

Read the following passage before answering the questions that follow.

Many large office buildings contain a lot of computer equipment. A fire in a computer room can cause a lot of very expensive damage to the hardware, as well as the loss of important data. Many fire safety systems involve spraying water into an area if the temperature goes above a certain value. However, spraying water into computers could cause almost as much damage as a fire. Computer rooms are therefore usually fitted with fire suppressant systems using **inert** gases, like nitrogen, carbon dioxide or one of the **noble gases**.

There are three main systems in use.

*Halons* are small hydrocarbon molecules where one or more of the hydrogen atoms has been replaced with a halogen molecule. When halon gas is released into an area, chemical reactions cause any fires to go out, even if there is still enough fuel, oxygen and heat present. The halon gases can produce giddiness if they are breathed in, and may sometimes form toxic products at high temperatures. These gases also destroy the ozone layer when they are released into the atmosphere, and so halon systems are now being replaced throughout Europe.

*Carbon dioxide* puts out fires if it is at a concentration of around 40 per cent, by depriving the fire of oxygen. The gas is cheap and readily available. However, there is a risk of suffocation if anyone is in the area, and people have died in rooms where carbon dioxide fire suppressant has been used.

The third type of system uses a mixture of *nitrogen and argon*. Nitrogen reacts more readily than argon, but is still fairly inert compared with many other gases. A measured amount of this mixture of nitrogen and argon is released into a room so that it reduces the oxygen concentration to around 14%. People can still breathe at this oxygen concentration, but there is not enough oxygen to allow fires to continue burning.

- 1 Explain why water sprinkler fire suppressant systems are not suitable for use in a computer room.
- 2 State one property of noble gases that makes them suitable to use for putting out fires.
- 3 In computer rooms fitted with halon systems, there is usually a warning alarm. The alarm gives people time to leave the room before the gas is released. Explain why the warning alarm is needed.
- 4 Describe the difference between the way that the halon system and the nitrogen–argon system works.
- 5
  - a Explain why engineers fitting a nitrogen and argon fire suppressant system need to know the volume of the room.
  - b Describe what could happen if the engineers used a value that was too large in their calculations.
  - c State what could happen if the value for the volume was too small.
- 6 Explain why carbon dioxide systems are usually used to protect unoccupied rooms.
- 7 Summarise the advantages and disadvantages of the three different systems.

### Extra challenge

- 8 An advert for a nitrogen–argon fire suppressant system states:  
'The gases are obtained from the atmosphere, so there are no harmful effects from their use.'  
Comment on this statement.