Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature							

Leave blank

General Certificate of Secondary Education
June 2004

ASSESSMENT and QUALIFICATIONS ALLIANCE

APPLIED SCIENCE (DOUBLE AWARD) 3860/2F
FOUNDATION TIER
Unit 2 Science for the Needs of Society

Friday 18 June 2004 9.00 am to 10.30 am

F

In addition to this paper you will require:
a ruler.
You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information
- The maximum mark for this paper is 80.
- Mark allocations are shown in brackets.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
8			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

Answer **all** questions in the spaces provided.

1 An investigation was carried out on the effect of vigorous exercise on the breathing rate of an athlete.

The breathing rate was measured before, during and after exercise.

The results of the experiment are given in the table.

When the measurement was taken	Breathing rate in breaths per minute
Before exercise	18
During exercise	70
1 minute after exercise	32
5 minutes after exercise	19

(a) Describe how to measure the breathing rate of the athlete.

.....

.....

.....

.....

(2 marks)

(b) Use the words from the list below to complete the sentences which explain the changes in breathing rate with exercise.

aerobic **anaerobic** **decreases** **increases** **lactic** **stops**

During exercise the muscles need more oxygen, so the breathing rate _____.

At first, respiration is _____ but when oxygen debt occurs respiration becomes _____. The breathing rate _____ when the debt has been repaid.

(4 marks)

(c) Describe **one** other physical change that takes place to make sure that oxygen gets to the muscle cells as quickly as possible.

.....

.....

(1 mark)

(d) Respiration generates heat.

Describe **two** physical changes that occur to help prevent an increase in body temperature.

1 .....

.....

2 .....

.....

(2 marks)

9

TURN OVER FOR THE NEXT QUESTION

2 We need a source of energy to make things work.

The table lists five sources of energy and some of their uses.

Source of energy	Use
Batteries	Datalogger used for an outdoor experiment
Wind turbine	Small-scale generation of electricity on a remote island
Natural gas	Domestic heating
Mains electricity	Electrical heater for heating petrol in the laboratory
Nuclear fuel	Large-scale generation of electricity

(a) Which energy source is a fossil fuel?

.....

(1 mark)

(b) Which energy source is classified as renewable?

.....

(1 mark)

(c) Why is nuclear fuel **not** suitable for the small-scale generation of electricity?

.....

.....

(1 mark)

(d) Why are batteries a good choice as the energy source for a datalogger to be used outdoors?

.....

.....

(1 mark)

(e) Give **one** reason why natural gas is a good choice for heating a home.

.....

.....

(1 mark)

(f) Explain why an electrical heater is a good choice for heating petrol.

.....

.....

(2 marks)

7

3 The products we buy from the supermarket contain mixtures of materials. The materials may be solids, liquids or gases, and they can be mixed together in different ways.

(a) Complete the table by filling in the blank spaces using the words below.

Aerosol **Emulsion** **Foam** **Gel** **Solution** **Suspension**

One has been done for you.

Type of mixture	Composition
Solution	A solid, liquid or gas dissolved in a liquid.
	A liquid mixed with small lumps of solid that are not dissolved in the liquid.
	A gas trapped inside bubbles of a liquid.
	A fine spray of liquid particles in a gas.
	A liquid trapped inside a solid structure.
	Two liquids mixed together but not dissolved.

(5 marks)

(b) Give **one** example of a product that contains one of the mixtures listed above.

State which type of mixture it contains.

Example .....

Type of mixture .....

(2 marks)

7

TURN OVER FOR THE NEXT QUESTION

4 Farmers grow plants to provide food, materials for clothing and chemicals for making pharmaceutical products.

(a) (i) Circle the name of a material obtained from plants and used for clothing.

Aspirin **Cotton** **Leather** **Silk** **Wool**

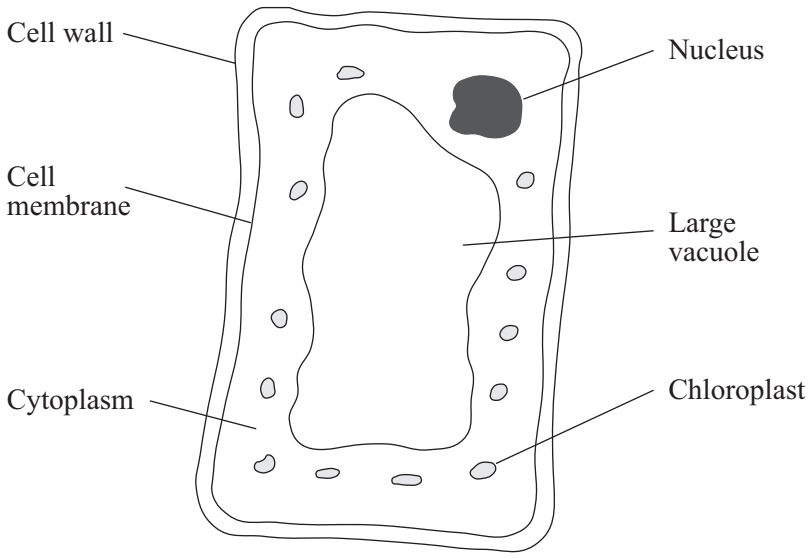
(ii) Circle the name of a chemical obtained from plants and used in making pharmaceutical products.

Aspirin **Cotton** **Leather** **Silk** **Wool**

(2 marks)

(b) Plant cells make food by photosynthesis.

A labelled diagram of a typical plant cell is shown below.



(i) Name **three** parts of a plant cell that are **not** present in an animal cell.

1 .....

2 .....

3 .....

(3 marks)

(ii) Which part of the plant cell is responsible for carrying out photosynthesis?

.....

(1 mark)

(c) During photosynthesis, plant cells use energy from sunlight to convert simple chemicals into glucose.

A chemical equation for this process is given below.

water + Gas **A** ⟶ glucose + Gas **B**

(i) Name the green pigment present in plant cells that absorbs light energy to enable them to carry out photosynthesis.

.....

(1 mark)

(ii) Name Gas **A** .....

Describe where the plant finds gas **A** and how it absorbs it.

.....

.....

.....

.....

.....

.....

(3 marks)

(iii) Name Gas **B** .....

Explain how gas **B** is used by the plant and why it is needed.

.....

.....

.....

.....

.....

.....

(3 marks)

QUESTION 4 CONTINUES ON THE NEXT PAGE

(d) As well as water, plants need minerals from the soil for healthy growth.
If the soil is poor the farmer may need to add extra minerals.

Examples of chemicals added to soil are compounds containing nitrate ions (NO_3^-), and magnesium ions (Mg^{2+}).

(i) Why are nitrate ions needed by plants?

.....

.....

(1 mark)

(ii) Why are magnesium ions needed by plants?

.....

.....

(1 mark)

(iii) Suggest the chemical formula for a compound containing both nitrate ions and magnesium ions.

.....

(2 marks)

(iv) Give **one** other method used by farmers to produce healthy plant growth.

Explain why this method produces healthy plant growth.

Method .....

Explanation .....

.....

.....

(2 marks)

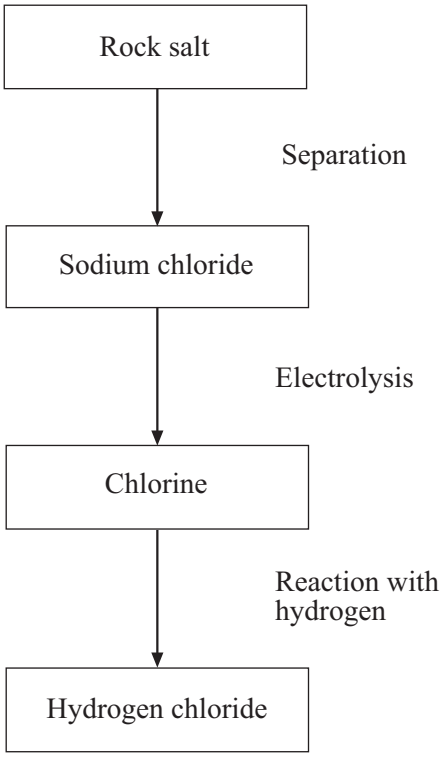
19

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

5 Hydrogen chloride is an important chemical used in the manufacture of hydrochloric acid.

The flow diagram shows the manufacture of hydrogen chloride from a natural raw material.



(a) The first stage of the process is the separation of sodium chloride from rock salt.

(i) Describe a method to separate sodium chloride from rock salt.

.....

.....

.....

.....

.....

(4 marks)

(ii) How do we classify sodium chloride?

Tick **one** box

organic mixture	
organic compound	
inorganic mixture	
inorganic compound	

(1 mark)

(b) An equation for the electrolysis of sodium chloride solution to produce chlorine is given below.

$$2NaCl + 2H_2O \longrightarrow 2NaOH + Cl_2 + H_2$$

(i) Chlorine is classified as a non-metal element.

Give **two** properties of chlorine that enable it to be classified as a non-metal element.

1 .....

2 .....

(2 marks)

(ii) Name the **two** other products of the electrolysis of sodium chloride solution.

1 .....

2 .....

(2 marks)

(c) Some properties of hydrogen chloride are listed below.

- melting point = – 115 °C
- boiling point = – 85 °C
- solubility in water – very soluble, dissolves to form hydrochloric acid

(i) Give the chemical formula for hydrochloric acid.

.....

(1 mark)

(ii) Why is hydrochloric acid classified as a bulk chemical?

.....

.....

(1 mark)

11

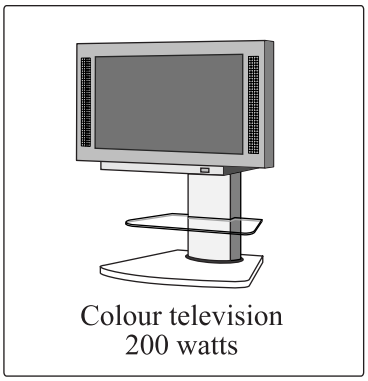
TURN OVER FOR THE NEXT QUESTION

6 A student was asked to calculate the cost of electricity used by a range of household appliances.

She used a table to record her calculations.

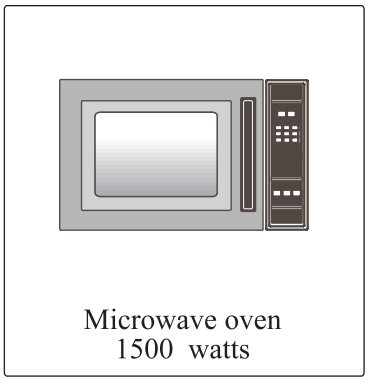
Electrical appliance	Power rating in kW	Time switched on in hours	Energy used in kWh	Cost in pence
Colour television	0.2	5.0	1.0	7.0
Microwave oven	1.5	0.2	0.3	2.1
Hairdryer		0.1		

(a) The student collected information about the power rating of each appliance.



Colour television
200 watts

Hairdryer
230 volts
8 amps



Microwave oven
1500 watts

(i) Calculate the power of the hairdryer.

Show your working.

.....

.....

.....watts
(3 marks)

(ii) Write the power rating of the hairdryer in kilowatts in the correct column of the table.
(1 mark)

(b) Use the equation below to calculate the energy used by the hairdryer.

energy use (kilowatt hour) = **power** (kilowatt) × **time** (hour)

Show your working.

.....

.....

.....kWh

Write the energy used by the hairdryer in the correct column of the table.

(2 marks)

(c) The cost of electricity is 7p per kilowatt hour (kWh).

Calculate the cost of using the hairdryer.

Show your working.

.....

.....

.....p

Write the cost of using the hairdryer in the correct column of the table.

(2 marks)

(d) Which of the appliances listed in the table cost the most money to use in the tests?

.....

Explain why this appliance cost the most money to use in the tests.

.....

.....

(2 marks)

10

TURN OVER FOR THE NEXT QUESTION

7 Yoghurt is produced when certain microorganisms feed on the sugar in milk and turn it into lactic acid.

(a) A simple method for making yoghurt is described below.

The process is started by adding a small quantity of yoghurt to warm milk.

Apparatus

- large pan
- spoon
- thermos flask

Method

1 Heat 500 cm^3 of milk in a pan until it reaches 37 °C.

2 Mix two spoonfuls of yoghurt with a little of the warm milk.

3 Add the yoghurt and milk mixture to the rest of the warm milk.

4 Pour the warm milk into a thermos flask, screw on the top, and leave for six hours.

(i) Name **two** items of laboratory equipment needed to carry out this experiment that are **not** listed above.

1 .....

