Unit 14: Installing and Maintaining Computer Hardware

Level: 1 and 2
Unit type: Optional specialist
Guided learning hours: 60
Assessment type: Internal

Unit introduction
Technology systems can include a multitude of external hardware devices and internal hardware components. Over time it is necessary to maintain the system to repair faults (such as a loose component) and improve performance or upgrade the system’s functionality (for instance by installing a faster processor). Job roles that demonstrate installing and maintaining computer hardware include computer technician, technical support engineer, service team leader, and helpdesk engineer.

In this unit, you will develop an understanding of the benefits and implications of installing and maintaining hardware in technology systems. For a specific brief, you will install and maintain hardware in a technology system. This will involve finding and repairing faults with the internal hardware components of a computer, such as the processor or internal bus, and upgrading other internal components, such as adding a network card or additional memory. You will also learn how to install a new external hardware device, such as a printer or barcode scanner.

The technology system will then be tested for functionality and performance. Once completed, you will review your modified technology system against the brief and obtain feedback from the ‘client’, and evaluate possible improvements.

In particular, this unit develops skills from Unit 2: Technology Systems and supports Unit 11: Computer Networks, Unit 15: Installing and Maintaining Computer Software and Unit 16: Automated Computer Systems.

Learning aims
In this unit you will:
A understand the benefits and implications of installing and maintaining hardware in technology systems
B plan installation and maintenance of hardware in a technology system
C install, maintain and test hardware in a technology system
D review the modified technology system.
## Learning aims and unit content

### What needs to be learnt

<table>
<thead>
<tr>
<th>Learning aim A: Understand the benefits and implications of installing and maintaining hardware in technology systems</th>
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</thead>
<tbody>
<tr>
<td><strong>Computer hardware</strong></td>
</tr>
<tr>
<td>Hardware to include:</td>
</tr>
<tr>
<td>● internal components of a computer, e.g. network card, memory, processor</td>
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<tr>
<td>● external hardware devices, e.g. printer, network router, barcode reader.</td>
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<tr>
<td><strong>Reasons to maintain technology systems</strong></td>
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<td>Know why we maintain technology systems, e.g.:</td>
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<tr>
<td>● to prevent faults occurring and/or to repair faults</td>
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<tr>
<td>● to upgrade internal components, e.g. processor, memory and/or storage, to improve performance</td>
</tr>
<tr>
<td>● to upgrade external hardware devices to improve performance</td>
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<tr>
<td>● to change system functionality, e.g. to network the technology system or allow printing/scanning.</td>
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<tr>
<td>Know that:</td>
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<tr>
<td>● computer faults are often connected to errors, mistakes, defects and/or failures found with some components of a technology system</td>
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<tr>
<td>● examples of typical faults include power supply faults, loose connections, and graphics, sound or network card faults</td>
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<tr>
<td>● faults vary depending on the hardware technology being maintained as hardware evolves over time.</td>
</tr>
<tr>
<td><strong>Benefits and implications of installing and maintaining hardware</strong></td>
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<tr>
<td>Benefits, e.g.:</td>
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<tr>
<td>● to reduce costs</td>
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<tr>
<td>● to improve performance, e.g. efficiency and effectiveness</td>
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<tr>
<td>● to improve/maintain customer service</td>
</tr>
<tr>
<td>● to improve health and safety awareness.</td>
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</tbody>
</table>

*continued*
## What needs to be learnt

Implications, e.g.:
- training
- compatibility
- decommissioning
- service level agreements
- risks, such as:
  - electrostatic discharge (damage to components including printed circuit boards, memory cards)
  - component damage
  - data risk, (data loss, data corruption)
  - other risks (e.g. service loss).

How these implications could impact on an individual or organisation, e.g.:
- upgrading a hard disk drive could mean losing valuable data
- causing an electrostatic discharge to a new processor could damage the component resulting in a financial loss.
### What needs to be learnt

Learning aim B: Plan installation and maintenance of hardware in a technology system

