OCR
RECOGNISING ACHIEVEMENT

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
SCIENCE A
Unit 1 Modules B1 C1 P1
HIGHER TIER
THURSDAY 14 JUNE 2007

H **A211/02**

Afternoon
Time: 40 minutes

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

Candidate
Name

Centre
Number

Candidate
Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.
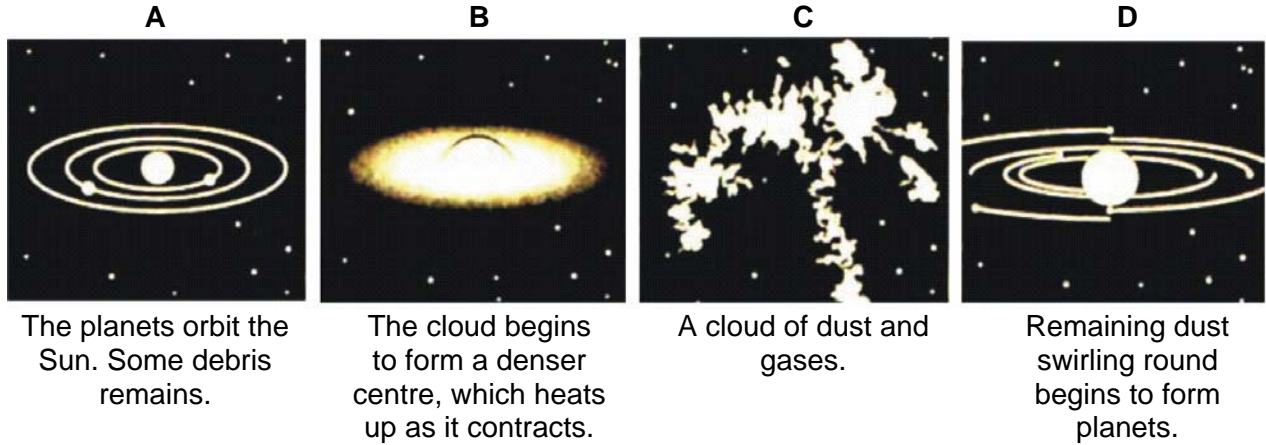
INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	5	
2	4	
3	5	
4	6	
5	4	
6	4	
7	4	
8	6	
9	4	
TOTAL	42	

This document consists of **20** printed pages and **4** blank pages.

Answer **all** the questions.

1 The diagram below shows stages **A**, **B**, **C** and **D** in the formation of our solar system.

They are not in the correct order.

A	B	C	D
The planets orbit the Sun. Some debris remains.	The cloud begins to form a denser centre, which heats up as it contracts.	A cloud of dust and gases.	Remaining dust swirling round begins to form planets.

(a) Fill in the boxes to show the correct order.

The first one has been done for you.

C			

[2]

(b) Which element is the main source of the Sun's energy?

Put a tick (✔) in the correct box.

carbon ☐

helium ☐

hydrogen ☐

oxygen ☐

uranium ☐

[1]

(c) Name the **process** that provides the Sun's energy.

answer .... [1]

(d) How long ago did the Solar system form?

Put a tick (✓) in the correct box.

