# Level 3 Advanced Technical Extended Diploma in Digital Technologies (720) (5220-32) Level 3 Digital Technologies 5220-038 / 5220-538 (Telecoms and Cabling)

# Guide to the examination

# Who is this document for?

This document has been produced for centres who offer

This document has been produced for centres who offer **City & Guilds Level 3 Advanced Technical Extended Diploma in Digital Technologies (720) (5220-32).** It gives all of the essential details of the qualification's external assessment (exam) arrangements and has been produced to support the preparation of candidates to take the exam/s.

The document comprises four sections:

1. **Details of the exam**. This section gives details of the structure, length and timing of the exam.
2. **Content assessed by the exam.** This section gives a summary of the content that will be covered in each exam and information of how marks are allocated to the content.
3. **Guidance.** This section gives guidance on the language of the exam, the types of questions included and examples of these, and links to further resources to support teaching and exam preparation.
4. **Further information.** This section lists other sources of information about this qualification and City & Guilds Technical Qualifications.

# 1. Details of the exam

## External assessment

City & Guilds Technical qualifications have been developed to meet national policy changes designed to raise the rigour and robustness of vocational qualifications. These changes are being made to ensure our qualifications can meet the needs of employers and Higher Education. One of these changes is for the qualifications to have an increased emphasis on external assessment. This is why you will see an external exam in each of our Technical qualifications.

An external assessment is an assessment that is set and/or marked by the awarding organisation (ie externally). All City and Guilds Technical qualifications include an externally set and marked exam. This must be taken at the same time by all candidates who are registered on a particular qualification. We produce an exam timetable each year. This specifies the date and time of the exam so you can plan your delivery, revision and room bookings/PC allocation in plenty of time.

The purpose of this exam is to provide assurance that all candidates achieving the qualification have gained sufficient knowledge and understanding from their programme of study and that they can independently recall and draw their knowledge and understanding together in an integrated way. Whilst this may not be new to you, it is essential that your learners are well prepared and that they have time to revise, reflect and prepare for these exams. We have produced a Teaching, Learning, and Assessment guide that is you should refer to alongside the present document *(Teaching, Learning and Assessment Guide).* If a learner does not pass the exam at their first attempt, there is only one opportunity to resit the exam, so preparation is essential.

## Exam requirements of this qualification

This qualification has **one** pathway. This pathway is assessed by the following examination:

- **Level 3 in Digital Technologies (038/538) (Telecoms and Cabling)** – Theory exam (2) (2 hours and 30 minutes).

The exam is graded and a candidate must achieve at least a Pass grade in order to be to be awarded the qualification. (In addition to the exam, a synoptic assignment must also be completed and passed. You can find full details of the synoptic assignment in the *Qualification Handbook* and the *Synoptic Assessment Guide* -please see the links at the end of this document).

## When does the exam take place?

The exam is offered on two fixed dates in March and June. The exact dates will be published at the start of the academic year in the *Assessments and Exam Timetable* http://www.cityandguilds.com/delivering-our-qualifications/exams-and-admin

At the start of the programme of study for each of the two years, in order to effectively plan teaching and exam preparation, centres should know when the exam will be taking place and allocate teaching time accordingly. Section 2 of this document gives a summary of the content that needs to be covered in order to prepare learners for the exam and full details of this are given in the Qualification Handbook.

## Form of exam

The exam for this qualification can be taken either on paper or online.

## Can candidates resit the exam?

Candidates who have failed an exam or wish to retake it in an attempt to improve their grade, can do so **twice**. The third and final retake opportunity applies to Level 3 only. The best result will count towards the final qualification. If the candidate fails the exam three times then they will fail the qualification.

## How the exam is structured

Each exam has a total of **80 marks** available.

Each exam is made up of:

- Approximately 10-12 short answer questions;
- 1-2 extended response questions.

Short answer questions are used to confirm **breadth of knowledge and understanding**.

The extended response questions are to allow candidates to demonstrate **higher level and integrated understanding** through written discussion, analysis and evaluation. These questions also ensure the exam can differentiate between those learners who are 'just able' and those who are higher achieving.

More details about and examples of question types are given in Section 3 of this document.

