

**Friday 20 January 2012 – Morning**

**GCSE TWENTY FIRST CENTURY SCIENCE  
PHYSICS 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



|                       |  |                      |  |
|-----------------------|--|----------------------|--|
| Candidate<br>forename |  | Candidate<br>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

$$\text{distance} = \text{wave speed} \times \text{time}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

#### Sustainable Energy

$$\text{energy transferred} = \text{power} \times \text{time}$$

$$\text{power} = \text{voltage} \times \text{current}$$

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

#### Explaining Motion

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

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

$$\text{momentum} = \text{mass} \times \text{velocity}$$

$$\text{change of momentum} = \text{resultant force} \times \text{time for which it acts}$$

$$\text{work done by a force} = \text{force} \times \text{distance moved in the direction of the force}$$

$$\text{amount of energy transferred} = \text{work done}$$

$$\text{change in gravitational potential energy} = \text{weight} \times \text{vertical height difference}$$

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

#### Electric Circuits

$$\text{power} = \text{voltage} \times \text{current}$$

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

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

#### Radioactive Materials

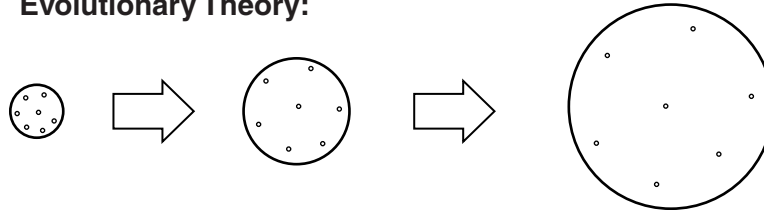
$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

Answer **all** the questions.

- 1 (a) (i) Scientists have found that distant galaxies are moving away from each other.

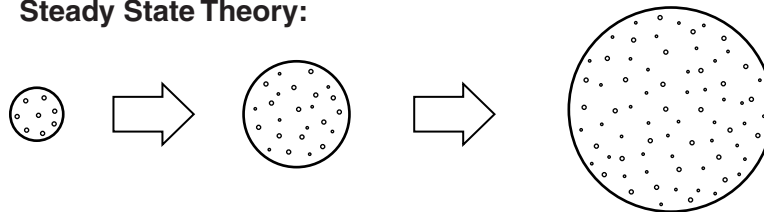
Here are two theories to show what happens as the galaxies move apart.

**Evolutionary Theory:**



The number of galaxies does not change with time.

**Steady State Theory:**



New galaxies form in between older galaxies.

Here are some possible observations.

Put ticks (✓) in the boxes to show which observations support each theory.

| observations                                 | evolutionary theory | steady state theory | both theories |
|----------------------------------------------|---------------------|---------------------|---------------|
| the number of galaxies increases             |                     |                     |               |
| galaxies move away from each other           |                     |                     |               |
| the average space between galaxies increases |                     |                     |               |

[2]

- (ii) The Andromeda galaxy is about 2.5 million light-years away from the Earth. It is made up of 1000 billion stars.

How long does it take light to reach the Earth from the Andromeda galaxy?

..... years

[1]

- (iii) Only very light elements were formed in the big bang.

Where are heavy elements like nitrogen and iron formed?

..... [1]

(b) Write down two ways of measuring the distance to stars.

1. ....

2. .... [2]

(c) Our Sun is a star.

What was the Sun formed from?

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

a collision between planets

☐

an asteroid exploding

☐

a cloud of dust and gas

☐

a collision between stars

☐

[1]

[Total: 7]

- 2 Earthquakes produce waves that can give us information about the structure of the Earth, including the core, crust and mantle.

Describe what earthquake waves tell us about the structure of the Earth. Include a labelled diagram of the structure of the Earth in your answer.



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

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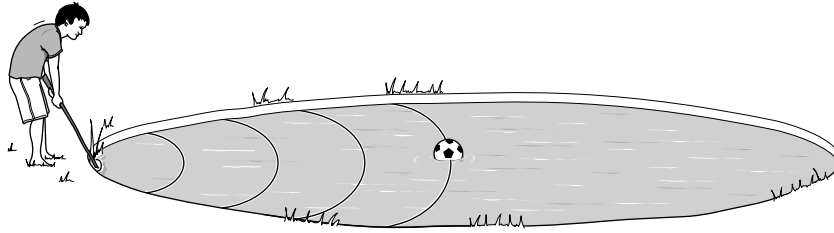
.....

..... [6]

[Total: 6]

- 3** This question is about the properties of waves.

Bobby has kicked his ball into the middle of a pond.



The ball is 10 m from the edge of the pond.