1 thousand million years ☐

3 thousand million years ☐

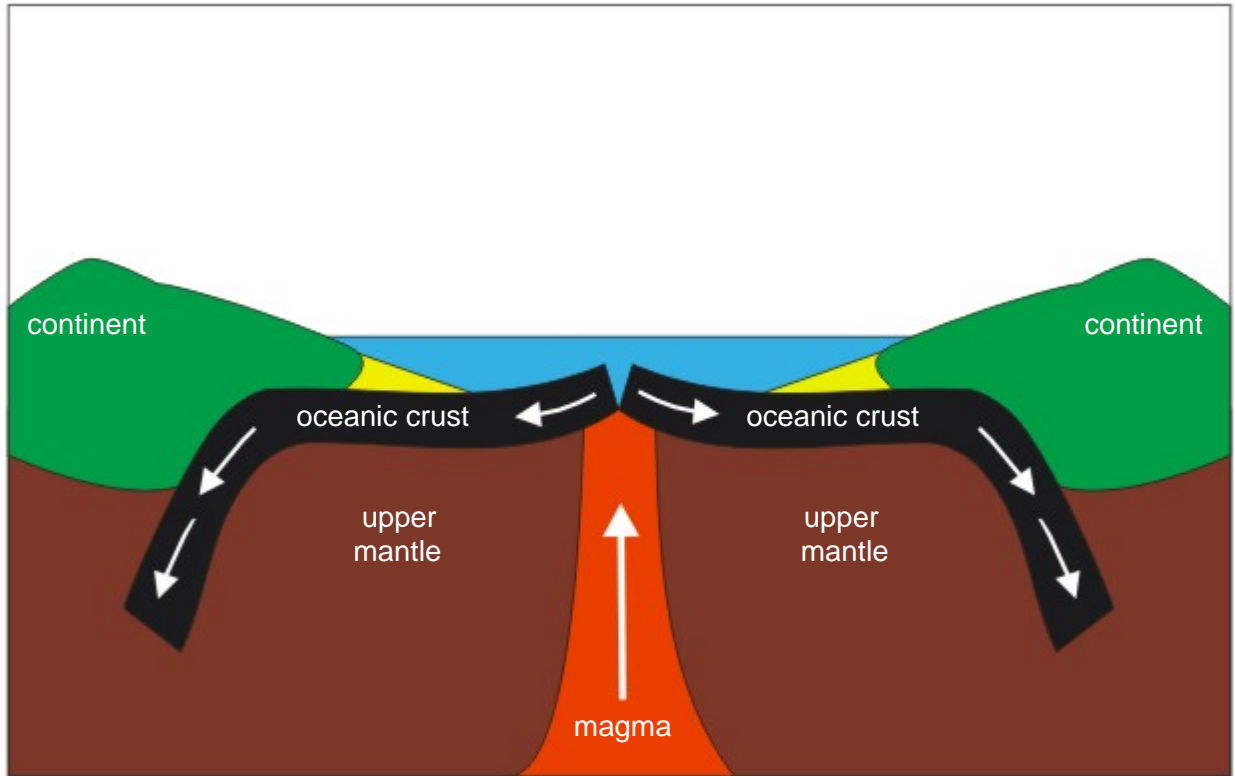5 thousand million years ☐

7 thousand million years ☐

14 thousand million years ☐

[1]

[Total: 5]

[Turn over

2 This diagram shows the seafloor around an oceanic ridge.

The arrows on the diagram indicate movement.

Around 50 years ago it was discovered that the seafloor is spreading, causing the continents to move further apart.

(a) Seafloor spreading is caused by movement in one of the Earth's layers. Which layer?

answer .... [1]

(b) How far does a typical seafloor spread in **50 years?**

Put a ring around the correct answer in the list below.

50 km	500 m	5 m	50 cm	50 mm

[1]

(c) Here are some statements about seafloor spreading.
Some provide **data**, the others are explanations.

Choose which statements are **data** by putting a **D** in the correct boxes.

Seafloor spreading makes continents move apart.

There is a chain of mountains under the Atlantic Ocean.

There is a pattern of magnetic stripes in the rocks on either side of the oceanic ridge.

Magnetic stripes form when hot magma solidifies.

[2]

[Total: 4]

[Turn over

3 In 1961, Dr Frank Drake developed an equation to estimate the number of intelligent, communicating civilizations there are in our galaxy.

The following passage is based on an extract from an article on the Drake equation.

The Drake equation is

$$N = R \times p \times n \times f \times i \times c \times L$$

Where the letters in the equation stand for

N = number of civilizations in the Galaxy sending detectable radio waves

R = the rate at which stars, that are suitable for the development of life, form

p = fraction of these stars with planets

n = number of planets per solar system with an environment suitable for life

f = fraction of suitable planets on which life actually appears

i = fraction of life-bearing planets on which intelligent life emerges

c = fraction of civilizations that develop a technology that releases detectable signs of their existence into space

L = the fractional length of time such civilizations release detectable signals into space

Source: written by Lynda Dunlop as part of a Gatsby Teacher Fellowship

(a) The value of **N** is thought to be somewhere in the range 1 to 10 million.

