

GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
PHYSICS A

UNIT 1 – Modules P1 P2 P3 (Higher Tier)

SAMPLE ASSESSMENT MATERIAL
(from 2010 onwards)

Time: 40 minutes

Candidates answer on the question paper

Additional materials (enclosed):

None

Calculators may be used.

Additional materials: Pencil
 Ruler (cm/mm)

Candidate
 Forename

Candidate
 Surname

Centre
 Number

| | | | | |
|--|--|--|--|--|
| | | | | |
|--|--|--|--|--|

Candidate
 Number

| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

INSTRUCTIONS TO CANDIDATES

- Write your name 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 you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

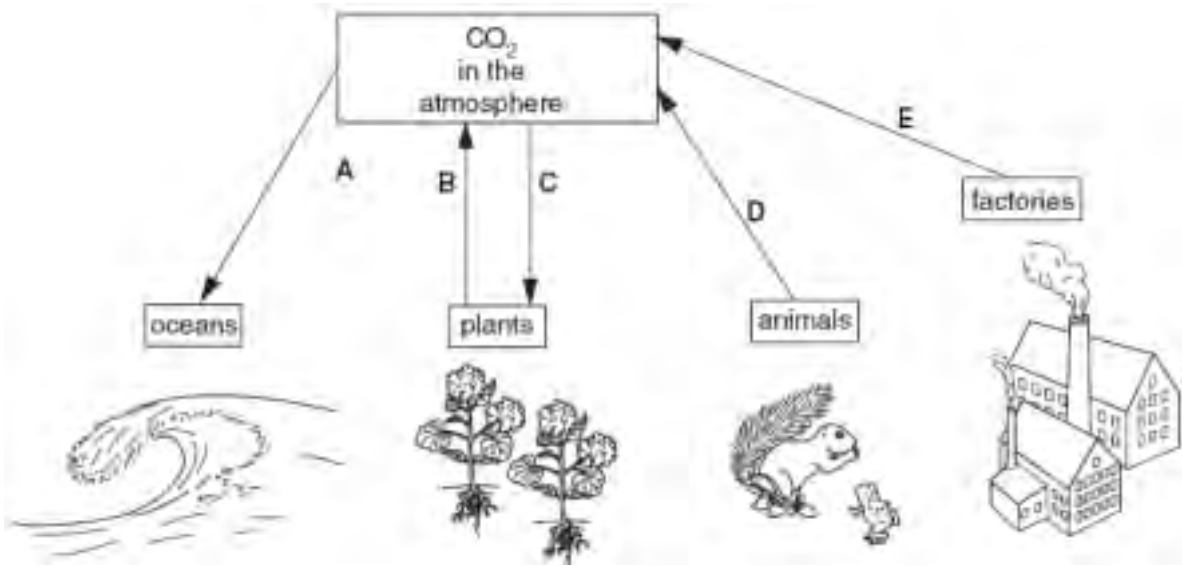
- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **42**.

| FOR EXAMINER'S USE | | |
|--------------------|-----------|------|
| Qu. | Max | Mark |
| 1 | 9 | |
| 2 | 6 | |
| 3 | 7 | |
| 4 | 4 | |
| 5 | 6 | |
| 6 | 6 | |
| 7 | 4 | |
| TOTAL | 42 | |

This document consists of **15** printed pages and **1** blank page

Answer **all** the questions.

1 This diagram represents part of the Carbon Cycle.



(a) Match the following processes to the arrows in the diagram above. Write the correct letter, **A, B, C, D** or **E**, in each box.

- photosynthesis
- respiration
- combustion
- dissolving

[3]

(b) Before 1800 the amount of carbon dioxide in the atmosphere was steady for thousands of years.

In the last 200 years the amount of carbon dioxide in the atmosphere has risen.

Explain why the amount of carbon dioxide was steady, and give reasons for the recent increase.

.....

.....

.....

.....

.....

[4]

(c) Carbon dioxide is a greenhouse gas found in the atmosphere.

Choose **two** other greenhouse gases that can also be found in the atmosphere.
Put ticks (✓) in the boxes next to the **two** best answers in the list below.

nitrogen

water vapour

argon

oxygen

methane

[2]

[Total: 9]

2

Around 100 years ago many scientists believed that mountains on the Earth were caused by the surface of the Earth shrinking as it cooled down.

Alfred Wegener came up with a different idea to explain how mountains formed.

In 1912 Wegener presented his big idea to a meeting of geologists in Germany.

Wegener's big idea became known as continental drift.

He published a book that described his ideas in 1922.

After 'peer review' of his work his ideas were rejected by most geologists at the time.



© Science Photo Library

(a) What is 'peer review'?

Make the best description you can by drawing **one** straight line from a box on the left to a box on the right.

| | |
|------------------------------------|----------------------------------|
| The public look at your work ... | ... and they give their opinion. |
| Scientists look at your work ... | ... to see if it is interesting. |
| Your friends look at your work ... | ... and repeat the experiments. |

[1]

(b) Read the following statements about continental drift.

Some statements are data, others are explanations.

Choose which statements are **data** about continental drift and mark them with a **D**.

The continents could have once been joined together.

The outlines of the continents appear to fit like a jigsaw.

Fossils found in Africa match those found in South America.

A land bridge may have once joined Africa to South America.

[2]

- (c) The theory of plate tectonics has now taken Wegener's idea of continental drift further. Plate tectonics can help to explain how mountains form, as is happening today in the Himalayas.

Describe the process of mountain formation using ideas about plate tectonics.

.....
.....
.....
.....
.....

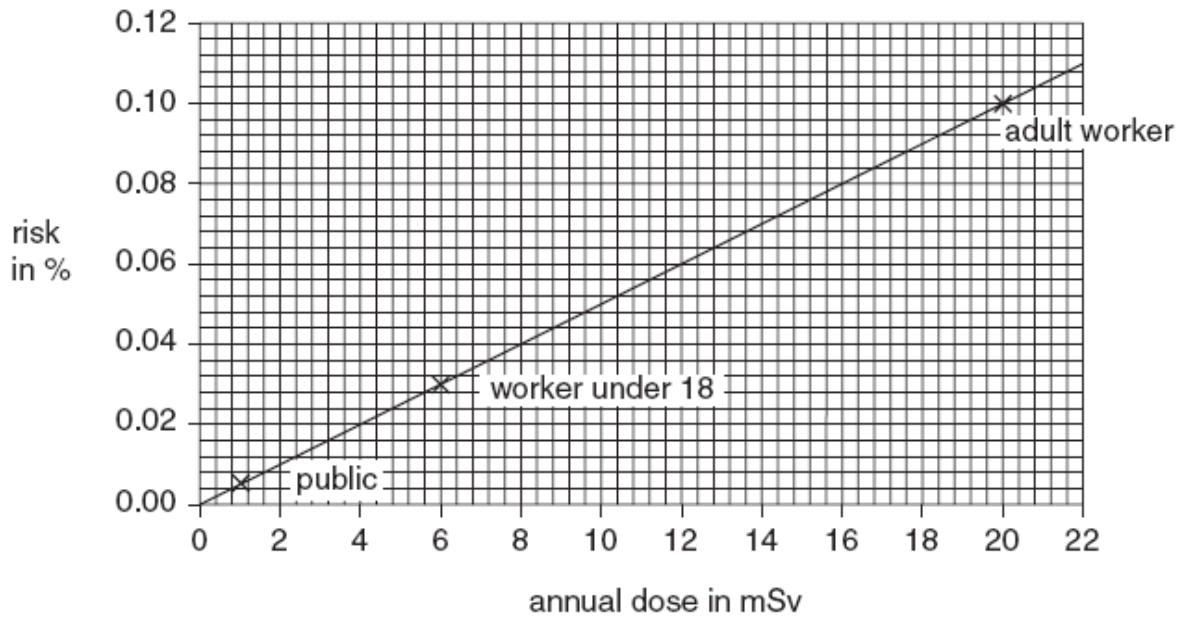
[3]

[Total: 6]

3 Workers in a nuclear power station have their radiation dose carefully monitored.

This chart shows how risk is related to radiation dose.

The **annual dose limits** for different categories of people are marked with a cross.



(a) Use the chart to answer the following questions.

(i) What dose produces a risk of 0.07%?

Put a **(ring)** around the correct answer.

10 mSv

12 mSv

14 mSv

16mSv

[1]

(ii) If a worker receives a dose of 12 mSv, what is the risk?

Put a **(ring)** around the correct answer.

1 mSv

0.10%

6 mSv

0.06%

20 mSv

zero

[1]

(b) The annual dose limit for a worker in a nuclear power station is much higher than for a member of the public.

(i) When working out the annual dose limits the ALARA principle will have been applied.

What is meant by the ALARA principle in this situation?

