Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

For Examiner's Use

General Certificate of Secondary Education
January 2007

APPLIED SCIENCE (DOUBLE AWARD) **3860/2F**
Unit 2 Science for the Needs of Society
Foundation Tier

F

Friday 19 January 2007 1.30 pm to 3.00 pm

For this paper you must have:
- 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.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

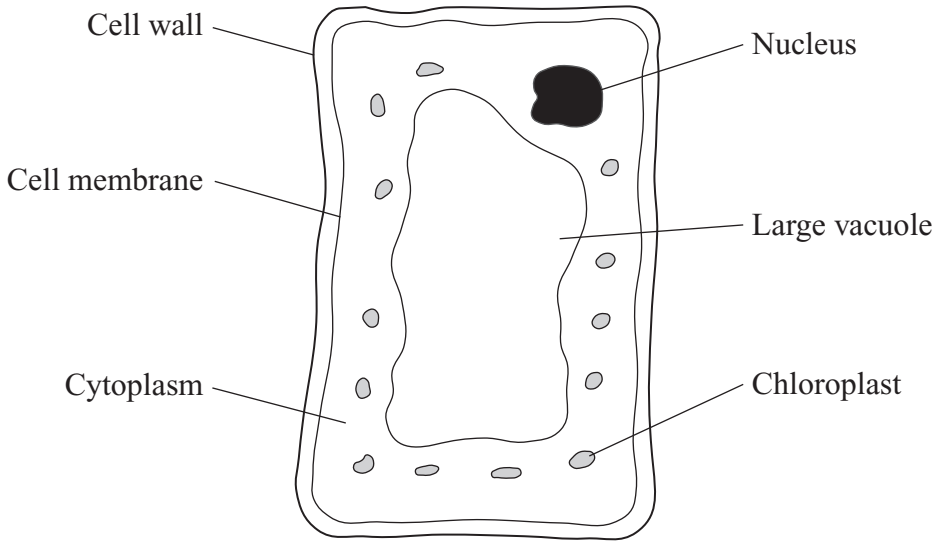
Information
- The maximum mark for this paper is 80.
- The marks for questions are shown in brackets.

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

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

1 Plants are made up of cells. Our understanding of how plant cells work helps us to keep plants healthy.

(a) The diagram shows the structure of a plant cell.



Name **three** parts of a plant cell that can also be found in an animal cell.

1 .....

2 .....

3 .....

(3 marks)

(b) In the sentences below, draw a ring around the correct answer in each box.

(i) Plant cells make food by | diffusion / photosynthesis / respiration | .

(ii) The green pigment in plant cells is called | chlorine / chlorophyll / chloroplast | .

(iii) The mineral needed to make the green pigment is called | magnesium / phosphate / potassium | .

(iv) Plants obtain minerals from | air / rain / soil | .

(4 marks)

(c) We obtain many useful products from plants.

Draw a ring around **one** useful product that is obtained from a plant.

cotton **leather** **silk** **wool**

(1 mark)

8

Turn over for the next question

2 Chemical compounds are used in different ways.

(a) The names and chemical formulae of some important compounds are listed below.

Name of compound	**Chemical formula**
Ammonia	NH_3
Calcium carbonate	$CaCO_3$
Hydrochloric acid	HCl
Lead oxide	PbO
Sodium chloride	NaCl
Sulphuric acid	H_2SO_4

(i) Name the compound that is used to flavour food.

.....

(1 mark)

(ii) Name the compound that is found in limestone and marble.

.....

(1 mark)

(iii) Name the compound that is described as a metal ore.

.....

(1 mark)

(iv) Name the compound that contains nitrogen.

.....

(1 mark)

(v) Name the **three** elements in sulphuric acid.

1 .....

2 .....

3 .....

(2 marks)

(b) Polyethene is classified as an organic compound

(i) Name the element that is always found in organic compounds.

.....

(1 mark)

(ii) Give **one** use for polyethene.

.....

.....

(1 mark)

8

Turn over for the next question

3 We need energy resources to generate electricity.

(a) Some examples of energy resources are listed in the table below.

Coal	
Hydroelectric power	
Natural gas	
Oil	
Solar energy	
Wind energy	

Three of the energy resources in the table are renewable energy resources.

Put a tick in the boxes next to the **three** renewable energy resources.

(3 marks)

(b) Electricity can also be generated from nuclear fuel.