**Planning for installation and maintenance**

**Plan to include:**

- purpose of the installation or maintenance, e.g. compatibility, increased capacity, increased speed, increased reliability, software requirements, network requirements
- requirements of the brief ('client'/user requirements)
- alternative ideas for installing and maintaining hardware, i.e. there will be more than one way of improving the performance of the technology system, e.g. by increasing the memory or upgrading the processor
- hardware required, e.g.:
  - internal components of a computer, such as:
    - motherboard
    - central processing unit (CPU) or graphics processing unit (GPU)
    - memory
    - sound/video/network cards
    - heat dispersal systems, e.g. fans, heat sinks
    - storage devices, e.g. solid state, optical, magnetic
    - power supply unit (PSU)
    - connectors/ports
  - external hardware devices, such as:
    - monitor
    - printer
    - scanner
    - webcam
    - router
    - storage devices
    - broadcasting devices
    - lighting and/or sound devices
- tools required, e.g.:
  - antistatic equipment, e.g. antistatic packaging, wrist straps, antistatic mats
  - computer toolkits, e.g. chip inserter, chip extractor, assembly tweezers, slotted screwdriver, Phillips screwdriver, Torx screwdriver
- software resources, e.g. printer driver, installation setup and configuration
- installation and maintenance activity list, e.g. replace the motherboard battery, remove the heat sink and fan to access the processor, back up data and add a printer (external device) as part of an upgrade
- constraints (costs and technical), e.g. component cost, hardware and software availability, tools and component/device compatibility
- test plan and, if appropriate, test data (for functionality and performance).
What needs to be learnt

Learning aim C: Install, maintain and test hardware in a technology system

Install and maintain hardware
Preparation, e.g.:
- read manufacturer’s hardware instructions
- test selection
- test configuration
- health and safety considerations, including antistatic equipment, precautions
- obtain resources (tools, hardware components and devices, access rights, software resources)
- check equipment
- other tasks (backing up data, recording serial numbers).

Fault finding
Tools and techniques, e.g.:
- utility
- run-time analysers
- test procedures, e.g. follow a test plan
- validating information
- responding to test plan (error messages, inconsistent data)
- loose connections
- jumper settings
- power support
- power-on self-test (POST)
- diagnostic software.

Installation and maintenance activities
Activities including, e.g.:
- fit new components and reconnect components and devices
- reassemble the computer system
- download software resources (hardware drivers)
- clean
- carry out safety checks
- system test
- dispose of packaging
- other tasks (i.e. restore data).

Feedback from ‘client’, e.g. functionality and performance.
Potential improvements to the technology system (e.g. performance, capacity, accessibility, reliability, security, user requirements).

continued
<table>
<thead>
<tr>
<th>What needs to be learnt</th>
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</thead>
<tbody>
<tr>
<td>Health and safety issues throughout the installation and maintenance of a computer system, e.g.:</td>
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<tr>
<td>- hardware</td>
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<tr>
<td>- electrical connection risks and guidelines</td>
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<td>- handling equipment.</td>
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</table>

<table>
<thead>
<tr>
<th>Learning aim D: Review the modified technology system</th>
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<tbody>
<tr>
<td>Review the modified technology system against:</td>
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<tr>
<td>- the original brief (‘client’/user requirements)</td>
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<tr>
<td>- purpose</td>
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<tr>
<td>- choice of hardware components</td>
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<tr>
<td>- constraints, e.g. budget and compatibility of hardware components.</td>
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</tbody>
</table>
### Assessment criteria

