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Centre number						Candidate number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE**

A181/01

**TWENTY FIRST CENTURY SCIENCE
PHYSICS A**

Modules P1 P2 P3 (Foundation Tier)

FRIDAY 20 JANUARY 2012: Morning

DURATION: 1 hour

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

**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)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes on the first page. 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).

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil ()
- A list of physics equations is printed on pages 4 and 5.
- 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.

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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

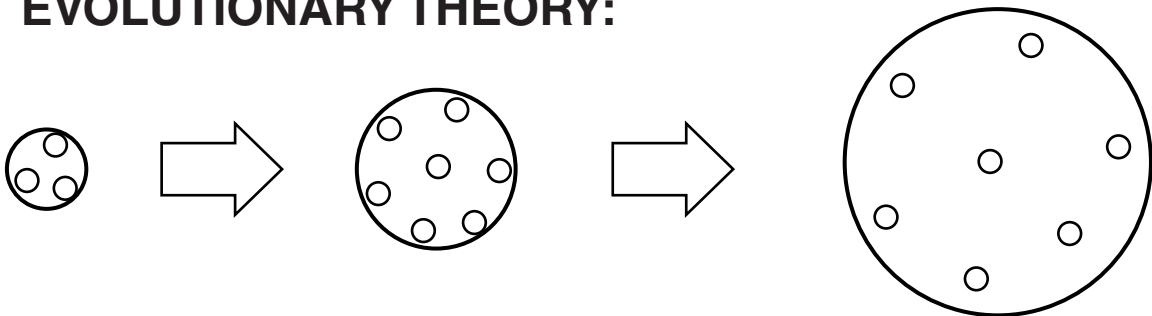
$$\text{energy} = \text{mass} \times [\text{speed of light in a vacuum}]^2$$

Answer ALL the questions.

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

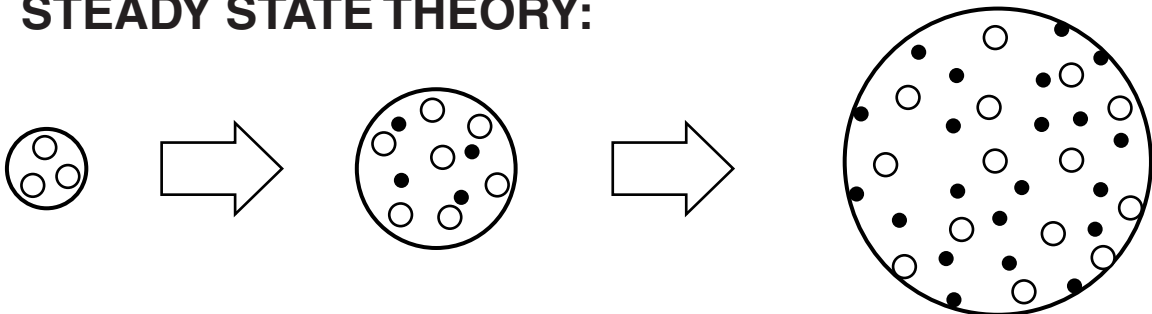
Here are two theories to show what happens as the galaxies move apart.

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]

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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.



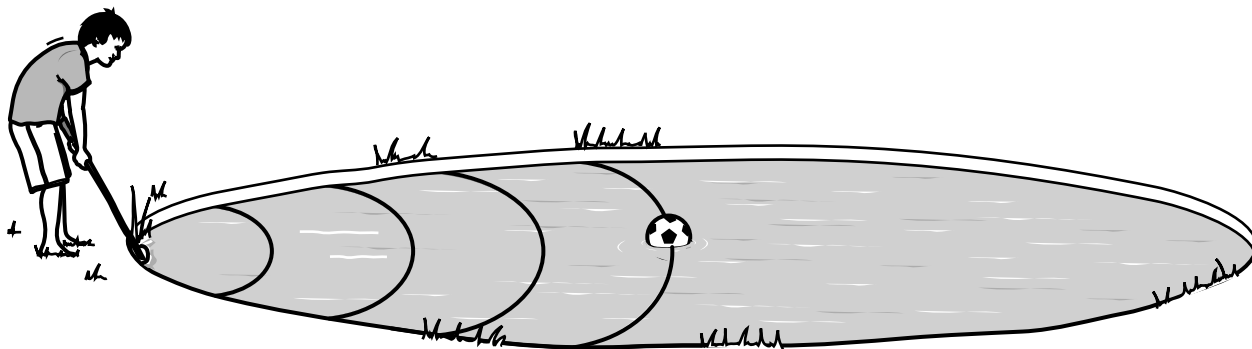
The quality of written communication will be assessed in your answer.

[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.

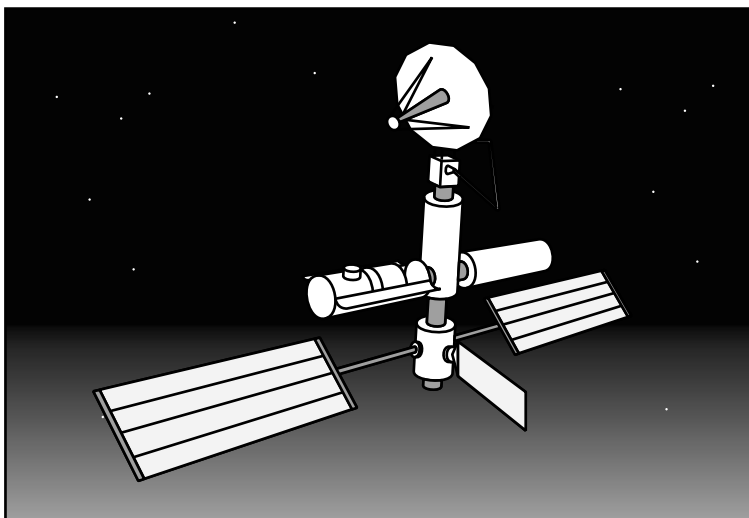
Is Bobby right?

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 SIGNAL	DIGITAL SIGNAL	BOTH ANALOGUE 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 1s and 0s.			
The signal can be transmitted as an electromagnetic wave.			

[4]

[Total: 6]

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- 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 _____

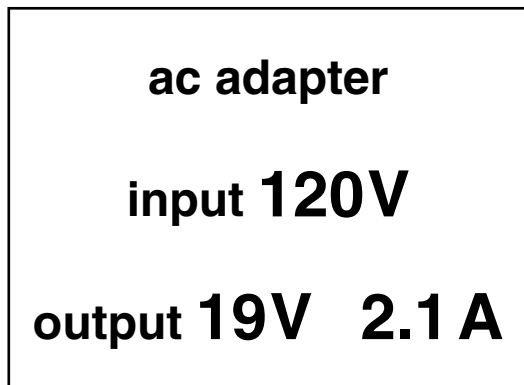
of _____ .

Therefore there are no plants on Venus. [3]

[Total: 9]

7 John buys a new computer in America.

He looks at the power adapter label.



(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]

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8 Jenny draws a block diagram of a power station.

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

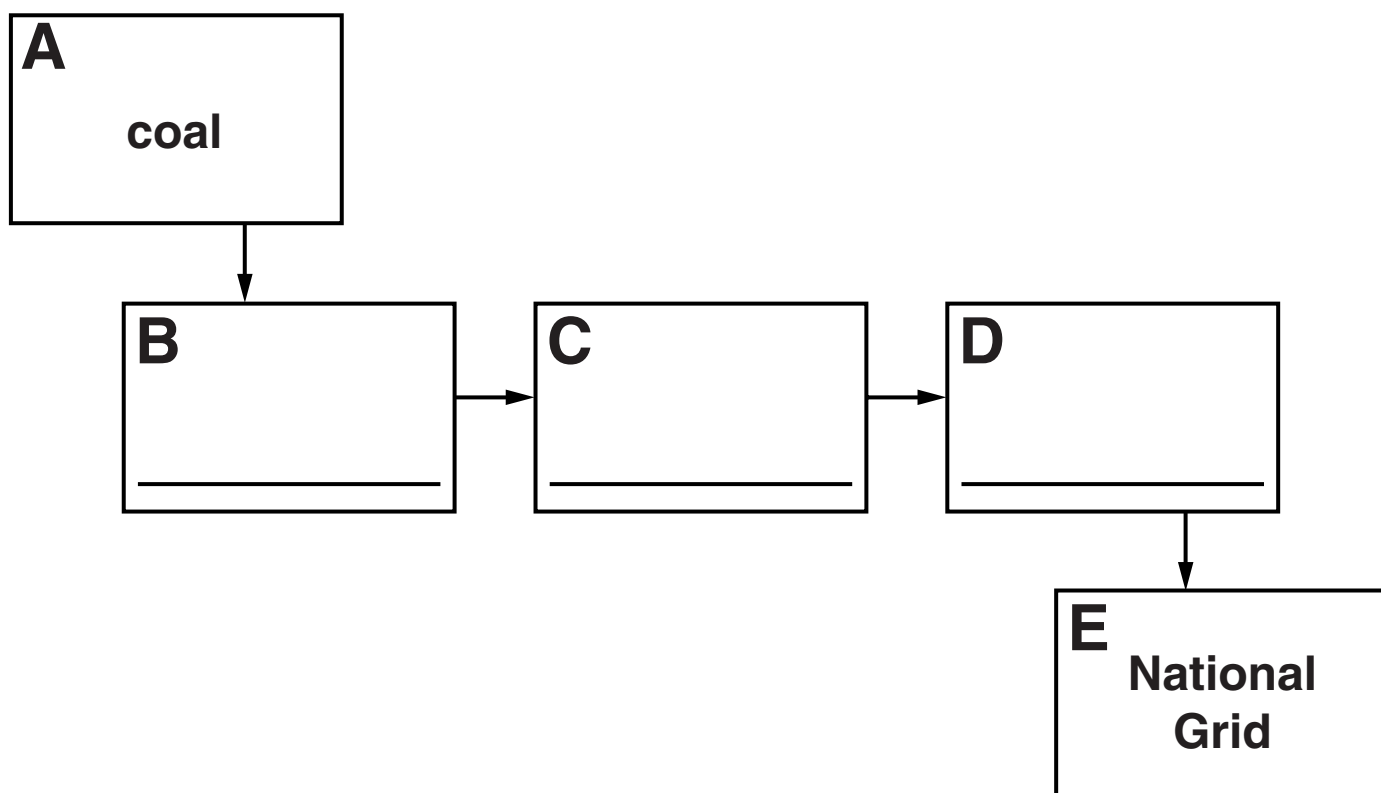
Complete the diagram.

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? [1]

Put a ring around your answer.

A-B

B-C

C-D

D-E

(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]

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