(i) Use words from the list to complete the sentences about the generation of electricity from nuclear fuel.

boil **condense** **generator** **smoke** **steam** **turbine**

The energy released from nuclear fuel is used to ..... water to make ..... , which turns a ..... .

Electricity is produced by an electrical ..... .

(4 marks)

(ii) Nuclear fuel does not produce carbon dioxide.

Why is this an important advantage when using nuclear fuel?

.....

.....

(1 mark)

(iii) Give **two** disadvantages of using nuclear fuel.

1 .....

.....

2 .....

.....

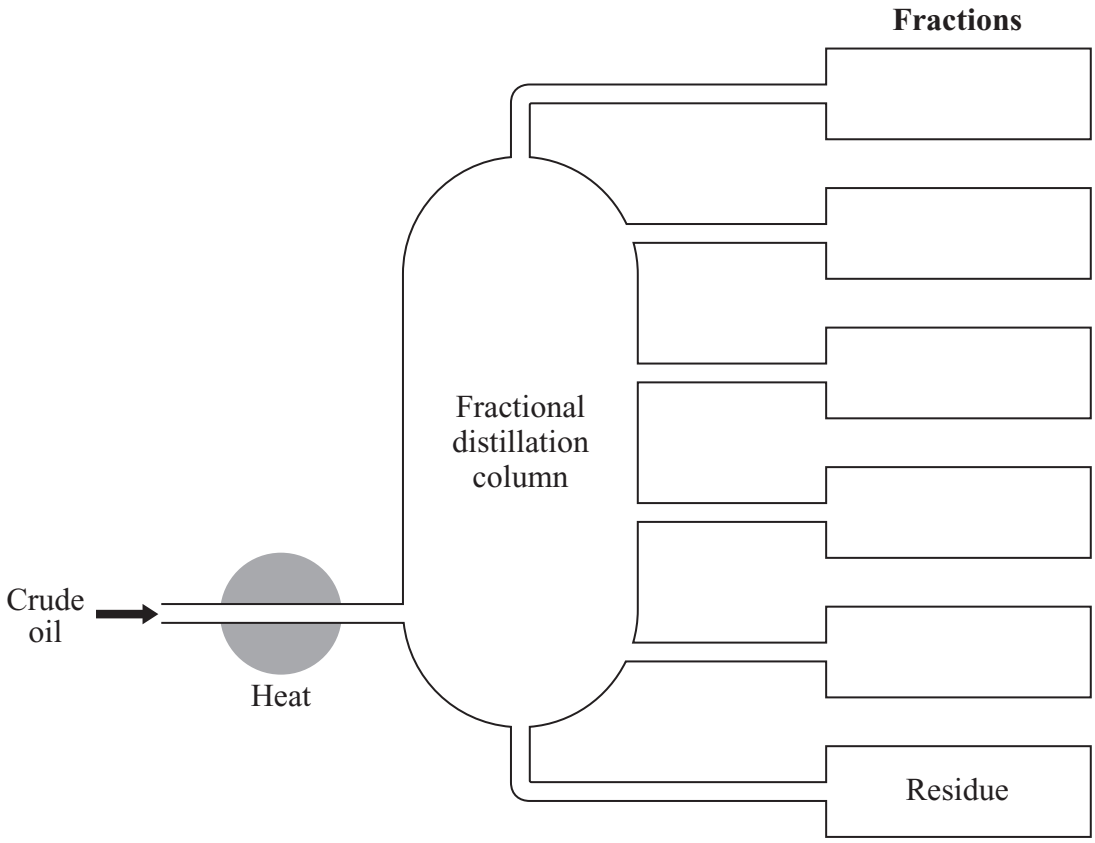
(2 marks)

10

Turn over for the next question

4 Fractional distillation is used to separate crude oil into useful fractions.

The fractional distillation of crude oil is carried out on a large scale at an oil refinery.



The fractions collect at different levels on the column.

The position of the fraction collected on the column depends on the boiling point of the fraction.

The table shows the boiling point ranges of the different fractions.

Name of fraction	**Boiling point range in °C**
Naphtha	75–190
Gas	Less than 25
Gas oil	250–350
Petrol	25–75
Kerosine	190–250

(a) Write the names of the fractions in the correct boxes at the side of the fractional distillation column. *(4 marks)*

(b) Give a use for **one** of the fractions in the table.

Name of fraction .....

Use .....