## Assessment Objectives

The exams are based on the following set of assessment objectives (AOs). These are designed to allow the candidate's responses to be assessed across the following three categories of performance:

- **Recollection** of knowledge.
- **Understanding** of concepts, theories and processes.
- **Integrated application** of knowledge and understanding.

In full, the assessment objectives covered by the exam for this qualification are:

| Assessment objective<br><br>*The candidate..* | Mark allocation (approx %) |
|---|---|
| AO1 **Recalls knowledge** from across the breadth of the qualification | 22.5% |
| AO2 **Demonstrates understanding** of concepts, theories and processes from a range of learning outcomes. | 55% |
| AO4 **Applies knowledge, understanding and skills** from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes. | 22.5% |

## Booking and taking the exam

All assessments for City & Guilds Technical Exams must be booked through Walled Garden. There is a deadline for booking exams, synoptic assessments and any other centre marked assessments, please refer to the time line to check these dates.

The exam must be taken under the supervision of an invigilator who is responsible for ensuring that it is conducted under controlled conditions. Full details of the conditions under which the exam must be taken can be found in the Joint Council for Qualifications (JCQ) document, *Instructions for Conducting Examinations (ICE)*.

## Special consideration

Candidates who are unable to sit the exam owing to temporary injury, illness or other indisposition at the scheduled time may qualify for special consideration. This is a post-examination adjustment that can, in certain circumstances, be made to a candidate's final grade. The Joint Council for Qualifications' guide to the special consideration process can be found at www.jcq.org.uk .

To make a request for special consideration, please contact: policy@cityandguilds.com

## Access arrangements

Access arrangements are arrangements that allow candidates with particular requirements, disabilities or temporary illness to take assessments, where appropriate, using their normal way of working. The Joint Council for Qualifications document, *Access Arrangements and Reasonable Adjustments* gives full details and can be downloaded here.

For further information and to apply for access arrangements please see:

Access arrangements - When and how applications need to be made to City & Guilds

Applying for access arrangements on the Walled Garden

# 2. Content assessed by the exam

**Level 3 Advanced Technical Extended Diploma in Digital Technologies (720) (5220-32)**

The exam assesses:

- **Unit 342: Designing and planning communication networks**
- **Unit 343: Troubleshooting Telecommunications Networks**
- **Unit 344: Fibre Optic Cabling**
- **Unit 345: PSTN and Data Networks**
- **Unit 346: Telecommunications Fundamentals**
- **Unit 347: Wireless Technologies**

Each exam assesses a sample of the content of these units. This means that a single exam will **not** cover 100% of the unit content. The full range of content will be assessed over a number of examination series. Details of the coverage of a particular exam paper will **not** be released in advance of the exam itself. Centres should **not** make assumptions about what will be assessed by a particular exam based on what has been covered on previous occasions. In order to be fully prepared for the exam, learners **must** be ready to answer questions on **any** of the content outlined below.

The table below provides an overview of how the qualification's Learning Outcomes are covered by each exam and the number of **marks** available per Learning Outcome (ie **not** the number of *questions* per Learning Outcome). In preparing candidates for the exam, we recommend that centres take note of the number of marks allocated to Learning Outcomes and to assign teaching and preparation time accordingly.

In preparing candidates for the exam, centres should refer to the Qualification Handbook which gives full details of each Learning Outcome.

The following is a summary of only that qualification content which is assessed by the exam and **not** a summary of the full content of the qualification.

| Unit | Learning outcome | Topics | Number of marks |
|------|------------------|--------|-----------------|
| 342 Designing and planning communication networks | LO1 Understand the available information sources relating to existing networks | 1.1 Floor plans<br>1.2 Utility Duct prints<br>1.3 Rack Layout diagrams | 4 marks |
| | LO2 Understand how to prepare for network surveying | 2.1 Internal and external survey areas<br>2.2 Existing infrastructure | |