He tries to move the ball by making waves on the water with a stick.

- (a)** Bobby hits the edge of the pond with the stick. He makes 6 complete waves in 12 seconds.

He counts exactly 4 complete waves between his stick and the ball.

The waves are all equal.

- (i)** What is the frequency of Bobby's wave?

Show your working.

frequency = ..... hertz [2]

- (ii)** What is the wavelength of Bobby's wave?

Show your working.

wavelength = ..... m [2]

- (b) (i)** Calculate the speed of the wave.

Show your working.

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

- (ii)** Bobby thinks his ball will be carried by the waves to the shore.

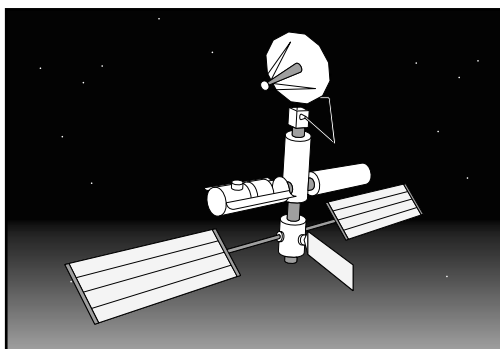
Is Bobby right?

Explain your answer.

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

**[Total: 8]**

#### 4 Space missions to Venus have to communicate back to Earth.



They do this using radio waves or microwaves.

**(a)** What is the advantage of using radio waves or microwaves to communicate with Earth?

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

They can be used for listening to music.

☐

They are not absorbed by the Earth's atmosphere.

☐

They are a health hazard.

☐

They can both be used to carry information.

☐

[2]

**(b)** Information can be transmitted as an analogue signal or a digital signal.

For each statement, decide whether it applies to an **analogue** signal, a **digital** signal or **both**.

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

| statement                                                           | analogue<br>signal | digital<br>signal | both<br>analogue<br>and digital |
|---------------------------------------------------------------------|--------------------|-------------------|---------------------------------|
| The signal carries information coded as a sequence of short pulses. |                    |                   |                                 |
| The signal varies continuously.                                     |                    |                   |                                 |
| The signal is a code made up of <b>1</b> s and <b>0</b> s.          |                    |                   |                                 |
| The signal can be transmitted as an electromagnetic wave.           |                    |                   |                                 |

[4]

[Total: 6]

- 5 Venus has a much higher average surface temperature than the Earth.

Venus has an average surface temperature of approximately 480 °C.

The Earth has an average surface temperature of approximately 15 °C.

- (a) One reason for the temperature difference is the amount of energy that Venus gets from the Sun.

Why does this cause Venus to have a much higher surface temperature than the Earth?

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

Venus gets more energy because it is closer to the Sun than the Earth is.

☐

The Earth gets more energy because we live there and use the energy.

☐

Venus gets more energy from the Sun because it gets hit by more photons.

☐

Venus gets less energy because it is in space, which is very cold.

☐

[2]

- (b) The other reason Venus is so hot is because of its atmosphere.

| gas in atmosphere | Earth            | Venus            |
|-------------------|------------------|------------------|
| nitrogen          | 78%              | 3.5%             |
| oxygen            | 21%              | less than 0.05%  |
| carbon dioxide    | less than 0.05%  | 96%              |
| neon              | less than 0.002% | less than 0.002% |

The greenhouse effect is much greater on Venus than on Earth.

- (i) Which one of the gases in the table is a greenhouse gas?

..... [1]

- (ii) Use the data in the table to suggest why Venus is much hotter than the Earth.

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

- (c) Scientists say that there are no green plants on Venus.

Complete the sentences to explain why the scientists think this.

Use words and data from the table to help.

In the light, plants remove ..... from the atmosphere and produce oxygen.

This process is called .....

It is suggested that there is no oxygen being produced on Venus.

The evidence for this is that the atmosphere contains .....%  
of .....

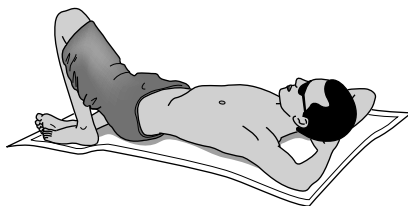
Therefore there are no plants on Venus.

[3]

[Total: 9]

- 6 Ultraviolet radiation can be harmful.

Sunbathing exposes people to ultraviolet radiation.



Why do people sunbathe in spite of the risks?

Your answer should consider the risks and benefits.



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

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..... [6]

**[Total: 6]**

- 7 John buys a new computer in America.

