GCSE

ADDITIONAL SCIENCE A

F **A218/01**

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 FOUNDATION tier candidates who will be entered for A218/01.

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 4 printed pages.

Answer all questions.

Question 1

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

It is important that the body stays at 370 ^{o}C 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.

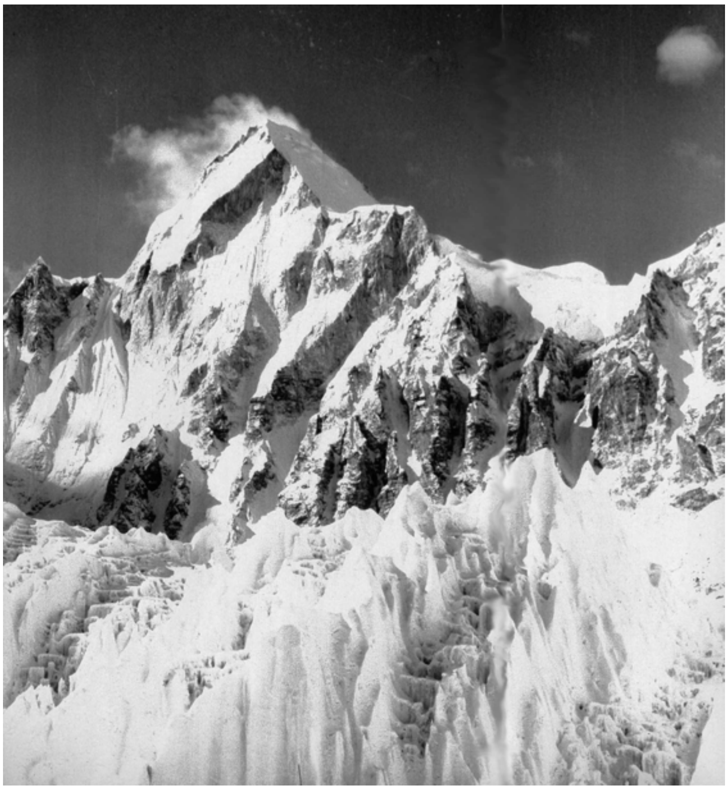
INTO THE DEATH ZONE

Climbers call mountains over 26000 feet, the death zone. Mount Everest is 29035 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 25000 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 29000 feet high. These high levels of ultraviolet radiation can cause blindness.

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



29000 feet
Air pressure 30%.
Climber may hallucinate.
Resting heart rate 123 beats per minute.

18000 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.

9000 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 beats per minute.

Question 2

Bromine

Bromine could save your life if you had a house fire and it was used for decades to keep petrol burning smoothly.

F
Cl
Br
I
At

What is bromine?

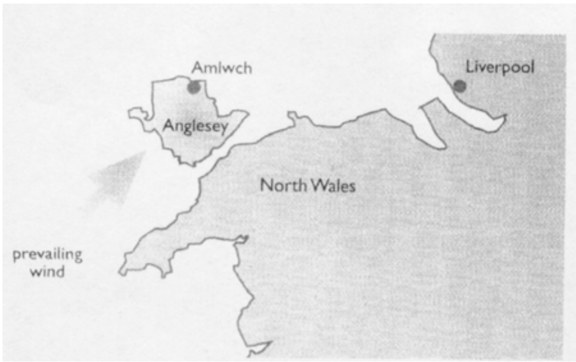
Bromine is an element in Group 7 of the Periodic Table Elements from this group are also known as halogens. The halogens that have similar properties.

Bromine has the chemical symbol Br. This reminds you of two things - it is made from brine (salty sea water) and it is a red/brown liquid.

Where does bromine come from?

In Britain, bromine is extracted from sea water off the coast of Anglesey in Wales. The siting of a chemical plant is very important.

Anglesey is a good site because there are plenty of people to use for a labour force, 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 from normal sea water, because the water evaporates 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 in 1 litre of sea water / g	mass in 1 litre of Dead Sea water / g
sodium	11	39
potassium	0.4	6.9
magnesium	1.3	39
calcium	0.4	17
chloride	19	208
bromide	0.07	5.2
sulfate	2.5	0.6

If the sea water evaporates completely, seasalt crystals which contain solid salts are left behind. These are sold for use in food and also in bath salts.

How is bromine made from sea water?

The most important stage in the extraction of bromine 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 makes bromine. Chlorine displaces bromine from sodium bromide, because it is a more reactive halogen.

chlorine + sodium bromide → bromine + sodium chloride

How is bromine used?

Bromine is a very important chemical with many different uses.

Table 2 shows information about the production and use of bromine in the UK.

Over half the bromine made in the UK used to be used as an additive in leaded petrol. Leaded petrol is not used anymore, and so much less bromine is used for making fuel additives.

The main use of bromine today is for making flame retardants. These are added to fabrics and foam furnishings so that they are less likely to catch fire.

Table 2: UK bromine production and use in fuel additives

Year	UK bromine production / tonnes	% of bromine produced used in fuel	Fuel additive produced/ 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
- 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. 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.

antenna → amplifier → decoder → display

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.

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!