OCR
RECOGNISING ACHIEVEMENT

SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE **A181/01**

PHYSICS A

Unit A181: 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 Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- A list of useful relationships is printed on page **2**.
- The number of marks for each question is given in brackets **[ ]** at the end of the question or part question.
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

For Examiner's Use		
	Max	**Mark**
1	**6**	
2	**4**	
3	**6**	
4	**4**	
5	**5**	
6	**3**	
7	**2**	
8	**6**	
9	**4**	
10	**4**	
11	**6**	
12	**5**	
13	**5**	
TOTAL	**60**	

TWENTY FIRST CENTURY SCIENCE DATA SHEET

Useful Relationships

The Earth in the Universe

distance = wave speed x time

wave speed = frequency x wavelength

Sustainable Energy

energy transferred = power x time

power = voltage x 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 x velocity

change of momentum = resultant force x time for which it acts

work done by a force = force x distance moved in the direction of the force

amount of energy transferred = work done

change in gravitational potential energy = weight x vertical height difference

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

Electric Circuits

power = voltage x current

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

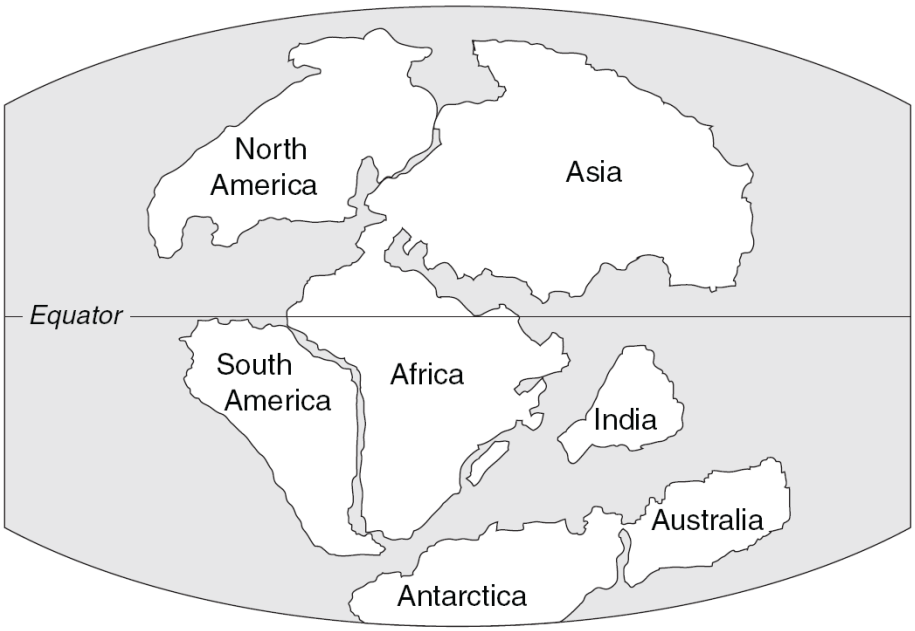
$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

Radioactive Materials

energy = mass x [speed of light in a vacuum]^2

Answer **all** the questions.

1 Wegener proposed his theory of continental drift in 1912.



Wegener's theory was not accepted by geologists when he first suggested it.

Wegener's theory became accepted in the 1960s.

Explain why Wegener thought the continents had moved, why geologists rejected his ideas, and how the theory became accepted.

✎ *The quality of written communication will be assessed in your answer to this question.*

.....

.....

.....

.....

.....

.....

.....

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

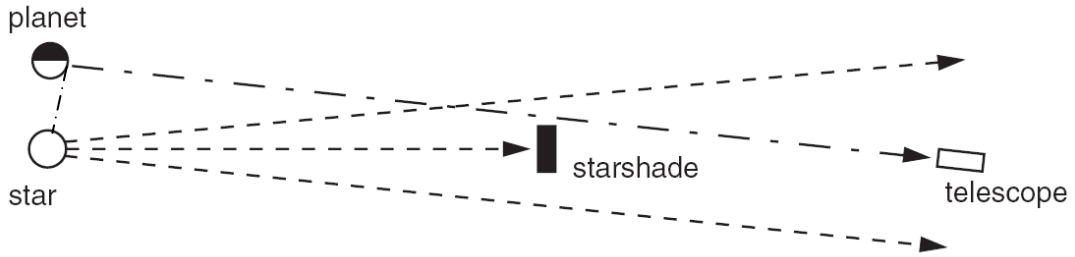
[Total: 6]

2 Read the article.

'Starshade' could help us see planets around other stars

The giant 'starshade' would be launched into space together with a space telescope, and would orbit the Earth at a distance of around 1 million kilometres. The 'starshade' and the telescope would be around 15 000 kilometres apart from each other.

