

Wednesday 30 May 2012 – Afternoon

**GCSE TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A**

A218/02 Unit 4: Ideas in Context (Higher Tier)

INSERT

Duration: 45 minutes



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- This Insert contains the three articles required to answer the questions.

INFORMATION FOR CANDIDATES

- This document consists of **8** pages. Any blank pages are indicated.

Hypothermia – a hazard for mountaineers



Any climb or walk that exposes people to extremely cold conditions can put them at risk of suffering from hypothermia. Mountaineers are particularly at risk.

Hypothermia is a condition where the core body temperature drops below that required for normal reactions and body functions.

Core body temperature is usually maintained within the normal range of 36.5–37.5°C by a process called temperature regulation. This is a form of homeostasis, using special receptors and effectors in the nervous system and involving negative feedback.

If a person is exposed to cold external conditions and if their internal mechanisms are unable to balance heat loss with heat gain, a drop in core body temperature occurs. As the core body temperature decreases, characteristic symptoms occur, such as shivering and mental confusion.

Signs and symptoms

The signs and symptoms vary depending on the degree of hypothermia. There are three main stages of this condition: mild, moderate and severe. The table shows one way of classifying the stages of hypothermia.

Table showing the classification of hypothermia

	hypothermia stages		
	mild	moderate	severe
core body temperature in °C	35–32	32–28	below 28

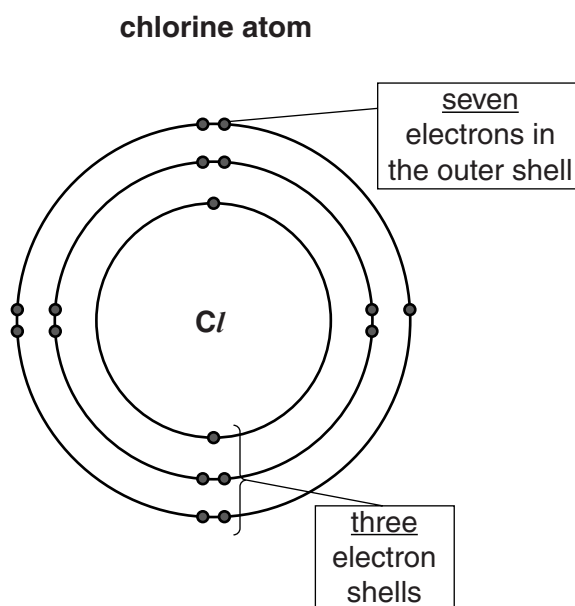
- Symptoms of **mild** hypothermia include shivering and some mental confusion.
- During **moderate** hypothermia, shivering becomes more violent. The person may stumble over objects and have mild confusion. The lips, ears, fingers and toes can also appear pale.
- A person with **severe** hypothermia finds it difficult to speak and can lose the use of their hands. Stumbling often occurs. Under extreme conditions, the person may find walking impossible and the pulse and breathing rates decrease significantly.

Advice to reduce the risk of getting hypothermia when climbing mountains

- Eat properly, with plenty of carbohydrates and fats.
- Drink plenty of water.
- Get enough sleep. Climbing mountains is hard work.
- Change out of wet clothes as soon as possible.
- Wear warm clothing, particularly around the head and neck.

The dangers and delights of chlorine and bromine

Chlorine and bromine are elements from the halogens (group 7 of the Periodic Table). They are both much more important to our everyday lives than many people realise.



Like any family, all the halogens are similar to each other, but like any family there are differences between them too. For example, each element has a similar outer shell electron arrangement but their physical properties change down the group.

Physical properties

element	melting point in °C	boiling point in °C	density in g/cm ³
chlorine	-101	-34	0.003
bromine	-7	59	3.1

Chlorine

Chlorine is the second element in group 7 (below fluorine in the Periodic Table). Chlorine is a very toxic gas. It is more toxic than all the other elements in group 7, apart from fluorine. It is so hazardous to handle that it is usually made right next to the factories that use it.

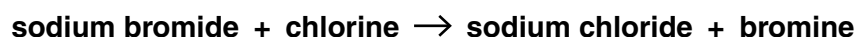
Chlorine is very hazardous to transport by road. If there is a large spillage, it spreads quickly over a very wide area. Even small concentrations can cause serious health problems.

concentration of chlorine in air in parts per million	effect on people
0.2	noticeable smell
30	coughing and vomiting
60	lung damage
1000	death

Chlorine is made by passing an electric current through a solution of sodium chloride in water. This is just salty water. The solution conducts electricity because sodium chloride is an ionic compound. Other useful products are made in the same reaction, so it is a very useful process.

Bromine

Bromine is the third element in group 7. Bromine can also be made from sea water – this time it is the bromide salts that are important. No electricity is used – chlorine is used instead. When chlorine bubbles through a solution of a bromide compound, the element bromine is made.



This works with any **halogen compound**, as long as the **halogen** is less reactive than chlorine.

Bromine is nasty stuff. It is toxic and corrosive. It can be transported by road in special tankers lined with lead.

Chlorine is used to treat drinking water. All of our sofas and chairs are treated with flame retardants made using bromine (flame retardants make fabrics less flammable).

It is amazing to think that both of these elements come from sea water.

The National Grid

The National Grid is the high-voltage electric power transmission grid in the UK. It ensures that electricity generated anywhere in the UK can be used anywhere else in the country.

Generators used in power stations produce electricity at about 23kV. Transformers increase this voltage for transmission through the Grid. The National Grid delivers electricity to major substations. Transformers then reduce the voltage for the electricity supply to factories and homes.



History

This table shows the history of the National Grid.

End of 19th century	Nikola Tesla establishes the principles of alternating current high-voltage electrical power distribution while working for Westinghouse in the United States.
1901	Charles Merz opens the first major UK power station (the Neptune Bank power station near Newcastle upon Tyne).
1912	The integrated power system developed by Merz in the north east of England is the largest in Europe. It uses an alternating current system. The rest of the UK, however, continues to use a patchwork of small supply networks.
1925	The UK government asks William Douglas Weir, a Glasgow industrialist, to solve the problem of Britain's inefficient electricity supply industry. Weir consults Merz, and the result is the formation of the Central Electricity Board.
1933	The Central Electricity Board sets up the UK's first nationwide a.c. grid, running at 132 kV, 50 Hz.
1949	The Grid is upgraded when links at 275 kV are added.
1965	The Grid is further upgraded by adding some 400 kV links.

Facts from the 2005/6 National Grid Report

- Maximum demand: 63 Gigawatts
- Annual electrical energy used in the UK : 360TWh (1.3EJ)
- Capacity: 80 GW
- Number of large power stations: 181

Power Losses in the Grid

- Generator transformer heating losses: 0.157 GW
- In cables: 0.858 GW
- Substation transformer heating losses: 0.142 GW
- Other losses: 0.266 GW

Planning for the future

On average, approximately 11 GW produced in the north of the UK (particularly Scotland and northern England) is transferred through the National Grid to be used in the south of the UK. This is expected to grow to approximately 12 GW by 2014. It has been suggested that any new power stations should be built in the south.

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