THIS IS A NEW SPECIFICATION

OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

CHEMISTRY B (SALTERS)

Chemistry for Life

F331

Candidates answer on the question paper
A calculator may be used for this paper

OCR Supplied Materials:
- *Data Sheet for Chemistry B (Salters)* (inserted)

Other Materials Required:
- Scientific calculator

Friday 9 January 2009
Afternoon

Duration: 1 hour 15 minutes

CUP/T69920

F 3 3 1

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.

  This means for example you should:
  - ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
  - organise information clearly and coherently, using specialist vocabulary when appropriate.
- You may use a scientific calculator.
- A copy of the *Data Sheet for Chemistry B (Salters)* is provided as an insert with this question paper.
- You are advised to show all the steps in any calculations.
- The total number of marks for this paper is **60**.
- This document consists of **12** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**16**	
2	**13**	
3	**18**	
4	**13**	
TOTAL	**60**	

SP SHW 00212 4/08 T69920/5

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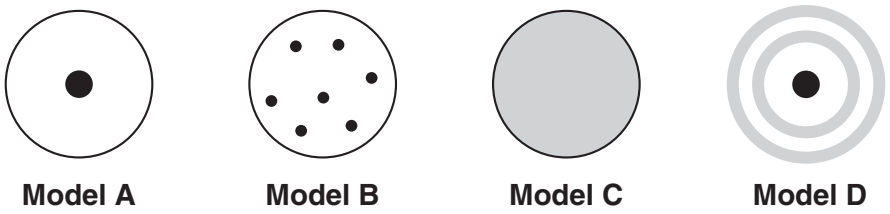
Answer **all** the questions.

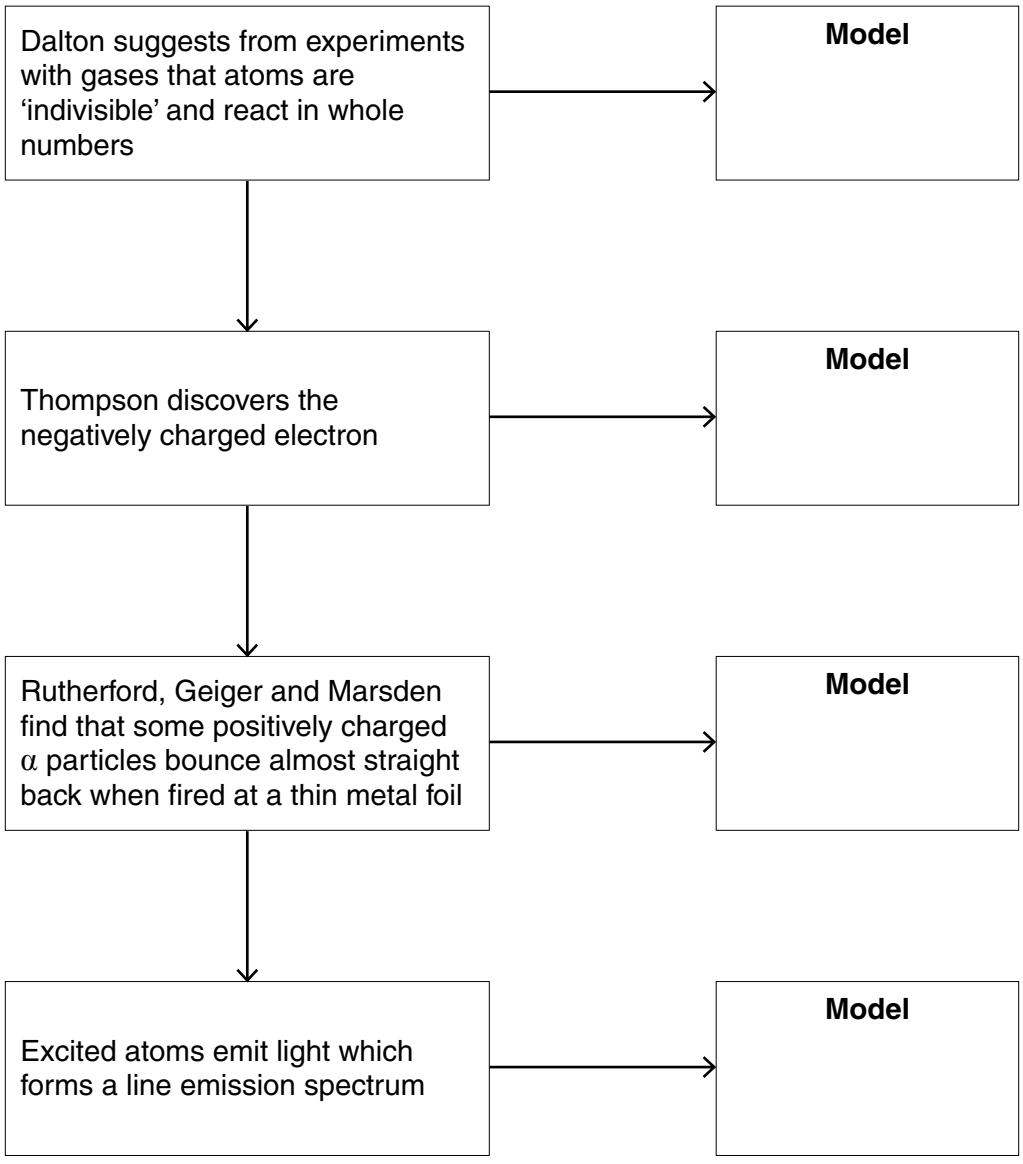
1 Chemists have put forward various models to try to explain atomic structures. Scientific models often change in the light of new evidence.