| | | | |
|---|---|---|---|
| | LO3 Understand legislative and environmental requirements related to surveying for networks | 3.1 Hazards and Environmental Conditions<br>3.2 Legislation and Regulations | |
| | LO4 Produce planning documentation | 4.1 Produce planning documentation | |
| 343 Troubleshooting Telecommunications Networks | LO1 Understand troubleshooting methodologies | 1.1 Visual and physical methodologies<br>1.2 Logical methodologies | 7 marks |
| | LO2 Carry out troubleshooting using appropriate tools | 2.1 Troubleshooting using physical tools<br>2.2 Troubleshooting using logical tools<br>2.3 Troubleshooting visually | |
| | LO3 Document issues, findings and resolutions | 3.1 Documentation related to troubleshooting<br>3.2 Document troubleshooting resolutions | |
| 344 Fibre Optic Cabling | LO1 Understand types of cabling | 1.1 The purpose of different cable types<br>1.2 Transmitting devices | 14 marks |
| | LO2 Understand characteristics of fibre optics | 2.1 Characteristics of different fibre optic cable types<br>2.2 Types of fibre optic cable termination | |
| | LO3 Understand fibre optic cabling standards and testing | 3.1 Standards in Fibre Optic cabling<br>3.2 Testing methods in Fibre Optic Cabling | |
| 345 PSTN and Data Networks | LO1 Understand types of cabling | 1.1 Cable types<br>1.2 The use and purpose of cable types | 10 marks |
| | LO2 Implement Standards controlling PSTN and Data Networks | 2.1 Apply standards in data networks<br>2.2 Deploy protocols to data networks | |

| | LO3 Implement a PSTN / Data Network | 3.1 Equipment used in data networks<br>3.2 Implement data networks | |
|---|---|---|---|
| 346 Telecommunications Fundamentals | LO1 Understand the characteristics of analogue and digital signals | 1.1 Characteristics of signals<br>1.2 Methods of converting digital signals into analogue signals<br>1.3 Digital Encoding methods | 19 marks |
| | LO2 Describe the Media used as part of data and telecommunications networks | 2.1 Media<br>2.2 Characteristics of Media<br>2.3 Transmission methods | |
| | LO3 Understand the standards and protocols associated with data and telecommunications networks | 3.1 Organisations that establish data and telecommunications standards<br>3.2 OSI Model<br>3.3 Standards associated with data and telecommunications networks<br>3.4 Protocols associated with data and telecommunications networks | |
| 347 Wireless Technologies | LO1 Understand wireless technologies | 1.1 Wireless technologies<br>1.2 Wireless topologies<br>1.3 Components of a wireless LAN | 8 marks |
| | LO2 Understand the technologies used to implement cellular networks | 2.1 Cellular Technologies<br>2.2 Components of a Cellular Network<br>2.3 How a Cellular network functions | |
| | LO3 Configure wireless LANs | 3.1 Install components<br>3.2 Configure components | |

Total marks for sections: 62 marks

|  | Integration across units*: | 18 marks |
|---|---|---|
|  | **Total marks for exam:** | **80 Marks** |

*\* Integration across units.* These marks relate to Assessment Objective 4). These marks are awarded to differentiate between levels of performance by candidates taking the exam. The marks are given for how well a candidate has applied their knowledge, understanding and skills from across the units that make up the qualification in an integrated way to meet the requirements of the exam questions.

# 3. Guidance

## Vocabulary of the exam: use of 'command' verbs

The exam questions are written using 'command' verbs. These are used to communicate to the candidate the type of answer required. Candidates should be familiarised with these as part of their exam preparation.

The following guidance has been produced on the main command verbs used in City & Guilds Technicals exams.

A more detailed version of this table, which also includes the command verbs used in the assignments is published in C*ity & Guilds Technical Qualifications Teaching, Learning and Assessment* guide.

| Command verb | Explanation and guidance |
|---|---|
| **Analyse** | Study or examine a complex issue, subject, event, etc in detail to explain and interpret, elements, causes, characteristics etc |
| **Calculate** | Work out the answer to a problem using mathematical operations |
| **Compare** (…and contrast) (or ***describe*** the similarities/differences) | Consider and describe the similarities (and differences) between two or more features, systems, ideas, etc |
| **Define** | Give the meaning of, technical vocabulary, terms, etc. |
| **Describe** | Give a detailed written account of a system, feature, etc **(..the effect of…on…)** the impact, change that has resulted from a cause, event, etc **(..the process..)** give the steps, stages, etc |
| **Differentiate** between | Establish and relate the characteristic differences between two or more things, concepts, etc |
| **Discuss** | Talk/write about a topic in detail, considering the different issues, ideas, opinions related to it |
| **Distinguish** between | Recognise and describe the characteristic differences between two things, or make one thing seem different from another |
| **Evaluate** | Analyse and describe the success, quality, benefits, value, etc (of an end product, outcome, etc ) |
| **Explain** | Make (a situation, idea, process, etc) clear or easier to understand by giving details, **(..how..)** Give the stages or steps, etc in a process, including relationships, connections, etc between these and causes and effects. |
| **Give example(s) illustrate/** | Use examples or images to support, clarify or demonstrate, an explanation, argument, theory, etc |