Small thruster rockets, fired by remote control from Earth, would allow scientists to move the 'starshade' in front of a star they wanted the telescope to look at. The 'starshade' will allow light reflected from planets orbiting the star to be seen.



(a) Read the following statements.

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

The ‘starshade’ will block out the light from the star.	☐
The ‘starshade’ will reflect light to the telescope.	☐
The ‘starshade’ will be fixed to a space telescope.	☐
The ‘starshade’ and space telescope will be launched separately.	☐
The space telescope will be able to detect light from distant planets.	☐

[2]

(b) Most telescopes are on the Earth's surface.

This telescope and 'starshade' will be put into orbit a long way from the Earth.

Which of these statements are correct reasons for doing this?

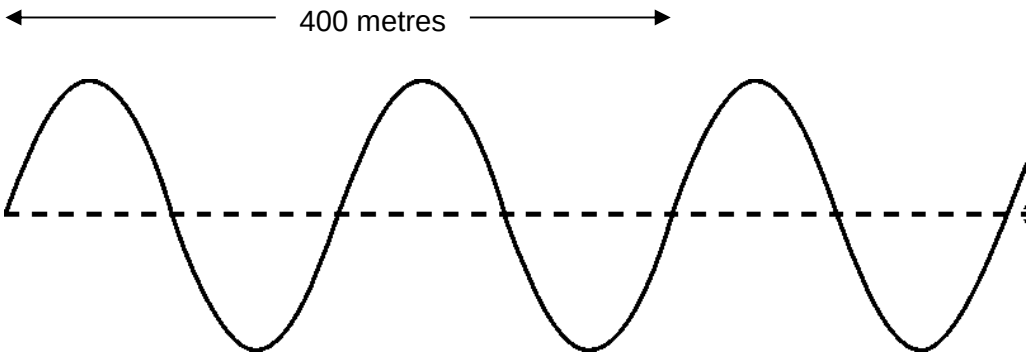
Put ticks (✓) in the boxes next to the **two** correct statements.

Light pollution from Earth will not affect the telescope if it is in space.	☐
It is too expensive to put the telescope and the 'starshade' on Earth.	☐
The telescope and 'starshade' would take up too much room on the Earth's surface.	☐
The Earth's atmosphere will not reduce the quality of the image if the telescope is in space.	☐

[2]

[Total: 4]

3 The diagram shows a seismic wave.



(a) Calculate the wavelength of this wave.

wavelength = ... m **[1]**

(b) Another wave has a wavelength of 500 metres.

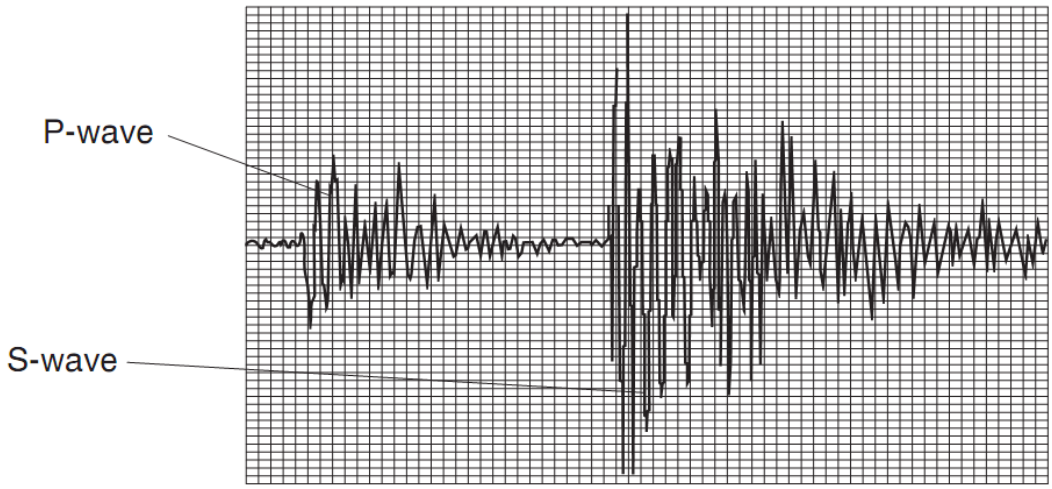
This wave has a frequency of 4 hertz.