(1 mark)

(c) The fractions can be separated because they have different boiling points.

The boiling point of a liquid can be measured in the laboratory.

(i) Describe an experiment to measure the boiling point of a liquid fraction.

.....

.....

.....

.....

.....

.....

(3 marks)

(ii) Give **one** important safety precaution that must be taken when this experiment is carried out in the laboratory.

Explain why the safety precaution is needed.

.....

.....

.....

.....

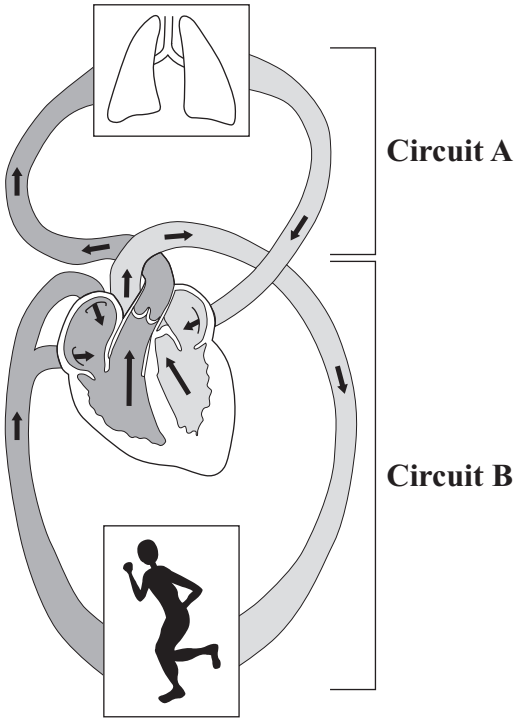
(2 marks)

10

Turn over for the next question

5 A first aid course will include a lesson on the human circulatory system.

The human circulatory system has two parts. These are labelled **Circuit A** and **Circuit B** on the diagram.



(a) Write labels on the diagram to show:

(i) the heart

(ii) the lungs

(iii) an artery

(iv) a vein.

(4 marks)

(b) Blood changes in different ways when it passes through each circuit.

(i) Give **two** ways in which blood changes as it passes through **Circuit A**.

1 .....

2 .....

(2 marks)

(ii) Give **two** ways in which blood changes as it passes through **Circuit B**.

1 .....

2 .....

(2 marks)

(c) Explain why it is more dangerous to cut an artery than a vein.

.....

.....

.....

.....

(2 marks)

(d) Give **two** ways in which a first aider can protect a cut from infection.

1 .....

.....

2 .....

.....

(2 marks)

12

Turn over for the next question

6 A designer is choosing a material to use to make the frame of a bicycle.

Three suitable materials are described in the table below.

Use the information in the table to answer the questions that follow.

Material	Properties	Cost
Steel (iron with small amounts of carbon)	High tensile strength High density Corrodes easily and needs to be painted	Inexpensive
Aluminium alloy (aluminium with small amounts of copper)	High tensile strength Low density Resists corrosion	Expensive
Carbon fibre (a composite material)	High tensile strength Low density Does not corrode	Very expensive

(a) Aluminium alloy is more expensive than steel.

Give **two** reasons why aluminium alloy is a better choice than steel for making a bicycle frame, even though it is more expensive.

1 .....

2 .....

(2 marks)

(b) Why is carbon fibre described as a composite material?

.....

.....

(1 mark)

(c) Polymers and ceramics are **not** used to make bicycle frames.

(i) Give **one** reason why a polymer is **not** used to make a bicycle frame.

.....

.....

(1 mark)

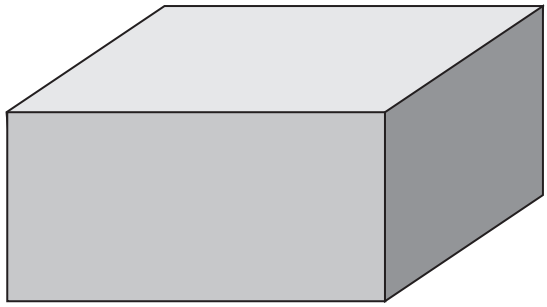
(ii) Give **one** reason why a ceramic is **not** used to make a bicycle frame.

.....

.....

(1 mark)

(d) The designer wants to measure the density of a block of aluminium alloy.



(i) Describe how the designer could measure the volume of the block.

.....

.....

.....

.....

.....

.....