(i) Why could the value of **N** calculated from the equation above **not** be less than 1?

Put a tick (✔) in the box next to the **best** answer.

It is not known how many stars have planets. ☐

There is life on Earth. ☐

There may be life on Mars. ☐

There may be life outside of our solar system. ☐

[1]

(ii) Why is there such a wide range in the possible values for **N**?

Put ticks (✔) in the boxes next to the two **best** answers in the list below.

There are too few scientists working on the problem. ☐

The scientists working on the problem need more time to collect enough data. ☐

The scientists working on the problem will never collect enough data. ☐

There are some factors in the formula that can only ever be estimated. ☐

Drake's equation is wrong because it does not give an accurate account. ☐

Drake's equation is wrong because there is no evidence for alien life. ☐

[2]

[Turn over

(b) Below are a set of statements relating to our current scientific understanding of the Universe.

Put ticks (✓) in the boxes next to those statements that most scientists believe to be **true**.

There is currently no evidence to support the existence of alien life.

There are planets outside of our solar system.

There is no life apart from that found on Earth.

The sun is the only star in the Milky Way galaxy.

[2]

[Total: 5]

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Question 4 starts on page 10

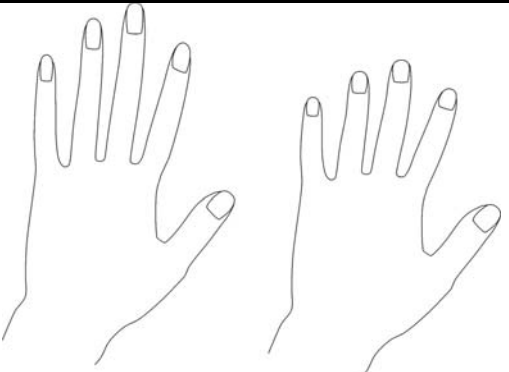**PLEASE DO NOT WRITE ON THIS PAGE**

4   Look at the information on Marfan syndrome.

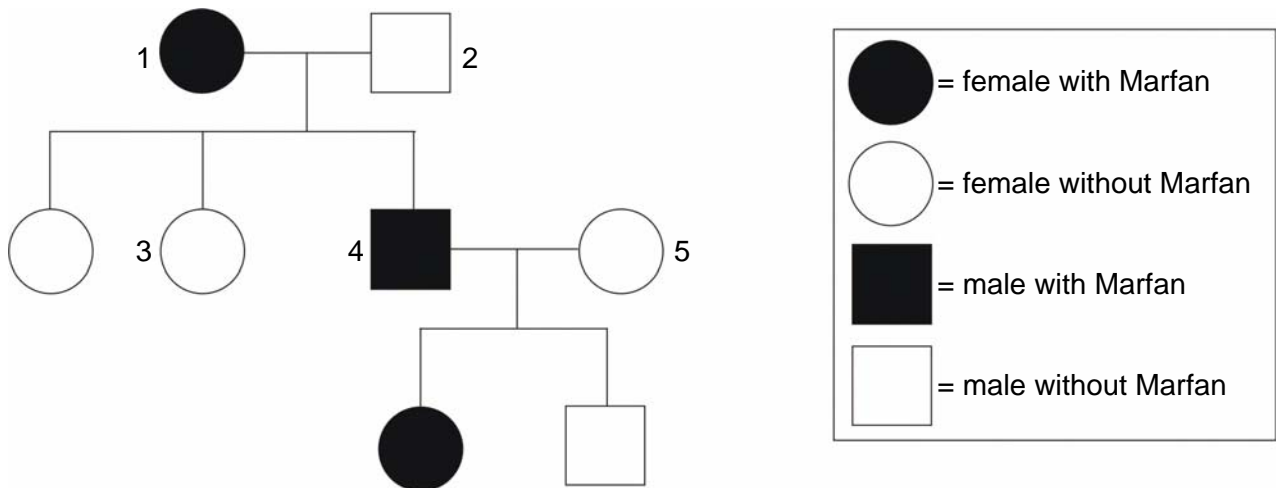Marfan syndrome is an inherited disorder.