| | |
|---|---|
| **Give a rationale** | Provide a reason/reasons/basis for actions, decisions, beliefs, etc |
| **Identify** | Recognise a feature, usually from a document, image, etc and state what it is |
| **Justify** | Give reasons for, make a case for, account for, etc decisions, actions, conclusions, etc, in order to demonstrate why they suitable for or correct or meet the particular circumstances, context |
| **Label** | Add names or descriptions, indicating their positions, on an image, drawing, diagram, etc |
| **List** | Give as many answers, examples, etc as the question indicates (candidates are not required to write in full sentences) |
| **Name** | Give the (technical) name of something |
| **Propose** | Present a plan, strategy, etc (for consideration, discussion, acceptance, action, etc). |
| **Select** | choose the best, most suitable, etc, by making careful decisions |
| **State** | Give the answer, clearly and definitely |
| **Summarise** | Give a brief statement of the main points (of something) |

## Question types

The following explains, and gives examples of, types of questions used in City & Guilds Technical exams. In preparing candidates to take the exam, it is recommended that you familiarise them with the requirements of each question type so that they can be effective and make best use of the time available when sitting the exam.

- An effective candidate will gauge the type and length of response required from the question and the number of marks available (which is given for each question on the exam paper).
- Short answer questions may not require candidates to write in complete sentences. Extended response questions will require a more developed response.
- Candidates should read the exam paper before attempting to answer the questions and should allocate time proportionate to the number of marks available for each question or section.

**Short answer questions (restricted response)**
These are questions which require candidates to give a brief and concise written response. The number of marks available will correspond to the number of pieces of information/examples and the length of response required by the question.

**Example question:**

**Mark scheme:**

| |
|---|
| State **two** items of equipment that would be shown in a rack layout diagram.  (2 marks)<br><br>**Answer:**<br>**Accept any of the following or any other reasonable answer**<br><br>   • Routers (1)<br>   • Switches (1)<br>   • PSUs (1)<br>   • Patch panels (1)<br><br>**One mark for each role stated, maximum of two marks.** |

| Test spec reference: 342 1.3 | Total marks: 2 |
|---|---|

## Question type:

**Structured Response Questions**

These are questions that have more than one part (eg a), b), etc.). The overall question is made up of linked, short answer questions which move the candidate through the topic in a structured way. For example, the question will usually start with a 'recall'/'state'/ 'describe' question followed by an 'explain' to draw out understanding of the topic. They usually have a shared introductory 'stem', and the number of marks may increase through the question.

## Example question:

**Mark scheme:**

a) State **two** characteristics of a fibre optic cable. (2 marks)
b) Describe **three** types of fibre optic cables. (6 marks)


**Answer:**
**a) Accept two of the following or any other reasonable answer**

- Segment length (1)
- Transmission methods (1)
- Insulation (1)
- Sensors (1)
- Power transmission (1)
- Index of reflection (1)
- Internal reflection (1)


**One mark for each characteristic, maximum of two marks.**

**Answer:**
**b) Accept any of the following or any other reasonable answer**

- A graded index cable core has a refractive index that decreases (1) as the distance from the optical axis increases (1).
- A single mode fibre cable is designed for the transmission of a single beam of light (1) and is used for long-distance signal transmission (1).
- Multimode fibre cable is designed to carry multiple light beams concurrently (1), each at a slightly different reflection angle within the optical fibre core (1).