Calculate the speed of this wave.

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

(c) The diagram shows a recording from an earthquake detector.

It has detected a P-wave and an S-wave from an earthquake.



What conclusion can you draw from the diagram about the damage caused by S-waves compared to the damage caused by P-waves?

Explain how you reach your conclusion.

Use the correct scientific terms in comparing the waves.

.....

.....

.....

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

[Total: 6]

4 The Solar System consists of many different objects.

The Earth, the Moon, the Sun and asteroids are some of these objects.

The table shows the diameters of four objects in the Solar System.

object	diameter in km	type of object
A	756	
B	12 742	
C	1 392 000	
D	3474	

(a) Complete the table to identify what each object is **most likely** to be from the data provided.

Choose from this list.

an asteroid **the Earth** **the Moon** **the Sun**

[2]

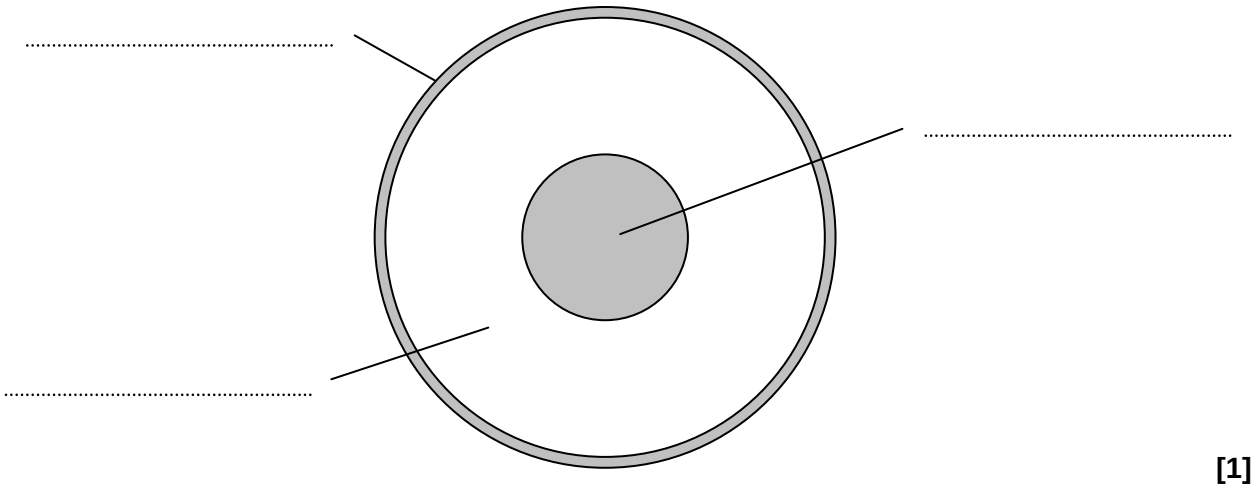
(b) Suggest why it is **not** possible to be certain of the identity of all of these objects from the data provided.

.....

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

(c) The diagram shows a section through the Earth.

Complete the labels on the diagram.



[1]

[Total: 4]

5 This question is about carbon dioxide in the atmosphere.

The table shows how the concentration of carbon dioxide in the atmosphere has changed in the past 100 000 years.

years before present	100 000	80 000	60 000	40 000	20 000
carbon dioxide concentration in parts per million	240	190	213	210	222

(a) Which of the following is the mean (average) value of the concentration?

Put a (ring) around the correct value.

190 **209** **215** **240**

[1]

(b) Scientists say that the concentration of carbon dioxide in the atmosphere has been approximately constant for hundreds of thousands of years.

Use the data in the table to explain why the scientists say this.

.....

.....

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

(c) In the present time, the concentration of carbon dioxide in the atmosphere is 360 parts per million.