The following diagrams show possible structures for atoms based on different models, **A**–**D**.



Model A **Model B** **Model C** **Model D**

(a) Complete the flow diagram by filling in the boxes on the right with the letter corresponding to the appropriate model.



[3]

(b) The current model of the atom describes a nucleus containing protons and neutrons surrounded by electrons in energy levels.

(i) Complete the following table showing the properties of the sub-atomic particles.

sub-atomic particle	relative mass	relative charge
proton		+1
neutron	1	
electron	negligible	

[1]

(ii) Explain why:

- mass numbers of atoms are always whole numbers;
- the relative atomic mass of an element may **not** be a whole number.

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..... **[3]**

(c) Geiger and Marsden used the radioactive isotope ^{226}Ra in their experiments. ^{226}Ra decays by α-emission.

Write a nuclear equation for this process.

[3]

(d) Some rocks contain radioactive isotopes that can be used to date the rocks.

Dating of rocks requires being able to accurately measure the amount of both original (parent) radioisotope and finishing (daughter) stable isotope.

(i) Suggest **two** assumptions that must be made if a radioisotope is to be used for dating a rock.

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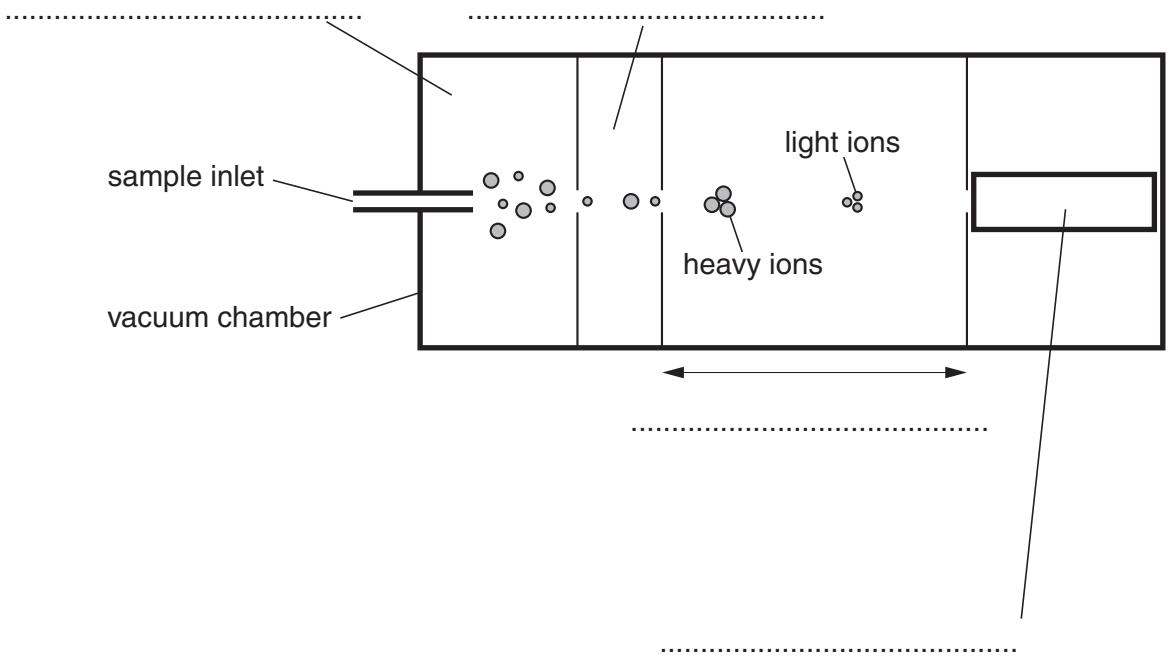
..... **[2]**

(ii) A time-of-flight mass spectrometer can be used to measure the amount of parent and daughter isotopes.

