UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

TWENTY FIRST CENTURY SCIENCE **0608/05**

Paper 5 **October/November 2013**

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **14** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

1 Read this article.

For Examiner's Use

The Earth's Ozone Layer

The Earth's ozone layer, formed high in the atmosphere, was discovered a hundred years ago. It absorbs nearly all of the dangerous high-frequency ultraviolet radiation from the Sun. Ozone is a form of oxygen, but it is an irritant chemical. It is also produced in car engines and is a major pollutant in many cities.

Man-made chemicals called CFCs (chlorofluorocarbons) were used in refrigerators and in aerosol spray cans because they easily evaporate. They are not poisonous or flammable. Unfortunately, they gradually rise through the atmosphere to the ozone layer, where they destroy ozone. This allows more ultraviolet radiation to reach the Earth's surface.

Damage to the ozone layer caused by these chemicals was observed in satellite pictures of the Earth's atmosphere in 1985. The ozone layer had a large hole over the South Pole, greatly increasing the risk from ultraviolet radiation to people in countries south of the Equator. Similar thinning of the ozone layer over the North Pole was soon observed.

International cooperation led to the ban of CFCs in spray cans and refrigerators. Spray cans now use propane as the propellant to push out the contents of the can. Although propane is flammable, it does not damage ozone. As a result of these changes, the ozone layer is beginning to repair itself.

Use information from 'The Earth's Ozone Layer' to help you answer question 1.

(a) Ozone is a pollutant gas produced in car engines.

Name one other pollutant gas produced in car engines, and explain why it is damaging.

gas .....

reason it is damaging .....

.....

.....[2]

(b) The ozone layer in the atmosphere protects living things from dangerous high-energy ultraviolet radiation.

Explain why high-energy radiation is so dangerous, and how it can harm living cells.

.....

.....

.....[2]

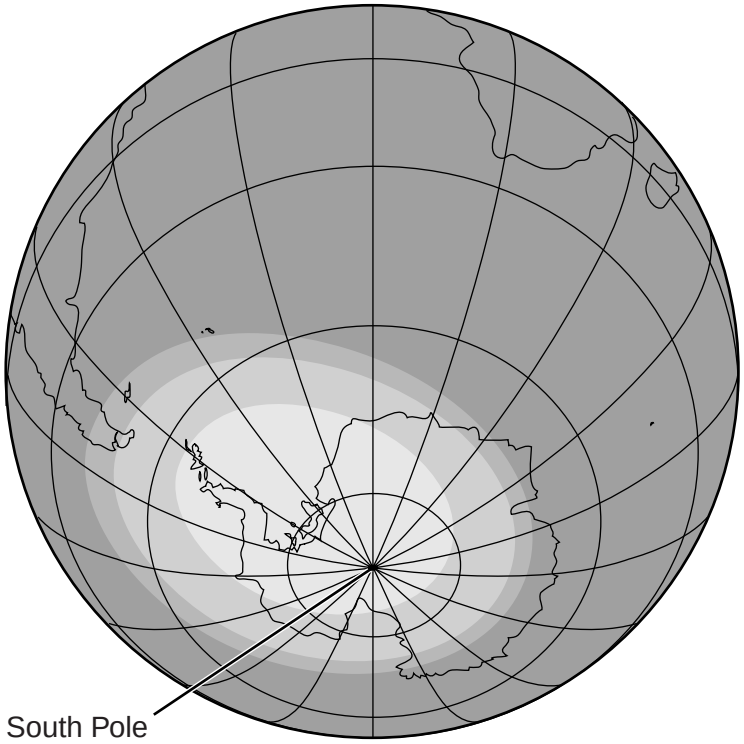
(c) Man-made chemicals can damage the ozone layer.

Name one of these chemicals and write down what it was used for.

name .....

use .....[2]

(d) The diagram shows a satellite image of the southern part of the Earth.



Key

concentration of ozone in parts per billion	shading
180	
330	
450	
600	

Explain how the diagram illustrates the problem discovered in 1985.

Use data from the key in your answer.

.....

.....

.....[2]

(e) People are warned about the dangers of sunbathing due to the increased ultraviolet radiation reaching the Earth's surface.

