OCR
Oxford Cambridge and RSA

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Wednesday 20 May 2015 – Afternoon

GCSE TWENTY FIRST CENTURY SCIENCE PHYSICS A/SCIENCE A

A181/01 Modules P1 P2 P3 (Foundation Tier)

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

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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

- The quality of written communication is assessed in questions marked with a pencil (✎).
- A list of physics equations is printed on page **2**.
- 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**.
- This document consists of **16** pages. Any blank pages are indicated.

TWENTY FIRST CENTURY SCIENCE DATA SHEET

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 Complete the sentences below.
Use the best words from the list.

carbon **galaxy** **hydrogen** **planet** **star**

The Milky Way is a ..... .

The Sun is a ..... , one of billions that make up the Milky Way.

The Sun produces energy by the fusion of ..... nuclei.

[3]

[Total: 3]

2 **(a)** Alfred Wegener was the first person to suggest that continents could move.
What reasons did he have for thinking this?

Put ticks (✓) in the **two** boxes next to Wegener's reasons.

Different continents look as though they fit together.	☐
Erosion causes mountains to be worn down.	☐
Similar fossils are found on different continents.	☐
The Earth's crust is made of tectonic plates.	☐
Volcanoes are found on different continents.	☐

[2]

(b) Other scientists did **not** agree with Alfred Wegener's idea of continental drift.
What reasons did they have for thinking Wegener's idea was wrong?

Put ticks (✓) in the **two** boxes next to the other scientists' reasons.

Wegener was a famous geologist.	☐
The continents do not seem to move.	☐
Different continents have exactly the same rocks.	☐
There was not enough evidence for the new theory.	☐
Satellite pictures show land bridges between continents.	☐

[2]

[Total: 4]

3 Earthquakes close to the coast often produce dangerous water waves called tsunamis.

The table below gives typical data for a tsunami.

Depth of water (metres)	Speed (metres per second)	Wavelength (km)
7000	260	282
4000	200	213
200	45	48
10	10	11

(a) The Indian Ocean is 4000 m deep.

(i) How fast do tsunamis travel in the Indian Ocean?

speed = ... metres per second **[1]**

(ii) A tsunami took 30 000 seconds to cross the Indian Ocean.
Calculate the distance travelled by the tsunami. Give your answer in kilometres.
Show your working.

distance = ... km **[2]**

(b) It has been suggested that the speed of a tsunami is directly proportional to the depth of the water.

Explain what **directly proportional** means and use the data in the table below to see if the suggestion is true.

Speed (metres per second)	Depth of water (metres)
45	200
10	10

.....

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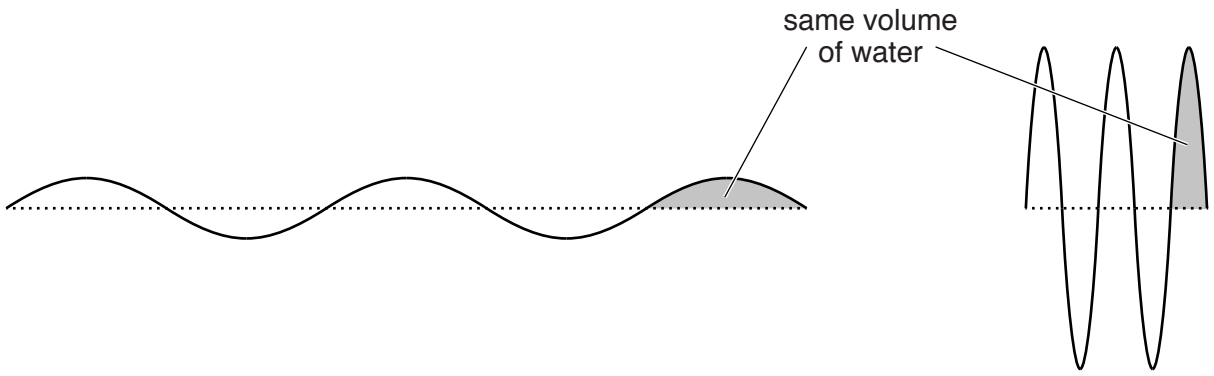
..... **[2]**

(c) The diagram below shows the tsunami waves in mid-ocean and near the land. The volume of water in each 'peak' of the wave stays the same.



tsunami in mid-ocean tsunami near the land

Explain why a tsunami may not be noticed by a ship in mid-ocean but can cause terrible damage when it strikes the land.

.....

.....

.....

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

[Total: 7]

4 Observations of the star Tau Ceti have shown that:

- it is very similar to our Sun
- it is surrounded by a cloud of dust
- it has several planets
- at least five of these planets are as big as the Earth or bigger.

Scientists think that the Tau Ceti system formed in the same way as our solar system.

Draw a labelled sketch of the Tau Ceti system showing how the different parts move, and describe how the different parts may have been formed.

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

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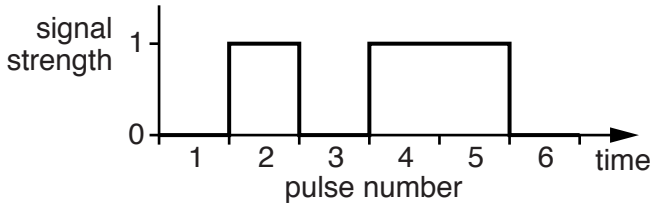
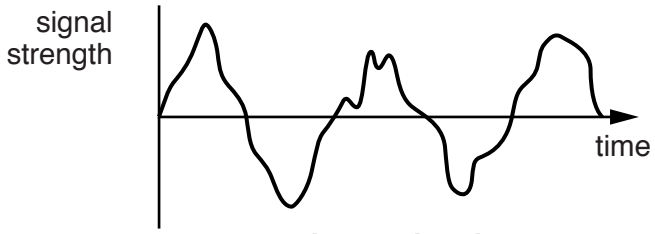
..... **[6]**

[Total: 6]

5 The diagrams below show a digital signal and an analogue signal.



digital signal



analogue signal

(a) Use information from the diagrams to describe the differences between a digital signal and an analogue signal.

.....

.....

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

(b) Complete the table below to show the coding for the digital signal.
The first pulse has been done for you.

pulse number	1	2	3	4	5	6
signal strength	0					

[2]

(c) Digital signals are now used far more often than analogue signals.

Write down **two** advantages of using digital signals.

1 .....

.....

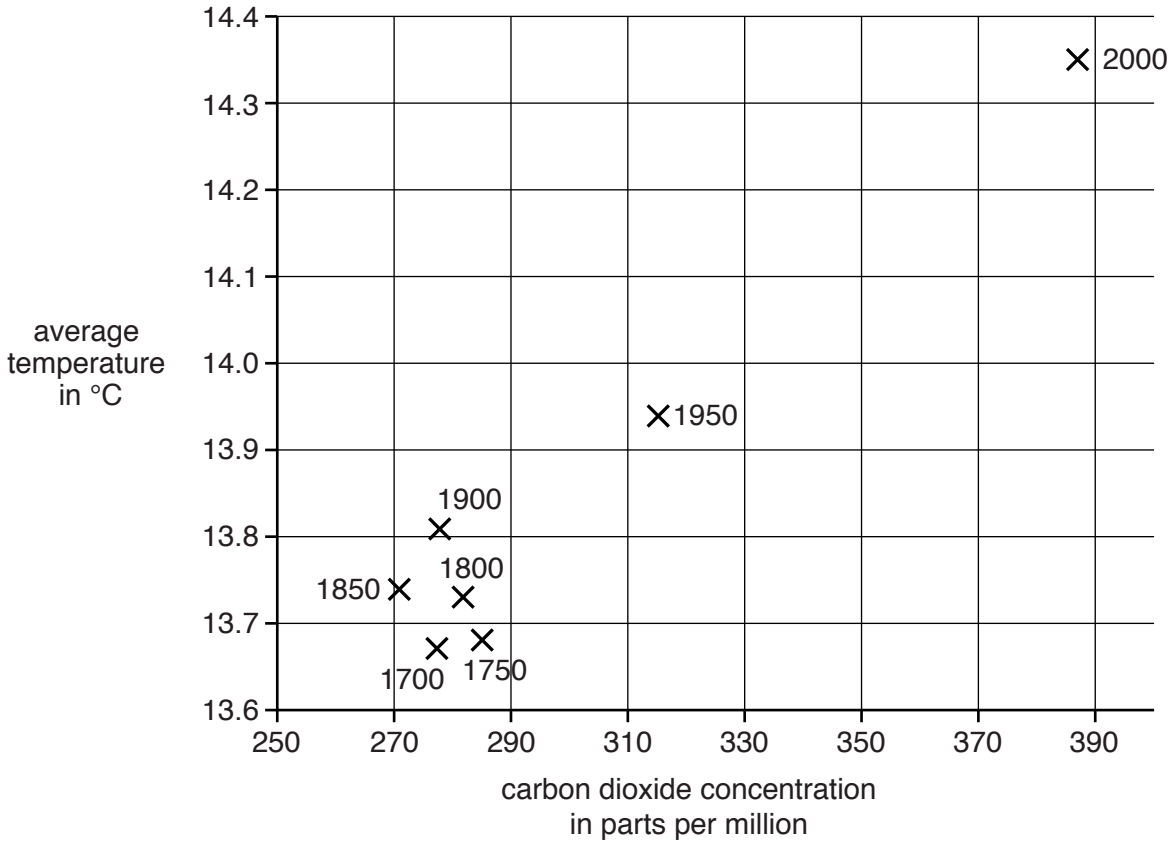
2 .....

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

[Total: 6]

6 The graph below shows how the average temperature of the Earth and the concentration of carbon dioxide in the atmosphere have changed over the last 300 years.

Each point is marked with the year the readings were taken.



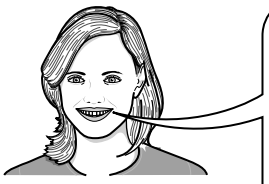
(a) (i) In which **two** years was the carbon dioxide concentration greater than 300 parts per million?

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

(ii) In which years was the average temperature less than 13.8 °C?

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

(b) Five friends have been looking at the graph on the opposite page.



Alice
There is a positive correlation between temperature and carbon dioxide concentration.

Ben
Burning fossil fuels increases the carbon dioxide concentration.

Chandra
Carbon dioxide concentration didn't change much until after 1900.

Debra
I'm worried about the effects of global warming on the environment.

Eddie
Carbon dioxide is a greenhouse gas. It makes the Earth absorb more of the Sun's radiation.

(i) Which two friends are **describing** the data shown in the graph?

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

Alice ☐

Ben ☐

Chandra ☐

Debra ☐

Eddie ☐

[2]

(ii) Which two friends are **explaining** the data shown in the graph?

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

Alice ☐

Ben ☐

Chandra ☐

Debra ☐

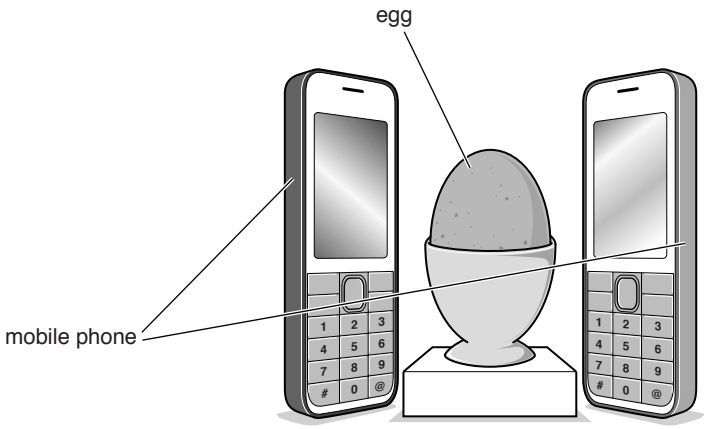
Eddie ☐

[2]

[Total: 8]

7 A few years ago some journalists claimed on the internet that they had used two mobile phones to cook an egg in an hour. If this claim had been true, this would be very worrying. However, it was just a joke.

A mobile phone emits microwaves with a very low power. A microwave oven is much more powerful.



Explain why this 'joke' would worry mobile phone users if it had been true. Suggest why people should not believe the journalists' claims.

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

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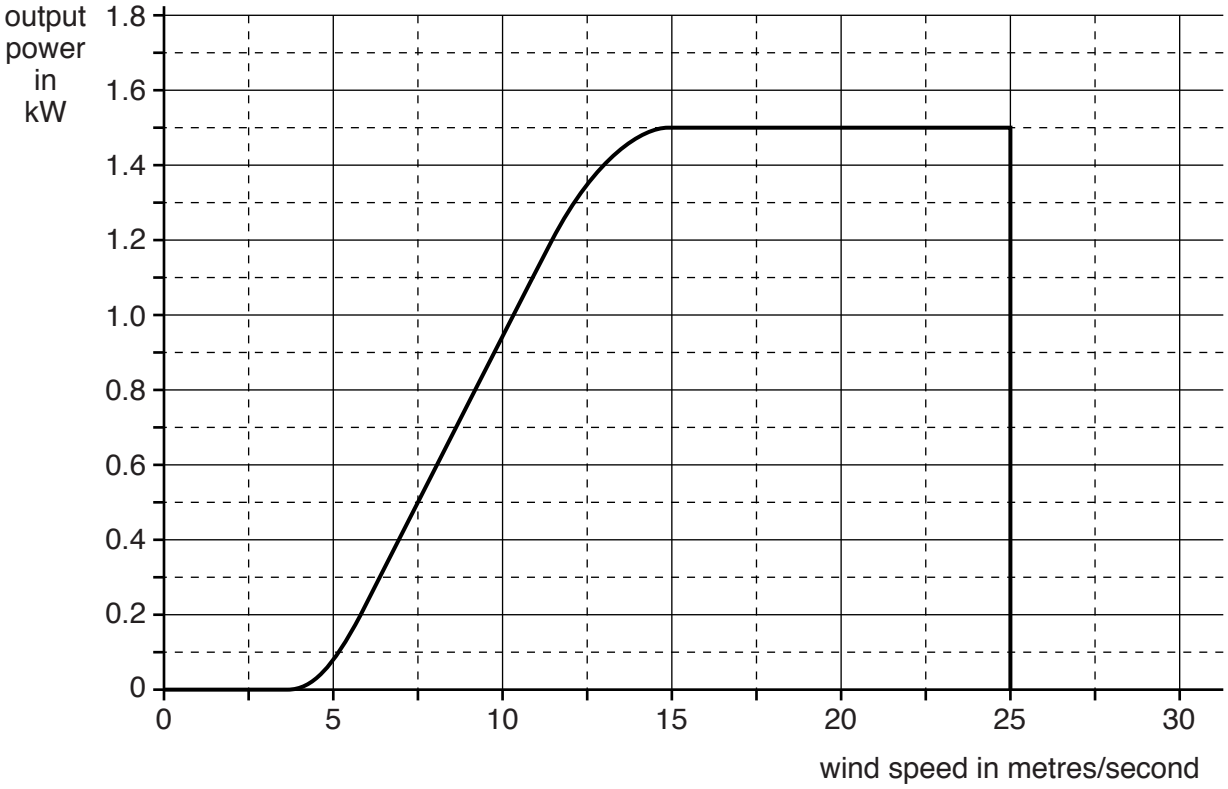
..... **[6]**

[Total: 6]

8 Wind turbines are used in wind farms in the UK to generate electricity.

The graph shows that a wind turbine does not give its maximum power all the time.



(a) (i) What is the **maximum** power output from the wind turbine, measured in kW?

Put a (ring) around the correct value.

1.5 **1.8** **25** **30** **[1]**

(ii) Use information from the graph to find the total electrical energy generated over a day (24h) when the wind speed was constant at 7.5 m/s.
Show your working, and give your answer in kWh.

electrical energy = ... kWh **[2]**

(b) In the UK, the weather is usually windier in the winter than in the summer.
Explain why this is an advantage for a wind farm in the UK.

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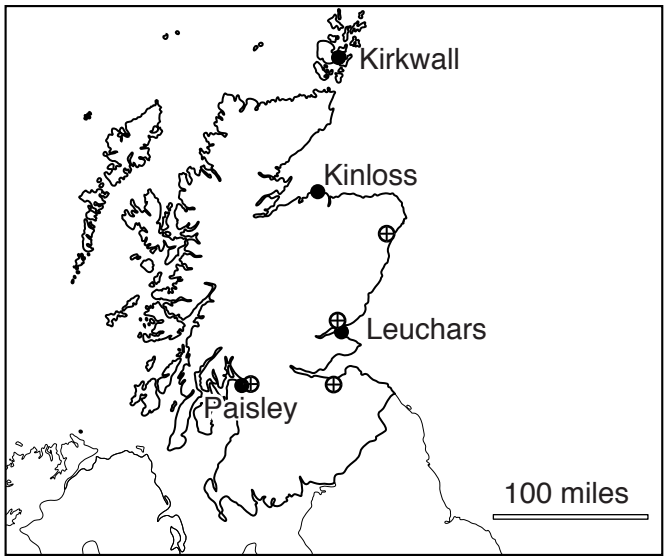
.....

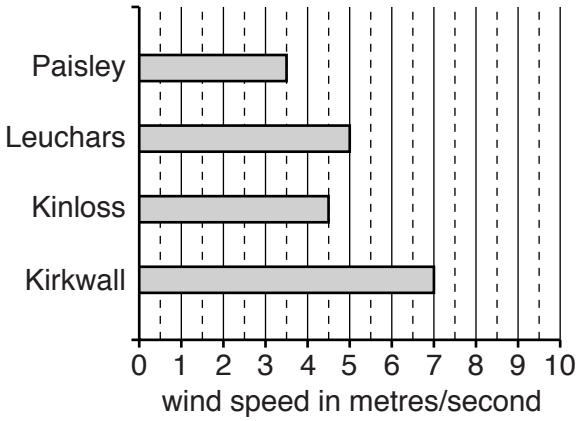
..... **[2]**

(c) In Scotland, part of the UK, some places have stronger winds than others. Four places, Paisley, Leuchars, Kinloss and Kirkwall, have stronger winds. These have been marked (●) on the map of Scotland.

The wind speed for these four places is shown in the bar chart.

Half of all people in Scotland live in the four largest Scottish cities (marked ⊕).





There is a plan to build wind farms to supply electricity for Scotland's major cities.

An ideal location would be one where:

- the wind speed is at least 5 metres/second
- the electricity does not have to be distributed for more than a 100 miles.

Using the information in the bar chart and the map, write '**Yes**' or '**No**' in each box in the table below.

Place	Suitable for wind speed?	Suitable for distribution?
Paisley		
Leuchars		
Kinloss		
Kirkwall		

[4]

[Total: 9]

9 Joe has been checking how much his electrical appliances are costing him to use.

He has kept a record of the power of each one and the time it is on for one day.

(a) Finish Joe's table by calculating the energy for each appliance and then find the total amount of energy he used in a day. Joe has already completed the first row.

Appliance	Power (kW)	Time (hours)	Energy (kWh)
all the lighting	0.6	5	3
oven	2.2	2	
kettle	2.0	0.5	
TV	0.1	10	
		total	

[3]

(b) On another day, all of Joe's electrical appliances transferred a total of 6 kWh.

How much is the total cost if each unit (kWh) costs 15p?

Put a (ring) around the correct value.

6p **15p** **21p** **90p**

[1]

(c) The power ratings of Joe's oven and kettle are much higher than power ratings for his lighting and TV.

What is the reason for this?

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

The oven and kettle are connected to a higher voltage. ☐

The currents through the oven and kettle are greater. ☐

The oven and kettle are connected to the mains supply. ☐

The oven and kettle are more efficient. ☐

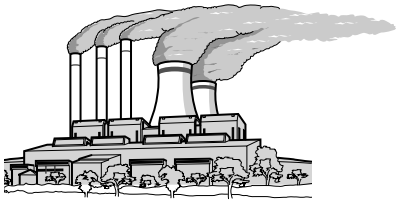
[1]

[Total: 5]

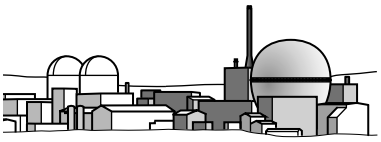
10 In the UK, the energy needed is increasing each year.

Burning gas (a fossil fuel) and using nuclear power have both been suggested as the best way to provide this increased energy.

Each method has advantages and disadvantages.



gas-burning power station



nuclear power station

Discuss the **advantages** and **disadvantages** of these two ways of supplying energy to the UK.

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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