



**Cambridge Assessment
International Education**

Syllabus

Cambridge International AS & A Level Information Technology 9626

For examination in June and November 2021.

Also available for examination in March 2021 for India only.



Changes to the syllabus for 2021

The syllabus has been updated. The latest syllabus is version 3, published September 2020.

- Page 11, in *Combining this with other syllabuses*
Cambridge International AS & A Level Computer Science (9618) has been added to the list of syllabuses that must **not** be combined with Cambridge International Information Technology (9626) in an examination series.

Previous changes to version 2 of this syllabus, published June 2019

- Page 29, in Paper 1 Theory
Calculators must **not** be used in this paper.
- Page 29, in Paper 3 Advanced Theory
Calculators must **not** be used in this paper.

Previous changes to version 1 of this syllabus, published September 2018

There are no significant changes which affect teaching.

You are strongly advised to read the whole syllabus before planning your teaching programme.

Any textbooks endorsed to support the syllabus for examination from 2017 are still suitable for use with this syllabus.

Teachers should take account of the changes made to the 2017–2019 syllabus and the changes above when using these textbooks.

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Contents

Introduction	2
Welcome	
Why Cambridge Assessment International Education?	
Why Cambridge International AS & A Levels?	
Why Cambridge International AS & A Level Information Technology?	
Teacher support	
1 Syllabus overview	9
1.1 Content	
1.2 Assessment	
2 Syllabus aims and assessment objectives	12
2.1 Syllabus aims	
2.2 Assessment objectives	
2.3 Relationship between assessment objectives and components	
2.4 Relationship between assessment objectives and qualifications	
3 Syllabus content	14
1. Data, information, knowledge and processing	
2. Hardware and software	
3. Monitoring and control	
4. eSafety and health and safety	
5. The digital divide	
6. Using networks	
7. Expert systems and other types of processing	
8. Spreadsheets	
9. Database and file concepts	
10. Sound and video editing	
11. Emerging technologies	
12. Role and impact of IT in society	
13. Networks	
14. Project management	
15. System life cycle	
16. Graphics creation	
17. Animation	
18. Mail merge	
19. Programming for the web	
4 Description of components	29
Paper 1 Theory	
Paper 2 Practical	
Paper 3 Advanced Theory	
Paper 4 Advanced Practical	
5 Glossary of command words.....	30
6 Other information	31
Equality and inclusion	
Language	
Grading and reporting	
Exam administration	

Why choose Cambridge International?

Cambridge Assessment International Education prepares school students for life, helping them develop an informed curiosity and a lasting passion for learning. We are part 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.

“ We think the Cambridge curriculum is superb preparation for university. ”

Christoph Guttentag, Dean of Undergraduate Admissions, Duke University, USA

“ Cambridge students develop a deep understanding of subjects and independent thinking skills. ”

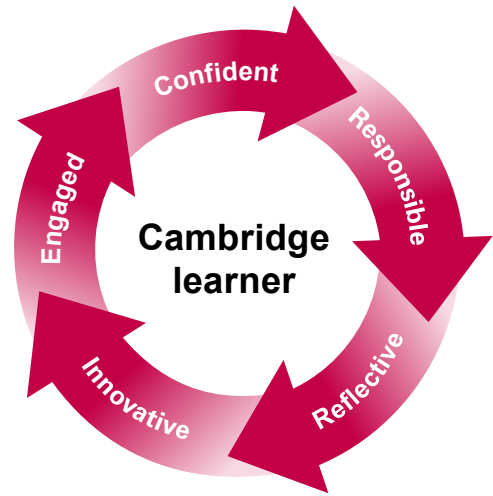
Tony Hines, Principal, Rockledge High School, USA

Why choose Cambridge International AS & A Levels?

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:

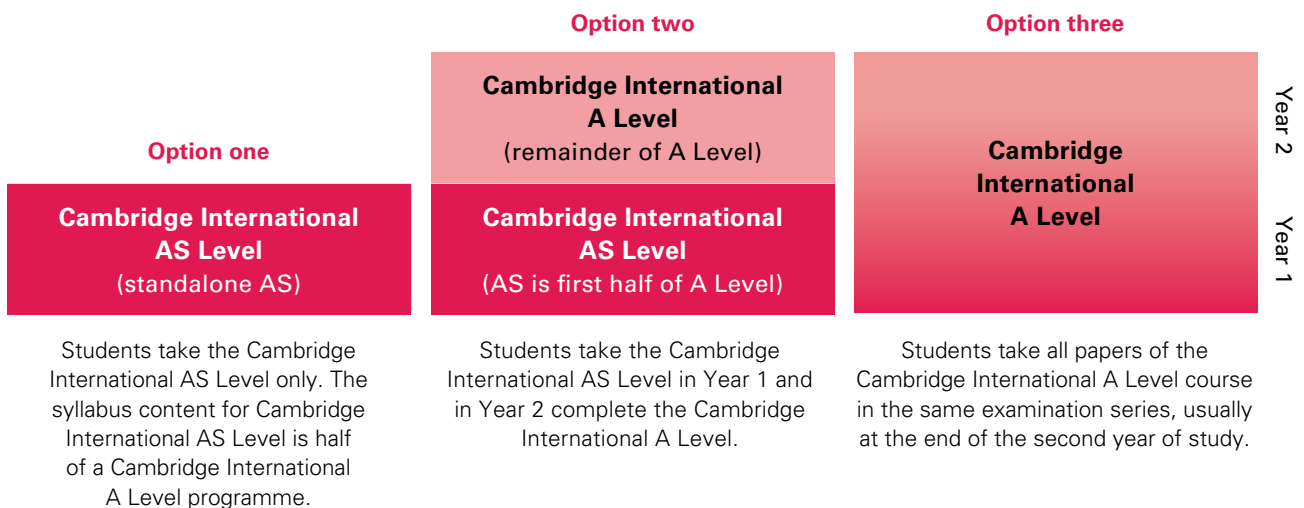
- a deep understanding of their subjects
- higher order thinking skills – analysis, critical thinking, problem solving
- presenting ordered and coherent arguments
- independent learning and research.



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

- **confident** in working with information and ideas – their own and those of others
- **responsible** for themselves, responsive to and respectful of others
- **reflective** as learners, developing their ability to learn
- **innovative** and equipped for new and future challenges
- **engaged** intellectually and socially, ready to make a difference.

Cambridge International AS & A Level offers a choice of assessment routes with staged assessment available in many subjects: Cambridge International AS Level can be offered as a standalone qualification or as part of a progression to Cambridge International A Level:



Recognition

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. They 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.

Learn more

For more details go to www.cambridgeinternational.org/recognition

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

“ The depth of knowledge displayed by the best A Level students makes them prime targets for America’s Ivy League universities ”

Yale University, USA

Why Cambridge International AS & A Level Information Technology?

About the syllabus

In a world where Information Technology (IT) is constantly changing, individuals increasingly need technological and information literacy skills that include the ability to gather, process and manipulate data.

The impact of IT on society is enormous and as the percentage of businesses and households connected to communication networks such as the internet grows, so does the need for individuals who understand these new technologies.

This syllabus encourages learners to become effective and discerning users of IT. It helps them to develop a broad range of IT skills, knowledge and understanding. Learners study the structure and use of IT systems within a wide range of organisations, including the use of a variety of computer networks. As a result, learners gain an understanding of IT system life cycles, and how these affect the workplace. They also learn about the wider impact of IT on society in general. At A Level, learners also study simple programming for the web relevant to their own use of IT.

Key concepts

The key concepts on which this syllabus is built are set out below. These key concepts, 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.

As a teacher, you will refer to these concepts again and again to help unify the subject and make sense of it. If mastered, learners can use the concepts to solve problems or to understand unfamiliar subject-related material.

- **Impact of Information Technology**

Information Technology (IT) is the application of technology to process information.

The impact of IT on all aspects of everyday life is immense. The enormity of the impact can be seen in industry and commerce, transport, leisure, medicine and the home. The impact on the work force is a very important factor to consider and communications using new technologies have made the world seem smaller.

- **Hardware and software**

Many hardware components and software applications are used in IT systems. It is important to understand how these work, and how they interact with each other and within our environment.

- **Network**

Computer systems can be connected together to form networks allowing them to share resources.

- **The internet**

The internet is a global communications network that allows computers worldwide to connect and share information in many different forms. Examples include email, web pages, and audio and video files. The impact of the internet on our lives is profound. While it provides huge benefits to society, security of data is an issue, both in the workplace and for personal data.

- **System life cycle**

Information systems are developed within a planned continuous cycle that covers the initial development of the system through to its scheduled updating or redevelopment. Each phase of development is organised into separate stages.

- **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.

Guided learning hours

Guided learning hours give an indication of the amount of contact time teachers need to have with learners to deliver a particular course. Our syllabuses are designed around 180 guided learning hours for Cambridge International AS Level, and around 360 guided learning hours for Cambridge International A Level.

These figures are for guidance only. The number of hours needed to gain the qualification may vary depending on local practice and the learners' previous experience of the subject.

Prior learning

We recommend that candidates who are beginning this course should have previously completed a Cambridge IGCSE™ course, or the equivalent, in Information and Communication Technology or in Computer Science.

Progression

Cambridge International A Level Information Technology provides a suitable foundation for the study of IT or related courses in higher education. Equally it is suitable for candidates intending to pursue careers or further study in IT, or as part of a course of general education. Cambridge International AS Level Information Technology is the first half of Cambridge International A Level Information Technology. Depending on local university entrance requirements, the qualification may permit or assist progression directly to university courses in information technology or some other subjects.

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

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

How can I find out more?

If you are already a Cambridge school

You can make entries for this qualification through your usual channels. If you have any questions, please contact us at info@cambridgeinternational.org

If you are not yet a Cambridge school

Learn more about the benefits of becoming a Cambridge school from our website at www.cambridgeinternational.org/startcambridge

Email us at info@cambridgeinternational.org to find out how your organisation can register to become a Cambridge school.

Cambridge AICE

Cambridge AICE Diploma is the group award of the Cambridge International AS & A Level. It gives schools the opportunity to benefit from offering a broad and balanced curriculum by recognising the achievements of candidates who pass examinations from different curriculum groups.

Learn more

For more details go to www.cambridgeinternational.org/aice

“ Our research has shown that students who came to the university with a Cambridge AICE background performed better than anyone else that came to the university. That really wasn't surprising considering the emphasis they have on critical research and analysis, and that's what we require at university. ”

John Barnhill, Assistant Vice President for Enrollment Management, Florida State University, USA

Supporting teachers

We provide a wide range of practical resources, detailed guidance, and innovative training and professional development so that you can give your learners the best possible preparation for Cambridge International AS & A Level.

Teaching resources

- School Support Hub
www.cambridgeinternational.org/support
- Syllabuses
- Schemes of work
- Learner guides
- Discussion forums
- Endorsed resources

Exam preparation resources

- Question papers
- Mark schemes
- Example candidate responses to understand what examiners are looking for at key grades
- Examiner reports to improve future teaching

Support
for Cambridge
International
AS & A Level

Training

- Introductory – face-to-face or online
 - Extension – face-to-face or online
 - Enrichment – face-to-face or online
 - Coursework – online
 - Cambridge Professional Development Qualifications
- Find out more at
www.cambridgeinternational.org/profdev

Community

You can find useful information, as well as share your ideas and experiences with other teachers, on our social media channels and community forums.

Find out more at
www.cambridgeinternational.org/social-media

“ 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. ”

US Higher Education Advisory Council

1 Syllabus overview

1.1 Content

Candidates for Cambridge International AS Information Technology study the following topics 1–10.

1. **Data, information, knowledge and processing**
2. **Hardware and software**
3. **Monitoring and control**
4. **eSafety and health and safety**
5. **The digital divide**
6. **Using networks**
7. **Expert systems and other types of processing**
8. **Spreadsheets**
9. **Database and file concepts**
10. **Sound and video editing**

Candidates for Cambridge International A Level Information Technology study topics 1–10 **and** the following topics 11–19.

11. **Emerging technologies**
12. **Role and impact of IT in society**
13. **Networks**
14. **Project management**
15. **System life cycle**
16. **Graphics creation**
17. **Animation**
18. **Mail merge**
19. **Programming for the web**

1.2 Assessment

For Cambridge International AS and A Level Information Technology, candidates:

- take Papers 1 and 2 only (for the Cambridge International AS Level qualification)
- or
- follow a staged assessment route by taking Papers 1 and 2 (for Cambridge International AS Level qualification) in one series, then Papers 3 and 4 (for Cambridge International A Level qualification) in a later series
- or
- take Papers 1, 2, 3 and 4 in the same examination series, leading to the full Cambridge International A Level.

All components are externally assessed.

Component	Weighting	
	AS Level	A Level
<p>Paper 1 Theory 1 hour 45 minutes</p> <p>This written paper tests sections 1–10 of the syllabus content. Candidates answer each question in the spaces provided on the question paper. All questions are compulsory. 90 marks</p>	50%	25%
<p>Paper 2 Practical 2 hours 30 minutes</p> <p>This paper tests sections 8–10 of the syllabus content. Candidates will also need to use their previous knowledge from sections 1–7. All tasks are compulsory. Candidates must use the most appropriate software and the most appropriate methods. 110 marks</p>	50%	25%
<p>Paper 3 Advanced Theory 1 hour 45 minutes</p> <p>This written paper tests sections 11–19 of the syllabus content. The content of sections 1–10 is assumed knowledge. Candidates answer each question in the spaces provided on the question paper. All questions are compulsory. 90 marks</p>	–	25%
<p>Paper 4 Advanced Practical 2 hours 30 minutes</p> <p>This paper tests sections 16–19 of the syllabus content, and sections 8–9 of the syllabus content within a problem-solving context. Candidates will also need to use their previous knowledge from all sections of the syllabus. All tasks are compulsory. Candidates must use the most appropriate software and the most appropriate methods. 110 marks</p>	–	25%

Availability

This syllabus is examined in the June and November examination series. This syllabus is also available for examination in March for India only.

This syllabus is available to private candidates.

Detailed timetables are available from www.cambridgeinternational.org/timetables

Centres in the UK that receive government funding are advised to consult the Cambridge International website www.cambridgeinternational.org for the latest information before beginning to teach this syllabus.

Combining this with other syllabuses

Candidates can combine this syllabus in an examination series with any other Cambridge International syllabus, except:

- Cambridge International AS & A Level Computer Science (9608)
- Cambridge International AS & A Level Computer Science (9618)
- syllabuses with the same title at the same level.

2 Syllabus aims and assessment objectives

2.1 Syllabus aims

The syllabus aims to enable candidates 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 basic computer networks
- develop an understanding of how IT systems affect society in general
- develop an understanding of the main system life cycle and apply this understanding to workplace situations
- develop a broad knowledge of the use of IT in workplace situations
- develop an understanding of project management skills (A Level only)
- be aware of new and emerging technologies
- be aware of the role of the internet and its potential but also its risks
- apply their knowledge and understanding of IT to solve problems.

2.2 Assessment objectives

Cambridge International AS and A Level Information Technology has three assessment objectives:

AO1 Recall, select and communicate knowledge and understanding of IT

AO2 Apply knowledge, understanding and skills to produce IT-based solutions

AO3 Analyse, evaluate, make reasoned judgements and present conclusions

2.3 Relationship between assessment objectives and components

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

The table shows the assessment objectives (AO) as a percentage of each component.

Component	AO1 %	AO2 %	AO3 %
Paper 1 Theory	78	0	22
Paper 2 Practical	0	100	0
Paper 3 Advanced Theory	72	0	28
Paper 4 Advanced Practical	0	100	0

2.4 Relationship between assessment objectives and qualifications

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

The table shows the assessment objectives (AO) as a percentage of each qualification.

Assessment objective	Weighting in AS Level %	Weighting in A Level %
AO1	39	37
AO2	50	50
AO3	11	13

3 Syllabus content

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 updates page for this syllabus on the Cambridge International website www.cambridgeinternational.org/alevel

Candidates for Cambridge International AS Level Information Technology study topics 1–10.
Candidates for Cambridge International A Level Information Technology study all topics.
The content of the AS Level topics 1–10 is assumed knowledge for the A Level components.

The following information identifies content which must be covered within topics 1–19. Where the term ‘including’ is used, everything listed must be studied. However, this list is not exhaustive and other related aspects should also be studied.

To illustrate this, in Topic 2.2 ‘System, application and user interface software’, when designing a user interface (see bullet point 7), candidates need to study only the use of colour, layout, font size, quantity of information and controls. However, when evaluating the characteristics of different types of user interface (see bullet point 6), other characteristics should be studied in addition to those listed.

Note that no marks are awarded for brand names in candidate responses.

1. Data, information, knowledge and processing

Candidates should be able to:

1.1 Data, information and knowledge

- define data, clearly identifying that data has no meaning
- define information and show how data can become information through context and meaning
- define knowledge and understand that information becomes knowledge when human experience is applied

1.2 Sources of data

- define static data and give an example
- define dynamic data and give an example
- compare the use of static information sources with dynamic information sources
- define direct and indirect data source
- understand the advantages and disadvantages of gathering data from direct and indirect data sources

1.3 Quality of information

- understand how accuracy, relevance, age, level of detail and completeness of the information can affect its quality

1.4 Coding, encoding and encrypting data

- describe the coding of data (including: M for male, F for female) and more intricate codes (including: clothing type, sizes and colour of garment)
- discuss the advantages and disadvantages of the coding of data
- evaluate the need for encoding data and analyse the different methods that can be used to encode data (including: codecs)
- define encryption and describe different methods of encryption (including: symmetric, asymmetric, public key, private key)
- evaluate the need for encryption and how it can be used to protect data such as on a hard disk, email or in HTTPS websites
- discuss encryption protocols (including: the purpose of Secure Socket Layer (SSL)/Transport Layer Security (TLS) and the use of SSL/TLS in client server communication)

1.5 Checking the accuracy of data

- define validation and analyse a range of validation methods (including: presence check, range check, type check, length check, format check and check digit, lookup check, consistency check, limit check)
- define verification and analyse verification methods (including: visual checking and double data entry)
- explain the need for both validation and verification
- define proofreading

2. Hardware and software

Candidates should be able to:

2.1 Hardware

- define the term hardware
- evaluate internal hardware devices (including: central processing unit (CPU), motherboard, random access memory (RAM), read-only memory (ROM), graphics card, sound card, hard disk drive (HDD), solid-state drive (SSD))
- evaluate external hardware devices (including: monitor, keyboard, mouse, printer (laser, inkjet, dot matrix, plotter), speakers, camera (digital, video), webcam, scanner, magnetic ink character reader (MICR), optical mark reader (OMR), optical character reader (OCR), bar code reader, pen drive, portable hard disk drive, blu-ray disc drive, memory card)
- explain the purpose of storage devices
- evaluate storage devices (including: cloud, magnetic tape drive, optical, hard disk drive (HDD), solid-state drive (SSD))
- explain the purpose of input and output devices
- evaluate different input, storage or output devices for a given task

2.2 System, application and user interface software

- define the term software
- evaluate types of software (system software and application software)
- explain the purpose of system software (including: compilers, interpreters, linkers, device drivers, operating systems and utilities)
- evaluate application software (including: word processing, spreadsheet, database management systems, control software, measuring software, applets and apps, photo editing software, video editing software, graphics manipulation software, communications software, web authoring software)

- evaluate application software for a given task
- evaluate the characteristics of different types of user interface (including: command line interface, graphical user interface, dialogue interface, gesture based interface)
- evaluate the use of colour, layout, font size, quantity of information and controls when designing a user interface
- evaluate mental models and how they can be used when designing a user interface

2.3 Utility software

- define utility software
- describe the role of different utility software (including: anti-virus, backup, data compression, disk defragmentation, formatting, file copying, deleting)

2.4 Custom written software and off-the-shelf software

- compare the benefits and drawbacks of custom written software and off-the-shelf software

2.5 Compiler and interpreter

- describe the function of a compiler
- describe the function of an interpreter
- evaluate the difference between a compiler and an interpreter

3. Monitoring and control

Candidates should be able to:

- identify a range of sensors and describe their use in monitoring technologies
- identify a range of sensors and describe their use in control technologies
- evaluate the use of monitoring technologies in everyday life (including: CCTV monitoring, environmental monitoring, workplace monitoring)
- evaluate the use of control technologies in everyday life (including: household appliances, car park barriers, traffic lights)

4. eSafety and health and safety

Candidates should be able to:

- explain why personal data should be kept confidential
- describe how personal data can be gathered by unauthorised persons (including: by smishing, vishing, phishing and pharming), and how this might be prevented
- discuss why eSafety is necessary
- describe malware issues (including: Trojan horse, worms, spyware, adware, rootkit, malicious bots, ransomware)
- describe a range of potential health issues that could arise from using IT
- describe a range of safety issues relating to the use of IT

5. The digital divide

Candidates should be able to:

- understand that the digital divide refers to the gap between people and regions that have access to aspects of modern technology (including: telephone, television, personal computers and the internet), and those that do not or those that have restricted access
- understand that the digital divide can exist between:
 - people in cities and people in rural areas
 - the educated and the uneducated
 - socioeconomic groups
 - more and less industrially developed nations
 - high and low performance computers, wireless connections

6. Using networks

Candidates should be able to:

6.1 Network types

- discuss the advantages and disadvantages of networking computers
- compare the characteristics of a local area network (LAN) with a wide area network (WAN)
- describe client-server and peer-to-peer networks
- describe the characteristics and purpose of virtual private networks (VPN)
- discuss the advantages and disadvantages of different network types (including: client-server, peer-to-peer, VPN)
- describe the characteristics and purpose of intranets and extranets
- describe the characteristics and purposes of the internet
- define the term the internet
- describe how the internet is used for communication (including: IM, VOIP and news services)
- discuss the benefits and drawbacks of using the internet
- define the term World Wide Web
- discuss the difference between the internet and the World Wide Web
- discuss the advantages and disadvantages of mobile networks

6.2 Video and web conferencing

- describe how to set up a video-conference
- describe how to set up a web-conference
- describe the use of networks in video and web-conferencing (including: Integrated Services Digital Network (ISDN), LAN, WAN, VPN, 802.11 a/b/g/n (wireless), Asynchronous Digital Subscriber Lines (ADSL), Synchronous Digital Subscriber Lines (SDSL), 3G/4G mobile networks)
- discuss the impact of video-conferencing on society (including: the general public, legislation, education, medicine, business, media)
- describe how data is transmitted and converted in a video-conference (including: use of codecs)

7. Expert systems and other types of processing

Candidates should be able to:

- describe the components of an expert system
- explain how the components of an expert system produce possible solutions
- explain how an expert system can be used by organisations
- describe the terms backward chaining and forward chaining
- explain the use of master and transaction files (including in: payroll and customer orders)
- analyse the different types of processing and their uses (including: batch, online (interactive), real time)

8. Spreadsheets

Candidates should be able to:

8.1 Create a spreadsheet

- create structure
 - explain the purpose of cells, rows, columns, ranges, worksheets and multiple worksheets in a single data file
 - insert a row and a column, delete a row and a column, resize a row and a column, hide a row and a column
 - manipulate cells and their content (including: date and time functions; extracting numeric values from strings, concatenating cell content, protecting: cells, rows, columns, worksheets and multiple worksheets in a single data file)
 - adjust cell, row and column width and height
 - freezing panes and windows
- create formatting
 - format cells (including: date, time, text, numeric, currency, percentage, fractions, text orientation, alignment, conditional formatting)
 - format cell emphasis (including: colour, shading, merge, borders, comments)
 - format page (including: page setup, fit to page, margins, header, footer)
- create formulae and functions
 - explain the difference between a formula and a function
 - use formulae (including: add, subtract, multiply, divide, indices)
 - use absolute reference, relative reference, nested formulae, named cells, named ranges
 - explain why absolute and relative referencing are used
 - use functions (including: sum, average, minimum, maximum, integer, rounding, counting, IF, nested IF, lookup (including: vertical, horizontal), INDEX/MATCH, conditional formulae to include counting, sum, average)
- use validation rules (see 1.5)
- test validation applied to a spreadsheet
- test a spreadsheet model and evaluate the effectiveness of test plans for a spreadsheet model
- verify and validate data entry

- extract data
 - search using: text, numeric, date, time, Boolean operators (AND, OR, NOT), >, <, =, >=, <=, contains, starts with, ends with
- sort data (including: ascending, descending) on multiple columns
- summarise and display data using pivot tables and pivot charts
- import and export data (including: .csv, .txt, .rtf, graphs and charts)

8.2 Graphs and charts

- analyse and select the most appropriate type of graph or chart (including: bar chart, pie chart, line graph, comparative bar chart, comparative line graph)
- create a graph or chart (including: appropriate data series, from contiguous data, from non-contiguous data, specified range(s))
 - label a graph or chart (including: title, legend, segment labels, segment values, percentages, category axis labels, series labels, value axis labels, scales, set axis scale maximum, set axis scale minimum)

8.3 Modelling

- use of what-if analysis (including: the use of scenarios)
- describe the characteristics of modelling software
- analyse the need for computer models
- evaluate the effectiveness of spreadsheet models (including for: financial forecasting)

8.4 Simulations

- describe the advantages and disadvantages of using a model to create and run simulations
- evaluate the use of simulation (including for: natural disaster planning, pilot training, car driving, nuclear science research)

9. Database and file concepts

Candidates should be able to:

9.1 Create a database

- assign a data type and an appropriate field size to a field (including: text, alphanumeric, numeric (integer, decimal), date/time, Boolean)
- describe the three relationships: one-to-one, one-to-many and many-to-many
- create and use relationships (including: one-to-one and one-to-many)
- create and interpret an entity relationship diagram
- evaluate the difference between a flat file and a relational database and why one might be preferred in certain situations
- create a relational database
- analyse the function of key fields (including: primary key, compound key, foreign key)
- set keys (including: primary key, compound key, foreign key)
- define and use referential integrity and explain its importance

- validate and verify data entry
 - use validation rules (see 1.5)
 - test validation applied to a database
 - verify data entry (see 1.5)
- perform searches
 - simple query on single criterion
 - complex queries using multiple criteria
 - queries using static parameters
 - queries using dynamic parameters
 - nested queries
 - summarise data (including: cross-tab queries, pivot tables)
 - using text, numeric, date, time, wildcard, Boolean operators (AND, OR, NOT), >, <, =, >=, <=
- use arithmetic operations, numeric and logical functions to perform calculations within a database (including calculated controls and calculated fields)
- sort data
 - ascending, descending, grouped
- design, create and evaluate an appropriate data entry form (including: appropriate font styles and sizes, spacing between fields, character spacing of individual fields, use of white space, radio buttons, drop down menus, highlighting key fields, use form controls, create linked subforms)
- design, create and evaluate database reports including grouped reports
- design, create and evaluate a switchboard/menu within a database
- import data (including: .csv, .txt, .rtf)
- export data (including: table, query, report, export as .csv, .txt, .rtf)

9.2 Normalisation to third normal form (3NF)

- describe the characteristics of data in unnormalised form (ONF), first normal form (1NF), second normal form (2NF) and third normal form (3NF)
- discuss the advantages and disadvantages of normalisation
- normalise a database to 3NF

9.3 Data dictionary

- describe the components of a data dictionary
- select appropriate data types for a given set of data and a given situation
- identify different data types (including: text, alphanumeric, numeric (integer, real, percentage, currency), date/time, Boolean/logical (yes/no, true/false))

9.4 Query selection

- evaluate the use of static and dynamic parameters in a query (see 9.1)
- analyse when static and dynamic parameters should be used in queries (see 9.1)
- analyse when simple, complex, nested and summary queries (including: cross-tab queries/pivot tables) should be used (see 9.1)

9.5 File and data management

- evaluate different file types and their use
- explain what is meant by proprietary and open-source file formats, and why open-source file formats are needed
- explain why generic file formats are needed
- explain the use of indexed sequential access
- explain the use of direct file access
- explain the use of a hierarchical database management system
- describe the features of a management information system (MIS)
- explain how a MIS can be used by organisations

10. Sound and video editing

Candidates should be able to:

- edit a video clip to meet the requirements of its intended application and audience
 - set an aspect ratio
 - trim a video clip to remove unwanted footage
 - join together video clips
 - create text based slides
 - create credits
 - add captions and subtitles
 - add fading effects
 - add animation effects
 - extract a still image from a video clip
 - insert a still image
 - add sound to a video clip
 - remove sound from a video clip
 - alter the speed of a video clip
 - export a video clip in different file formats
 - compress a video to different resolutions to suit different media (including: DVD, internet)
- describe how typical features found in video editing software are used in practice
- edit a sound clip to meet the requirements of its intended application and audience
 - trim a sound clip to remove unwanted material
 - join together two sound clips
 - fade in and fade out a sound clip
 - alter the speed of a sound clip
 - change the pitch of a sound clip
 - add or adjust reverberation
 - overdub a sound clip to include a voice over
 - export a sound clip in different file formats
 - compress (including: the use of MP3) the sound file to different sample rates to suit different media
- describe how typical features found in sound editing software are used in practice
- describe how file sizes depend on sampling rate and sampling resolution

11. Emerging technologies

Candidates should be able to:

- describe emerging technologies (including: 3D printing, 4G and 5G cellular communications, artificial intelligence, augmented reality, biometrics, cloud computing, computer-assisted translation, holographic and 4th generation optical data storage, holographic imaging, quantum cryptography, robotics, QR codes, wearable computing, ultra-high definition television (including: 4K resolution screens) vision enhancement, virtual reality, and their possible uses in different fields, (including: medicine, manufacturing, space exploration)
- evaluate the impact of emerging technologies on individuals and their lifestyles (including: smartphones performing many of the tasks that PCs and laptops perform)
- evaluate the impact of emerging technologies on organisations
- evaluate the impact of emerging technologies on medicine (including: development of prosthetics and medical products, tissue engineering, artificial blood vessels and the design of medical tools and equipment)
- evaluate the impact of emerging technologies on the environment
- discuss the advantages and disadvantages of storing data in the cloud

12. Role and impact of IT in society

Candidates should be able to:

12.1 eBusiness

- evaluate the impact of information technology on eBusiness (including: banking, shopping, trading goods)
- describe how it is possible to be subjected to fraud when using credit cards online
- evaluate the impact of digital currency (including: Bitcoin, Litecoin)
- explain how IT is used in eBusiness (including: electronic funds transfer, automatic stock control, electronic data exchange, business-to-business buying and selling, online stores)
- discuss how organisations mine data to analyse social and economic trends

12.2 Social networking

- evaluate methods used for social networking (including: chat rooms, instant messaging, forums, email, blogs, microblogs) and their impact on changing social patterns

12.3 Video conferencing and teleworking

- describe video-conferencing and the hardware and software used
- describe web-conferencing and the hardware and software used
- discuss the advantages and disadvantages of video-conferencing on employers and employees
- discuss the advantages and disadvantages of web-conferencing on employers and employees
- describe teleworking
- discuss the effects of teleworking on employers and employees

12.4 Technology in society

- evaluate the impact of information technology on society (including: sport, manufacturing, medicine, education, banking, eBusiness)

12.5 Technology enhanced learning

- discuss the advantages and disadvantages of software-based training methods
- evaluate the impact of technology on learning (including: Massive Open Online Courses (MOOC), computer based training, online tutorials, video-conferencing)

13. Networks

Candidates should be able to:

13.1 Network components

- describe the role and operations of the following components in a network: switches, hubs, wireless access points, network interface cards, wireless network interface cards, routers, repeaters, gateways, bridge, firewalls (hardware and software) and servers
- describe bandwidth
- describe bit rate
- describe bit streaming (both real-time and on demand)
- discuss the importance of bit rates/broadband speed on bit streaming
- describe packet switching, circuit switching and message switching
- describe optical communication/transmission methods (fibre optic, laser), their advantages, disadvantages and their typical applications
- evaluate wireless communication/transmission methods (including: Bluetooth[®], infrared, WiFi, radio), their advantages, disadvantages and their typical applications
- explain the importance of bandwidth and bit rate when transmitting data
- analyse how different types of communication/transmission media (cables, wireless, optical) govern the bandwidth available for transmitting data
- describe what a protocol is and different types of protocols (including: Wide Area Network protocols and Local Area Network access protocols)
- describe how the BitTorrent protocol provides peer-to-peer file sharing

13.2 Network security

- describe the security issues that could arise from networking computers
- explain how security issues can be prevented on a computer network
- evaluate a range of physical and software based security methods for a computer network
- list the principles of a data protection act
- analyse the need for a data protection act
- evaluate methods for combating IT crime (including: physical security methods, biometric methods, firewalls, back-up, encryption, access rights, malware security, anti-virus, anti-spyware)

13.3 Satellite Communication Systems

- describe how satellite communication systems are used and work in data transfer systems, television and radio broadcasting systems and global positioning systems (GPS)
- discuss the advantages and disadvantages of using satellites for data transfer systems, television and radio broadcasting systems, and GPS

14. Project management

Candidates should be able to:

14.1 Stages in project management

- describe the stages of project management from project conception to project close

14.2 Types of project management

- discuss the types of project management software and the advantages and disadvantages of each type

14.3 Project management software

- explain how project management software is used (including: planning, scheduling of tasks, allocation of resources, costings, communications, decision-making)

14.4 Critical path analysis

- describe, interpret and create a critical path analysis

14.5 Gantt charts

- describe, interpret and create a Gantt chart

14.6 Disaster recovery management

- describe disaster recovery management (including: risk analysis, perpetrator analysis, risk testing, quantifying the risk, securing the risk, software protection, password controls, recovery management)

14.7 Prototyping

- describe prototyping
- describe types of prototyping (including: evolutionary, incremental, throw-away, rapid)
- discuss the advantages and disadvantages of prototyping
- describe Rapid Application Development (RAD) and other methods of software development (including: the conventional 'waterfall' method)
- discuss the advantages and disadvantages of rapid application development (RAD)

14.8 CAD/CAM

- evaluate the use of computer-aided design (CAD) and computer-aided manufacturing (CAM)
- describe the uses of computer-aided design (CAD) and computer-aided manufacturing (CAM)
- discuss the benefits and drawbacks of using computer-aided design (CAD) and computer-aided manufacturing (CAM)

15. System life cycle

Candidates should be able to:

15.1 Analysis

- analyse and evaluate different methods of researching a situation (including: questionnaires, interviews, observation, document analysis)
- describe the content of the requirements specification, system specification and design specification

15.2 Design

- identify a flow of data through a system and create a data flow diagram (DFD) and a system flowchart
- design and evaluate data collection forums and screen layouts
- design and evaluate validation routines
- create a data dictionary for a given situation
- evaluate suitable hardware and software for a new system

15.3 Development and testing

- describe the purpose of test data
- explain the purpose of alpha testing
- explain the purpose of beta testing
- analyse the difference between alpha testing and beta testing
- explain the purpose of black box testing
- explain the purpose of white box testing
- analyse the difference between black box testing and white box testing
- explain the importance of testing and having a test plan
- describe how a test plan is created
- create a test plan for a given situation

15.4 Implementation

- describe the different methods of implementing a system (including: parallel running direct changeover, phased implementation, pilot implementation)
- analyse the suitability of an implementation method for a given situation

15.5 Documentation

- design and develop elements of technical documentation
- design and develop elements of user documentation
- explain the need for technical and user documentation

15.6 Evaluation and maintenance

- evaluate a new system in terms of efficiency, ease of use and meeting user requirements
- explain the need for maintenance
- explain perfective, adaptive, preventive and corrective maintenance

16. Graphics creation

Candidates should be able to:

16.1 Vector images

- create a vector image that meets the requirements of its intended application and audience
 - use layers to overlap items
 - use grouping or merging tools
 - use rotation and place an item
 - use transform tools to resize
 - use selection tools to select parts of an image
 - use crop tools to crop part of an image
 - use fill tools to colour items
 - use colour gradients
 - use node editing
 - fit text to a path
 - save an image in different file formats
 - compress an image to different resolutions using file formats (including: .jpg and .png) to suit different media file size requirements

16.2 Bitmap images

- create a bitmap image that meets the requirements of its intended application and audience
 - use layers to overlap items
 - use rotation and place an item
 - use grouping or merging tools
 - use selection tools to select parts of an image
 - use crop tools to crop part of an image
 - use masking tools
 - use tools to improve parts of an image (including: blend, replicate, retouch)
 - use tools to remove red eye
 - use filters (including: blur, distort, sharpen)
 - convert between colour, duotone and black and white images
 - use colour gradients
 - resize an image
 - resize the canvas
 - change the opacity of all or part of an image
 - use text tools to include text
 - save an image in different file formats
 - compress an image to different resolutions using file formats (including: .bmp, .jpg, .png, .gif to suit different media file size requirements)
- describe the difference between a bitmap and a vector graphic
- describe how typical features found in bitmapped and vector graphics software are used in practice
- evaluate their suitability for a given scenario
- evaluate the impact of image editing on society (including: media, advertising, fashion, shopping, politics, entertainment)

17. Animation

Candidates should be able to:

- create and evaluate an animation (stop frame and key frame) that meets the requirements of its intended application and audience
 - place objects
 - place an image
 - use frames
 - set key frames
 - use timings
 - use layers
 - show and hide objects
 - resize objects
 - use coordinates to move and place objects
 - understand the use of tweening and what effect it creates
 - use tweening (motion tweening) to create a smooth transition between frames
 - use morphing (shape tweening)
 - understand the use of morphing and what effect it creates
 - use morphing to create a smooth transition between images
 - add text
 - change the opacity of objects and text
 - use masking layers

18. Mail merge

Candidates should be able to:

- create a master document structure (including: standard letter)
- create a source file using appropriate software
- link a master document to a source file, identifying and using correct field names, using conditional operators
- specify rules for managing recipients and content of a mail merge
- set up fields for manual completion
- create appropriate prompts to the user for manual completion
- use the software to automatically select the required records
- use manual methods and software tools to ensure error-free accuracy
- perform mail merge using the master document and data sources
- create variable fields to control record selection and omission when merging
- explain why mail merge documents are created

19. Programming for the web

It is recommended that for this section of the syllabus, candidates should have a working knowledge of HTML and CSS, (for example, have studied website authoring in Cambridge IGCSE Information and Communication Technology, syllabus 0417).

Candidates should be able to use JavaScript to:

- demonstrate a range of object-based programming techniques
 - recognise data types (including: number, string, Boolean, array, object)
 - assign and understand the term variables
 - carry out calculations and basic string manipulation
 - use arrays
 - use comparison and logical operators
 - use conditional statements (including: if, else, else if, switch)
 - use loops (including: for, for/in, while, do/while)
 - use iterative methods
 - create functions
 - trap errors
 - control events
 - create html forms to interact with the user
 - add comments to explain JavaScript code
- output/display data to:
 - HTML documents
 - HTML elements
 - alert boxes
 - the browser console
- add interactivity to web pages
- explain JavaScript terms and programming techniques

4 Description of components

Paper 1 Theory

This is a compulsory written paper which tests sections 1–10 of the syllabus content. Each examination paper consists of short-answer and structured questions of variable mark value. Candidates must answer all questions. Candidates answer on the question paper.

Calculators must **not** be used in this paper.

Paper 2 Practical

This is a compulsory practical paper which tests sections 8–10 of the syllabus content. Candidates perform practical tasks within a structured problem-solving context and submit their work electronically. They will also need to apply their knowledge from sections 1–7 of the syllabus content. Candidates must answer all questions. Candidates **must not** have access to the internet or email. Candidates will 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.

Work must be saved in the correct file format as stated in the tasks. If work is saved in an incorrect file format, candidates will **not** receive marks for that task.

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

This is a compulsory written paper which tests sections 11–19 of the syllabus content. The content of sections 1–10 is assumed knowledge. Each examination paper consists of a variable number of short-answer and structured questions of variable mark value. Candidates must answer all questions. Candidates answer on the question paper.

Calculators must **not** be used in this paper.

Paper 4 Advanced Practical

This is a compulsory practical paper which tests sections 16–19 of the syllabus content. The exam also includes practical tasks from sections 8–9 within a problem-solving context. Candidates perform practical tasks and submit their work electronically. Candidates apply their knowledge from all sections of the syllabus. Candidates must answer all questions. Candidates **must not** have access to the internet or email. Candidates will 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.

Work must be saved in the correct file format as stated in the tasks. If work is saved in an incorrect file format, candidates will **not** receive marks for that task.

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

5 Glossary of command words

This glossary should prove helpful to candidates as a guide, although it is not exhaustive and it has deliberately been kept brief. The number of marks allocated for any part of a question is a guide to the depth required for the answer.

Command word	What it means
Analyse	explain the main points or effectiveness in detail, identify their characteristics, examine closely
Annotate	add an explanatory note
Calculate	work out the value of something
Compare	identify similarities
Complete	finish a task by adding to given information
Contrast	identify differences
Create	produce
Define	specify meaning
Describe	set out characteristics
Discuss	give the important arguments for and against, often requires a conclusion; this command word requires 'Analysis' and 'Evaluation'
Enter	put in information
Evaluate	discuss the importance of, weigh up the advantages and disadvantages, judge the overall effectiveness, weigh up your opinions
Examine	investigate closely
Explain	set out purposes or reasons
Export	send data file from one piece of software to another piece of software
Extract	take out
Format	determine features
Give	produce an answer from recall
Identify	name or otherwise characterise
Import	insert data file from one piece of software to another piece of software
Insert	add new data item to file
Merge	combine into single structure
Name	identify or specify
Open	access a file
Perform	carry out
Prepare	make ready
Provide	supply
Replicate	copy formula from one cell to another
Round	write a value as whole number/number of specified decimal places
Set	fix format as
Sort	put in order, including ascending or descending
State	express in clear terms
Suggest	present a possible case

6 Other information

Equality and inclusion

We have taken great care in the preparation of this syllabus and related assessment materials to avoid bias of any kind. To comply with the UK Equality Act (2010), we have designed this qualification with the aim of avoiding direct and indirect discrimination.

The standard assessment arrangements may present unnecessary barriers for candidates with disabilities or learning difficulties. Arrangements can be put in place for these candidates to enable them to access the assessments and receive recognition of their attainment. Access arrangements will not be agreed if they give candidates an unfair advantage over others or if they compromise the standards being assessed. Candidates who are unable to access the assessment of any component may be eligible to receive an award based on the parts of the assessment they have taken.

Information on access arrangements is in the *Cambridge Handbook* at www.cambridgeinternational.org/examsOfficers

Language

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

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.

Estimated entries

You **must** make estimated entries for this syllabus. This will enable us to send you early question papers and pre-release materials, and ensure you have the necessary materials to carry out assessments at the specified time.

Further information about making estimated entries can be found in the *Cambridge Handbook* for the relevant year at www.cambridgeinternational.org/examsOfficers

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.

Retakes

Candidates can retake Cambridge International AS Level and Cambridge International A Level as many times as they want to. Cambridge International AS & A Levels are linear qualifications so candidates cannot re-sit individual components. Information on retake entries is in the *Cambridge Handbook* at www.cambridgeinternational.org/examsofficers

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, subject to the rules and time limits described in the *Cambridge Handbook*.

Grading and reporting

Cambridge International A Level results are shown by one of the grades A*, A, B, C, D or E, indicating the standard achieved, A* being the highest and E the lowest. 'Ungraded' indicates that the candidate's performance fell short of the standard required for grade E. 'Ungraded' will be reported on the statement of results but not on the certificate. The letters Q (result pending), X (no result) and Y (to be issued) may also appear on the statement of results but not on the certificate.

Cambridge International AS Level results are shown by one of the grades a, b, c, d or e, indicating the standard achieved, 'a' being the highest and 'e' the lowest. 'Ungraded' indicates that the candidate's performance fell short of the standard required for grade 'e'. 'Ungraded' will be reported on the statement of results but not on the certificate. The letters Q (result pending), X (no result) and Y (to be issued) may also appear on the statement of results but not 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.

How students, teachers and higher education can use the grades

Cambridge International A Level

Assessment at Cambridge International A Level has two purposes:

- to measure learning and achievement
The assessment:
 - confirms achievement and performance in relation to the knowledge, understanding and skills specified in the syllabus, to the levels described in the grade descriptions.
- 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
 - help students choose the most suitable course or career.

Cambridge International AS Level

Assessment at Cambridge International AS Level has two purposes:

- to measure learning and achievement
The assessment:
 - confirms achievement and performance in relation to the knowledge, understanding and skills specified in the syllabus.
- 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
 - help students choose the most suitable course or career
 - help decide whether students part way through a Cambridge International A Level course are making enough progress to continue
 - guide teaching and learning in the next stages of the Cambridge International A Level course.

'While studying Cambridge IGCSE and Cambridge International A Levels, students broaden their horizons through a global perspective and develop a lasting passion for learning.'

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

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