Suggest **two** reasons why people continue to sunbathe despite this warning.

.....

.....

.....[2]

(f) It took many discussions before countries agreed to ban the use of chemicals that damage the ozone layer.

For Examiner's Use

Suggest **two** reasons why some countries did not want to ban these chemicals.

.....

.....

.....[2]

(g) Propane is now used as a propellant in aerosol spray cans.

(i) Write down what a propellant is.

.....[1]

(ii) Compare the risks of using aerosol spray cans containing propane with those containing CFCs.

.....

.....

.....[2]

[Total: 15]

QUESTION 2 BEGINS ON PAGE 6

2 Read this article.

For Examiner's Use

Pollution and heart disease

A study has found that polluted air in towns and cities increases the risk of dying from heart disease or stroke. Tiny carbon particulates in the air can be breathed deep into the lungs. These particulates are emitted by vehicles and factories.

Scientists studied 66 000 women for nine years, but say the results are likely to apply equally to men. Data on the women's health was compared with air pollution readings from the 36 cities in which they lived. Heart disease occurs mostly in people aged over 50 and becomes more common with increasing age. Women in the study were aged between 50 and 79 and had no sign of heart disease at the start. Over the course of the study 1816 suffered from a heart attack or stroke.

Scientists suggest that the particulates enter the bloodstream through vessels in the lung. They may then cause the arteries to narrow which affects blood flow to the heart.

The study suggests that heart disease could be reduced by lowering particulate pollution. If the average concentration of particulates can be reduced, it may prevent many heart attacks and strokes.

Use information from 'Pollution and heart disease' to help you answer question 2.

(a) The study suggests there is a correlation between air pollution and the risk of heart disease.

Describe this correlation.

.....[1]

(b) Carbon particulates in the atmosphere may affect blood flow to the heart muscle.

Suggest how these particulates reach the vessels taking blood to the heart.

.....

.....

.....[2]

(c) **(i)** Name the type of blood vessel taking blood to the heart muscle cells.

.....[1]

(ii) Explain why the heart muscle cells need their own blood supply.

.....

.....

.....[2]

(iii) Explain how the carbon particulates may cause a heart attack.

.....

.....

.....

.....[3]

(d) Calculate the percentage of the women in the study who had a heart attack or stroke.

percentage = ...% [2]

(e) The article says "If the average concentration of particulates can be reduced, it may prevent many heart attacks and strokes."

Suggest reasons why reducing the concentration of particulates may **not** prevent heart attacks and strokes.

.....

.....

.....

.....[2]

(f) A second study investigating the link between pollution and heart disease is carried out by a different group of scientists.

In this study, 5000 women aged between 20 and 30 are followed for 15 years.

Write down and explain one advantage of the design of **each** study.

first study .....

.....

.....

second study .....

.....

.....
[2]

[Total: 15]

3 A student investigates the effect of a nitrogen-containing fertiliser on the growth of seedlings.

Each seedling is watered with a solution of fertiliser.

(a) Suggest how the student does this investigation.

.....