Write the following labels on the diagram of a time-of-flight mass spectrometer below.

acceleration area **ion detector** **ionisation area** **time measurement**



[4]

[Total: 16]

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TURN OVER FOR QUESTION 2

2 Much of our knowledge of outer space is based on spectroscopic data.

(a) Absorption spectra give information about the elements present in stars.

(i) Describe the main features in the appearance of an atomic absorption spectrum.

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..... **[3]**

(ii) How does an atomic **emission spectrum** differ in appearance from an absorption spectrum?

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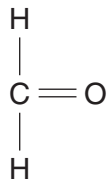
..... **[2]**

(b) Radiowaves can provide information about the molecules found in some regions of space.

(i) One molecule found in the coldest regions of outer space has the formula H_2CO. This molecule can be represented as:



Draw the '*dot-and-cross*' diagram for this molecule.

[3]

(ii) Use your diagram from **(i)** to help you describe and explain the shape of H_2CO, giving the bond angle.

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..... **[5]**

[Total: 13]

3 The search for alternatives to fuels made from crude oil is becoming more important. 'Biofuels' such as ethanol and biodiesel are now readily available.

(a) Suggest **two** benefits associated with using 'biofuels'.

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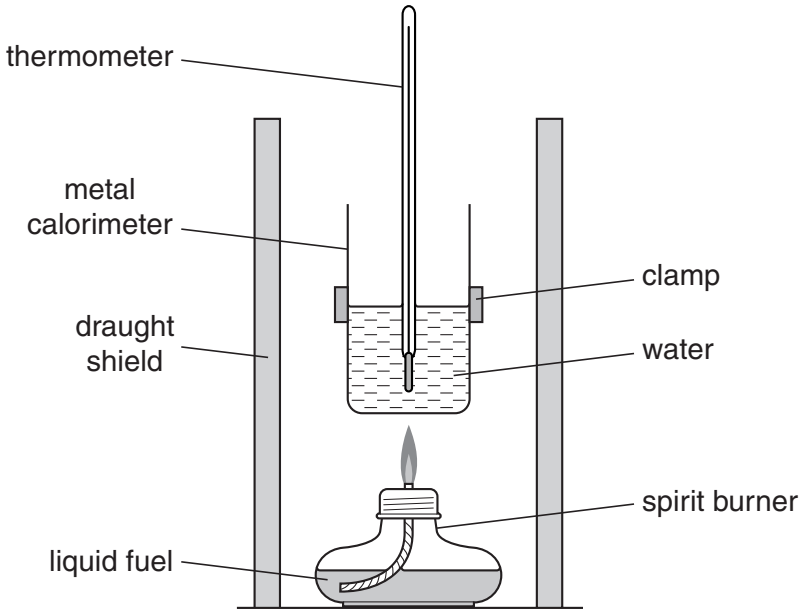
..... **[2]**

(b) A student determined the enthalpy change of combustion of ethanol using the apparatus shown below.



The student's results are shown below.

mass of calorimeter	= 120 g
mass of water in calorimeter	= 100 g
mass of spirit burner at start	= 43.56 g
mass of spirit burner at end	= 42.36 g
initial temperature of water	= 20 °C
final temperature of water	= 45 °C

(i) Calculate the energy transferred to the water.

Specific heat capacity of water = 4.18 $J\,g^{-1}\,K^{-1}$.

energy transferred = ... J **[2]**

(ii) Use your answer to **(i)** to work out the enthalpy change of combustion of ethanol, in $kJ\,mol^{-1}$.

Give your answer to **three** significant figures.

M_r (ethanol) = 46.0.

enthalpy change of combustion of ethanol = ... $kJ\,mol^{-1}$ **[4]**

(iii) A data book shows that when one mole of ethanol burns under standard conditions, 1370 kJ are produced.

Suggest **two** reasons why this value is very different from the student's experimental result.

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..... **[2]**

(c) (i) List the bonds that are broken and made when ethanol burns.

[3]

(ii) Use the ideas of bond making and bond breaking to explain why the combustion of ethanol gives out energy.

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..... **[2]**

(d) An added benefit of using ethanol as a fuel is that it has a high octane number.

Explain what the *octane number* measures and why a high value for octane number is desirable in a fuel.

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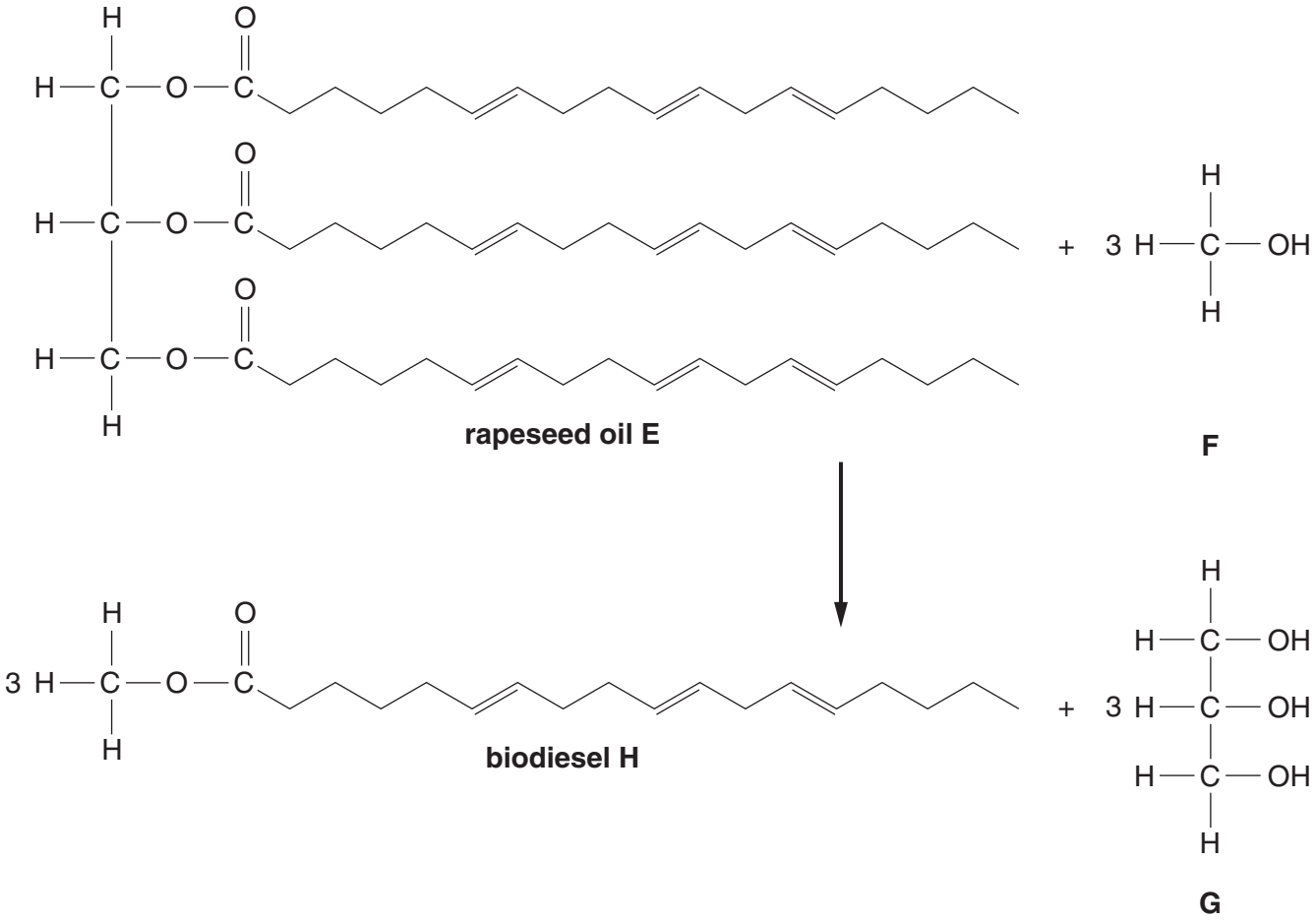
..... **[3]**

[Total: 18]

4 A fuel made from rapeseed oil can be used to replace diesel in cars. The following reaction scheme shows how this 'biodiesel' can be made from rapeseed oil.



You are **not** expected to know all of the functional groups in these structures.

(a) Answer the following questions based on the reaction scheme opposite.

(i) Give the letter or letters of the structure(s) that contain alcohol groups.

..... **[2]**

(ii) Structure **E** contains hydrocarbon chains. Draw a circle around **one** hydrocarbon chain. **[1]**

(iii) What **type** of formula has been used to represent this hydrocarbon chain?

..... **[1]**

(iv) What is the molecular formula of **G**?

..... **[1]**

(b) The equation below represents the **complete** combustion of rapeseed biodiesel.

$$C_{19}H_{32}O_2(l) + 26O_2(g) \rightarrow 19CO_2(g) + 16H_2O(g)$$

(i) What volume (dm^3) of CO_2 gas will be produced at room temperature and pressure when 1.0 mol of biodiesel burns in excess oxygen?

One mole of any gas occupies 24 dm^3 at room temperature and pressure.

volume = ... dm^3 **[1]**

(ii) When biodiesel burns it produces less carbon monoxide than similar fuels made from crude oil.

Explain why less carbon monoxide is produced and why this is desirable.

In your answer, you should use appropriate technical terms, spelt correctly.

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..... **[3]**

(c) Cars that run on biodiesel produce oxides of nitrogen. Nitrogen and oxygen react under the high temperatures in the combustion chamber.

(i) Where does the nitrogen come from?

..... **[1]**

(ii) Write a balanced equation for the reaction between nitrogen and oxygen to produce nitrogen monoxide. Include state symbols.

..... **[2]**

(iii) Suggest why high temperatures are needed for this reaction to take place.

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..... **[1]**

[Total: 13]

END OF QUESTION PAPER