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2 Pass</th>
<th>Level 2 Merit</th>
<th>Level 2 Distinction</th>
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</thead>
<tbody>
<tr>
<td>Learning aim A: Understand the benefits and implications of installing and maintaining hardware in technology systems</td>
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<tr>
<td>1A.1 Identify the benefits of installing and maintaining hardware for two different technology systems.</td>
<td>2A.P1 Explain the benefits of installing and maintaining hardware for two different technology systems.</td>
<td>2A.M1 Review how installing and maintaining hardware for one technology system could impact an individual or organisation.</td>
<td>2A.D1 Discuss the strengths and weaknesses of hardware for a given technology system.</td>
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<tr>
<td><strong>Learning aim B: Plan installation and maintenance of hardware in a technology system</strong></td>
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<tr>
<td>1B.2 Identify the purpose and 'client' requirements for installing and maintaining hardware in a technology system.</td>
<td>2B.P2 Describe the purpose and 'client' requirements for installing and maintaining hardware in a technology system.</td>
<td>2B.M2 Produce a detailed plan including reasons why alternative ideas for installing and maintaining hardware have been discarded.</td>
<td>2B.D2 Justify final decisions, explaining how the technology system will fulfil the stated purpose and 'client' requirements, describing the impact of any constraints on the plan.</td>
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<tr>
<td>1B.3 Produce a plan for installing and maintaining hardware in a technology system, with guidance, including:</td>
<td>2B.P3 Produce a plan for installing and maintaining hardware in a technology system including:</td>
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<tr>
<td>● a list of installation and maintenance activities</td>
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<td>● a list of hardware components and devices and software resources required for an upgrade.</td>
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<td>● a description of fault-finding tools and techniques</td>
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<td>● a test plan.</td>
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<tr>
<td><strong>Learning aim C: Install, maintain and test hardware in a technology system</strong></td>
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<tr>
<td><strong>1C.4</strong> Install and maintain hardware in a technology system, with guidance, that includes the:</td>
<td><strong>2C.P4</strong> Install and maintain hardware in a technology system that includes the:</td>
<td><strong>2C.M3</strong> Install and maintain hardware in a technology system, using appropriate tools and techniques to protect the data and system settings, demonstrating awareness of the user requirements and taking account of usability.</td>
<td><strong>2C.D3</strong> Refine the modified technology system in order to improve performance, taking account of feedback.</td>
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<tr>
<td>● repair of at least one different internal hardware component faults</td>
<td>● repair of at least two different internal hardware component faults</td>
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<tr>
<td>● upgrade of at least one internal hardware component.</td>
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<tr>
<td><strong>1C.5</strong> Test the modified technology system for functionality and repair any faults, with guidance.</td>
<td><strong>2C.P5</strong> Test the modified technology system for functionality against the purpose and repair any faults as necessary.</td>
<td><strong>2C.M4</strong> Test the modified technology system and gather feedback, and use it to improve the technology system for user experience.</td>
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<tr>
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<tr>
<td><strong>Learning aim D: Review the modified technology system</strong></td>
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<tr>
<td>1D.6 For the modified technology system, identify how it is suitable for the intended purpose and original requirements.</td>
<td>2D.P6 Explain how the modified technology system is suitable for the intended purpose and original requirements.</td>
<td>2D.M5 Review the extent to which the modified technology system meets the original requirements, considering feedback from others and any constraints.</td>
<td>2D.D4 Evaluate the initial plan against the modified technology system and justify any changes that were made, making recommendations for further improvements.</td>
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</table>
Teacher guidance

Resources
As a minimum, each learner will need to access a technology system that can be dismantled, repaired and upgraded to meet a brief. Learners will need:

- access to internal hardware components in a computer, e.g. a memory card, processor, hard disk drive, optical storage device, graphics card
- at least one additional external hardware device, e.g. a printer, scanner, webcam.

It is important that the hardware components and devices have the accompanying manuals and any software installation disks (or at least links to download these from the manufacturer’s website).

The practical activities should take place in a workshop with appropriate tools and take account of health and safety requirements.

Learners need access to a brief. The brief can either be created by the centre or be generated by the learner and approved by the centre.

Assessment guidance
This unit is assessed internally by the centre and externally verified by Pearson.
Please read this guidance in conjunction with Section 8 Internal assessment.

Learning aim A
Learners will develop an understanding of the computer hardware in two different technology systems, describing the benefits and implications of maintaining them.

For 2A.P1: learners should explain the benefits of installing and maintaining hardware in two different technology systems. For example, a benefit for a computer owner of maintaining their own technology system is saving on consultancy and labour costs.

For level 1, as a minimum, learners should have identified the benefits of installing and maintaining the hardware in two different technology systems. They are likely to have listed only two examples, without any description.

For 2A.M1: learners should review how installing and maintaining the hardware in one technology system could affect an individual or organisation. For example, hardware components could be damaged during an installation or upgrade because of mishandling, resulting in a financial loss to a business.

For 2A.D1: learners should discuss the strengths and weaknesses of hardware for a given technology system. For example, one weakness of the hardware could be that the manufacturer’s warranty could be void if anyone attempts to upgrade the technology system. Learners should discuss at least one strength and at least one weakness.

Learning aim B
Learners should have an understanding of the typical faults found in most technology systems, as well as the range of hardware components that could be upgraded to improve performance.

Learners will establish the requirements for installing and maintaining hardware in a technology system based on a brief. The brief should allow learners to explore different possibilities for fulfilling the requirements. It should also allow them to produce a plan, outlining their ideas for repairing and upgrading a technology
system, for both the internal hardware components of the computer and external hardware devices. The brief should ideally be written with a ‘client’ in mind and must include the following requirements (as a minimum):

- the reason (purpose) for a change to the hardware in a technology system and/or user requirements, and the requirements of any ‘client’ for the system
- a description of at least two different faults (arising from malfunctioning internal hardware components of a technology system)
- an outline of at least two different performance enhancements that would require the internal hardware components of a computer to be upgraded, e.g. additional memory to stream video
- a description of additional system functionality that would require the addition of at least one new external hardware device
- any special requirements/instructions/configuration
- timeframe
- budget (costs)
- constraints.

Centres are encouraged to use evidence for the installation and maintenance of the technology system as part of the learner’s digital portfolio (Unit 3: A Digital Portfolio).

For 2B.P2: in order to produce a plan for the installation and maintenance of hardware in a technology system, learners must first be able to understand and interpret the requirements from the brief. Learners should be able to provide a description of the purpose and ‘client’ requirements for installing and maintaining hardware in a technology system.

If it is to be upgraded, learners will need to investigate the technology system to get an idea of its current state of repair and of its capabilities. It is expected that learners will ‘lift the lid’ of the technology system to maintain and upgrade what is inside.

For level 1, as a minimum, learners will identify the ‘client’ requirements and purpose for installing and maintaining hardware in a technology system.

For 2B.P3: learners will plan the installation and maintenance of hardware in a technology system.

They should include:

- a list of installation and maintenance activities
- a description of internal hardware components and external hardware devices
- software resources they would need to carry out an upgrade, including the role of the software and its relationship to the technology system and user
- a description of fault-finding tools and techniques to determine the hardware faults (observation, diagnostic tools).

They should also provide a test plan to cover the installation and maintenance of hardware in a technology system, giving an outline of the range of tests that they will perform once the technology system is modified. The test plan should also clearly show how they would find system faults, e.g. use of diagnostic tools and software.

For level 1, as a minimum, learners should produce a plan for the installation and maintenance of hardware in a technology system. An outline plan would contain a list of installation and maintenance activities to be carried out, and a list of hardware components and devices and software resources needed for the upgrade.
For 2B.M2: learners should consider alternative ideas for an upgrade within their plan. For example, in a scenario to increase the performance of a technology system, the alternatives to achieve this could include increasing the memory, swapping the processor or replacing magnetic hard disk drives for new solid state disk drives.

For 2B.D2: learners should justify decisions in their plan, explaining why they have chosen different hardware components, fault-finding tools and techniques while rejecting others, making reference to the given purpose and the ‘client’ requirements. Learners must also think about constraints, e.g. the availability of tools and hardware and whether or not this will have an impact on maintaining the hardware in a technology system. If it does, are there any alternatives for modifying the technology system to meet the same requirements? For example, if the ‘client’ requires an 80 GB hard disk drive but the only size available is 160 GB, consideration of this would be sufficient to cover the requirements.

Learning aim C

Learners will install and maintain hardware in a technology system. They should apply their practical skills and knowledge to do this.

For 2C.P4: learners should use appropriate resources and fault-finding tools and techniques (as identified in their plan) to install and maintain the hardware in a technology system.

As a minimum, learners should have used appropriate fault-finding tools and techniques to identify and repair at least two different internal hardware faults in a technology system. They should also install and configure (upgrade) at least two internal hardware components and add at least one additional external hardware device.

For level 1, as a minimum, learners should repair at least one internal hardware faults and upgrade at least one internal hardware component.

For 2C.M3: learners should demonstrate good practice to protect data and system settings when maintaining hardware in a technology system. Learners should use appropriate tools and techniques to safely back up data prior to making any modifications to the technology system. They should also safely restore the data and system settings to the technology system after the modifications are complete. The modified technology system must demonstrate the learner’s awareness of purpose, meet the user requirements and improve the usability of the system.

For 2C.P5: learners will be expected to follow their test plans (as identified in their plan) and test for functionality and purpose against the original requirements of the modification.

Learners are likely to experience technical difficulties as they install and maintain the hardware in a technology system. Where this happens, learners are expected to troubleshoot and resolve the difficulties, finding and repairing any internal computer hardware faults. It is important that learners make appropriate comments in their plans and test plans about any issues they discover and how they resolved them. Where appropriate to do so, it is acceptable to photograph problems and solutions or use witness statements and observation records as evidence of this process.

Learners must adhere to all health and safety guidelines when undertaking practical activities with electronic equipment.

For level 1, as a minimum, learners should test their system and repair any faults.
For 2C.M4: learners will be required to test the functionality of the technology system while ensuring that data is safely backed up and that system settings can be restored. Learners will also complete user-experience testing with the help of at least one person who can act as the ‘client’. The ‘client’ should be commenting on the usability and the user-experience of the modified technology system. Learners should record this feedback as part of the testing process.

For 2C.D3: teachers should recognise that the process of installing, maintaining and testing hardware in technology systems is an iterative one.

Learners should refine the modified technology system in order to improve its performance. Learners are also expected to make further refinements based on their test results and feedback. These refinements will probably involve customising the hardware components to suit the ‘client’. Other refinements could include accessing the advanced settings of the hardware components to see if they can be customised to make full use of their features and capabilities in a way that satisfies the ‘client’ or user, for example, by using software drivers to optimise a graphics card that takes full advantage of memory and processing power. This can be achieved by either reallocating physical memory resources or utilising USB flash drives to extend and support the memory, for example, ReadyBoost. Cleaning the internal hardware components, such as the power supply unit or heat sink, will also improve the performance of a technology system and prevent any overheating caused by particle build-up.

If it is not possible for learners to apply their refinements (for example, because of software or hardware constraints), learners should explain what they would do if they had the opportunity, focusing on performance. For example, the scarcity of high-performance graphics cards could prevent learners from refining the modified technology system. However, they could discuss how these graphics cards would improve performance with an explanation of how they would be configured.

All of the ideas from testing, reviewing and receiving feedback on the modified technology system should be considered as learners go through the refinement process.

Learning aim D

For 2D.P6: learners should explain why their modified technology system is suitable for the intended purpose and the original requirements.

For level 1, as a minimum, learners should identify how their modified technology system is suitable for the purpose and the original requirements.

For 2D.M5: learners should build on the explanations for the Pass criteria, and review how well the ‘client’ requirements and purpose have been met, and should include details of how any constraints have affected the modified system. They should also seek feedback from the ‘client’ about the modified technology system. An interview would be an ideal way of discussing the modified technology system and recording the feedback.

Learners should consider any constraints that they have had to deal with when modifying the system.

For 2D.D4: learners should evaluate their initial plans against the modified technology system. They should justify any changes that were made and explain the rationale for those changes. They should also give recommendations for at least three improvements but do not need to implement any enhancements.
Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

<table>
<thead>
<tr>
<th>Criteria covered</th>
<th>Assignment title</th>
<th>Scenario</th>
<th>Assessment evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A.1 2A.P1, 2A.M1, 2A.D1</td>
<td>Investigation</td>
<td>You work as a consultant for an IT company that specialises in maintaining technology systems. For this scenario, a ‘client’ manages a small company with employees who use technology systems. They have found a few technical problems. Before the ‘client’ decides whether to buy a brand new system, they would like some advice from you about repairing and maintaining the existing system. They want to know: • the benefits of installing and maintaining hardware in at least two different technology systems • the implications for the organisation of maintaining hardware in at least one technology system. You need to consider the strengths and weaknesses of the hardware for a given technology system. Prepare a presentation or a report for the ‘client’.</td>
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</table>
### Criteria covered  |
| Assignment  |
| Scenario  |
| Assessment evidence  |

1B.2, 1B.3  
2B.P2, 2B.M2,  
2B.P3, 2B.D2  

Planning  
The ‘client’ would like you to upgrade and maintain the hardware in one technology system. Your task is to plan the installation and maintenance of hardware to fulfil your user requirements for the ‘client’. Produce a plan to include:
- a list of the installation and maintenance activities  
- a description of hardware components and devices and software resources required for an upgrade  
- a description of fault-finding tools and techniques  
- a test plan.  
You must also consider alternative ideas, e.g. alternative hardware solutions that will fulfil the same purpose.

It is important that you explain how the plan meets the purpose and ‘client’ requirements and what effect it will have on users.

- Web page.  
- Report.
<table>
<thead>
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</table>
| 1C.4, 1C.5        | Repair and Upgrade | You should now have everything you need to start maintaining the technology system. You must demonstrate that you can follow your plan to: 1) safely back up all data and system settings in preparation for a system restore 2) fault-find and repair at least two different hardware faults within the technology system 3) install and configure at least two different internal hardware components in a technology as part of an upgrade 4) install and configure at least one external hardware device as part of an upgrade 5) restore all data and system settings. Test the modified technology system for functionality and performance and record the results. Meet with your ‘client’ to discuss your progress and to gather some feedback about your modified technology system. Make any necessary improvements to the modified technology system to improve the overall performance, taking on board feedback from your ‘client’ and test results. | - Witness statements.  
- Observation records. |
| 2C.P4, 2C.M3, 2C.P5, 2C.M4, 2C.D3 |                   |                                                                                             |                                          |
| 1D.6              | Review           | Evaluate the modified technology system, explaining why and how it meets the brief, suggesting improvements and considering any constraints. | - Report.                               |
| 2D.P6, 2D.M5, 2D.D4 |                 |                                                                                           |                                          |