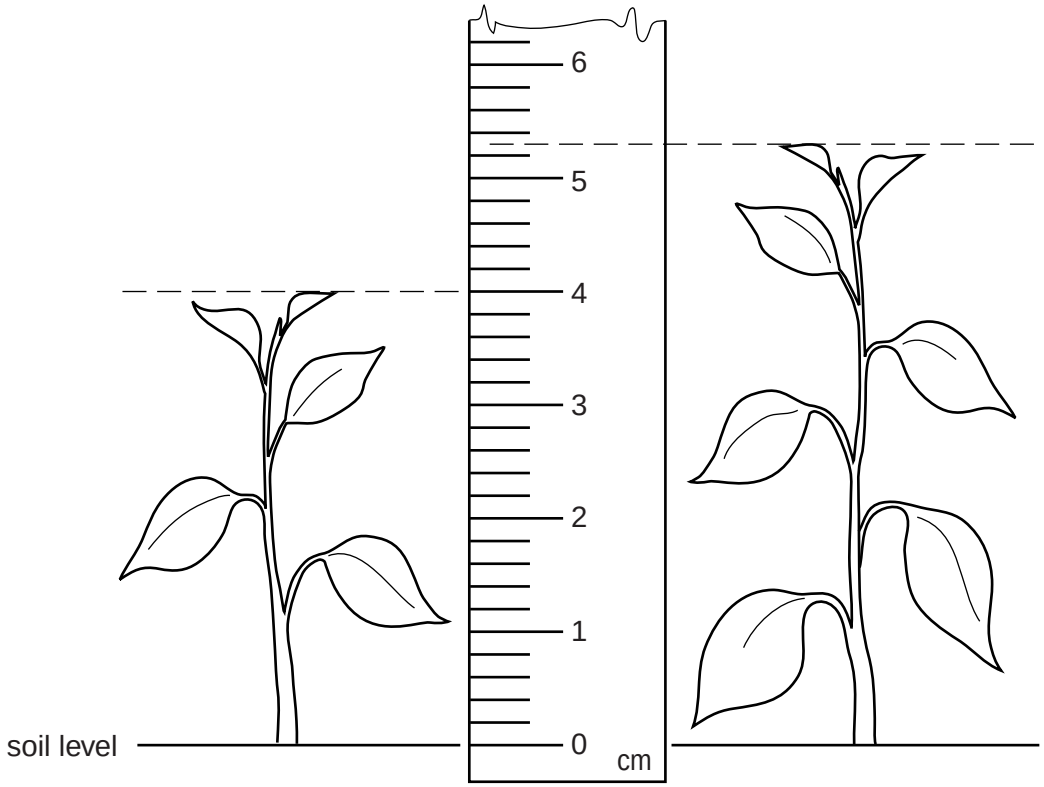
.....

.....

..... [3]

(b) The diagram shows two seedlings.

One is watered with a 4% fertiliser solution and the other with a 6% fertiliser solution.



What is the height of each seedling?

height of 4% fertiliser solution seedling = ... cm

height of 6% fertiliser solution seedling = ... cm [2]

(c) The table shows the results for other concentrations of fertiliser solution.

Add your measurements from **(b)** to complete the table.

% fertiliser	1	2	3	4	5	6	7	8	9	10
height in cm	1.6	2.4	3.1		4.6		5.6	5.7	5.7	5.7

What conclusions can be made from the results of this investigation?

.....

.....

.....

.....[2]

(d) **(i)** Name one factor that should be kept constant during this investigation.

.....[1]

(ii) Explain why this should be kept constant.

.....

.....[1]

(e) This investigation does not have a control.

Describe how the investigation could be modified to have a control.

.....

.....[1]

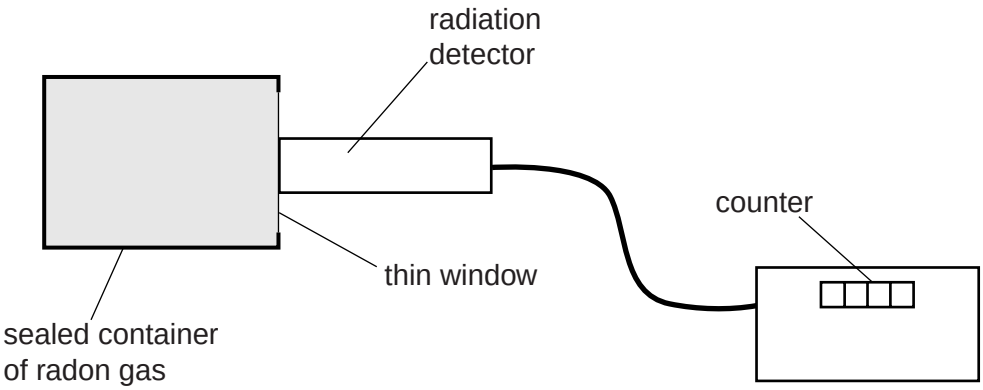
[Total: 10]

For Examiner's Use

4 Carine and Kelly are doing an experiment to measure the half-life of radon gas.

For Examiner's Use

They use the apparatus below to measure how the radiation given off by radon changes with time.



(a) Write down the name of one other piece of apparatus, not shown in the diagram, which Carine and Kelly will need in this experiment.

.....[1]

(b) Radioactive radon gas gives out alpha radiation.