2 .....

(2 marks)

(ii) What type of microorganism turns milk into yoghurt?

.....

(1 mark)

(iii) Why is it important to use clean equipment for yoghurt making?

.....

.....

(1 mark)

(iv) Why is it important not to have the milk at too high a temperature?

.....

.....

(1 mark)

(v) Why is the mixture left for six hours?

.....

.....

(1 mark)

(b) Once the yoghurt has formed, the microorganisms can continue to grow and the mixture becomes acidic and inedible.

Suggest a method to slow down this process and keep the yoghurt fresh.

.....

.....

(1 mark)

(c) Name **two** other useful products that can be produced using the growth of microorganisms.

1 .....

2 .....

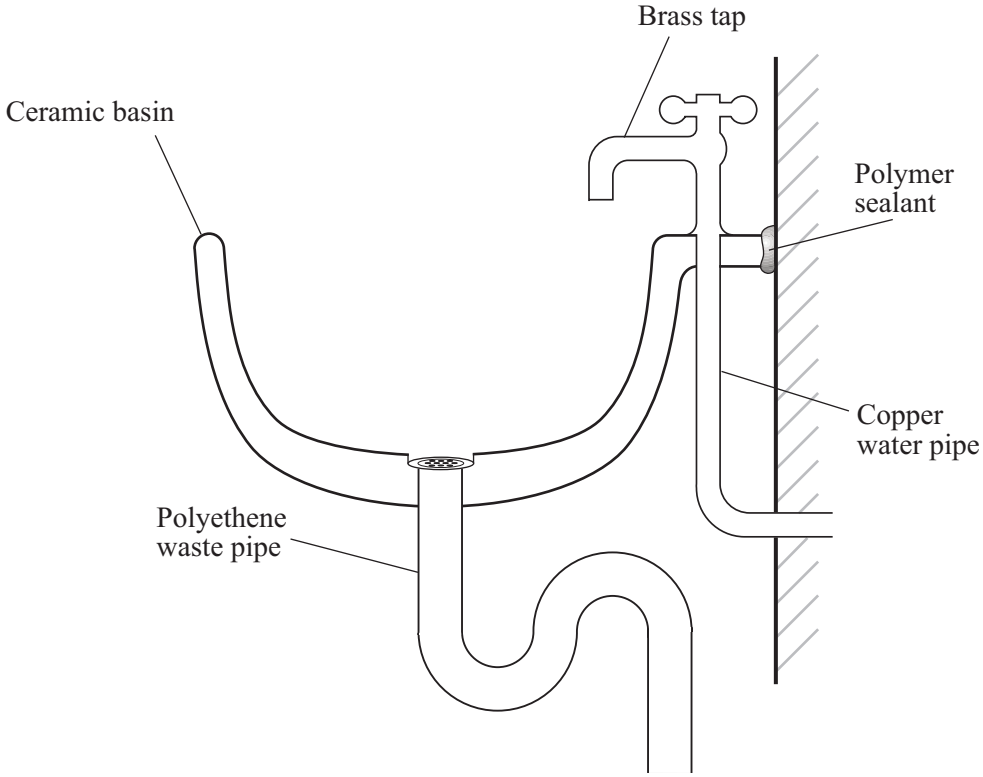
(2 marks)

9

TURN OVER FOR THE NEXT QUESTION

8 Many types of manufactured material can be found in the bathroom of a modern house.

The diagram shows some of the materials used in a wash basin.



(a) Give **two** properties of copper metal which mean it is a good choice for making the water pipe.

1 .....

2 .....

(2 marks)

(b) Give **two** properties of the ceramic which mean it is a good choice for making the basin.

1 .....

2 .....

(2 marks)

(c) Give **two** properties of polyethene which mean it is a good choice for making the waste pipe.

1 .....

2 .....

(2 marks)

(d) Brass is an alloy formed by adding zinc to copper metal.

The table shows how the amount of zinc affects the tensile strength of the metal.

Percentage of copper in the metal	Percentage of zinc in the metal	Tensile strength in Pa ($\times 10^7$)
100	0	23
90	10	26
80	20	30
70	30	33
60	40	36

Describe how the amount of zinc affects the tensile strength of the metal.

.....

.....

.....

.....

(2 marks)

8

END OF QUESTIONS