People with Marfan syndrome are usually tall and slim with long fingers and loose joints.

A single gene causes the disorder.

Marfan syndrome is caused by a dominant allele.

The diagram below shows a family tree.

(a) Complete the table showing the alleles present for each person.

Use   **A** to represent a dominant allele for Marfan syndrome
       a to represent a recessive allele for normal

The first one has been done for you.

individual	alleles
1	**Aa**
2	
3	
4	

[3]

(b) Look at the diagram opposite.

If individuals 4 and 5 have **another** child, what is the probability that it will have Marfan syndrome?

Put a tick (✔) in the box next to the correct answer.

0% ☐

25% ☐

50% ☐

75% ☐

100% ☐

[1]

(c) Complete the following sentence by filling in the gap.

Chromosomes are very long molecules made from ....   [1]

(d) What does a gene provide instructions to make?

Put a (ring) around the best answer in the list below.

chromosomes   **cells**   **protein**   **nuclei**

[1]

[Total: 6]

[Turn over

5 Read the following newspaper article.

Breast cancer is the most common cancer for women in the UK.

Up to a third of all cases are triggered by genetics. Two genes, BRCA1 and BRCA2, have already been identified which can significantly increase the risk of cancer if they mutate, but these genes only account for about 5% of breast cancer cases. Where breast cancer runs in a family, about one in five people has faulty BRCA1 and BRCA2 genes.

Researchers believe that there are possibly hundreds of unidentified natural variations in dozens of other genes which could each raise a person's risk of cancer by a tiny percentage. With new screening technology, British scientists are leading the way to discover which cocktails of genes carry the highest risk.

(a) Besides **genetic factors**, what else affects a woman's chance of getting breast cancer?

Put a tick (✓) in the box next to the **best** answer in the list below.

whether her father had lung cancer ☐

environmental factors ☐

whether her mother had breast cancer ☐

ecological factors ☐

[1]

(b) Breast cancer runs in Jane's family. She writes a list of reasons for and against being screened for BRCA1 and BRCA2.

The lists show reasons for and against screening and Jane's conclusions.

Draw a straight line from each **reason** to its **conclusion**.

reason	**conclusion**

Only 5% of breast cancers are due to BRCA1 and BRCA2.	So, it is better for no one to know.
Genetic tests can give false results.	So, it would be wrong to have a test.
The result may affect her life insurance premiums.	So, there is a good chance her mother's cancer may not have a genetic cause.
She thinks genetic testing is unnatural.	So, tests aren't worth having.

[3]

[Total: 4]

[Turn over

6 Read these statements about genes and inheritance.

  A Each person has two alleles for any gene. These can be the same or different.

  B Genes occur in pairs in body cells. One gene comes from the mother's egg and one from the father's sperm.

  C Some alleles are dominant, and some are recessive.

  D Sexual reproduction produces a random selection of alleles.

  E Only one dominant allele is needed to cause an effect.

  F Two recessive alleles are needed to cause an effect.

  G Humans are known to have at least 23 688 different genes.

 Choose from the statements above to answer the following questions.

 Put the correct letter, **A**, **B**, **C**, **D**, **E**, **F** or **G**, in each space below.

 (a) Which **two** statements explain why it is possible for two healthy parents to have a child with a disease caused by a recessive allele?

    answer .... and .... [1]

 (b) Which **one** statement explains why there are no carriers in genetic diseases caused by dominant alleles?

    answer .... [1]

 (c) Which **three** statements explain why offspring are only similar to their brothers or sisters and not exactly the same?

    answer .... , ... and .... [2]

[Total: 4]

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Question 7 starts on page 16

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7 In December 2005, there was an explosion at Buncefield oil depot.

Large quantities of petrol and diesel oil caught fire.

The fire lasted several days, and a large cloud of black smoke drifted southwards.

Here is what five local people said about the smoke on the day of the explosion.

Ahmed

We must stay inside and close all windows and doors.

Kate

The black cloud is rising, so it will stay in the air.

Barry

It will be worse if it rains and the pollutants are washed down on us.

Roshi

It will cover the fields and houses with soot.

Tom

If the wind changes it will blow away from us.

(a) Which **two** people have identified factors that might **change** the amount of local pollution?

.... [2]

(b) Which **one** person is referring to a **correlation** between a risk factor and an outcome?

.... [1]
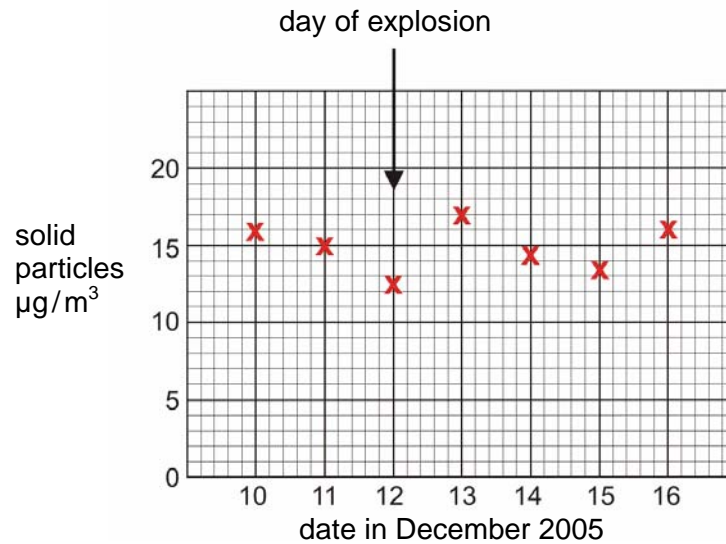
(c) The wind continued to blow towards the south.

Measurements of solid particles in the air were taken at a monitoring station 20 miles south of Buncefield.

The daily mean values are shown in the graph below.

What correlation, if any, does the graph show between the number of solid particles in the air and the time after the explosion?

Put a tick (✓) in the correct box.

The number of solid particles decreased with time. ☐

The number of solid particles increased with time. ☐

There is no correlation. ☐

[1]

[Total: 4]

[Turn over

8 This question is about cars.

> An image has been removed due to copyright restrictions.
>
> Details:
> a clipart-style illustration of a car

(a) Many cars use petrol as a fuel.
Petrol is a mixture of compounds of carbon and hydrogen.

What scientific term can be used to describe these compounds?

answer .... [1]

(b) Car engines may pollute the air with **carbon monoxide** and **nitrogen monoxide.**

(i) Which of the statements, **A**, **B**, **C** or **D**, describes how **carbon monoxide** is made in a car engine?

A   Carbon dioxide from the air reacts with carbon in the petrol.

B   Carbon dioxide and oxygen from the air react with each other.

C   Carbon in the petrol reacts with a limited supply of oxygen from the air.

D   The petrol burns completely in oxygen from the air.

answer .... [1]

(ii) Which of the statements, **A**, **B**, **C** or **D**, describes how **nitrogen monoxide** is made in a car engine?

A   Nitrogen in the petrol reacts with oxygen in the air.

B   Nitrogen and oxygen in the petrol react with each other.

C   Oxygen in the petrol reacts with nitrogen in the air.

**D**   Nitrogen and oxygen in the air react with each other.

answer .... [1]

(c) A catalytic converter removes carbon monoxide and nitrogen monoxide by reacting them together to make nitrogen and carbon dioxide.

