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Thursday 23 May 2013 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE PHYSICS A

A181/01 Modules P1 P2 P3 (Foundation Tier)

A137260613

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

A181101

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 (✎).
- 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 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 The Earth is part of the solar system.

Describe the solar system.

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

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

[Total: 6]

2 Scientists in the early part of the 20th century could see what appeared to be faint clouds of stars through their telescopes. They called these clouds 'nebulae'.

Two scientists had different ideas about the spiral nebula called Andromeda.

Curnow thought the Andromeda nebula was inside the Milky Way galaxy.
Moore thought the Andromeda nebula was outside the Milky Way galaxy.

Curnow and Moore had exactly the same data about the nebula.

(a) (i) They may have disagreed because Curnow was an amateur astronomer and Moore was a professional astronomer.

Suggest **two other** reasons why the scientists arrived at different interpretations of the data.

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

(ii) To decide between the theories, the two scientists each made a prediction based on their theory.

Here are some predictions about the stars in the Andromeda nebula.

A They will all look bluer than stars in the Milky Way galaxy.

B They will be brighter than stars in the Milky Way galaxy.

C They will be closer than some stars in the Milky Way galaxy.

D They will be much further away than all the stars in the Milky Way galaxy.

Which prediction fits Curnow's ideas?

answer **A**, **B**, **C** or **D** .....

Which prediction fits Moore's ideas?

answer **A**, **B**, **C** or **D** .....

[2]

(b) In fact, a new method for measuring the distances to stars provided new evidence showing that the Andromeda nebula was outside the galaxy.

(i) State **two** methods that can be used to find the distance to stars.

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

(ii) How would the new evidence be reported to other **scientists**?

.....

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

[Total: 8]

3 **(a)** Complete the sentences about earthquake waves.

Use the best words from the list.

amplitude **disturbance** **energy** **frequency** **matter** **wavelength**

Earthquake waves are a ..... caused by vibrating rocks in an earthquake.

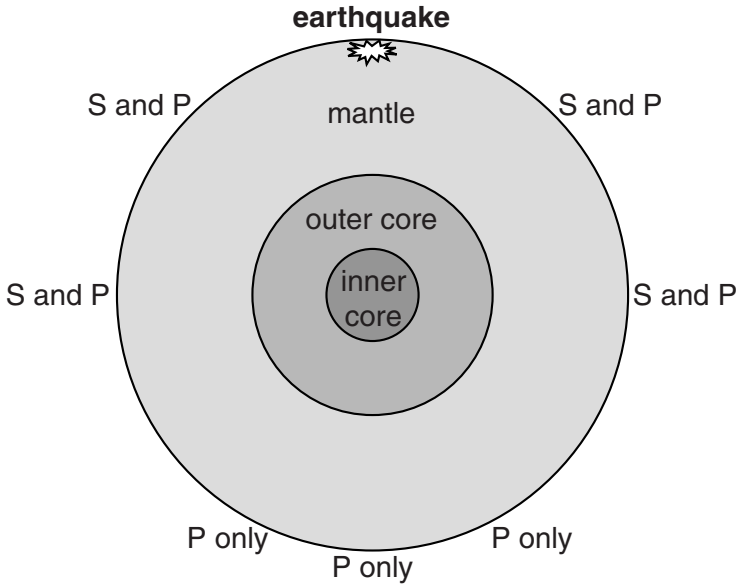
Earthquake waves transfer ..... in the direction the wave travels,

but the earthquake waves do not transfer ..... . **[3]**

(b) Information from earthquake waves can be used to find out about the structure of the Earth.

- **S**-waves can only travel through solids.
- **P**-waves can travel through both solids and liquids.

The diagram shows which waves are detected at different points on the Earth from an earthquake.



This evidence can be used to make conclusions about the structure of the Earth.

Complete the table to show which conclusions can be made from **this evidence**.

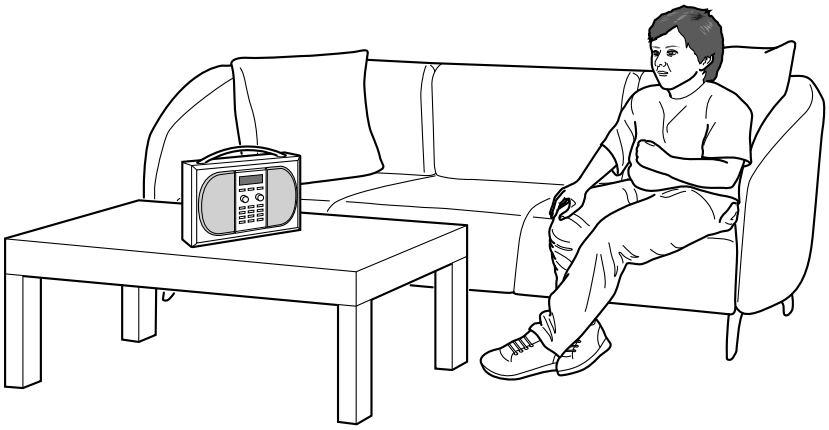
Put one tick (✓) in each row.

	is liquid	**is solid**	**cannot tell**
crust			
mantle			
outer core			
inner core			

[3]

[Total: 6]

4 Rai is listening to a live concert on his digital radio.



The sound waves produced by the band are analogue.

The radio receives a digital signal.

The sound Rai hears is analogue.

Describe what is happening to the signal between the sound being produced by the band and Rai hearing the sound on his radio.

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

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

[Total: 6]

5 Ultraviolet, X-ray and gamma radiation are all used in medicine.

(a) What do high-energy ultraviolet, X-ray and gamma radiation have in common?

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

They are blocked by sun-screens. ☐

They are electromagnetic radiation. ☐

They can remove electrons from atoms. ☐

They have lower frequencies than microwaves. ☐

They are used to carry information in optic fibres. ☐

[2]

(b) **(i)** X-rays are used by doctors to produce pictures of the inside of the human body.

Explain how X-rays are used to produce pictures of the inside of the body and why they are used instead of ultraviolet radiation.

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

(ii) Joel thinks the X-rays are dangerous and might cause cancer.

He asks each of the patients on a cancer ward if they have ever had an X-ray picture taken.

Here are his results.

	male	**female**
had an X-ray	15	7
never had an X-ray	0	1

Joel thinks this shows he is correct.

Is Joel correct? Justify your answer.

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.....

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

[Total: 8]

6 On a clear night, we can see the Moon.

(a) Complete the following sentences to explain how we see the Moon.

Use words from the list.

absorbed **emitted** **reflected** **transmitted**

Light is ..... by the Sun.

When the light reaches the Moon it is ..... towards the Earth.

The light is then ..... by our eyes, so we can see the Moon.

[3]

(b) (i) The visible light from the Moon is a mixture of all the colours of the spectrum.

Which colour will have the most energy for each photon?

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

(ii) How fast is the light travelling?

Put a (ring) around the correct speed.

100 000 km / s **150 000 km / s** **300 000 km / s** **500 000 km / s**

[1]

(c) Some of the light coming from the Moon is ultraviolet light, but we don't get a tan from the moonlight.

Suggest a reason why.

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

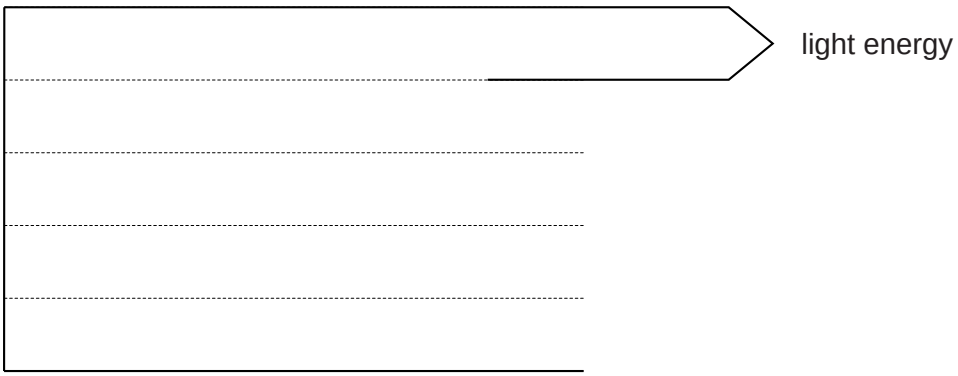
[Total: 6]

7 **(a)** A TV set uses 500 J of electrical energy.

The TV produces 100 J of sound energy and 300 J of heat energy.

It also produces light energy.

(i) Complete and label the Sankey diagram to show the energy transfers in the TV set.



[4]

(ii) How much light energy is produced by the TV set?

light energy = ... J **[1]**

(b) A new television is designed to be more efficient.

It uses 500 J of electrical energy to produce 120 J of light energy and 180 J of sound energy.

Calculate how efficient the new television is.

efficiency = ... % **[3]**

(c) Without turning off the TV, what would be the best way to reduce the amount of energy it uses?

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

(d) The electrical energy used by the TV is produced in power stations.

(i) The electrical energy used by the TV is called a secondary energy source.

Why is it called a **secondary** energy source?

.....

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

(ii) Write down one example of a **primary** energy source.

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

(iii) Which of the following are reasons why electricity is a convenient energy source?

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

It is easily transmitted over distances.	☐
It is easy to store.	☐
There is no risk.	☐
It can be used in many ways.	☐
Many people think electricity pylons are attractive.	☐

[2]

(iv) The electricity company uses kilowatt hours as the unit for energy.

Why don't they use joules?

.....

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

[Total: 14]

8 Margaret runs a small transport company.

She decides to review the possible fuel sources for her delivery trucks.

At present all her vehicles use petrol.

She finds the following table of information on the internet.

Fuel	Energy efficiency	CO_2 equivalent emission units	Cost of fuel per tonne
biogas	22%	20	similar for all three fuels
diesel	35%	750	
petrol	27%	740	

The data are given for equal masses of fuel.

She wants to take into account economic factors, sustainability and environmental impact.

Use the information in the table and your knowledge of energy sources to discuss the three fuel sources and make a recommendation about which one Margaret should use.

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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