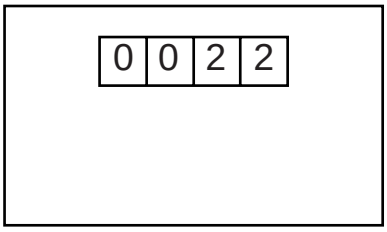
Alpha radiation is not very penetrating.

How is the apparatus designed to allow alpha radiation to enter the detector?

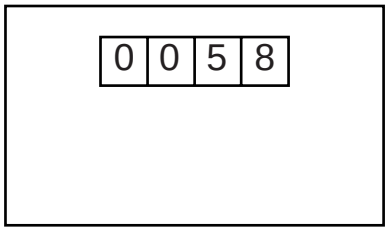
.....[1]

(c) The first thing that Kelly and Carine do is to measure the background radiation when the container of radon gas is not there.

They do this by noting the counter reading at the start and after 60 seconds.



reading at the start



reading after 60 seconds

Use the readings to calculate how many background radiation counts there were in **10 seconds**.

Show your working.

number of background counts in 10 seconds = ...[2]

(d) It is important to allow for the background radiation in analysing the results of the experiment.

Explain why this is necessary, and how Carine and Kelly should use the answer to **(c)** to correct their readings.

.....

.....

.....[2]

(e) Kelly obtains this set of results.

count corrected for background	40	30	24	20	15	11
time in seconds	0	20	40	60	80	100

Use the data in the table to suggest a value for the half-life of radon.

Explain your reason for choosing this value.

half-life = ... seconds

reason .....

.....

.....[2]

(f) Carine says that a better way to find the half-life would be to draw a graph of the results and then draw a best-fit curve. The half-life could then be found from the curve.

Explain why this would be better than just using data from the table.

.....

.....

.....

.....[2]

[Total: 10]

[Turn over

5 Jo has read in her science text book that tea tree oil kills bacteria. She wants to investigate this.

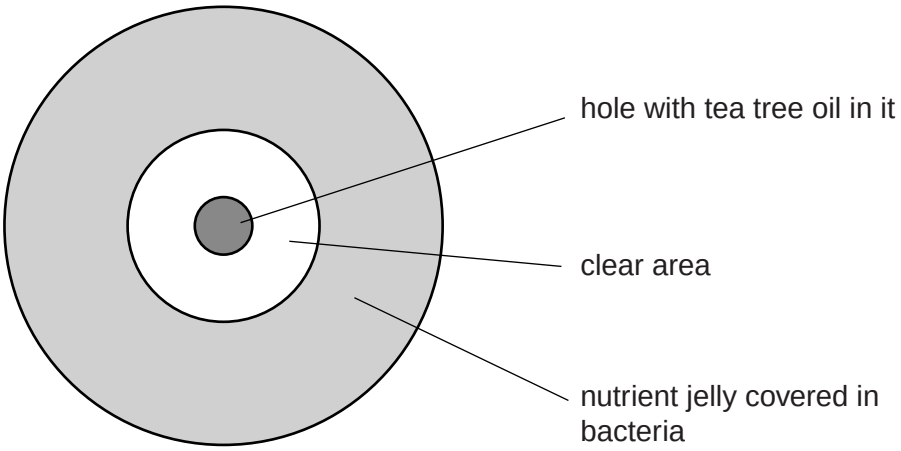
She uses some nutrient jelly covered in bacteria.

Jo makes a small hole in the centre of the nutrient jelly and puts some tea tree oil into it.

She puts the nutrient jelly in a warm place for two days.

Jo then measures the clear area that appears around the hole.

The clear area shows where the bacteria have died.



Jo repeats her experiment twice and records her results in a table.

Jo does the experiment again using different concentrations of tea tree oil.

Here are Jo's results.

concentration of tea tree oil in %	diameter of the clear area in mm			
	experiment 1	experiment 2	experiment 3	mean (average)
0	0	0	0	0
20	4	7	7	6
40	10	8	13	10
60	20	20	15	18
80	26	24	5	25
100	38	35	32	35

(a) Suggest what apparatus Jo used to measure the clear area.

.....[1]

(b) Explain why Jo did the experiment three times for each concentration.