(3 marks)

(ii) The designer's results are recorded below:

Volume of block = 12.0 cm^3

Mass of block = 31.2 g

Calculate the density of the block in g/cm^3.

.....

.....

(2 marks)

10

7 Plant scientists study how water moves in and out of plant cells by osmosis.

(a) Complete the following definition of osmosis.

Osmosis is the movement of water:

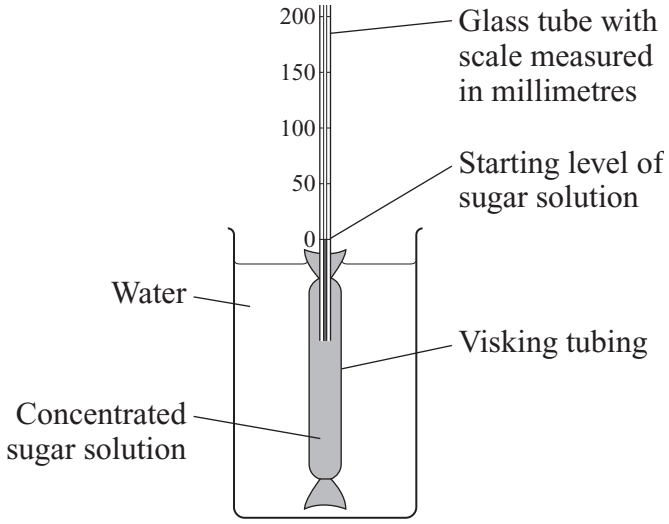
from .....

to .....

through .....

(3 marks)

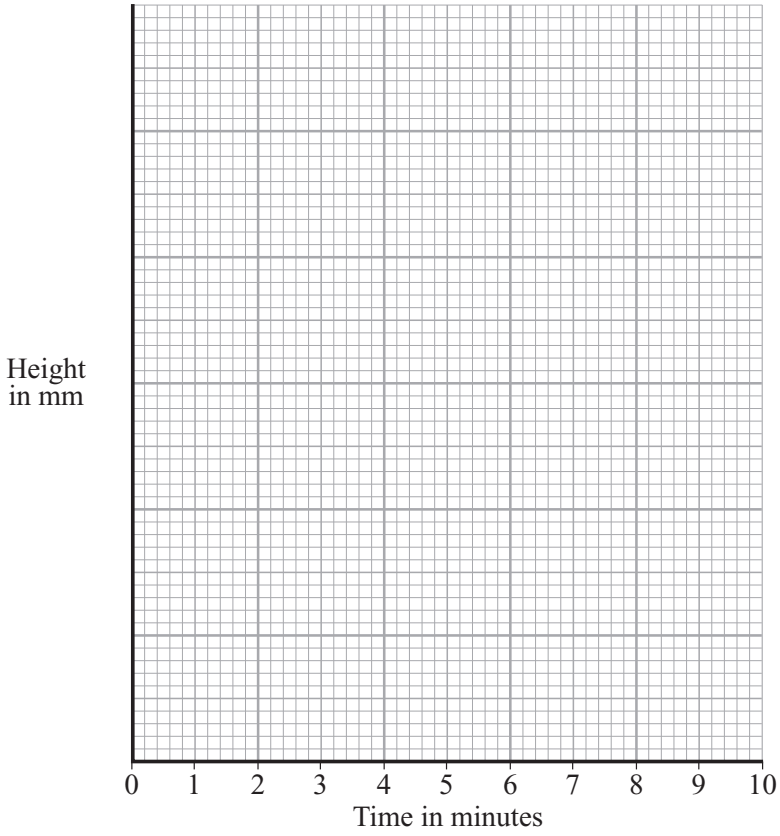
(b) A student set up an experiment to investigate osmosis.



The student measured the height of the sugar solution in the glass tube for 10 minutes.

Her results are recorded in the table.

Time in minutes	Height of sugar solution in mm
0	0
1	17
2	34
3	49
4	61
5	71
10	108



(i) Draw a graph of the student's results. *(3 marks)*

(ii) Join the points with a smooth curve. *(1 mark)*

(iii) Use your graph to estimate the height of the sugar solution after 8 minutes.

.....

(1 mark)

(iv) Why does the level of the sugar solution rise in the glass tube during the student's experiment?

.....

.....

(1 mark)

(v) The student repeated the experiment using less concentrated sugar solution in the visking tubing.

Predict the result of this experiment by drawing a second line on the graph and labelling it Experiment 2. *(2 marks)*

11

8 Many homes in the UK have gas central heating. Methane is burned in a boiler and the heat energy is used to heat water. Hot water circulates around the house through pipes and radiators.

In older boilers, heat energy is wasted when the methane burns. Hot gases are released as the products of combustion and pass out of the house through the chimney.

Modern condensing gas boilers are more efficient because they are fitted with a stainless steel heat exchanger. This extracts heat from the hot gases before they pass into the chimney.

Heat energy from the hot gases is used to pre-heat water before it enters the boiler.

One of the combustion products is condensed into a liquid.

(a) The chemical equation for the combustion of methane is given below.

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$

(i) Name the combustion product that is condensed into a liquid in a modern condensing gas boiler.

.....

(1 mark)

(ii) Suggest why the heat exchanger is made from stainless steel.

.....

.....

(1 mark)

(b) Each room in the house is fitted with a hot water radiator.

Describe how a radiator filled with hot water transfers its heat to a room.

.....

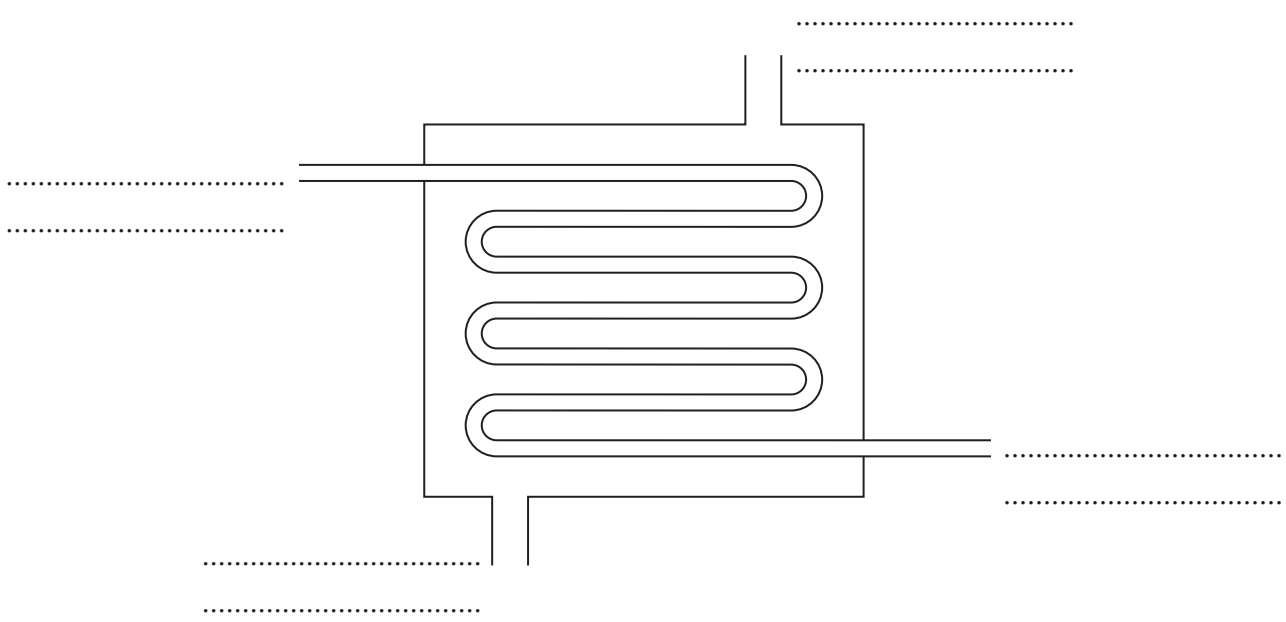
.....

.....

.....

(2 marks)

(c) The diagram shows the heat exchanger that transfers heat energy from the hot combustion products to cold water.



Add the following labels to the diagram, and use arrows to show the direction of flow of water and gases.

cold water **cool gases** **warm water** **hot gases**

(3 marks)

(d) Explain why a modern condensing gas boiler is cheaper to run than an older boiler.

.....

.....

.....

.....

(2 marks)

(e) Describe **two** other ways in which a modern home can be made more energy efficient.

1 .....

.....

2 .....

.....

(2 marks)

11

END OF QUESTIONS

There are no questions printed on this page

There are no questions printed on this page

There are no questions printed on this page