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OCR
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Tuesday 15 May 2012 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE SCIENCE A

A141/01 Modules B1 C1 P1 (Foundation Tier)

A135750612

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour

A141101

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- A list of physics equations is printed on page 2.
- This document consists of **20** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE EQUATIONS

Useful relationships

The Earth in the Universe

distance = wave speed × time

wave speed = frequency × wavelength

Sustainable energy

energy transferred = power × time

power = voltage × current

$$\text{efficiency} = \frac{\text{energy usefully transferred}}{\text{total energy supplied}} \times 100\%$$

Explaining motion

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

momentum = mass × velocity

change of momentum = resultant force × time for which it acts

work done by a force = force × distance moved in the direction of the force

amount of energy transferred = work done

change in gravitational potential energy = weight × vertical height difference

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times [\text{velocity}]^2$$

Electric circuits

power = voltage × current

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

Radioactive materials

energy = mass × [speed of light in a vacuum]^2

Answer **all** the questions.

1 Chromosomes are arranged in pairs in human body cells.

(a) Complete the sentence.

Genes are instructions for a cell that describe how to make ..... . **[1]**

(b) **(i)** One of these pairs of chromosomes is called the sex chromosomes.

Complete the Punnett square to show how the sex chromosomes are inherited.

		Mother	
		X	**X**
Father	**X**	**XX**	.....
	.....	.....	.....

[2]

(ii) What is the probability of a baby being female?

Put a (ring) around the correct answer.

0 **0.25** **0.5** **0.75** **1** **[1]**

(c) The table below shows the number of girls and boys born in four hospitals, **A**, **B**, **C** and **D**, during one year.

	Number of babies born in one year in each hospital			
	A	**B**	**C**	**D**
Girls	324		442	350
Boys	326	362	300	350
Total	650	720	742	700

(i) Calculate the number of girls born in hospital **B**.

Show your working.

number of girls born in hospital **B** = ... **[1]**

(ii) Calculate the ratio of girls to boys born in hospital **D**.

ratio of girls to boys born in hospital **D** = ... : ..... **[1]**

(iii) A doctor looks at the data and is surprised by the results in one of the hospitals.

Suggest which hospital, **A**, **B**, **C** or **D**, has surprising results and explain why you chose this hospital.

hospital .....

explanation .....

.....

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

[Total: 8]

2 All living things can reproduce. Some use **sexual** reproduction and some use **asexual** reproduction.

Describe the differences between sexual and asexual reproduction.

Use examples of living things for each type of reproduction.

The quality of written communication will be assessed in your answer.

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..... **[6]**

[Total: 6]

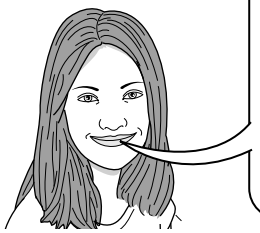
3 **(a)** Embryos can be made by fertilising eggs outside the mother's body.

The genes of an embryo can then be tested.

This makes it possible to choose which embryos to implant into the mother.

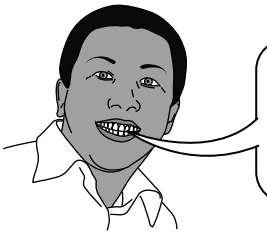
This is called **embryo selection**.

Read the different views on embryo selection.



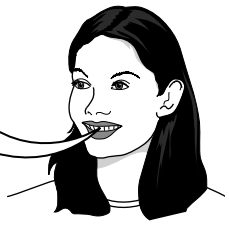
Bek
Embryo selection should be used, even though some embryos will be wasted.
It will help lots of people because it will reduce the number of people with genetic diseases.

Chris
It is a personal choice whether a couple use embryo selection.



Den
Embryo selection should never be allowed under any circumstances.

Eve
It is okay to select embryos without genetic diseases but you shouldn't be allowed to select an embryo just because it is a particular sex.



Frank
Just because we are able to select an embryo, does not mean it is always the right thing to do.

(i) Which person thinks that embryo selection is wrong, whatever the consequences?