The reaction is represented in the diagram, but carbon dioxide is missing.
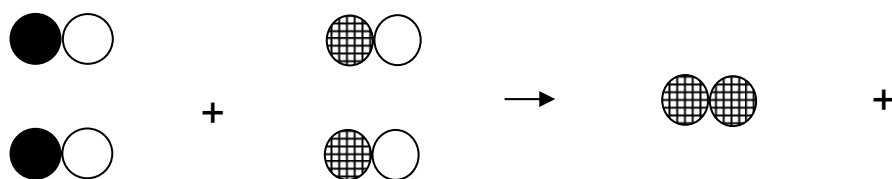
key

●	carbon atom
▦	nitrogen atom
○	oxygen atom

Complete the diagram above to show how **all** the atoms are rearranged during the chemical reaction.

[2]

(d) Some of the carbon dioxide made in car engines is removed from the air.
Here are four suggestions about how carbon dioxide is removed from the air.

Put a tick (✔) in the box next to **each** correct suggestion.

Some carbon dioxide is used by plants in photosynthesis. ☐
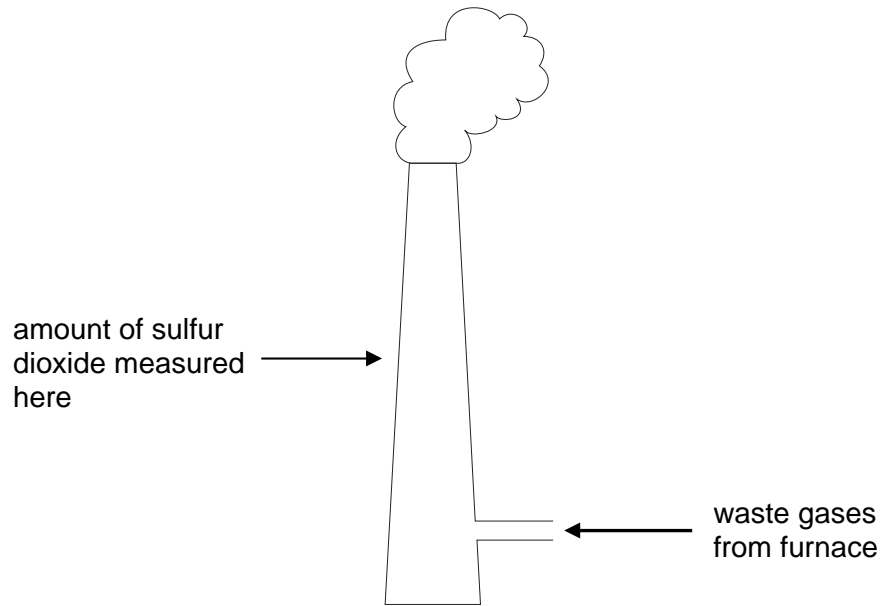
Some carbon dioxide is lost into space. ☐

Some carbon dioxide is oxidised in the air. ☐

Some carbon dioxide dissolves in the oceans. ☐

[1]

[Total: 6]

[Turn over

9 The sulfur dioxide released from power stations is measured by testing the gas going up the chimneys.

amount of sulfur dioxide measured here →

← waste gases from furnace

A power station uses natural gas as a fuel.

Scientists have begun to remove sulfur from natural gas before it is burned.

They want to know if their new technology is working.

The scientists tested the gas given off by the old fuel and the gas given off by the new fuel to see if there had been any change.

Here are the results.

amount of sulfur dioxide in the emitted gases (ppm)	
old fuel	new fuel
170	120
190	110
155	125
140	102
180	110

The mean value for the **old** fuel is **167** ppm.

(a) Work out the mean value for the **new fuel**.

answer .... ppm [1]

(b) Write down the **range** of values for the new fuel.

answer .... to .... ppm   [1]

(c) The data shows that there has been a change in the sulfur dioxide levels produced by the power station.

Here are five statements about the data.

Choose the **two** statements which provide the **best** evidence for this change.

Put ticks (✔) in the boxes next to the two **best** answers.

The ranges of values for the old and new fuels do not overlap. ☐

The mean values are different. ☐

The mean value from the new fuel is more than the mean value from the old fuel. ☐

The range of values of the new fuel is less than the range for the old fuel. ☐

The mean value of the new fuel is outside the range of the values for the old fuel. ☐

[2]

[Total: 4]

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