THE RESOURCE BOOKLET FOLLOWS THIS ERRATUM NOTICE

RECOGNISING ACHIEVEMENT

ERRATUM NOTICE

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE **A218/01/RB**
ADDITIONAL SCIENCE A

Unit 4: Ideas in Context

(Foundation Tier)

RESOURCE BOOKLET **JUNE 2009**

A CORRECTION TO THE RESOURCE BOOKLET FOR A218/01

There is one correction that candidates should be made aware of in the Resource Booklet (A218/01/RB) which was released for use by candidates from 10th March 2009.

Please turn to **page 6** of the **Resource Booklet**.

Within the table, the text for **1861** currently reads:

'**James Clerk Maxwell** produces the first colour photograph. He took the photograph through red, yellow and blue filters…'

The text should read:

'**James Clerk Maxwell** produces the first colour photograph. He took the photograph through red, green and blue filters…'

Please amend the **Resource Booklet** by crossing out the word 'yellow' and adding the word 'green'.

Any enquiry about this erratum should be referred to the Customer Contact Centre on 01223 553 998 or general.qualifications@ocr.org.uk

Erratum JUNE 09

The Resource Booklet follows this page.

OCR
RECOGNISING ACHIEVEMENT

F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE
ADDITIONAL SCIENCE A

A218/01/RB

Unit 4: Ideas in Context
(Foundation Tier)

RESOURCE BOOKLET

JUNE 2009

To be opened on receipt

OCE/T75999

INSTRUCTIONS TO CANDIDATES

- This booklet contains three articles.
- Take these articles away and read them through carefully.
- Spend some time looking up any technical terms or phrases you do not understand.
- For the examination on **Thursday 4 June 2009** you will be given a fresh copy of these articles, together with a question paper.
- You will **not** be able to take your original copy into the examination with you.

INFORMATION FOR CANDIDATES

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

BLANK PAGE

Acids in the body

We need acids in our bodies, but too much can cause problems. We need acid to digest food, but if our stomach produces too much, the pH becomes very acidic. This can make us feel ill and can even result in ulcers forming in our stomach walls.

Acids are also made as waste products in our muscles when we exercise. These acids are carried away by our blood before they cause muscle cramp. Our blood usually has a slightly alkaline pH. In extreme cases, waste acids build up too much in our blood and cause it to become very acidic. This is very serious and can cause a coma or even death.

However, the good news is that we can take medicines to neutralise excess acid. These are sometimes called ‘antacids’. Different compounds are used in medicines to neutralise acids in the stomach or the bloodstream. Most of these compounds contain carbonates. These neutralisation reactions are very straightforward to investigate in the lab.

The table shows the results from a student’s experiment. The student reacted antacid tablets with different concentrations of an acid. The results show how much time it took for the tablets to produce 5 cm^3 of gas. The pH of the acid was checked at the beginning of the experiment using a pH meter.

volume of acid used in cm^3	concentration of acid used in g/dm^3	time to produce 5 cm^3 gas in s	temperature in °C
25	40	10	20.0
25	20	50	19.5
25	80	4	19.5
25	4	90	20.0

Several different carbonate compounds are used in medicines. They contain different positive ions. Tablets to neutralise stomach acids often contain carbonates such as magnesium carbonate ($MgCO_3$) or calcium carbonate ($CaCO_3$). Both these compounds are insoluble in water, so don’t pass from the stomach into the blood. One side effect of taking them, though, is that people often complain of wind, because the reaction of carbonates with hydrochloric acid produces a gas.

Sodium hydrogencarbonate ($NaHCO_3$) can neutralise acids in the blood because it is very soluble in water and so can pass through the stomach wall. Some athletes take it to stop acid build-up in muscles during marathons, but it can have very unpleasant side effects – stomach cramps and explosive diarrhoea!

Help for patients with kidney failure

Within the human body, the blood is filtered by the kidneys. The kidneys play an important role in homeostasis. Waste urea is removed from the blood and other chemicals are balanced in the blood. Urea is harmful to the body if not removed. Water levels are balanced by producing dilute or concentrated urine as a response to the concentration of blood plasma. This process varies with a number of factors including external temperature, exercise level, and intake of fluids, salt and alcohol.

Healthy kidneys can …

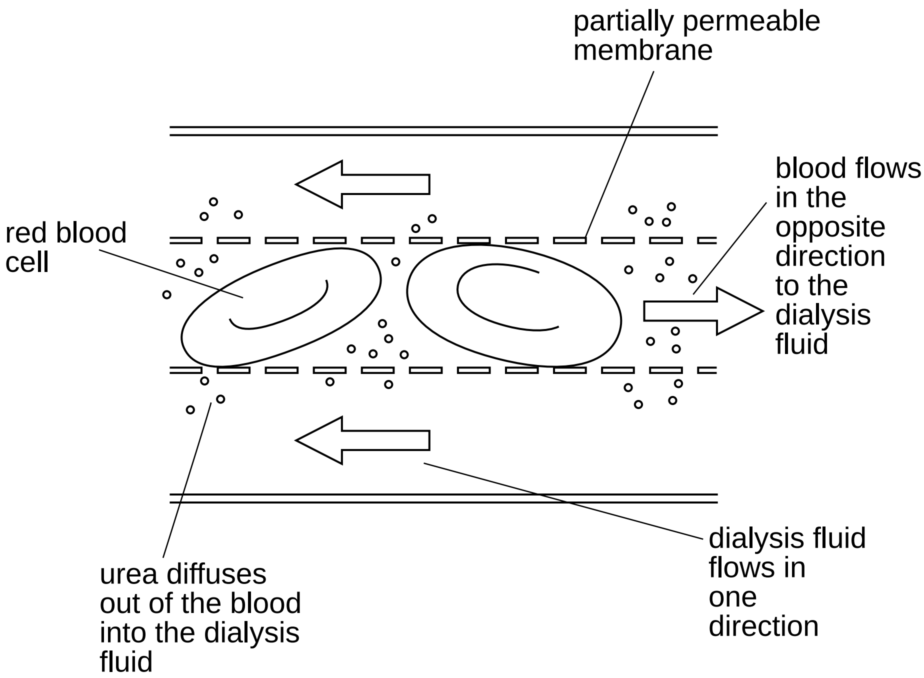
… **filter** small molecules and ions out of the blood (water, salt, sugar, urea).	✓
… reabsorb all the **sugar** back into the blood.	✓
… reabsorb as much **salt** as the body needs.	✓
… reabsorb as much **water** as the body needs.	✓
… **excrete** the remaining urine, which is stored in the bladder.	✓

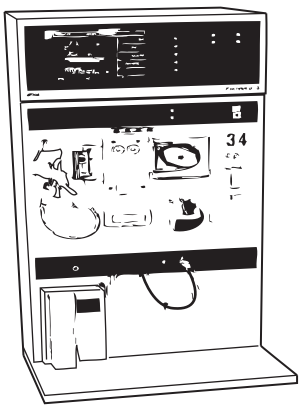
The artificial kidney or dialysis machine is designed to act like a healthy kidney. It carries out the work of the kidney for patients with kidney failure. Without the machine, such patients can become very ill. Patients on dialysis are advised by their doctors not to drink alcohol because it affects the processes in the body that control urine production.

Read the information about what happens when a person is connected to a dialysis machine.

Life-saving dialysis

Dialysis works on the principle of the diffusion of molecules across a partially permeable membrane. Blood flows on one side of the partially permeable membrane, and dialysis fluid flows on the opposite side. Small molecules, like urea, sugar, water and salts can pass through the membrane. The red blood cells are too big to pass through the membrane and so they remain in the patient's blood. The blood flows in one direction and the dialysis fluid flows in the opposite direction. Constant replacement of the dialysis fluid means that the concentration of urea is kept very low on this side of the membrane. The 'cleansed' blood is returned via the circuit back to the patient's body.





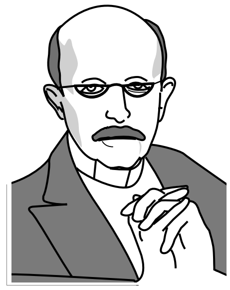
Some more facts about dialysis

- The size of the UK population is 60 million.
- About 5000 patients a year in the UK develop chronic kidney failure.
- Each dialysis treatment may take 4 hours.
- The treatment sessions are often given 3 times per week but sometimes even 6 treatments are needed each week.

A time-line of scientific discoveries about light

The table shows some events that have helped scientists to understand the electromagnetic spectrum.

1666	**Isaac Newton** observes what happens when white light passes through a prism. The light separates into different colours. His letter explaining that different colours are refracted at different angles is published by the Royal Society in 1672. In 1704, **Isaac Newton** puts forward a new theory of light in his publication 'Opticks'. He suggests that light might be made of particles.	 Isaac Newton (1643–1727)
1678	**Christiaan Huygens** first establishes his wave theory of light. He did not publish the theory until 1690. This theory can explain observations about light that Newton's theory could not. For example, light waves can pass through other light waves without being affected.	 Christiaan Huygens (1629–1695)
1817	**Thomas Young** carries out many experiments on light. He discovers light interference patterns and suggests that light is a transverse wave, not a longitudinal wave.	 Thomas Young (1773–1829)
1861	**James Clerk Maxwell** produces the first colour photograph. He took the photograph through red, yellow and blue filters. He then recombined the images to give a single photograph.	 James Clerk Maxwell (1831–1879)
1865	**James Clerk Maxwell** uses mathematics to work out that electromagnetic waves travel at the speed of light. He doesn't believe this is a coincidence and concludes that light is a type of electromagnetic wave.	

1888	**Heinrich Hertz** performs a series of experiments that support James Clerk Maxwell's conclusion that light is an electromagnetic wave. During the next 50 years many other types of electromagnetic radiation are discovered.	 **Heinrich Hertz (1857–1894)**
1900	**Max Planck** theorises that electromagnetic radiation is emitted in discrete packets of energy. He suggests that light is like both waves and particles. This is the start of theories now called 'quantum mechanics'.	 **Max Planck (1858–1947)**
1905	**Albert Einstein** publishes a paper presenting the idea that light radiation is made up of packets of energy, now called photons. **Einstein** also publishes a paper proposing the special theory of relativity in which the speed of all electromagnetic waves in a vacuum is always the same at 300 000 000 m/s.	 **Albert Einstein (1879–1955)**