.....

.....[1]

(c) Jo's friend, Helen, thinks Jo has calculated the mean incorrectly for the 80% concentration of tea tree oil.

Helen thinks the mean should be 18.

Explain why Jo's calculation is correct.

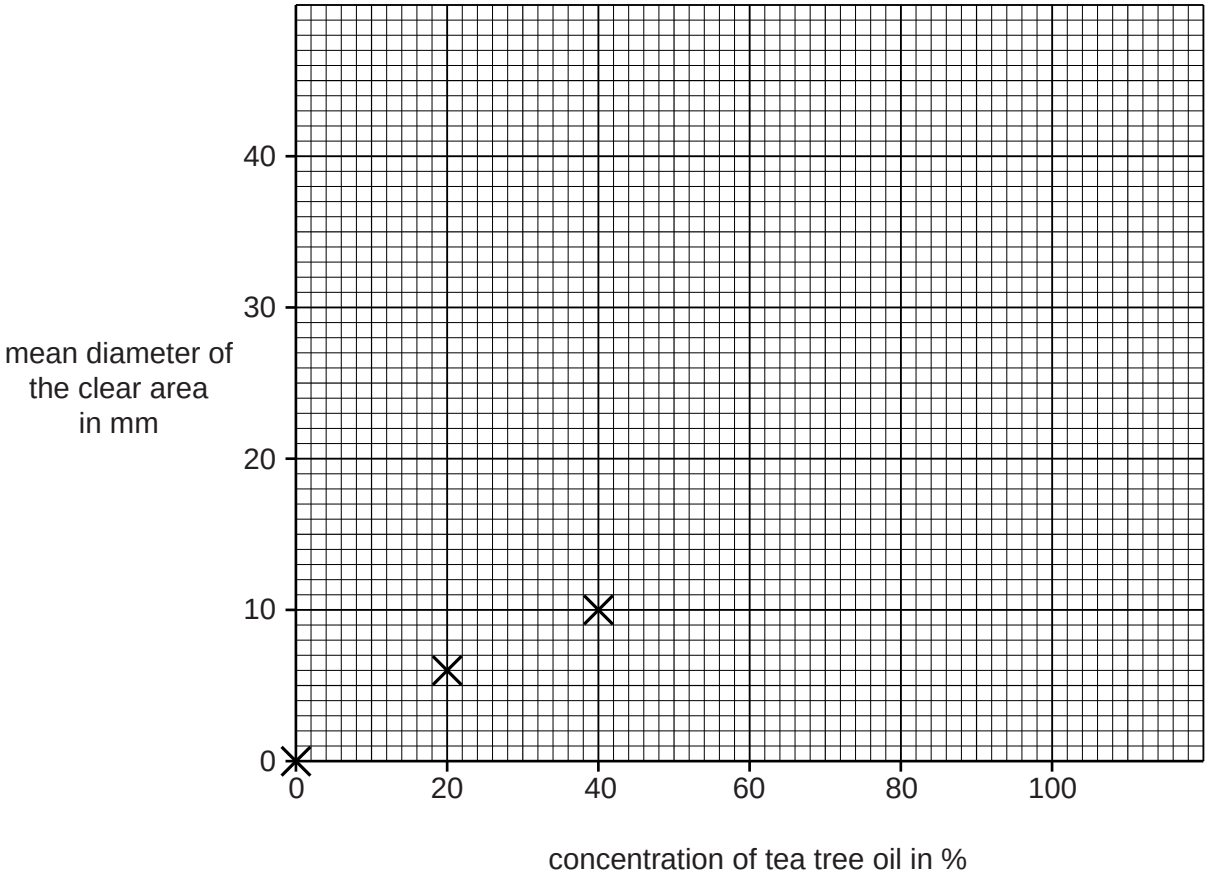
.....

.....

.....[2]

(d) On the grid below, plot the points for the mean diameter of the clear area.

Three points have been plotted for you.



[2]

(e) Draw a line of best fit on your graph. [1]

(f) Describe a conclusion that can be made from the graph.

.....

.....[1]

(g) Suggest **and** explain one way Jo could improve her experiment.

For Examiner's Use

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.....[2]

[Total: 10]

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