Explain why this evidence convinces some scientists that the level of carbon dioxide in the atmosphere has risen significantly in recent times.

.....

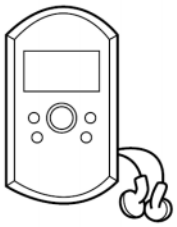
.....

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

[Total: 5]

6 Radio programmes in the United Kingdom are now broadcast as both analogue and digital signals.

Analogue radio



Digital radio

For each statement decide whether it applies to **analogue** signals, **digital** signals or **both**.

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

	analogue signals	**digital signals**	**both analogue and digital**
the signal is a code made up of two digits, 1s and 0s			
the signal is transmitted as an electromagnetic wave			
the signal varies continuously			

[3]

[Total: 3]

7 Adam knows that the energy of photons of light increases from the red end of the spectrum to the blue end.

Adam predicts that there will be more energy in a beam of blue light than a beam of red light.

He tests his prediction with a simple experiment. Here are his results.

	energy detected in beam in microjoules per second
red beam	100
blue beam	75

Write down what you would conclude from these data, and suggest an explanation for the data.

.....

.....

.....

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

[Total: 2]

8 This question is about global warming and ozone.

Many people get confused between ‘the greenhouse effect’ and ‘holes in the ozone layer’.

Name the gases involved in each case, and explain what these gases are doing to electromagnetic radiation.

✎ *The quality of written communication will be assessed in your answer to this question.*

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

[Total: 6]

9 The properties of microwaves mean that they are used for many purposes.

(a) Which of the following statements about microwaves are true?

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

Microwaves can be used to heat food by causing particles to vibrate.	
Microwaves are ionising radiation.	
The screen on a microwave oven lets light through but blocks microwaves.	
Mobile phones produce microwaves.	
Microwaves are blocked by the ozone layer.	
The higher the intensity of microwaves in a microwave oven, the less the food is heated.	

[3]

(b) Microwave photons transfer less energy than light photons.

However, microwaves can be used to cook many foods but light cannot.

Explain why.

.....

.....

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

[Total: 4]

10 Mary and John are doing an experiment to measure the power in a wire.

They measure the electrical current through a wire at different voltages.

voltage in V	0	1	3	4	5
current in A	0.0	1.6	4.8	6.4	8.0

(a) Calculate the power when the current is 4.8 amps.

power = ... W **[2]**

(b) Mary notices that the wire gets very hot when the power is 40 W.

She says 'We have only had this on for 30 seconds! I wonder how much energy we have transferred?'

Calculate the energy transferred.

energy = ... J **[2]**

[Total: 4]

11 One way of supplying electricity to the country is with nuclear power stations.

Many people are very concerned about the risk to the public from the waste produced in these power stations.

Explain what the danger might be from this waste, and suggest how the Government could make sure that the use of nuclear power is as safe as possible.

✎ *The quality of written communication will be assessed in your answer to this question.*

.....

.....

.....

.....

.....

.....

.....

.....

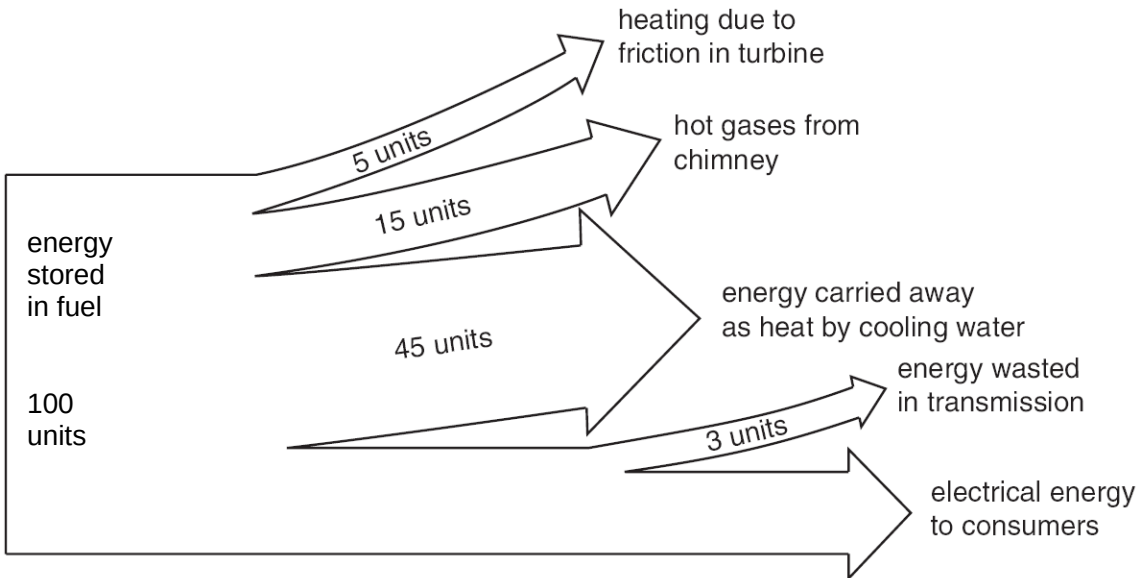
.....

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

[Total: 6]

12 Generating and distributing electricity is not 100 % efficient.

Look at this diagram for electricity generation by a fossil fuel power station.



(a) How many units of electricity go to4 the consumers?

Put a (ring) around the correct answer.

3 **32** **35** **68** **100**

[1]

(b) What is the efficiency of the power station?

Put a (ring) around the correct answer.

3 % **35 %** **45 %** **54 %** **65 %**

[1]

(c) Some fossil fuel power stations provide hot water to heat houses in nearby towns.

Discuss how this would affect the efficiency of a fossil fuel power station.

.....

.....

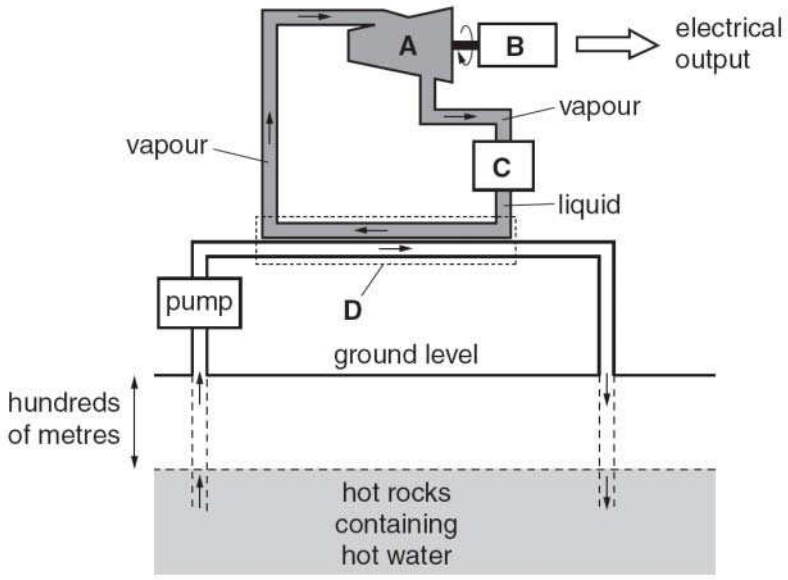
.....

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

[Total: 5]

13 (a) The diagram shows one type of geothermal power station.

The power station gets its energy from hot rocks deep underground.



The four parts labelled **A**, **B**, **C** and **D** in the diagram are a condenser, a generator, a heat exchanger and a turbine.

Draw a line to join each part of the power station to the correct description of what happens there.

One part has been done for you.

part	description
A	Hot water from underground is pumped through the **heat exchanger** which boils a liquid into vapour. The cooled water then goes back underground
B	The vapour goes back into the **turbine**.
C	A **generator** is turned to make electricity.
D	A **condenser** turns the vapour back into a liquid ready to be used again.

[2]

(b) The Government is planning to build a new power station.

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

type of power station	efficiency	cost of generating electricity per kWh in pence	environmental factors
coal	38%	2 to 3	produces carbon dioxide
nuclear	34%	2 to 2.5	produces radioactive waste
wind	35%	4 to 5.5	can damage local wildlife (eg birds)

Which type of power station would you recommend building?

Justify your choice, using **only** information from the table.

.....

.....

.....

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

[Total: 5]

[Paper Total: 60]

END OF QUESTION PAPER

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE