OCR
RECOGNISING ACHIEVEMENT

GCSE

ADDITIONAL SCIENCE A

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A218/02

Additional Science A Unit 4 Ideas in Context

Pre - release Material

To be opened immediately
For issue to candidates on or after
DATE MARCH YEAR

This version is for HIGHER tier candidates who will be entered for A218/02.

Sufficient time should be allowed for study of the material in the classroom.

INSTRUCTIONS TO CANDIDATES

- Take the article and read it through carefully. Spend time looking up any technical terms or phrases you do not understand. You are **not** required to do more research of your own on this topic.

- For the examination you will be given a fresh copy of this article, together with the question paper. You will not be able to take this original copy into the examination with you.

This Pre–release paper consists of 5 printed pages.

 Registered Charity Number: 1066969

Question 1

Homeostasis is the process where the body prevents the outside environment from changing things inside the body.

It is important that the body stays at 370C and keeps the same level of water in the blood no matter what is happening outside the body.

Read the following article about what happens to the human body when mountaineers attempt to climb Mount Everest.

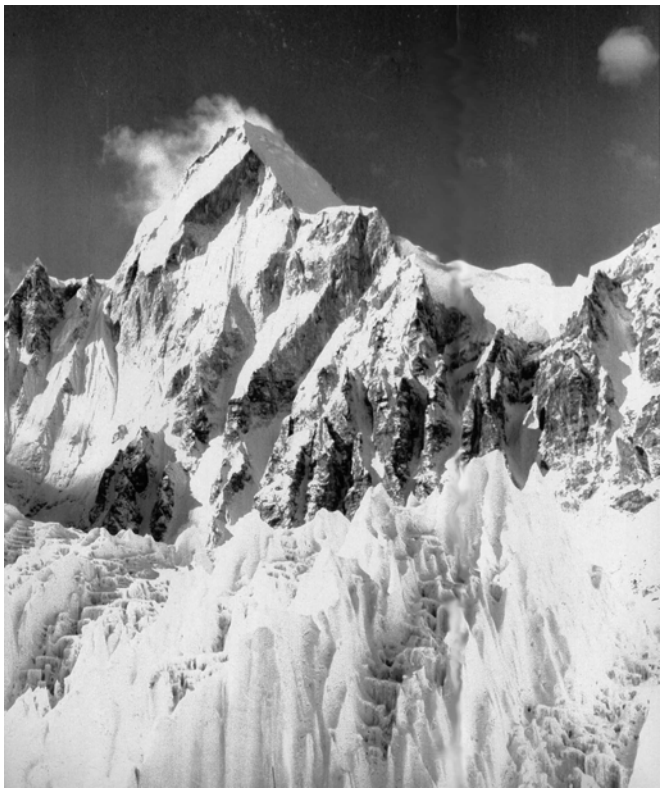
INTO THE DEATH ZONE

Climbers call mountains over 26,000 feet, the death zone. Mount Everest is 29,035 feet high. Over 90 climbers have climbed Mount Everest.

Climbers can suffer from frostbite, when fingers and toes freeze. They also have to survive winds of over 90 miles per hour. Above 25,000 feet, the air is so dry, that climbers can breathe out 5 litres of water in their breath every day.

Ultra violet radiation increases by 4% for every thousand feet and Everest is over 29,000 feet high. These high levels of ultra violet radiation can cause blindness.

The following data show what happens to the body at higher altitudes.



29,000 feet
Air pressure 30%
Climber may hallucinate.
Resting heart rate 123 per minute.

18,000 feet
Air pressure 50%
No one on Earth has a home above this height.
Lungs breathe out too much carbon dioxide turning blood alkaline.
Kidneys excrete more water.

9,000 feet
Air pressure 75%
People feel out of breath.
People get headaches as brain starts to swell.
Body starts to make more red blood cells.
Resting heart rate 85 per minute.

Question 2

Bromine

Bromine is red-brown corrosive liquid that has a range of uses –including the manufacture of fire resistant foam rubber and an additive for leaded petrol.

What is bromine?

F
Cl
Br
I
At

Bromine has the chemical symbol Br.

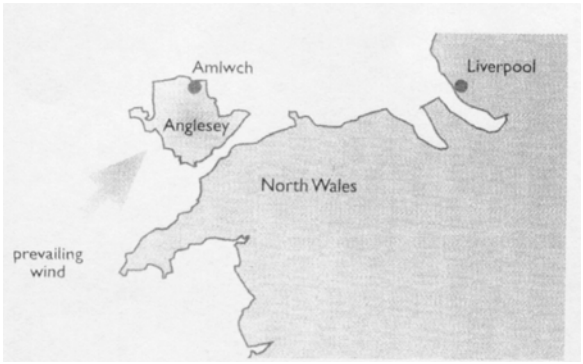
It is an element in Group 7 of the Periodic Table – one of the Halogens.

Sodium bromide is a constituent of sea water.

Where does bromine come from?

