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Friday 22 June 2012 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE SCIENCE A

A142/01 Modules B2 C2 P2 (Foundation Tier)

A135770612

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

A142201

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.
- A list of useful relationships is printed on page **2**.
- The total number of marks for this paper is **60**.
- 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

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Question 1 begins on page 4

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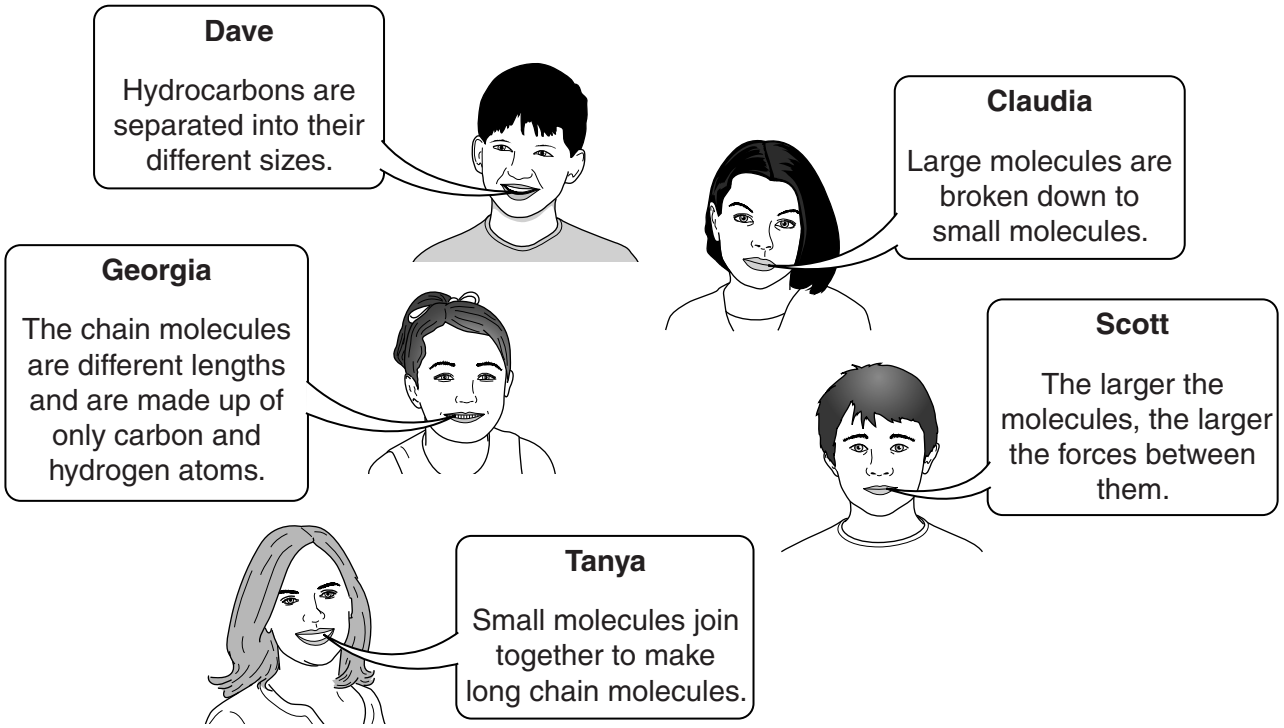
Answer **all** the questions.

1 Some students are talking about the importance of crude oil as a source of new materials.

(a) Here is what they say.



(i) Who is giving the best description of the chemicals in crude oil?

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

(ii) Who is talking about refining crude oil into fuels and lubricants?

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

(iii) Who is describing polymerisation?

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

(b) A polymer can be changed to give it different properties.

Which change would make a polymer **more** flexible?
Put a tick (✓) in the box next to the correct answer.

increasing cross-linking ☐

decreasing chain length ☐

adding a plasticizer ☐

[1]

[Total: 4]

2 Climbing ropes are made from fibres.

One hundred years ago fibres used in climbing ropes were made from plants.