He looks at the power adapter label.

|                  |
|------------------|
| ac adapter       |
| input 120V       |
| output 19V 2.1 A |

- (a) (i) Calculate the power output of the adapter to the computer.

Show your working.

power to computer = ..... watts [3]

- (ii) John needs a desk lamp when working on the computer.

The lamp uses a 60W bulb.

Which device costs more to run?

Explain your answer.

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

- (b) John realises that the input voltage is different from the mains voltage in the UK.

What is the mains supply voltage to homes in the UK?

..... volts [1]

[Total: 5]

8 Jenny draws a block diagram of a power station.

(a) (i) The block diagram shows how a coal-burning power station works.

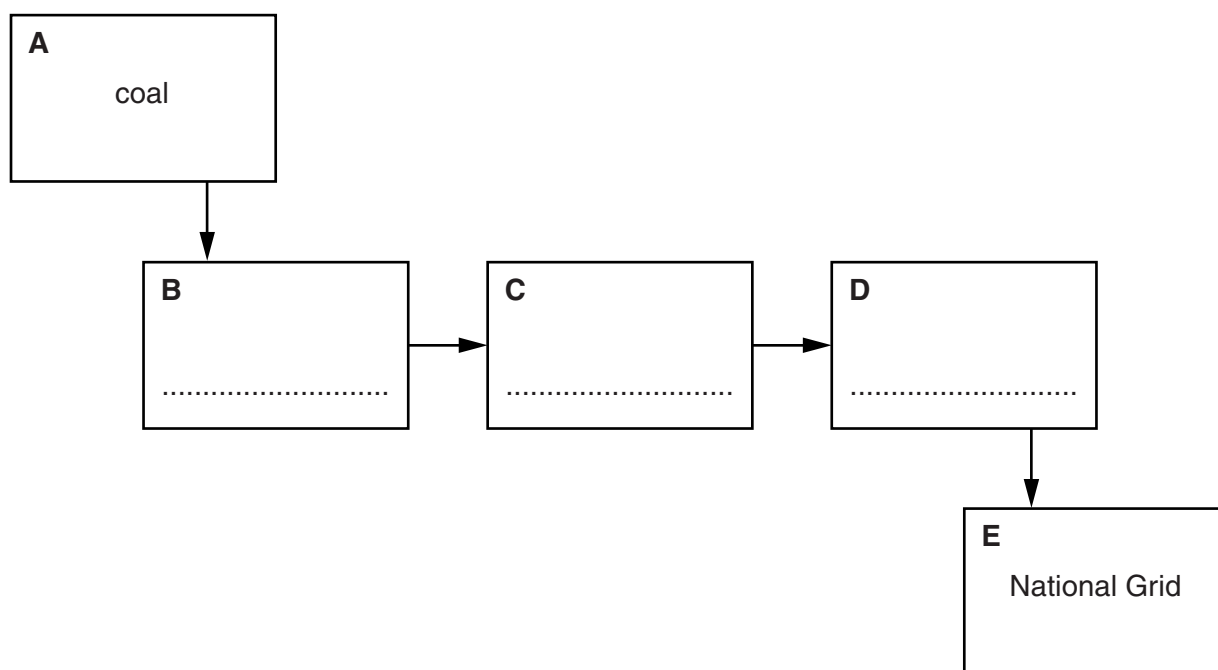
Complete the diagram.

Use the words from this list.

**furnace**

**generator**

**turbine**



[2]

(ii) Jenny has missed out a block.

A boiler is needed to turn water into steam.

Between which two blocks should the boiler be on the diagram?

Put a ring around your answer.

**A-B**

**B-C**

**C-D**

**D-E**

[1]

(iii) Some power stations do not have a boiler.

Name an energy source for a power station that does not have a boiler.

..... [1]

(b) The table gives some information about three different types of power station.

| type of power station | efficiency | cost per kWh in pence | environmental factors               |
|-----------------------|------------|-----------------------|-------------------------------------|
| wind                  | 34%        | 4 to 5.5              | may damage local wildlife, eg birds |
| nuclear               | 35%        | 2 to 2.5              | produces radioactive waste          |
| gas                   | 38%        | 2 to 3                | produces carbon dioxide             |

Which type of power station would you recommend building?

Use information from the table to decide.

Explain your choice.

.....

.....

.....

.....

..... [3]

[Total: 7]

- 9 The Government want to build a hydroelectric power station to replace 2 coal-burning power stations. The hydroelectric power station will need a dam to be built. This will flood a large area of farmland above the dam.

Suggest one group of people who will be in favour of building the power station and dam, and one group of people who will be against it.

Explain how each group will be affected and what arguments they may make in favour of or against the building of the power station and dam.



*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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