Answers

Task 1

For each of the following computer related terms in the table below, tick to indicate if they are an application, operating system, user or hardware.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Application** | **Operating system** | **User** | **Hardware** |
| **Excel** | 🗸 |  |  |  |
| **Android** |  | 🗸 |  |  |
| **Programmer** |  |  | 🗸 |  |
| **Mouse** |  |  |  | 🗸 |
| **Android** |  | 🗸 |  |  |
| **iOS** |  | 🗸 |  |  |
| **Microsoft Word** | 🗸 |  |  |  |
| **Windows** |  | 🗸 |  |  |
| **IT technician** |  |  | 🗸 |  |
| **Ubuntu** |  | 🗸 |  |  |
| **Google Chrome** | 🗸 |  |  |  |
| **CPU** |  |  |  | 🗸 |
| **RAM** |  |  |  | 🗸 |

Task 2

(a) Choose **two** different operating systems that you have used.

Operating system 1:

Operating system 2:  
  
Answers will depend on the student. Possible answers include: Windows, Android, iOS, MacOS, Linux

(b) Compare both these operating systems. You may need to use the Internet to research your chosen operating systems further. Consider the following points in your comparison:

* What hardware and devices does it work with?
* Who makes it?
* What features does the Graphical User Interface (GUI) provide?
* What are the feature differences between the two operating systems?
* Can the operating system run programs made for the other operating system?
* What other features do the operating systems provide that the user doesn’t necessarily see or realise are there?

**Answers**

Answers will depend on the operating systems used. The following offers some areas to consider in answers:

* Hardware supported will have many similarities such as CPU and RAM. Desktop operating systems are more likely to have support for hard disks and printers whilst mobile operating systems will have support for cameras, touchscreens and GPS. There is likely to be a lot of cross over in support. This is a good opportunity to discuss device drivers which are covered later in the lesson.
* Windows – Microsoft, Android – Google (and Linux), iOS – Apple, MacOS – Apple, Linux – Linus Torvalds and community.
* Windows, icons, menus, pointers and many other features.
* These may be in the way icons are installed, programs are installed, keyboards (virtual or real) along with many others.
* Generally, programs need to be made (compiled) for a specific operating system. It is likely that programs will work on different versions of an operating system, but not for different operating systems – e.g. a Windows program wouldn’t work on Android. Emulators can allow some programs made for different operating systems to work – examples include Parallels for MacOS to run Windows programs and Wine for Linux to run Windows programs.
* Network management, security, device drivers, memory management, virtual memory, multi-tasking – these are all covered later in the lesson.

Task 3

1. Faraday is a new car company. As with all modern cars they will be incorporating a small computer called an electronic control unit (ECU). This will control devices such as the brakes, engine performance and electric windows. For example, when the brakes are pressed the brake lights must be switched on within 0.05 seconds.

(a) What type of operating system would be chosen for the ECU?  
  
Real-time operating system.

(b) Describe how the following are controlled by the ECU and its operating system.

(i) Speed control / cruise control  
  
The speed is set at a particular level and if it rises above it the control unit will reduce the fuel to the engine / accelerator and/or apply the brakes to reduce the speed. If the speed is below the level the brakes will be released and then the accelerator increased.

(ii) Antilock braking system (ABS)  
  
These systems prevent skidding by monitoring the amount of pressure on the brakes and preventing the wheels from locking up. They will reduce the pressure on the brakes if the wheels stop turning when they are beginning to skid. Once traction is regained, and the wheels are turning they will again apply the brakes. This allows the driver to steer and stop.

(c) Explain what happens if the ECU is delayed in carrying out operations of both speed control and ABS.

Speed control: \_\_\_  
  
If the speed/cruise control is delayed then it could apply to much brake slowing the car beyond its target speed. It could also increase the speed well beyond the target speed, causing speeding / accidents / fines. The erratic behaviour could cause stress in the driver and other road users and accidents.  
  
ABS: \_\_\_  
  
ABS needs to react very quickly to skidding. If it did not release the brakes then a skid would continue (as if ABS wasn’t enabled). If it failed to re-apply the brakes there would be no way of stopping the car.

Task 4

Zahra set up and runs a multinational perfume company. The perfumes are produced by machines that need to combine ingredients in correct proportions and at exact temperatures.

The workers in the manufacturing facility each have a small hand-held device which is used to monitor data provided by sensors in the machines. Sales employees each have tablets they use whilst they are visiting shops and buyers.

The company head office is in Paris. Employees there make use of ‘thin client’ computers. These are very simple computers which connect to a server which does most of the work, such as running programs and storing data.

(a) Suggest, giving reasons, the types of operating systems that should be selected for:

(i) The manufacturing machines.  
  
Real-time operating system. This ensures that a required event will occur at exactly the right time and for the correct duration.

(ii) The small, hand-held devices.

Single-user single-task operating system as each device is used by only one user and only one program is in operation.

It is possible for other answers to be considered if a correct justification is given. For example, the operating system could be multi-user if it needs to keep track of which user is using it or making changes.

(iii) The employees’ tablets.

Single-user multitasking as each tablet has only one user who needs to run several programs at the same time.

(iv) The server at head office which allows ‘thin clients’ to connect.

Multi-user operating system. This would manage the sharing of CPU time and resources needed by many users.

(b) Many computers have only one CPU and can only carry out one instruction at a time. These computers, with operating system support, are still able to carry out many tasks at the same time. For instance, a user of a mobile phone could be listening to music, whilst browsing a website, whilst still able to receive voice calls and text messages. This is due to multi-tasking.  
  
Explain how multi-tasking works.  
  
The operating system will interrupt a program whilst it is running. Everything stored on the CPU will be moved into RAM. Another program will then be run on the CPU. The operating system will make sure that all the tasks have an amount of time on the CPU based on how important they are. By switching between tasks quickly, the mobile phone can appear to be doing all the tasks at the same time. If too many tasks are carried out at the same time, the operating system may find it cannot manage them all quickly enough. This may result in the phone slowing down and becoming unresponsive, or short pauses in the music playing.

Task 5

Three tasks that operating systems are responsible for are:

* Network management
* Security
* Device drivers

1. Choose **two** different operating systems.

Operating system 1: \_\_\_

Operating system 2: \_\_\_

Explain how each of the tasks are carried out by the operating system. Find examples or images to illustrate these from the two operating systems you have selected.  
  
Answers will vary according to the operating systems selected.  
  
Students may have access to laptops, desktops or mobile phones where they can find screenshots. Equally they may find screenshots by searching for images.  
  
These areas can become quite involved, so suggested searches (replacing the operating system name) may include:  
  
selecting network iOS  
user security Windows (this may include information about firewalls and malware protection)  
adding users MacOS  
device drivers Windows  
  
Answers should also reflect the information given on the slides.

Task 6

Modern operating systems are responsible for both memory management and virtual memory.

Adapt the diagram below to explain how an operating system manages loading a web browser to browse a web page, and what happens if too many web pages or tabs are opened.

RAM

|  |
| --- |
| Operating system |
| Browser |
| Page 1 |
| Page 2 |
| Page 3 |
| Page 4 |
| Page 5 |
| Page 6 |

Hard Disk

CPU

Network Interface Card (NIC)

2

1

4

3

1. The web browser program is loaded from the hard disk to an area of RAM which the operating system allocates.

2. The CPU runs the instructions for the browser.

3. As each web page is received from the Internet it is stored in RAM. It will also be processed by the CPU (arrow not shown).

4. When page 7 is received from the Internet there is nowhere left to store it in RAM. The operating system decides that page 1 hasn’t been used for some time and so stores it in virtual memory. Page 7 can now be stored in the area of RAM that has been freed and can be processed by the CPU to display it.