**Two marks for each description, maximum of six marks.**

| **Test spec reference: 344 1.1, 2.1** | **Total marks: 8** |

**Extended response questions**

Extended response questions are those that require the candidate to write a longer written response using sentences and paragraphs. These usually require candidates to discuss, explain, etc. a topic in some detail. The question is often based on a short case study, scenario or other prompt. The level of detail should be gauged from the question and the number of marks available.

## Example question:

**Mark scheme:**

A small company is looking to upgrade their existing network to include Bring Your Own Devices (BYOD) to enable employees to access resources stored on the network using mobile devices.

Discuss the technologies available and what considerations will need to be taken into account when planning this upgrade.

(9 marks)

**Answer**

**Indicative content**
- network design, development and testing
- technologies and protocols used to implement networks
- data and network security

**0 – No awardable material**

**Band 1:**
**1– 3 marks**

The response demonstrates a limited understanding of the processes and technologies involved and is mostly a statement of facts which are not developed. The approach to the task is inconsistent. Statements may be occasionally incorrect and the use of precise technical language is sparse.

**Band 2:**
**4 – 6 marks**

The candidate has produced a discussion that expands on the factual knowledge but lacks detail in some areas. They show an adequate understanding of the processes and technologies involved including some reasons for their selection. They have provided some valid reasons for their choices. The response is structured and presented in a logical order.

**Band 3:**
**7 – 9 marks**

The candidate has produced a thorough discussion in a logical and professional manner. They show a thorough understanding of the processes and technologies involved and have covered these in the correct logical order, including reasons behind the processes and technologies, the factors that need to be considered and the impact these factors may have on the implementation. They have clearly understood how all of the processes and technologies link to one another in terms of order and importance. They have provided valid reasons for their choices. The response is clear, coherent and all information has been presented in a logical order.

| Test spec reference: | Total marks: 9 |
|---|---|
| **342: 1.1, 1.2, 1.3, 2.1, 2.2, 3.2, 4.1** | |
| **343: 2.2, 3.1** | |
| **345: 1.1, 1.2, 3.1** | |
| **346: 2.1, 2.2, 2.3, 3.3, 3.4** | |
| **347: 1.1, 1,2, 1.3, 3.1, 3.2** | |

**Band 1**

**1– 3 marks**

**Example band 1 response**

The company would have to decide which type of devices that they are going to use, such as NFC printers and how to control access to these devices. For instance, WPA2 can be used to secure devices connecting wirelessly. They should then plan where each of the devices is going to be situated and install them.

Once the devices have been installed and configured they should be tested to ensure that they work properly. This testing should include trying to log on to the network with a device that has not previously joined the network. All of the results should be documented so there is a record of the issues that occurred and how they were rectified.

The staff would then need training on how to join the network using mobile devices.

**Band 2**

**4 – 6 marks**

**Example band 2 response**

Prior to undertaking the upgrade the company would have to establish the parameters of the upgrade this could include issues such as controlling the access to the network. Certain types of technologies such as Near Field Communications (NFC) and Bluetooth allow users to connect smart phones to networks. This offers the advantage of being able to access data from many locations within the company without the need for PCs.

The additional equipment will need to be identified and a plan prepared that identifies how these devices are going to be integrated into the existing network. They would have to ensure that devices meet the security requirements for accessing the network.

After the equipment has been purchased they should be installed and tested to ensure compatibility with the existing network. This would allow IT technicians to monitor the impact of BYOD and rectify any issues encountered. These issues should be recorded so that they can be referred to at a later date.

Following the testing of the network the company should introduce a BYOD policy so that all staff are aware of how to us their mobile devices on the network.

**Band 3**

**7 – 9 marks**

**Example band 3 response**

Prior to undertaking the upgrade the company would have to establish a policy for the use of BYOD, this would need to consider issues such as controlling the access to the network. Certain types of technologies such as Near Field Communications (NFC) and Bluetooth allow users to connect smart phones to networks. This offers various advantages such as being able to access data from various locations within the company without having to access to PCs or laptops. The use of smart phones presents a potential security risk as the users can store the information required to access the network on the phone, as smartphones are small they are easy to misplace or lose. If an unauthorised individual gained access to a device that had this information stored they would then be able to access to the network and data.