The properties of these climbing ropes are shown in the table.

	rope made from …			
property	**… cotton**	**… jute**	**… manila**	**… sisal**
density in g/cm^3	1.54	1.50	1.62	1.43
tensile strength in N/mm^2	29 – 43	44 – 56	49 – 75	60 – 70
stretch at break point in %	3	2	7	3
moisture absorbency in %	25	45	33	51

(a) This label has been torn from one of the ropes.

ROPE made fr

tensile
strength: 60 N/mm^2

stretch
before breaking: 3%

(i) What is this rope made from?

Put a (ring) around the correct answer.

cotton **jute** **manila** **sisal**

[1]

(ii) Joe has a twenty metre length of each type of rope.

All the ropes have the same thickness.

Which rope is the heaviest?

Put a (ring) around the correct answer.

cotton **jute** **manila** **sisal**

[1]

(b) Joe buys some rope made of jute.
The tensile strength is labelled as 44 N/mm^2, the lowest value in the range.
Why is it more useful to show the tensile strength as the lowest value in the range rather than a range or a mean?

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

(c) Modern climbing ropes are made from nylon.
A scientist tests samples of a nylon rope.
Here are the results for its tensile strength.

sample	1	2	3	4	5
tensile strength in N/mm^2	62	66	75	79	73

(i) Why did the scientist do the test five times?

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

(ii) What is the range of values of the tensile strength of nylon?
Put your answer in the table below.

	rope made from …	
property	**… manila**	**… nylon**
density in g/cm^3	1.62	1.14
range of tensile strength in N/mm^2	49 – 75	— …..… ..…...
stretch at break point in %	7	22
moisture absorbency in %	33	4

[1]

(iii) Joe needs the best rope for climbing.

He looks at the data in the table in part **(ii)** to decide whether he should buy a rope made from manila or nylon.

Which rope should he buy?

Explain why.

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

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

[Total: 13]

3 This is a question about nanotechnology.

(a) Which sentence below is the **best** description of nanotechnology?

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

It is the use of particles that are 1 cm in size. ☐

It is the use of particles that are the size of some molecules. ☐

It is the reaction of different elements. ☐

It is using science to make materials stronger. ☐

[1]

(b) There are advantages and disadvantages in using nanoparticles.

Describe **one** advantage and **one** disadvantage of using nanoparticles.

advantage .....

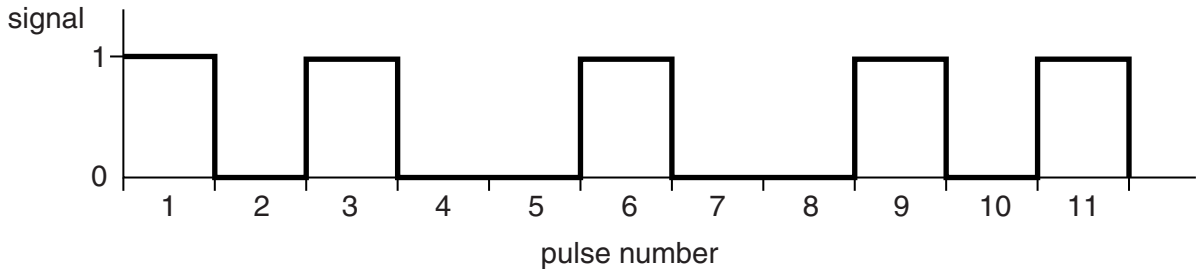
.....

disadvantage .....

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

[Total: 3]

4 The diagram shows part of a digital signal about to be sent to a receiver.



(a) (i) How can you see that this is a digital signal and not an analogue signal?

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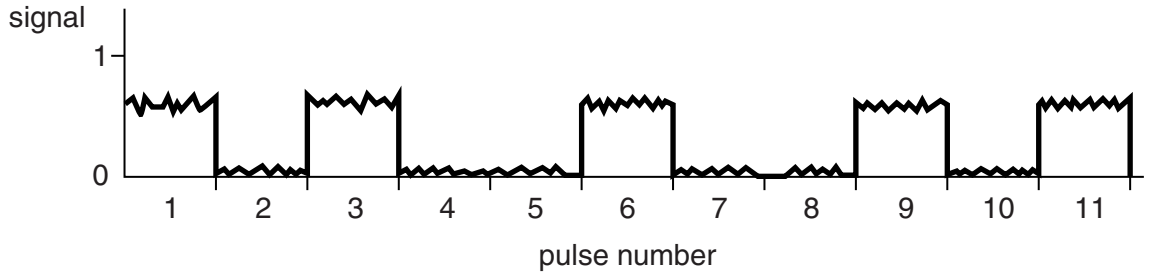
..... **[1]**

(ii) This is the same signal, when received some distance from the transmitter.



Explain how you can see that this is the same signal.

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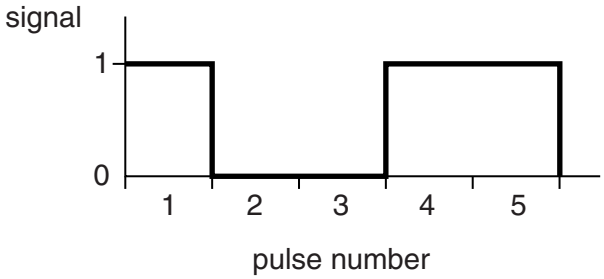
..... **[1]**

(b) The digital signal in part **(a)(i)** has the code **1 0 1 0 0 1 0 0 1 0 1.**

The diagram below is a short part of another digital signal.



Write down the code for this signal in the table below.

Part of the code has been done for you.

signal level	1	0	.....	.....	.....
pulse number	1	2	3	4	5

[1]

[Total: 3]

5 Use the words from this list to complete the sentences below about a beam of light travelling through space.

photons	**electrons**	**waves**
increases	**decreases**	**stays the same**

The beam of light consists of 'packets' called ..... .

If you increase the frequency of the light, the energy of each 'packet' ..... .

If you increase the frequency of the light, the speed of the light ..... .

[3]

[Total: 3]

6 **(a)** The diagram below shows the electromagnetic spectrum with some parts left blank.
Write **X-rays** in the correct box.

radio waves		infrared		ultraviolet		gamma rays

[1]

(b) Dentists often take an X-ray image of teeth as part of a regular check-up.
Some people worry about the risk to their health from the X-rays.
Explain what the risk is.

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

[Total: 3]

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Question 7 begins on page 12

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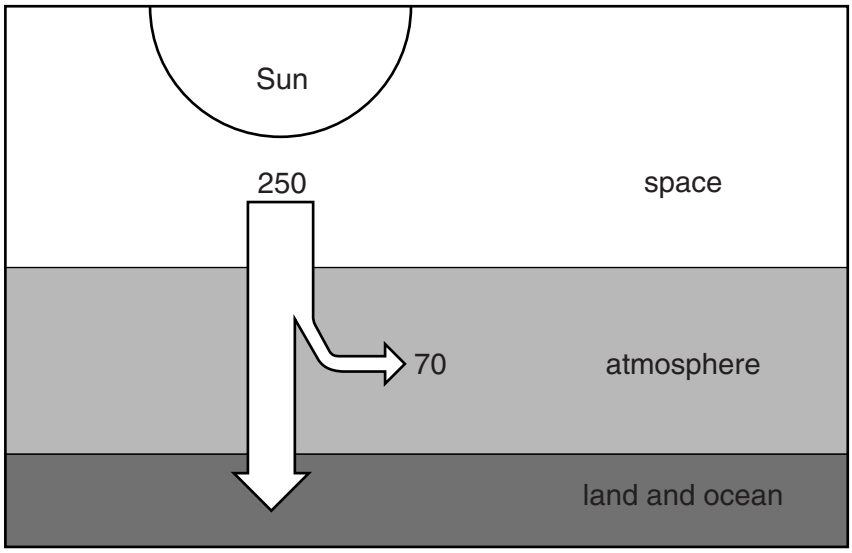
7 This question is about the Earth's atmosphere.

(a) The diagram shows radiation from the Sun reaching the Earth.