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

(ii) Which person thinks that the right decision is the one that leads to the best outcome for the greatest number of people involved?

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

(iii) Which person gives an opinion about when embryo selection should and should not be allowed?

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

(b) Genetic tests can also be carried out on fetuses whilst they are developing inside the mother.

Alison is pregnant and Mike is the father. They both have relatives who have cystic fibrosis.

Mike thinks they should have a genetic test carried out on their baby before it is born.

Alison does not want to have the test.

Discuss the reasons **for** and **against** having a genetic test on the fetus.

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

[Total: 6]

4 **(a)** This question is about gases in the air.
Sulfur dioxide is made when fossil fuels burn.

(i) Which diagram shows a molecule of sulfur dioxide?

Put a (ring) around the correct answer.

[1]

(ii) Explain how burning fossil fuels can make sulfur dioxide.

Include in your answer

- where the sulfur atoms come from
- how sulfur atoms turn into sulfur dioxide.

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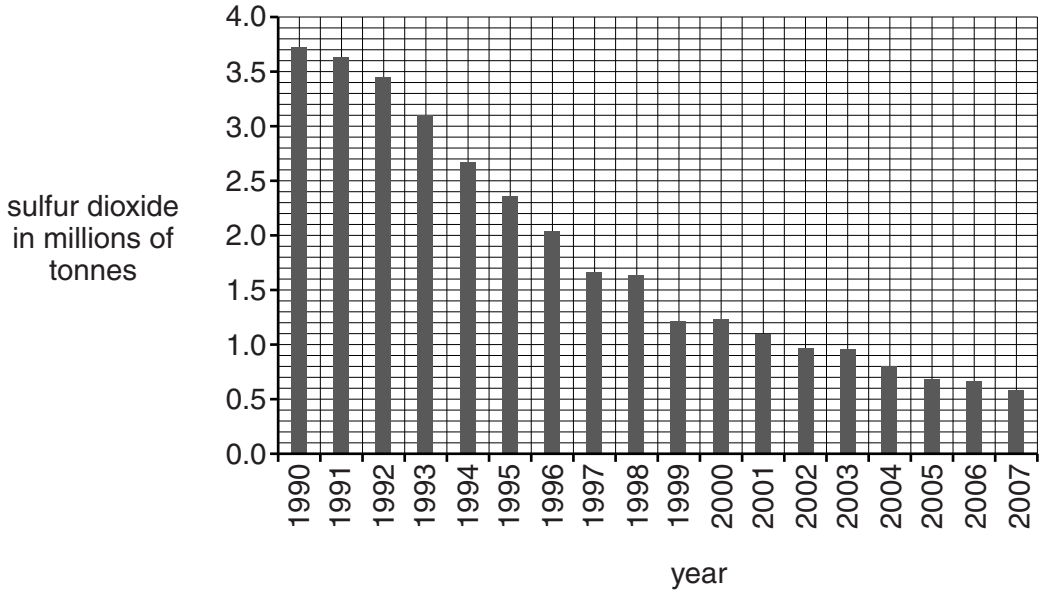
..... **[2]**

(b) The chart shows how much sulfur dioxide entered the air in the UK each year from 1990 to 2007.



(i) Here are some statements about the chart.

They are either true or false.

Put a tick (✓) in the correct box for each statement to show whether it is **true** or **false**.

	True	**False**
In 1995 a total of 2.1 million tonnes of sulfur dioxide was put into the air.	☐	☐
From 1997 to 1998 the amount of sulfur dioxide put into the air decreased.	☐	☐
The biggest drop in the amount of sulfur dioxide put into the air from one year to the next was from 1992 to 1993.	☐	☐
The first time sulfur dioxide emissions fell below 1 million tonnes was 2002.	☐	☐
Twice as much sulfur dioxide was put into the air in 1993 as in 2000.	☐	☐

[3]

(ii) Describe the changes shown by the chart between 1990 and 2007.

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.....

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

(iii) A scientist wants to find out if there is a correlation between

- the quantity of sulfur dioxide entering the air in the UK each year, and
- the quantity of electricity generated in the UK each year.

As well as the chart, what extra data would the scientist need?

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

The mean electricity generated in the UK from 1990 to 2007. ☐

The total electricity generated in the UK for each year from 1990 to 2007. ☐

The range of the electricity generated in the UK from 1990 to 2007. ☐

The total electricity generated from 1990 to 2007. ☐

[1]

(iv) The statements below describe some changes that have happened since 1990.

Which two statements would explain the trend shown by the chart?

Put ticks (✓) in the boxes next to the **two** correct statements.

The amount of traffic on UK roads has increased. ☐

Electricity generated from renewable resources has increased. ☐

Some hydroelectric power stations have been closed down. ☐

Electricity generated by power stations burning fossil fuels has increased. ☐

More sulfur is taken out of fossil fuels before they are burned. ☐

[2]

[Total: 11]

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Question 5 begins on page 12

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5 Cars use hydrocarbon fuels.

(a) (i) Finish this sentence about burning hydrocarbons.

Put a tick (✓) in the box next to the correct word.

Hydrocarbons burn in **plenty** of oxygen to make carbon dioxide and

carbon.	
hydrogen.	
water.	

[1]

(ii) Describe what happens when hydrocarbons burn in **very little** oxygen.

.....

.....

.....

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

(b) Since 1993 new cars have been fitted with catalytic converters.
The table shows amounts of polluting gases in the exhaust gases from a car.
Pollutants are measured both before they enter the catalytic converter and after they leave it.

	Amount of pollutant in the exhaust gases		
	Carbon dioxide (%)	**Carbon monoxide (%)**	**Nitrogen monoxide (%)**
Before the catalytic converter	23	0.80	0.50
After the catalytic converter	25	0.15	0.10

Use the data in the table **and** your knowledge of these gases to explain how the catalytic converter is improving air quality.

The quality of written communication will be assessed in your answer.

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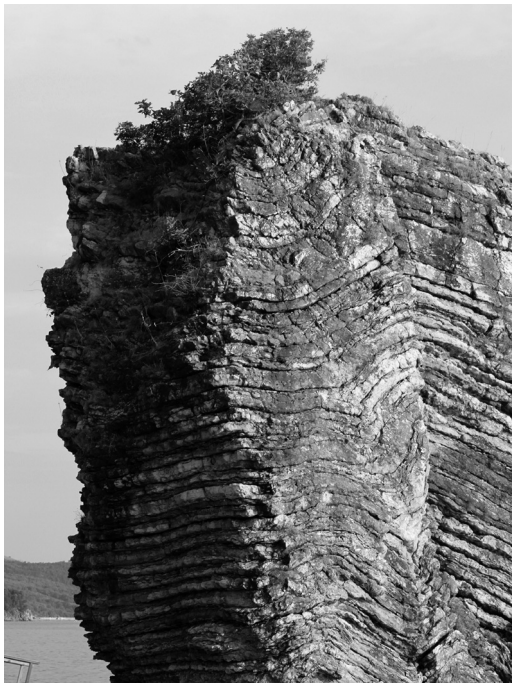
..... **[6]**

[Total: 9]

6 Look at the photograph of rock layers in a cliff.



oldest fossils

(a) Where would you expect to find the **oldest** fossils in this cliff?

Draw a line to link the **oldest fossils** label to the correct layer of rock. **[1]**

(b) You can easily see the rock layers in this cliff.

These rock layers were once deep underground.

Since the layers of sediment were deposited

- the layers are no longer straight
- they are no longer buried deep underground.

What has happened to make the rocks like this?

.....

.....

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

(c) Most scientists agree that these layers show that the rocks must be very old.

Some people do not accept that the Earth is very old.

Suggest **one** reason why they do not think the Earth is so old.

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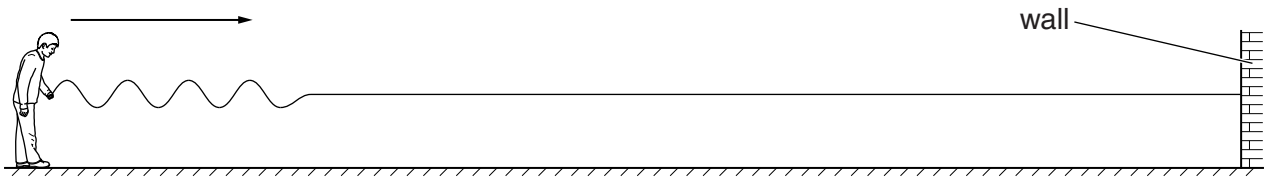
..... **[1]**

[Total: 4]

7 Phil sends waves down a rope fixed to a wall.
The waves move in the direction shown by the arrow.



(a) Here are some data about one wave.

wavelength = 0.5 m speed of wave = 5 m/s time to reach the wall = 2 s

Use **some** of the data to calculate the distance travelled by the wave from Phil's hand to the wall.

Show your working.

distance = ... m **[2]**

(b) Phil pulls the rope tighter and makes new waves on the rope.

Phil measures the frequency and the wavelength of the new waves.

frequency = 3 Hz wavelength = 2 m

(i) Calculate the speed of the new waves.

speed = ... m/s **[2]**

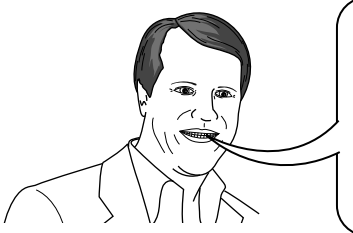
(ii) Use your answer to **(i)** to describe the relationship between the tightness of the rope and the wave speed.

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

[Total: 5]

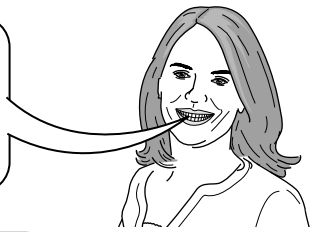
8 Five scientists are discussing the ages of the Universe and our solar system.

They are all referring to data from their research.



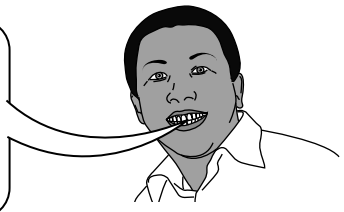
Dr Adams
I use a telescope to study the movement of galaxies. By analysing their distances and speeds, I found that the best estimate of the age of the Universe is 13.7 thousand million years old.

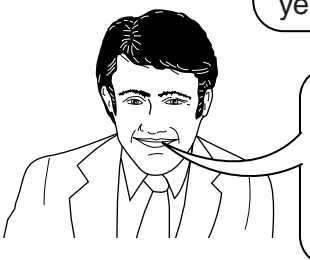
Dr Baker
I study rocks. The age of the oldest rocks on the surface of the Earth is about 3.8 thousand million years old.



Dr Curtis
I study the light from nearby stars. This shows me they are approximately 12 thousand million years old.

Dr Das
I study meteorites – bits of asteroid that get through our atmosphere. The oldest of these is around 5 thousand million years old.





Professor Eddington
I use satellite observations to study images from the Sun at different wavelengths. The Sun is less than 8 thousand million years old.

(a) Which three scientists study objects inside our solar system?

Put ticks (✓) in the boxes next to the **three** correct answers.

Dr Adams	☐
Dr Baker	☐
Dr Curtis	☐
Dr Das	☐
Professor Eddington	☐

[2]

(b) Which three scientists study the radiation emitted from stars?

Put ticks (✓) in the boxes next to the **three** correct answers.

Dr Adams	☐
Dr Baker	☐
Dr Curtis	☐
Dr Das	☐
Professor Eddington	☐

[2]

(c) Use the data given by these scientists to choose the best estimate for the age of our **solar system**.

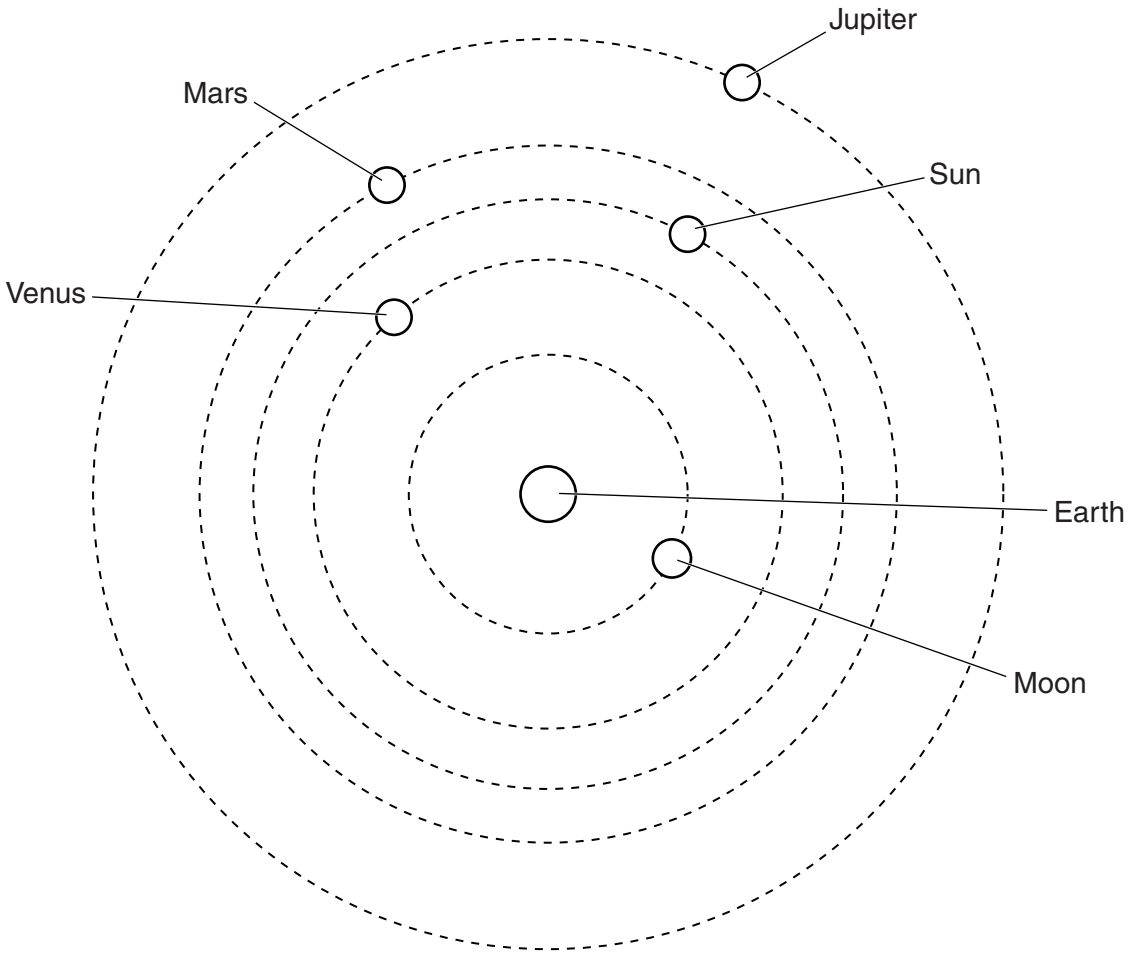
Put a tick (✓) in the box next to the correct answer.

less than 3.8 thousand million years old	☐
between 3.8 and 5 thousand million years old	☐
between 5 and 8 thousand million years old	☐
between 8 and 12 thousand million years old	☐
between 12 and 13.7 thousand million years old	☐

[1]

[Total: 5]

9 At one time, most people thought that the Earth was the centre of the solar system.



Old view of the solar system (not all planets shown)

In 1536, the astronomer Nicolaus Copernicus suggested a different idea. This is now the accepted model of the solar system.

Describe the accepted model of the solar system and suggest reasons why this model is now accepted.

The quality of written communication will be assessed in your answer.

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..... **[6]**

[Total: 6]

END OF QUESTION PAPER

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