The company would have to conduct an audit of the existing network to establish the requirement for additional equipment and to establish a security baseline. This base line should include limiting user access to only data that they require enabling them to complete their role, remote access to the network and backing up of data.

Once the additional equipment has been identified they will need to research the available devices that are available to implement BYOD and prepare a plan that identifies how these devices are going to be integrated into the existing network. They would have to ensure that devices meet the security requirements such as the use of WPA2 and Virtual Private Networks (VPNs) to protect data.

After the equipment has been purchased a small segment of the network could be isolated from the main network or a test network could be created and have the hardware and software required to implement BYOD installed. This would allow the concurrent running of the BYOD and main network to allow IT technicians to monitor the impact of BYOD and rectify any issues encountered, without effecting the main network. Any issues that occurred should be recorded so that they can be referred to if the same or similar issues occur as they provide information on symptoms and how they were resolved.

Following the testing of the network the company should formalise its BYOD policy and disseminate it to all staff and conduct training to ensure staff are aware of the risks associated with the use of BYOD and how to mitigate them.

## Examination technique

Candidates with a good understanding of the subject being assessed can often lose marks in exams because they lack experience or confidence in exams or awareness of how to maximise the time available to get the most out of the exam. Here is some suggested guidance for areas that could be covered in advance to help learners improve exam performance.

## Before the exam

Although candidates cannot plan the answers they will give in advance, exams for Technical qualifications do follow a common structure and format. In advance of taking the exam, candidates should:

- be familiar with the structure of the exam (ie number and type of questions).
- be aware of the amount of time they have in total to complete the exam.
- have a plan, based on the exam start and finish time for how long to spend on each question/section of the exam.
- be aware of how many marks are available for each question, how much they should expect to write for each question and allow most time for those questions which have the most marks available.

## At the start of the exam session

At the start of the exam, candidates:

- should carefully read through the exam paper before answering any questions.
- may find it helpful, where possible, to mark or highlight key information such as command words and number of marks available on the question paper.
- identify questions which require an extended written answer and those questions where all or part of the question may be answered by giving bullets, lists etc rather than full sentences.

## Answering the questions

Candidates do not have to answer exam questions in any particular order. They may find it helpful to consider, for example:

- tackling first those questions which they find easiest. This should help them get into the 'flow' of the exam and help confidence by building up marks quickly and at the start of the exam.
- tackling the extended answer question at an early stage of the exam to make sure they spend sufficient time on it and do not run out of time at the end of the exam.

Candidates should avoid wasting time by repeating the question either in full or in part in their answer.

Candidates should **always** attempt every question, even questions where they may be less confident about the answer they are giving. Candidates should be discouraged however, from spending too long on any answer they are less sure about and providing answers that are longer and give more detail than should be necessary in the hope of picking up marks. This may be mean they have less time to answer questions that they are better prepared to answer.

## Extended answer questions

Before writing out in full their answer to extended questions, candidates may find it helpful to identify the key requirements of the question and jot down a brief plan or outline of how they will answer it. This will help clarify their thinking and make sure that they don't get 'bogged down' or provide too much detail for one part of the question at the expense of others.

## Towards the end of the exam

Candidates should always set aside time at the end of the exam to read back through and review what they have written in order to make sure this is legible, makes sense and answers the question in full.

If a candidate finds they are running out of time to finish an answer towards the end of the exam, they should attempt to complete the answer in abbreviated or note form. Provided the content is clear and relevant, examiners will consider such answers and award marks where merited.

Further guidance on preparing candidates to take the exam is given in the City & Guilds publication, Technical Qualifications, Teaching, Learning and Assessment which can be downloaded free of charge from City & Guilds website.

# 4. Further information

For further information to support delivery and exam preparation for this qualification, centres should see:

## City & Guilds

*Qualification homepage:* http://www.cityandguilds.com/qualifications-and-apprenticeships/it/it-professional/5220-technicals-in-digital-technologies#tab=information *which includes:*

- *Qualification handbook*
- *Synoptic Assignment*
- *Sample assessments*

*Technical Qualifications, Resources and Support:*
*http://www.cityandguilds.com/techbac/technical-qualifications/resources-and-support*

## Joint Council for Qualifications

*Instructions for Conducting Examinations: www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations*