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

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

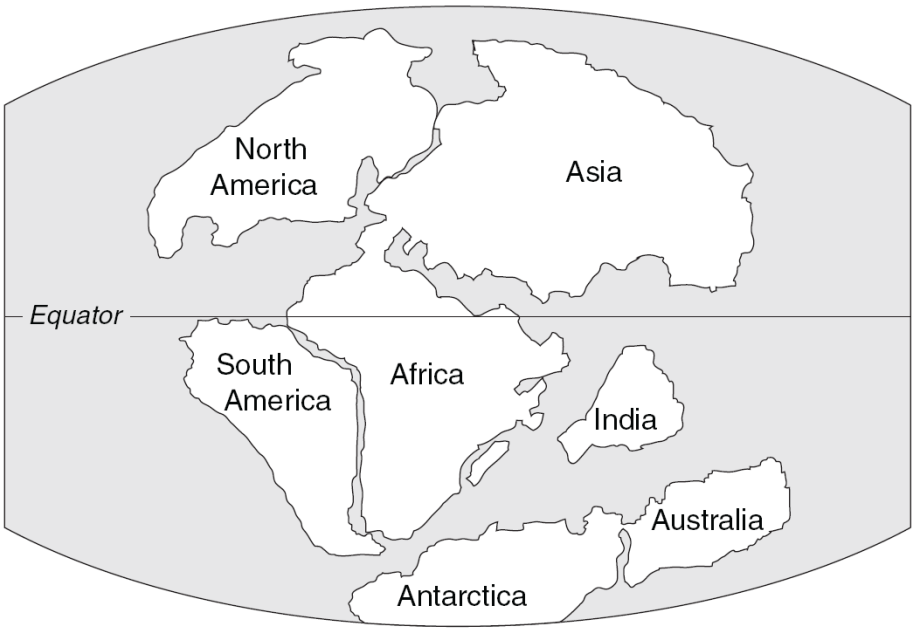
$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}$$

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.*

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

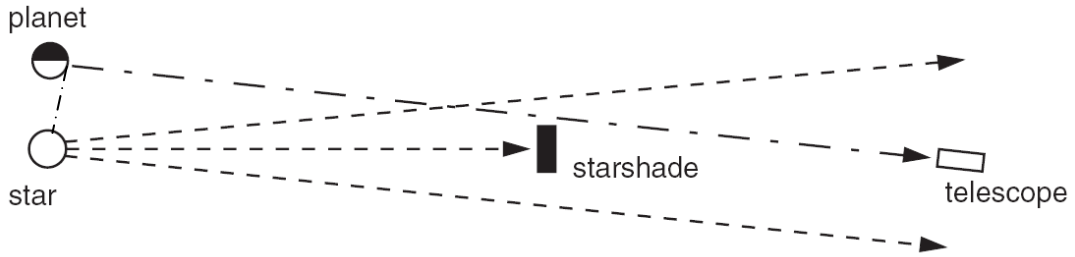
[Total: 6]

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?

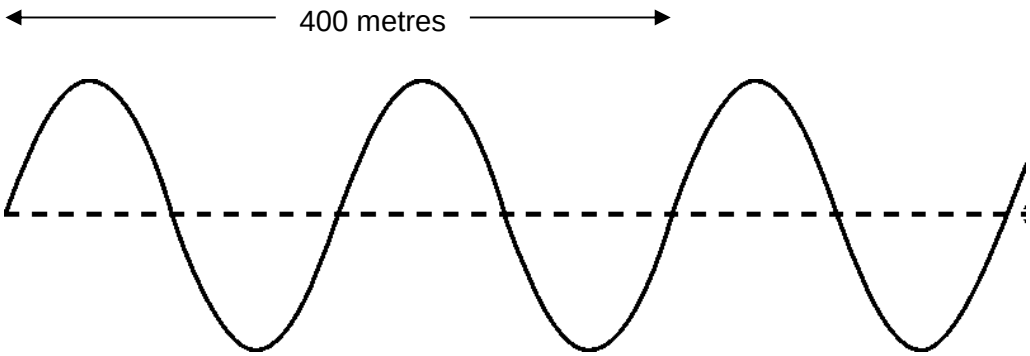
Put ticks (✓) in the boxes next to the **two** correct statements.

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.

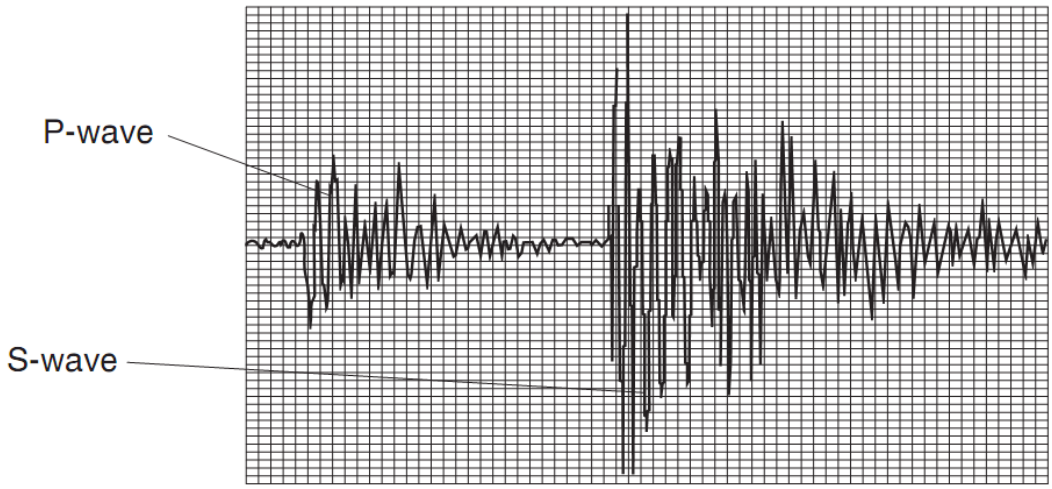
This wave has a frequency of 4 hertz.

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.

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.....

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..... **[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]

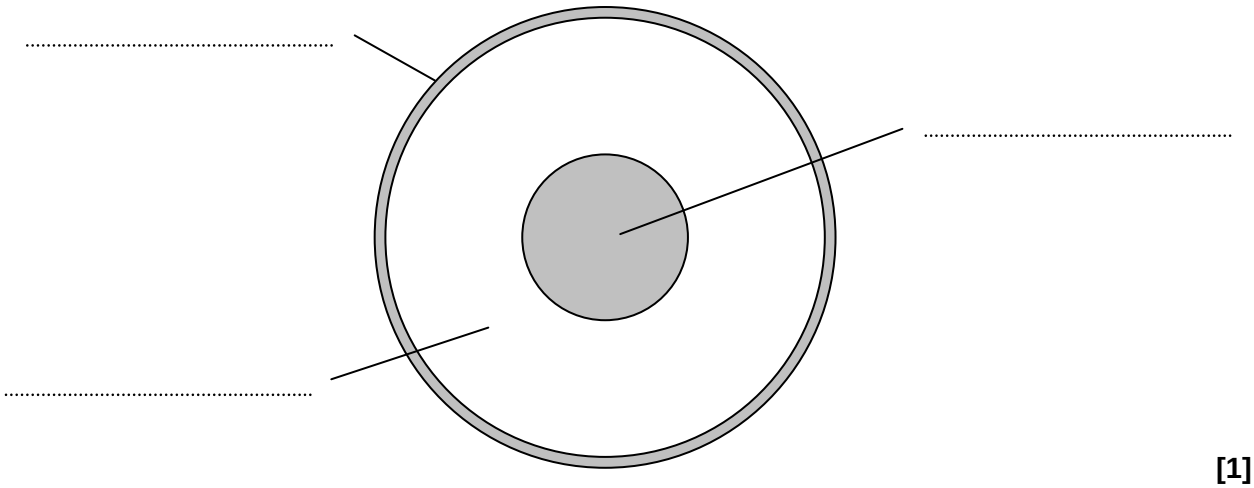
(b) Suggest why it is **not** possible to be certain of the identity of all of these objects from the data provided.

.....

..... **[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.

.....

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..... **[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.

.....

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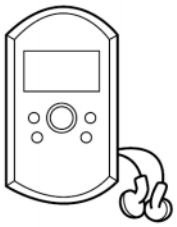
..... **[2]**

[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.

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..... **[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.*

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.....**[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.

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.....

.....**[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.*

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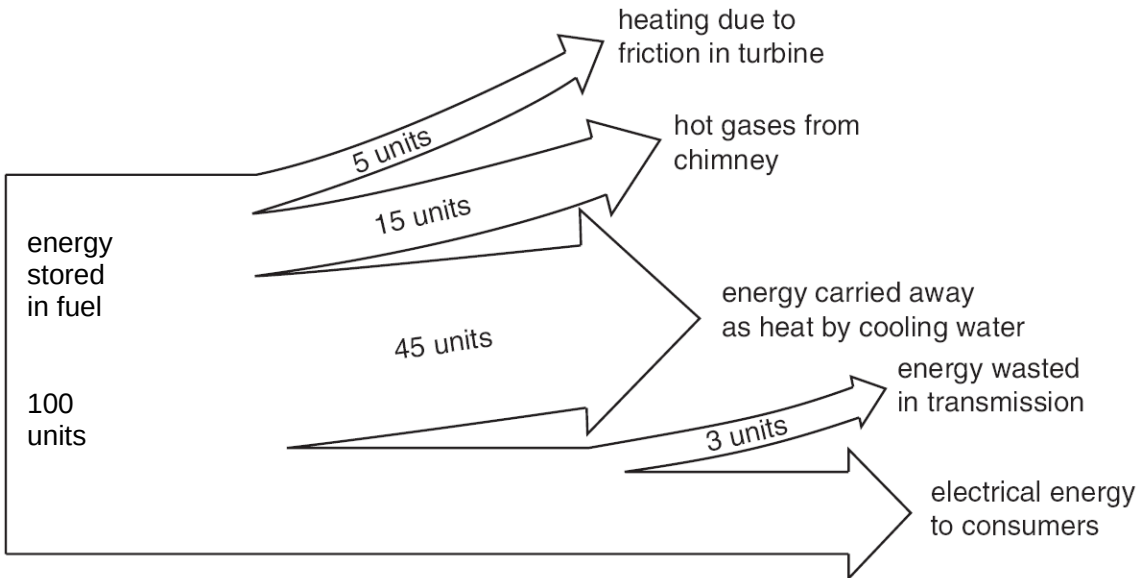
..... **[6]**

[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.

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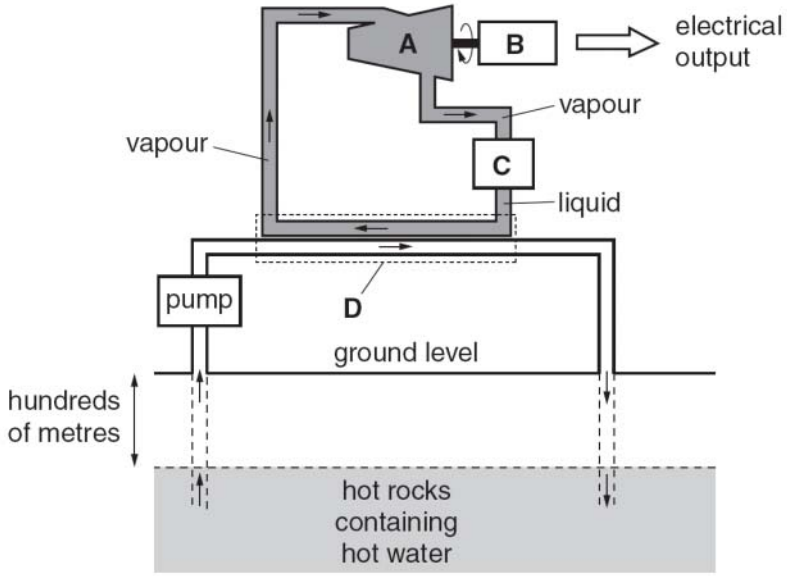
..... **[3]**

[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.

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

[Total: 5]

[Paper Total: 60]

END OF QUESTION PAPER

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RECOGNISING ACHIEVEMENT

SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

PHYSICS A **A181/01**

Unit A181: Modules P1, P2, P3 (Foundation Tier)

MARK SCHEME

Duration: 1 hour

MAXIMUM MARK 60

This document consists of 16 pages

Guidance for Examiners

Additional guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, eg mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

/	=	alternative and acceptable answers for the same marking point
(1)	=	separates marking points
not/reject	=	answers which are not worthy of credit
ignore	=	statements which are irrelevant - applies to neutral answers
allow/accept	=	answers that can be accepted
(words)	=	words which are not essential to gain credit
words	=	underlined words must be present in answer to score a mark
ecf	=	error carried forward
AW/owtte	=	alternative wording
ORA	=	or reverse argument

Eg mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)
work done = 0 marks
work done lifting = 1 mark
change in potential energy = 0 marks
gravitational potential energy = 1 mark

5. Annotations:
The following annotations are available on SCORIS.

✓	=	correct response
✖	=	incorrect response
bod	=	benefit of the doubt
nbod	=	benefit of the doubt **not** given
ECF	=	error carried forward
^	=	information omitted
I	=	ignore
R	=	reject

6. If a candidate alters his/her response, examiners should accept the alteration.

7. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

   Eg
   For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.
☐	☐	✓
☐	☐	✓
✓	✓	✓
✓	✓	✓
☐	☐	☐
This would be worth 0 marks.	This would be worth one mark.	This would be worth one mark.

8. The list principle:
   If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, eg one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

9. Marking method for tick boxes:

   Always check the additional guidance.

   If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
   If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, eg shading or crosses.
   Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

   Eg If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

   the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

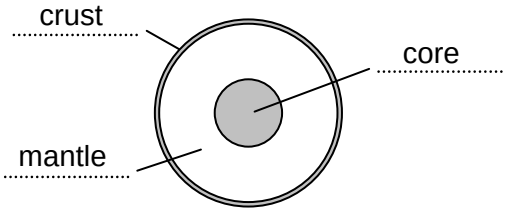
10. Three questions in this paper are marked using a Level of Response (LoR) mark scheme with embedded assessment of the Quality of Written Communication (QWC). When marking with a Level of Response mark scheme:

- Read the question in the question paper, and then the list of relevant points in the 'Additional guidance' column of the mark scheme, to familiarise yourself with the expected science. The relevant points are not to be taken as marking points, but as a summary of the relevant science from the specification.
- Read the level descriptors in the 'Expected answers' column of the mark scheme, starting with Level 3 and working down, to familiarise yourself with the expected levels of response.
- *For a general correlation between quality of science and QWC*: determine the level based upon which level descriptor best describes the answer; you may award either the higher or lower mark within the level depending on the quality of the science and/or the QWC.
- *For high-level science but very poor QWC*: the candidate will be limited to Level 2 by the bad QWC no matter how good the science is; if the QWC is so bad that it prevents communication of the science the candidate cannot score above Level 1.
- *For very poor or totally irrelevant science but perfect QWC*: credit cannot be awarded for QWC alone, no matter how perfect it is; if the science is very poor the candidate will be limited to Level 1; if there is insufficient or no relevant science the answer will be Level 0.

Question			Expected answers	Marks	Additional guidance
1	✎		**[Level 3]** Includes most relevant points in each category in the answer. Explains Wegener's ideas, objections to his theory, and acceptance following further evidence in terms of a causal mechanism. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** Outlines Wegener's ideas with some evidence, and makes reasonable suggestions why his contemporaries did not accept it. The idea of a mechanism for continental drift likely to be absent. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Outlines Wegener's ideas with little supporting evidence. Objections by contemporaries likely to be personal rather than scientific. 1960s evidence likely to be missing. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** Wegener's evidence: • continents 'fit together' • similar rock layers in different continents • similar fossils in different continents His contemporaries' objections: • Wegener was an outsider/not a geologist • no continental movement detectable • existing theories (land bridges) explained fossils • no mechanism proposed for movement For subsequent acceptance: • idea that a plausible mechanism is reasonable grounds for accepting the theory • sea-floor spreading provided a mechanism • movements in mantle as underlying cause **accept** description of magnetic stripes on seabed as evidence for seafloor spreading **ignore** references to mountain chains, unless specifically to chains on the West coast of North and South America **reject** objections to Wegener based on personality
			Total	**[6]**	

Question			Expected answers	Marks	Additional guidance
2	(a)		‘starshade’ will block out light… ✓ ☐ ☐ ☐ space telescope will be able to detect… ✓	[2]	2 marks for correct pattern 1 mark for just one mistake 0 marks for more than one mistake (mistake = tick in incorrect box, missing tick or extra tick)
	(b)		Light pollution will not affect … ✓ ☐ ☐ Earth’s atmosphere will not … ✓	[2]	2 marks for correct pattern 1 mark for just one mistake 0 marks for more than one mistake (mistake = tick in incorrect box, missing tick or extra tick)
			Total	[4]	

Question			Expected answers	Marks	Additional guidance
3	(a)		200 m	[1]	
	(b)		speed = 4 Hz × 500 m = 2000 metres/second	[2]	correct answer (if units are clearly shown) with no working gets 2 marks **accept** 2km/s
	(c)		S-waves cause more damage (than P-waves) because the graph shows that S-waves are 'larger' / have greater amplitude (than P-waves) therefore they have more energy (than P-waves)	[3]	throughout, **credit** reverse argument for P-waves
			Total	[6]	

Question			Expected answers	Marks	Additional guidance
4	(a)		A – asteroid B – Earth C – Sun D – Moon	[2]	all correct = 2 marks 2 or 3 correct = 1 mark 1 or 0 correct = 0 marks
	(b)		asteroids vary in size / asteroids overlap in size with other objects / there are other objects in the Solar System in this range of sizes	[1]	
	(c)			[1]	
			Total	[4]	

<table>
<tr><th colspan="3">Question</th><th>Expected answers</th><th>Marks</th><th>Additional guidance</th></tr>
<tr><td>5</td><td>(a)</td><td></td><td>215</td><td>[1]</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>the mean/average has not changed much
and there is no trend of increase or decrease</td><td>[2]</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>360ppm/present concentration is far above the <u>range</u> of the data in the table
in addition, the change in concentration in the last 20 000 years is much larger than the changes seen in the previous 20 000-year intervals</td><td>[2]</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[5]</td><td></td></tr>
<tr><td>6</td><td></td><td></td><td><table><tr><th></th><th>analogue</th><th>digital</th><th>both</th></tr><tr><td>0s & 1s</td><td></td><td>✓</td><td></td></tr><tr><td>em wave</td><td></td><td></td><td>✓</td></tr><tr><td>continuous</td><td>✓</td><td></td><td></td></tr></table></td><td>[3]</td><td>one mark per correct row
reject any row with two or three ticks</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[3]</td><td></td></tr>
<tr><td>7</td><td></td><td></td><td>prediction is wrong/not supported because blue beam has less energy than red beam / ora

red beam may have more photons (than blue beam) / red beam may have had different area (than blue beam) / detector used to measure red beam may have had different area</td><td>[2]</td><td>ignore statements attributing data to measurement error</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[2]</td><td></td></tr>
</table>

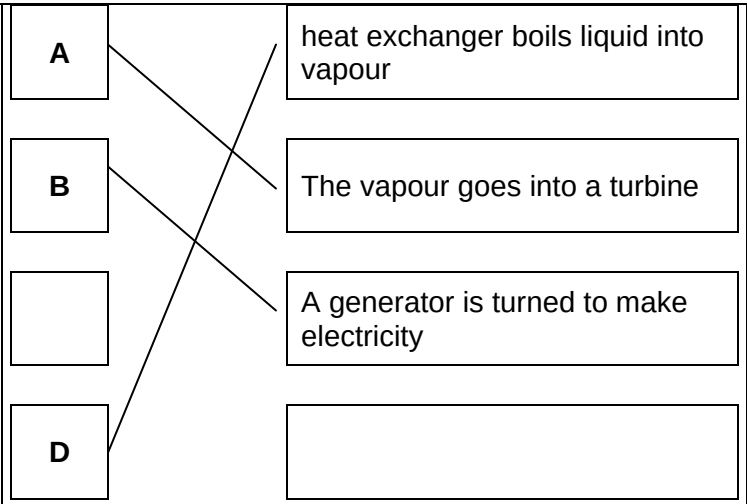
Question			Expected answers	Marks	Additional guidance
8	✎		**[Level 3]** Includes most relevant points in the answer. Correctly differentiates between the greenhouse effect and the hole in the ozone layer. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** Will recognise the two gases and the two distinct effects but may confuse the gases responsible. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Will either know that carbon dioxide is one of the gases, or recognise that ozone is a gas, but not both. May recognize that one blocks infrared or ultraviolet, but not know which. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** *Greenhouse effect* • carbon dioxide is a greenhouse gas • carbon dioxide absorbs/reflects radiation emitted from the Earth • The greenhouse effect keeps the earth warmer than it would otherwise be / causes global warming **accept** water and methane as greenhouse gases; reflected radiation is lower frequency/longer wavelength than the radiation (from the Sun) absorbed by the Earth *Hole in ozone layer* • ozone layer absorbs ultraviolet radiation • The lack of ozone/ozone depletion/hole in the ozone layer results in more harmful UV radiation (reaching the earth. **accept** ozone is a gas in the atmosphere pollution (e.g. CFCs) results in ozone reacting to form oxygen. **ignore** CFCs as greenhouse gases effects of global warming or depleted ozone layer
			Total	**[6]**	

Question			Expected answers		Marks	Additional guidance
9	(a)		Microwaves can be used to heat food by causing particles to vibrate.	✓	[3]	one mark for each correct tick
			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.			
	(b)		(some/certain) microwaves are strongly absorbed by water molecules but light waves are not		[1]	
			Total		[4]	

10	(a)		selects 3 V 14.4 (W)	[2]	
	(b)		40 x 30 1200 (J)	[2]	
			Total	[4]	

Question			Expected answers	Marks	Additional guidance
11	✎		**[Level 3]** Most relevant points are present. A balanced argument is provided recognising risk/benefit analysis. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** A balanced discussion is attempted, but significant aspects of the 'pros' or cons' are omitted. May confuse chemical and radioactive poisoning. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Recognises that waste is hazardous, but does not explain why. Will not accept that circumstances could make nuclear power necessary. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**relevant points include:** • uranium/nuclear fuel is a non-renewable energy source • waste is radioactive • radiation can cause cell damage/cancer • little CO_2 produced • Government responsible for regulation • radiation is 'invisible' **accept** hazards of terrorist attack waste can contaminate water supplies/soil/etc. must be kept securely for a long time in eg deep secure sites comments on perceived risk versus actual risk **ignore** arguments based on safety of power stations (Chernobyl, Japan etc) **reject** explosion or other confusion with nuclear bomb
			Total	**[6]**	

Question			Expected answers	Marks	Additional guidance
12	(a)		**32**	**[1]**	
	(b)		**35%**	**[1]**	
	(c)		any 3 use waste energy so increases efficiency most energy/45% is lost/wasted as hot water so will have big effect on efficiency no information about how much of the heat is used so difficult to say just what the effect is on efficiency	**[3]**	
			Total	**[5]**	

13	(a)			**[2]**	three links correct = 2 marks one or two links correct = 1 mark

Question			Expected answers	Marks	Additional guidance
	(b)		*coal:* because it is the most efficient and has one of lowest costs / is cheaper than wind power and these benefits outweigh the disadvantage/environmental cost of producing carbon dioxide **OR** *nuclear:* because it has the lowest cost / is cheaper than coal and wind power and this benefit outweighs the disadvantage/environmental cost of producing radioactive waste and outweighs the low efficiency **OR** *wind:* because it is more efficient than nuclear highest costs / expensive to produce but does not significantly harm the environment / is least damaging to the environment and these benefits outweigh the high cost of generation	**[3]**	candidates may choose any type of power station; no marks are awarded for the choice itself, only for the justification of the choice **ignore** references to any factors not described in the table (eg carbon capture in coal power stations, production of radioactive materials for medical use in nuclear power stations, wind turbines being a 'blot on the landscape', etc.)
			Total	**[5]**	

Assessment Objectives (AO) Grid

(includes quality of written communication✎)

Question	AO1	AO2	AO3	Total
1✎	4	2		**6**
2(a)	1	1		**2**
2(b)		2		**2**
3(a)		1		**1**
3(b)		2		**2**
3(c)			3	**3**
4(a)	1		1	**2**
4(b)		1		**1**
4(c)	1			**1**
5(a)		1		**1**
5(b)		2		**2**
5(c)		1	1	**2**
6	3			**3**
7			2	**2**
8✎	6			**6**
9(a)	2	1		**3**
9(b)		1		**1**
10(a)		2		**2**
10(b)		2		**2**
11✎	4	2		**6**
12(a)		1		**1**
12(b)		1		**1**
12(c)		3		**3**
13(a)	1	1		**2**
13(b)			3	**3**
Totals	**23**	**27**	**10**	**60**

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