 - pdf
- changing solid and gradient fills

19 Graphics creation (continued)

19.2 Vector graphics

- Using software tools for the creation and editing of vector graphics, including:
 - creating a vector graphic that meets the requirements of its intended application and audience
 - vector drawing tools:
 - freehand drawing
 - Bezier curves
 - straight lines
 - shape tools – creation of rectangles, ellipses, circles, arcs, stars, polygons and spirals
 - application of envelopes and perspectives
 - selection tools to select and manipulate parts of a vector graphic, including:
 - convert to curves
 - replication
 - transformation tools
 - fill tools to colour elements, including:
 - solid
 - gradient
 - node and path editing, including:
 - adding, moving and deleting nodes to simplify paths
 - using Bezier handles
 - working with symmetrical, asymmetrical, cusp, and smooth nodes
 - align and distribute nodes
- Converting bitmap images into editable vector shapes, including trace bitmaps
- Advantages and disadvantages of converting a bitmap image into an editable vector shape

19 Graphics creation (continued)

19.3 Bitmap images

- Using software tools for the creation and editing of bitmap graphics, including:
 - creating and editing bitmap images that meet the requirements of their intended application and audience
 - selection tools to select, remove or hide parts of a bitmap image, including:
 - lasso
 - magic wand
 - colour select
 - cut-out
 - crop
 - masking tools
 - working with colour, including:
 - solid and gradient fills
 - convert to black and white, greyscale
 - adjust brightness, contrast, colour balance, shadows and highlights
 - brush, pencil and pen tools, including:
 - pre-set and customised options
 - tools/filters to alter parts of an image, including:
 - distort
 - clone
 - erase
 - blur
 - smudge
 - sharpen
 - red eye removal
 - resizing the image/canvas, including the use of:
 - changing colour depth
 - changing resolution

19 Graphics creation (continued)

19.4 Compression

- What compression is
- Methods of compression
 - lossless compression
 - lossy compression
- Effects of different methods of compression on images

19.5 Text

- Selecting font style, including:
 - font face
 - size
 - kerning
 - letter spacing
 - line spacing
- Fitting text to path or shape
 - aligning text along a line or around a shape
- Setting text in a shape
- Converting text to curves
 - converting fonts into editable vector shapes
- Use of text and its manipulation within graphics software

20 Animation

20.1 Animation

- Using software tools for the creation and editing of computer animations, including:
 - creating an animation (stop motion and key frame) that meets the requirements of its intended application and audience
 - configuring the stage/frame/canvas for an animation, including setting:
 - colour
 - size
 - the aspect ratio using rulers, guides and grid settings
 - snapping options
 - importing and creating vector objects, including:
 - tracing bitmaps
 - adding text
 - controlling object properties, including:
 - stroke and fill settings
 - size position and orientation
 - transparency
 - setting paths
 - using layers
 - applying masks
 - controlling animations by:
 - adjusting frame rates
 - looping or stopping animations
- The basic principles of animation, including:
 - frames
 - key frames
 - property key frames
 - timings
 - coordinates
 - inbetweening ('tweening') tools to change:
 - motion
 - shape
 - size
 - colour
 - morphing and the effect it creates
- Different animation types and methods, including:
 - cel animation
 - stop motion
 - time lapse
 - flip book
 - CGI
 - 2D
 - 3D

20 Animation (continued)

20.1 Animation (continued)

- Components of an animation:
 - the primary, for example, the main focus of the animation, such as main characters
 - the secondary, for example:
 - sound
 - background
 - other components of animation
- The use of animation variables when creating animations, including:
 - to control the position of an animated object or parts of an animated object
- Advantages and disadvantages of different animation types

21 Programming for the web

21.1 Programming for the web

For this section of the syllabus, we recommend that candidates have a working knowledge of HTML and CSS (for example, have studied website authoring in Cambridge IGCSE Information and Communication Technology, syllabus code 0417/0983).

- Using JavaScript to:
 - add interactivity to web pages, including by:
 - inserting JavaScript in HTML
 - creating and using external scripts
 - change HTML content:
 - text/number, including calculations and string manipulation
 - images and image properties
 - change HTML styles:
 - change style of HTML elements using `document.getElementById(id).style.property = new style`
 - show/hide HTML elements using:
 - `document.getElementById(id).style.visibility=`
 - `document.getElementById(id).style.display=`
 - display data in different ways, including by writing into:
 - an HTML element, using `innerHTML`
 - the HTML output using `document.write()`
 - an alert box, using `window.alert()`
 - the browser console, using `console.log()`
 - react to common HTML Events, including:
 - `onload`
 - `onchange`
 - `onclick`
 - `onmouseover`
 - `onmouseout`
 - `onkeydown`
 - provide user interaction using:
 - `confirm()` and `prompt()` popups
- The structure and syntax of JavaScript code, including:
 - JavaScript statements composed of:
 - values (literals and variables)
 - operators (assignment, arithmetic, algebraic, string)
 - comparison (logical, conditional, type)
 - expressions
 - keywords
 - comments
 - functions to be executed:
 - when an event occurs
 - when invoked from code
 - automatically (self-invoked)
 - JavaScript timing events, including:
 - execution interval methods `setTimeout()` and `setInterval()`


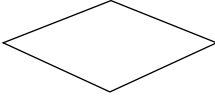

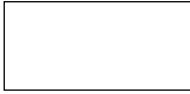



21 Programming for the web (continued)

21.1 Programming for the web (continued)

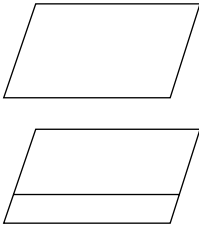


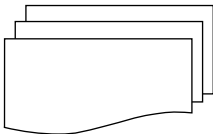
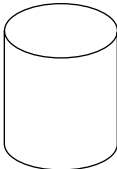
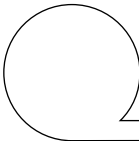
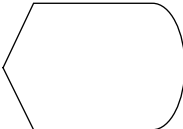
- comments to annotate and explain code, including:
 - single line and multi-line
- JavaScript loops for iterative methods, including:
 - for loop
 - for/in loop
 - while loop
 - do/while loop
- Object-based JavaScript programming techniques and terms, including:
 - JavaScript statements
 - data types (including: number, string, Boolean, array, object)
 - type conversions
 - variables and arrays
 - JavaScript operators
 - logical operators (AND, OR, NOT)
 - comparison operators (Logical, Ternary, equal to, equal value and equal type, not equal to, not equal value and not equal type, greater than, less than, greater than or equal to, less than or equal to)
 - conditional operators (if, else, else if, switch)
 - loops
 - break
 - interaction: alert(), prompt(), confirm()
 - functions
 - execution interval methods: setTimeout(), setInterval()

Flowchart, system flowchart and data flow diagram symbols

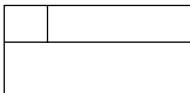
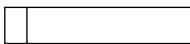

Flowchart symbols

Element	Symbol
Input/output	
Decision	
Terminator (Start/Stop)	
Process box	
Subroutine	
Connector	
Flow line	

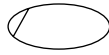
System flowchart symbols

Element	Symbol
Input/output	
Process	
Single document output	
Multiple document output	
Magnetic disk file	
Magnetic tape file	
Display	

Data flow diagram symbols

Element	Symbol
Process	
Data store	
Data source or destination (inputs and outputs)	

Duplication data source or
destination



4 Details of the assessment

Paper 1 – Theory

Written paper, 1 hour 45 minutes, 70 marks

Candidates answer all questions. The paper consists of short-answer and structured questions of variable mark value. Calculators are **not** allowed in Paper 1. Candidates answer on the question paper.

This written paper tests sections 1–11 of the syllabus content. The paper assesses AO1 Recall, select and communicate knowledge and understanding of IT and AO3 Analyse, evaluate, and present reasoned conclusions.

Paper 2 – Practical

Practical paper, 2 hours 30 minutes, 90 marks

Candidates answer all questions. This practical paper tests sections 8–11 of the syllabus content. Candidates also need to apply their knowledge from sections 1–7 of the syllabus content. They must not have access to the internet or email. The paper assesses AO2 Apply knowledge, understanding, skills and judgement to produce IT-based solutions.

Candidates perform practical tasks within a structured problem-solving context and submit their work electronically. Candidates select the most appropriate software and must use the most efficient methods to solve each task.

Candidates work with electronic resource files provided by Cambridge International. These files must be loaded onto the candidate's computer system before the start of the exam.

Candidates must save their work in the format specified in the tasks. If work is saved in an incorrect file format, candidates will not receive marks for that task. To ensure candidates are able to convert/export files in any format during the practical tests, file conversion software must be available to candidates on their computers. They should have experience of using this software during the teaching of the syllabus.

Details of how to administer the practical paper can be found in the *Cambridge Handbook*, which is available from the exams officer section of our website: www.cambridgeinternational.org/examsofficers

Paper 3 – Advanced Theory

Written paper, 1 hour 45 minutes, 70 marks

Candidates answer all questions. The paper consists of short-answer and structured questions of variable mark value. Calculators are **not** allowed in Paper 3. Candidates answer on the question paper.

This written paper tests sections 12–21 of the syllabus content. The content of sections 1–11 is assumed knowledge. The paper assesses AO1 Recall, select and communicate knowledge and understanding of IT and AO3 Analyse, evaluate, and present reasoned conclusions.

Paper 4 – Advanced Practical

Practical paper, 2 hours 30 minutes, 90 marks

Candidates answer all questions. This practical paper tests sections 17–21 of the syllabus content. The exam may also include practical tasks from sections 8–10 within a problem-solving context. Candidates must not have access to the internet or email. The paper assesses AO2 Apply knowledge, understanding, skills and judgement to produce IT-based solutions.

Candidates perform practical tasks and submit their work electronically. Candidates apply their knowledge from all sections of the syllabus. Candidates select the most appropriate software and must use the most efficient methods to solve each task.

Candidates work with electronic resource files provided by *Cambridge International*. These files must be loaded onto the candidate's computer system before the start of the examination.

Candidates must save their work in the format specified in the tasks. If work is saved in an incorrect file format, candidates will not receive marks for that task. To ensure candidates are able to convert/export files in any format during the practical tests, file conversion software must be available to candidates on their computers. They should have experience of using this software during the teaching of the syllabus.

Details of how to administer the practical paper can be found in the Cambridge Handbook, which is available from the exams officer section of our website: **www.cambridgeinternational.org/examsofficers**

Command words

Command words and their meanings help candidates know what is expected from them in the exam. The table below includes command words used in the assessment for this syllabus. The use of the command word will relate to the subject context.

Command word	What it means
Analyse	examine in detail to show meaning, identify elements and the relationship between them
Assess	make an informed judgement
Compare	identify/comment on similarities and/or differences
Contrast	identify/comment on differences
Define	give precise meaning
Describe	state the points of a topic/give characteristics and main features
Discuss	write about issue(s) or topic(s) in depth in a structured way
Evaluate	judge or calculate the quality, importance, amount, or value of something
Explain	set out purposes or reasons/make the relationships between things clear/say why and/or how and support with relevant evidence
Identify	name/select/recognise
Justify	support a case with evidence/argument
State	express in clear terms
Suggest	apply knowledge and understanding to situations where there are a range of valid responses in order to make proposals/put forward considerations

5 What else you need to know

This section is an overview of other information you need to know about this syllabus. It will help to share the administrative information with your exams officer so they know when you will need their support. Find more information about our administrative processes at www.cambridgeinternational.org/eoguide

Before you start

Previous study

We recommend that learners starting this course should have completed a course in Information Technology equivalent to Cambridge IGCSE™ or Cambridge O Level. The topics covered by Cambridge IGCSE Information and Communication Technology (0417/0983) are assumed knowledge for this syllabus.

Guided learning hours

We design Cambridge International AS & A Level syllabuses to require about 180 guided learning hours for each Cambridge International AS Level and about 360 guided learning hours for a Cambridge International A Level. The number of hours a learner needs to achieve the qualification may vary according to each school and the learners' previous experience of the subject.

Availability and timetables

All Cambridge schools are allocated to an administrative zone. Each zone has a specific timetable.

You can view the timetable for your administrative zone at www.cambridgeinternational.org/timetables

You can enter candidates in the June and November exam series. If your school is in India, you can also enter your candidates in the March exam series.

Check you are using the syllabus for the year the candidate is taking the exam.

Private candidates can enter for this syllabus. For more information, please refer to the *Cambridge Guide to Making Entries*.

Combining with other syllabuses

Candidates can take this syllabus alongside other Cambridge International syllabuses in a single exam series. The only exceptions are:

- Cambridge International AS & A Level Computer Science (9618)
- syllabuses with the same title at the same level.

Group awards: Cambridge AICE

Cambridge AICE (Advanced International Certificate of Education) is a group award for Cambridge International AS & A Level. It allows schools to offer a broad and balanced curriculum by recognising the achievements of learners who pass exams in a range of different subjects.

Learn more about Cambridge AICE at www.cambridgeinternational.org/aice

Making entries

Exams officers are responsible for submitting entries to Cambridge International. We encourage them to work closely with you to make sure they enter the right number of candidates for the right combination of syllabus components. Entry option codes and instructions for submitting entries are in the *Cambridge Guide to Making Entries*. Your exams officer has a copy of this guide.

Exam administration

To keep our exams secure, we produce question papers for different areas of the world, known as administrative zones. We allocate all Cambridge schools to one administrative zone determined by their location. Each zone has a specific timetable. Some of our syllabuses offer candidates different assessment options. An entry option code is used to identify the components the candidate will take relevant to the administrative zone and the available assessment options.

Support for exams officers

We know how important exams officers are to the successful running of exams. We provide them with the support they need to make your entries on time. Your exams officer will find this support, and guidance for all other phases of the Cambridge Exams Cycle, at **www.cambridgeinternational.org/eoguide**

Retakes and carrying forward marks

Candidates can retake Cambridge International AS Level and Cambridge International A Level as many times as they want to. Information on retake entries is at **www.cambridgeinternational.org/retakes**

Candidates can carry forward the result of their Cambridge International AS Level assessment from one series to complete the Cambridge International A Level in a following series. The rules, time limits and regulations for carry-forward entries for staged assessment can be found in the *Cambridge Handbook* for the relevant year of assessment at **www.cambridgeinternational.org/eoguide**

To confirm what entry options are available for this syllabus, refer to the *Cambridge Guide to Making Entries* for the relevant series.

Language

This syllabus and the related assessment materials are available in English only.

Accessibility and equality

Syllabus and assessment design

Cambridge International works to avoid direct or indirect discrimination. We develop and design syllabuses and assessment materials to maximise inclusivity for candidates of all national, cultural or social backgrounds and candidates with protected characteristics; these protected characteristics include special educational needs and disability, religion and belief, and characteristics related to gender and identity. In addition, the language and layout used are designed to make our materials as accessible as possible. This gives all candidates the fairest possible opportunity to demonstrate their knowledge, skills and understanding and helps to minimise the requirement to make reasonable adjustments during the assessment process.

Access arrangements

Access arrangements (including modified papers) are the principal way in which Cambridge International complies with our duty, as guided by the UK Equality Act (2010), to make 'reasonable adjustments' for candidates with special educational needs (SEN), disability, illness or injury. Where a candidate would otherwise be at a substantial disadvantage in comparison to a candidate with no SEN, disability, illness or injury, we may be able to agree pre-examination access arrangements. These arrangements help a candidate by minimising accessibility barriers and maximising their opportunity to demonstrate their knowledge, skills and understanding in an assessment.

Important:

- Requested access arrangements should be based on evidence of the candidate's barrier to assessment and should also reflect their normal way of working at school; this is in line with the *Cambridge Handbook* www.cambridgeinternational.org/eoguide
- For Cambridge International to approve an access arrangement, we will need to agree that it constitutes a reasonable adjustment, involves reasonable cost and timeframe and does not affect the security and integrity of the assessment.
- Availability of access arrangements should be checked by centres at the start of the course. Details of our standard access arrangements and modified question papers are available in the *Cambridge Handbook* www.cambridgeinternational.org/eoguide
- Please contact us at the start of the course to find out if we are able to approve an arrangement that is not included in the list of standard access arrangements.
- Candidates who cannot access parts of the assessment may be able to receive an award based on the parts they have completed.

After the exam

Grading and reporting

Grades A*, A, B, C, D or E indicate the standard a candidate achieved at Cambridge International A Level. A* is the highest and E is the lowest grade.

Grades a, b, c, d or e indicate the standard a candidate achieved at Cambridge International AS Level. 'a' is the highest and 'e' is the lowest grade.

'Ungraded' means that the candidate's performance did not meet the standard required for the lowest grade (E or e). 'Ungraded' is reported on the statement of results but not on the certificate. In specific circumstances your candidates may see one of the following letters on their statement of results:

- Q (PENDING)
- X (NO RESULT).

These letters do not appear on the certificate.

If a candidate takes a Cambridge International A Level and fails to achieve grade E or higher, a Cambridge International AS Level grade will be awarded if both of the following apply:

- the components taken for the Cambridge International A Level by the candidate in that series included all the components making up a Cambridge International AS Level
- the candidate's performance on the AS Level components was sufficient to merit the award of a Cambridge International AS Level grade.

On the statement of results and certificates, Cambridge International AS & A Levels are shown as General Certificates of Education, GCE Advanced Subsidiary Level (GCE AS Level) and GCE Advanced Level (GCE A Level).

School feedback: 'Cambridge International A Levels are the 'gold standard' qualification. They are based on rigorous, academic syllabuses that are accessible to students from a wide range of abilities yet have the capacity to stretch our most able.'

Feedback from: Director of Studies, Auckland Grammar School, New Zealand

How students, teachers and higher education can use the grades

Cambridge International A Level

Assessment at Cambridge International A Level has two purposes:

- 1 to measure learning and achievement
The assessment confirms achievement and performance in relation to the knowledge, understanding and skills specified in the syllabus.
- 2 to show likely future success
The outcomes help predict which students are well prepared for a particular course or career and/or which students are more likely to be successful.
The outcomes help students choose the most suitable course or career.

Cambridge International AS Level

Assessment at Cambridge International AS Level has two purposes:

- 1 to measure learning and achievement
The assessment confirms achievement and performance in relation to the knowledge, understanding and skills specified in the syllabus.
- 2 to show likely future success
The outcomes help predict which students are well prepared for a particular course or career and/or which students are more likely to be successful.
The outcomes help students choose the most suitable course or career.
The outcomes help decide whether students part way through a Cambridge International A Level course are making enough progress to continue.
The outcomes guide teaching and learning in the next stages of the Cambridge International A Level course.

Grade descriptions

Grade descriptions are provided to give an indication of the standards of achievement candidates awarded particular grades are likely to show. Weakness in one aspect of the examination may be balanced by a better performance in some other aspect.

Grade descriptions for Cambridge International A Level Information Technology will be published after the first assessment of the A Level in 2025.

Changes to this syllabus for 2025, 2026 and 2027

The syllabus has been reviewed and revised for first examination in 2025.

This is version 2 of the syllabus, published January 2023.

You must read the whole syllabus before planning your teaching programme.

Changes to version 2 of the syllabus, published January 2023.

Changes to syllabus content	<ul style="list-style-type: none"> We have added the below subject content to version 2: <ul style="list-style-type: none"> 1.1 Data and information – ‘census data’ in list of examples of indirect data sources 1.4 Checking the accuracy of data – ‘Advantages and disadvantages of validation and verification’ 10.4 File and data management – ‘Proprietary and open-source file formats, including why open-source file formats are needed’. We have added Assess to the list of command words on page 66 of this syllabus. Assess means ‘make an informed judgement’.
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Changes to version 1 of the syllabus, published September 2022.

Changes to syllabus content	<ul style="list-style-type: none"> We have refreshed the subject content for examination from 2025. The content to teach is largely the same. The updates to subject content include: <ul style="list-style-type: none"> removing out-of-date content giving additional detail and examples rewording points to provide greater clarity regrouping content within sections.
Changes to assessment (including changes to specimen papers)	<ul style="list-style-type: none"> We are publishing new specimen papers for examination from 2025. The 2022 specimen papers are still suitable for use with this syllabus.

In addition to reading the syllabus, you should refer to the updated specimen papers. The specimen papers will help your students become familiar with exam requirements and command words in questions. The specimen mark schemes explain how students should answer questions to meet the assessment objectives.

Any textbooks endorsed to support the syllabus for examination from 2022 are suitable for use with this syllabus.



School feedback: ‘While studying Cambridge IGCSE and Cambridge International A Levels, students broaden their horizons through a global perspective and develop a lasting passion for learning.’

Feedback from: Zhai Xiaoning, Deputy Principal, The High School Affiliated to Renmin University of China

We are committed to making our documents accessible in accordance with the WCAG 2.1 Standard. We are always looking to improve the accessibility of our documents. If you find any problems or you think we are not meeting accessibility requirements, contact us at **info@cambridgeinternational.org** with the subject heading: Digital accessibility. If you need this document in a different format, contact us and supply your name, email address and requirements and we will respond within 15 working days.

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