In Britain, bromine is extracted from sea water at a plant at Amlwch on the island of Anglesey in Wales.

Anglesey is a long way from large populations and the prevailing wind carries any hazardous gases out to sea.



One of the biggest bromine plants in the world is in Israel beside the Dead Sea. The water in the Dead Sea is very different to normal sea water. Water containing dissolved salts flows into the Dead Sea, but no water flows out. For millions of years water has evaporated, leaving behind a much more concentrated solution of useful ions (see Table 1).

Table 1: Ions in typical sea water and in Dead Sea Water		
ion	**mass of ions of sea water in mg/l**	**mass of ions in Dead Sea water in mg/l**
sodium	11.0	39.0
potassium	0.4	6.9
magnesium	1.3	39.0
calcium	0.4	17.0
chloride	19.0	208.0
bromide	0.07	5.2
sulphate	2.5	0.6

When the water in sea water evaporates completely, sea-salt crystals form. These contain solid salts, and are sold for use in food and in bath salts.

How is bromine made from sea water?

Extracting bromine from sea water involves many stages, but the most important stage is the displacement of bromine using chlorine.

Sea water contains sodium bromide in solution. Chlorine is bubbled through sea water to cause a reaction that releases bromine. Chlorine displaces bromine from sodium bromide solution, because it is a more reactive halogen.

chlorine + sodium bromide → bromine + sodium chloride

Bromine is a very important chemical all over the world. It has many different uses. Its main use today is for making flame retardants. These are added to fabrics and foam furnishings so that they are less likely to catch fire. Since a law was passed in the UK requiring all foam-filled furnishings to contain fire retardant, this use of bromine has increased.

In the past over half the bromine made in the UK was used to make an additive for leaded petrol. Leaded petrol is no longer used, and so much less bromine is needed for the manufacture of fuel additives.

Table 2 shows how the production and use of bromine has changed over the past 30 years.

Table 2: UK bromine production and use in fuel additives

Year	UK bromine production in tonnes	% of bromine produced used in fuel	fuel additive produced in tonnes
1975	28 000	55	15 400
1980	28 000	54	15 100
1987	31 000	24	7500
1997	31 000	10	3500

Question 3

NASA's Deep Space Network

NASA's Deep Space Network (DSN) is a collection of antennas at three sites around the globe used to communicate with interplanetary spacecraft missions.

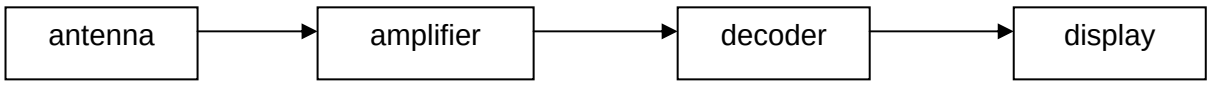
All of the DSN antennas are large "dish" antennas, used to:

- transmit commands to faraway spacecraft
- receive telemetry data from spacecraft
- track the position and speed of spacecraft
- receive science data from spacecraft

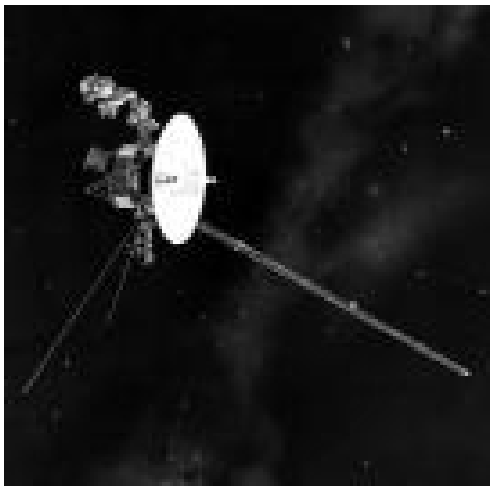
Microwaves are used for deep space communications. A microwave beam travels in a straight line through space, but is refracted by the Earth's atmosphere.

Radio signals weaken as they travel from a deep space probe across the great distance to Earth. Receiving antennas on Earth must have greater reflecting surface to pick up the weak signals. The signals are so weak it is important to use digital signals.

The digital signals received by the deep space network are processed and decoded to allow scientists to interpret the data.



The Voyager-1 spacecraft is exploring the far outer reaches of the Solar System. It is further away from Earth than any other space craft, many millions of kilometres from the Earth.



Voyager is so far away from Earth that a signal, travelling at the speed of light, takes over 12 hours to reach Voyager-1. By comparison, a signal sent to Mars, to command the Mars Global Surveyor spacecraft, takes only 15 minutes. The distance to the space craft can be calculated from the time taken for these signals to travel to the spacecraft.

Successfully sending a DSN signal into Voyager-1's receiver is like throwing a ball across thousands of miles of ocean into a porthole of a moving cruise ship.

In the future, as the Voyagers move even farther away from Earth, DSN engineers will invent new techniques to communicate with them.