The diagram shows that 250 joules of energy reach a square metre of the top of the Earth's atmosphere every second.

How many of the 250 joules reach the land and ocean surface?

answer = ... joules **[1]**

(b) The table shows how much carbon dioxide was released into the atmosphere from burning fossil fuels in two different years.

year	1990	2008
mass of carbon dioxide released from burning fossil fuels in millions of tons	6000	8700

It has been claimed that there has been a 50% increase in the carbon dioxide released from burning fossil fuels between 1990 and 2008.

Use the data in the table to check if this statement is correct.

Show your working.

[2]

(c) Most scientists agree that increased burning of fossil fuels is changing the Earth's climate. Explain the way in which this happens.

.....

.....

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

[Total: 5]

8 Read this article.

Everybody likes Sunny Weather!

Sunlight is a source of natural light and energy. It is good for our general health and makes us feel good.

Although sunbathing may be enjoyable it is important to remember that too much exposure to sunlight is a health hazard. The ultraviolet (UV) radiation in sunlight can harm the skin, so many people take steps to protect themselves from its effects.

Sunburn often affects skiers, climbers and trekkers in the mountains. As you go higher, the Sun's UV rays become stronger.

The Sun's rays can also penetrate through water. When swimming, people can underestimate their exposure to sunlight because of the cooling effect of the water.

The article shows that ultraviolet radiation is hazardous but that people still take part in activities that expose them to it.

Explain what the risk from exposure to ultraviolet radiation is, and suggest why people are willing to take this risk.

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

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

[Total: 6]

9 **(a)** Taking the drug Ecstasy can affect the production of urine.

Write down **two** ways in which urine production changes after a person has taken Ecstasy.

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

(b) **(i)** Drinking alcohol can also affect the production of urine.

As you drink more alcohol, the volume of urine you produce increases.

What is this is an example of?

Put a (ring) around the correct answer.

a cause **a correlation** **an evaluation** **an outlier**

[1]

(ii) Elliott and George investigate how drinking alcohol affects the amount of urine produced.

They use 10 men in their investigation. All the men are 40 years old.

Elliott thinks their conclusions can be applied to the whole population.

George disagrees.

Who is correct? Justify your answer.

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

[Total: 5]

10 (a) This question is about vaccinations.

Put a tick (✓) in the box next to the correct option to complete each sentence.

Vaccinations help protect the body from

microorganisms.	
drugs.	
placebos.	

They do this by making the body produce

viruses.	
antigens.	
memory cells.	

If reinfection occurs, antibodies are produced

occasionally.	
quickly.	
slowly.	

[3]

(b) Influenza is a common disease which causes fever, headaches and severe tiredness. In some cases, it can cause death.

Every year, a different vaccine against influenza has to be developed.

The vaccine is only offered to people over 65 years of age, pregnant women, young children and people with serious medical conditions.

These people can choose whether or not they are vaccinated every year.

Some people believe that **everyone** should be vaccinated **every year**.

Suggest reasons why other people might be against this idea.


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

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

[Total: 9]

11 Liam and Ryan are going to run a 100 m race.

They measure their pulse rate before they start. This is called their resting pulse rate.

Liam's resting pulse rate is 57 beats per minute. Ryan's resting pulse rate is 72 beats per minute.

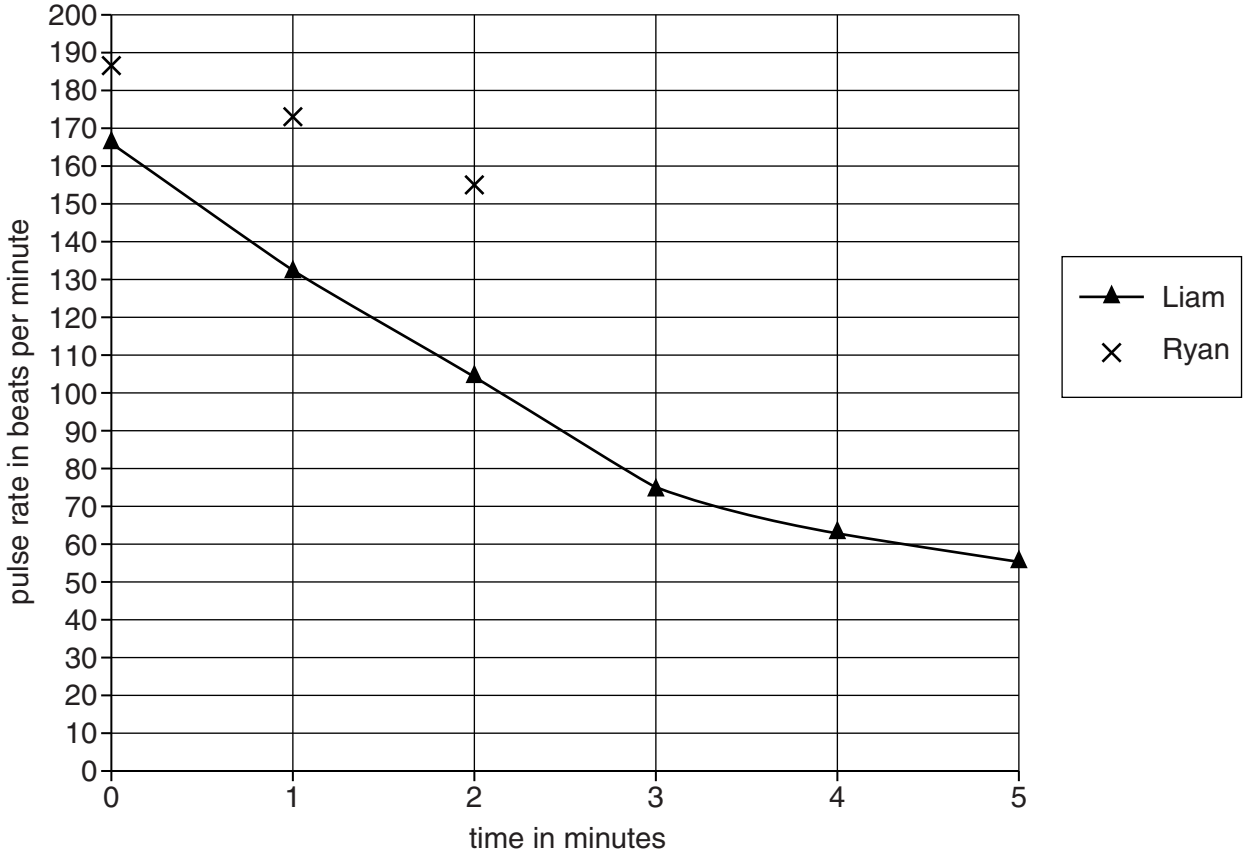
(a) Immediately after the race, Liam and Ryan record their pulse rate again.

They continue to record their pulse rate every minute for a further five minutes.

The table shows their results.

time after race ends in minutes	pulse rate in beats per minute	
	Liam	Ryan
0	168	187
1	132	172
2	104	155
3	74	136
4	62	122
5	57	103

Liam's pulse rate over the five-minute period after the race is plotted on the graph.



(i) Plot the data for Ryan's pulse rate over the same five-minute period, and draw a line of best fit.

The first three points have been done for you.

[2]

(ii) The graph shows that it takes 5 minutes after the race ends for Liam's pulse rate to return to his resting pulse rate of 57 beats per minute.

Put a (ring) around the correct option to join the start of each sentence to its end.

Ryan's resting pulse rate was …

higher than

lower than

the same as

… Liam's before the race started.

After the race ends, it takes …

more time

less time

the same time

… for Ryan's pulse rate to return to his resting pulse rate.

[1]

(iii) One indication of a person's fitness is their recovery rate after exercise.

Suggest what the graph shows about the relative fitness of Liam and Ryan.
Explain your answer.

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

(b) Exercising more increases your fitness. This is one way of reducing the risk of developing heart disease.

Write down **two** other changes in lifestyle factors that can reduce the risk of developing heart disease.

1 .....

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

[Total: 6]

END OF QUESTION PAPER

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