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

(ii) How many times greater is the acceptable risk for an adult worker compared to that for a member of the public?

answer = [1]

(iii) Why might the higher annual dose limit for an adult worker not be seen as a problem for the owners of the nuclear power station?

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

The owners are not required to consider the safety of their workers.

The risk to an adult worker would still be very low.

The owners supply their workers with protective clothing.

The owners continually measure the dose that each worker receives.

The power stations are normally built far from major centres of population.

[2]

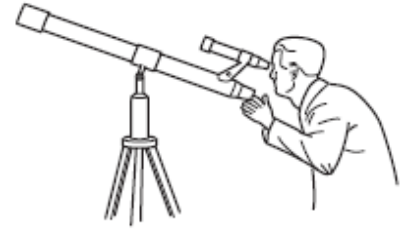
[Total: 7]

4 Heather takes part in an astronomy club at her school in London.

Heather has a friend called Stella.

Stella takes part in an astronomy club at her school in the Welsh countryside.

Both girls use the same type of telescope to observe the night sky.



(a) Heather does not see as much detail through the telescope as Stella.

Choose the best explanation for this from the list below.

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

Stella knows more about astronomy than Heather.

Light pollution is interfering with Heather's observations.

It rains more in the Welsh countryside.

Stella's telescope is on top of a hill.

[1]

(b) Heather's teacher tells her that looking at distant stars is like looking back in time.

What did Heather's teacher mean by this statement?

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

Stars have been around for a long time.

Stars do not ever change their appearance.

It takes time for light to reach us from the stars.

New stars are being formed all the time.

[1]

- (c) Scientists can use more powerful telescopes, such as the Hubble space telescope, to view distant galaxies.

Scientists can work out how fast each of these galaxies is moving

Draw straight lines to link the boxes below to make the most **accurate** statements possible.

| | |
|---|-------------------------------|
| | ... move at double the speed. |
| Galaxies that are closer ... | ... move more slowly. |
| Galaxies that are twice as far away ... | ... move more quickly. |
| | ... move at half the speed. |

[2]

[Total: 4]

5

No phones for kids?

A mobile phone designed for young children has been withdrawn from sale by the company that makes it.

A study found that people who regularly use a mobile phone for over 10 years are four times more likely to develop cancer of the ear. The study involved 750 people.

A spokesman for the mobile phone company said. 'The decision to withdraw the product is taken because of this new evidence. It suggests that long term exposure to radiation from mobile phones can damage health, especially in very young children.'

'Although we feel the product is safe if used as recommended with parental guidance, we are not experts in either radiation or medical fields. Any risk to our children is unacceptable.'

(a) What type of radiation is used by mobile phones to make a call?

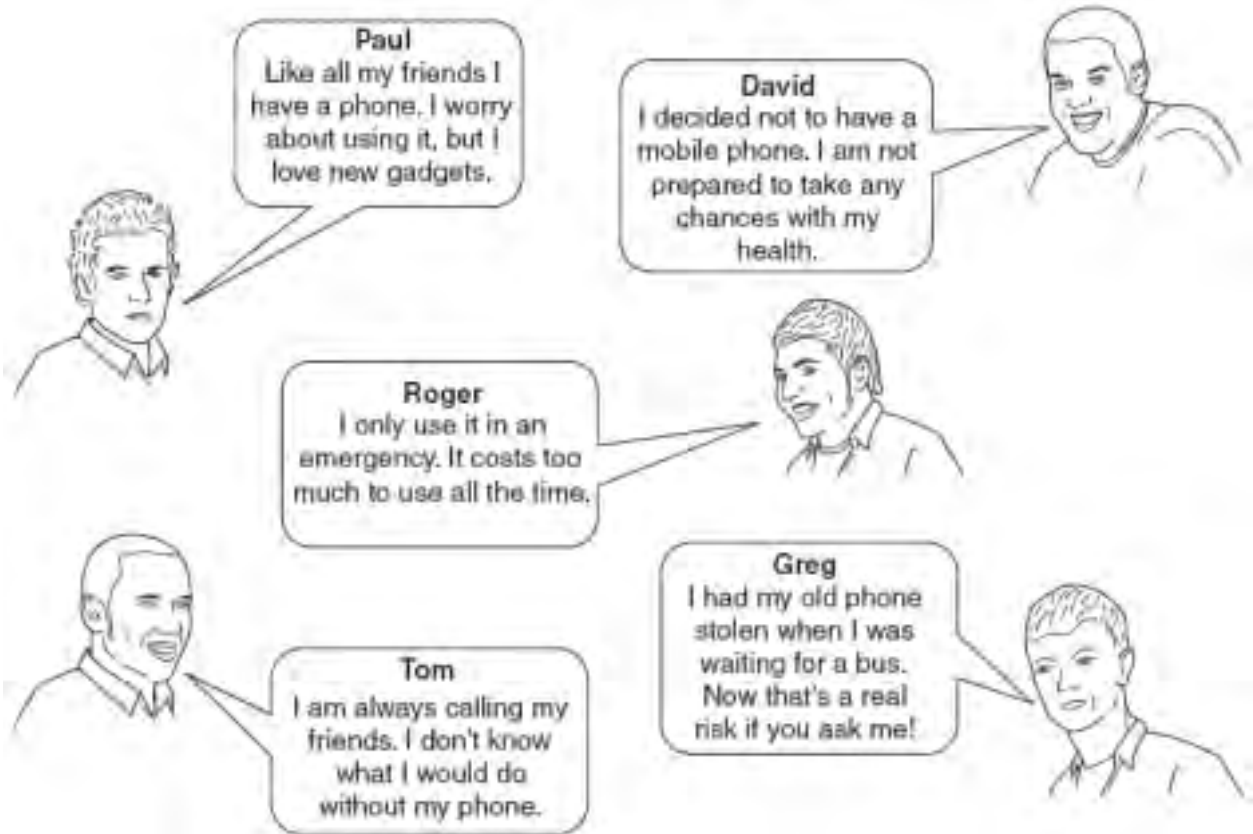
answer [1]

(b) The article identifies a correlation between two factors.

What is the correlation?

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

(c) A group of students are discussing their views on mobile phones.



(i) Which student has made a statement based on the **precautionary principle**?

answer [1]

(ii) How could you **explain** the decision that Paul has made?

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

- He is aware of the risk, but it doesn't bother him.
- He believes the benefit outweighs the risk.
- He is aware of a risk and decides not to go ahead.
- He believes that there is more risk than benefit.

[1]

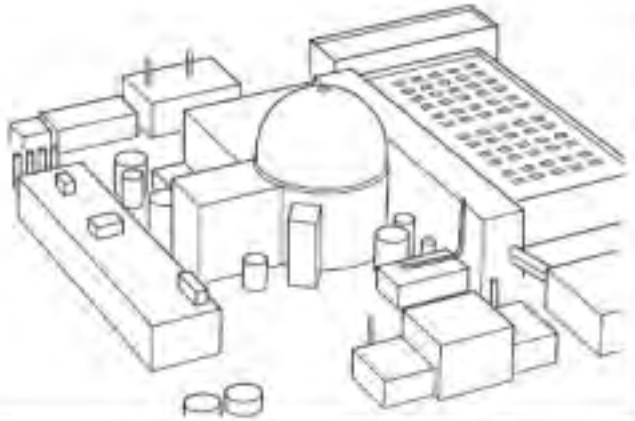
[Total: 6]

6

Nuclear power stations use uranium as a fuel.

Energy is released from the uranium by the process of nuclear fission.

Some people object to nuclear power stations because they produce radioactive waste.



- (a) The nuclear fission process needs to be controlled to release the energy safely. The following statements describe this control process. They are in the wrong order.

- A Coolant is used to carry the heat energy away from the reactor.
- B More neutrons are released.
- C The uranium undergoes fission.
- D Neutrons in the reactor collide with uranium.
- E Some of these neutrons are absorbed by control rods.

Fill in the boxes to show the right order. The last one has been done for you.

| | | | | |
|--|--|--|--|----------|
| | | | | A |
|--|--|--|--|----------|

[3]

- (b) The process of nuclear fission can carry on unaided once it is started.

Write the name for this type of reaction.

..... reaction [1]

- (c) If more nuclear power stations were built, the risk of radioactive material contaminating the environment would increase.

Some people are in favour of building more nuclear power stations.

Put a tick (✓) in the box next to each statement that is a good argument to support their case.

The need for a reliable energy resource outweighs the risks.

People might benefit from new employment opportunities.

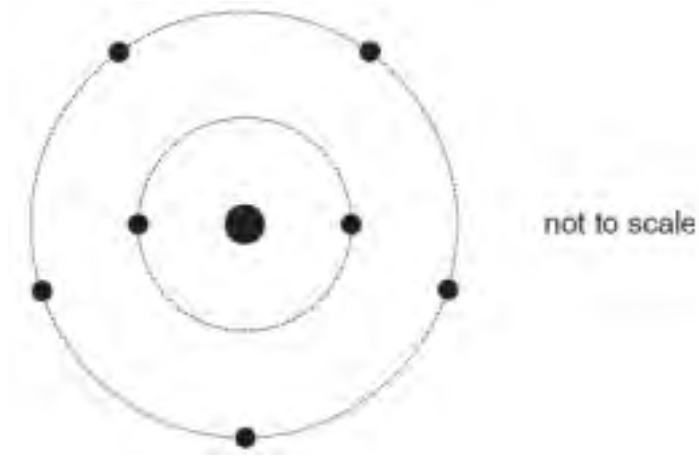
There is a problem with storing nuclear waste safely for as long as necessary.

Nuclear power stations do not release large amounts of greenhouse gases.

[2]

[Total: 6]

7 This diagram represents the particles that make up an atom.



(a) What is the **central** core of the atom called?

answer [1]

(b) This is an atom of nitrogen. Complete the sentence below.

All atoms of nitrogen contain the same number of
in the core of the atom.

[1]

(c) This particular atom is radioactive. It emits beta radiation.

What effect does this have on the atom after the radiation is emitted?

Write **true** or **false** in the box next to each statement.

| | true or false |
|---|--------------------------|
| The atom will have the same number of particles in its core | <input type="checkbox"/> |
| The atom will still be of the same element. | <input type="checkbox"/> |
| The atom will have gained energy. | <input type="checkbox"/> |
| The atom will have the same number of neutrons in its core. | <input type="checkbox"/> |

[2]

[Total: 4]

END OF QUESTION PAPER

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GCSE Unit

MARK SCHEME

SAMPLE ASSESSMENT MATERIAL
(from 2010 onwards)

Physics A (J635)
Modules P1, P2 and P3
Higher Tier

A331/02

Maximum Mark: 42

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, e.g. 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 |
| <u>words</u> | = underlined words must be present in answer to score a mark |
| ecf | = error carried forward |
| AW/owtte | = alternative wording |
| ORA | = or reverse argument |

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

8. 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, e.g. 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.

E.g. 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 | ✓ | x | ✓ | ✓ | ✓ | | | | ✓ | |
| Paris | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | |
| Southampton | ✓ | x | | ✓ | | ✓ | ✓ | | ✓ | |
| Score: | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | NR |

| Question | | Expected Answers | Marks | Rationale | | | | | | | | | | | | |
|----------------|-------------------------------------|--|----------------|-----------------------------------|-----|-------------|-------------------------------------|---|------------|--------------------------|--|------------|-------------------------------------|-----|---|--|
| 1 | a | <table border="1"> <tr> <td>photosynthesis</td> <td>C</td> <td></td> </tr> <tr> <td>respiration</td> <td>B</td> <td>D</td> </tr> <tr> <td>combustion</td> <td>E</td> <td></td> </tr> <tr> <td>dissolving</td> <td>A</td> <td></td> </tr> </table> | photosynthesis | C | | respiration | B | D | combustion | E | | dissolving | A | | 3 | <p>All correct 3 marks 3 or 4 correct 2 marks 1 or 2 correct 1 mark B & D may be in either order</p> |
| photosynthesis | C | | | | | | | | | | | | | | | |
| respiration | B | D | | | | | | | | | | | | | | |
| combustion | E | | | | | | | | | | | | | | | |
| dissolving | A | | | | | | | | | | | | | | | |
| | b | <p>steady because: amount put into atmosphere equalled amount taken out; (1) relevant example e.g. plants absorb / animals produce (1)</p> <p>increased because: more fossil fuels burnt; (1) forests cut down (1)</p> | 4 | <p>accept more cars/factories</p> | | | | | | | | | | | | |
| | c | <table border="1"> <tr> <td>water vapour</td> <td><input type="checkbox"/></td> <td>(1)</td> </tr> <tr> <td></td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td></td> </tr> <tr> <td>methane</td> <td><input checked="" type="checkbox"/></td> <td>(1)</td> </tr> </table> | water vapour | <input type="checkbox"/> | (1) | | <input checked="" type="checkbox"/> | | | <input type="checkbox"/> | | methane | <input checked="" type="checkbox"/> | (1) | 2 | <p>2 marks for both second box and bottom box correct and no other ticks. 1 mark for second box or bottom box correct and <u>at least</u> three blanks. (Note: if three boxes ticked including the two correct boxes 1 mark scored). Accept any clear indication of correct choice</p> |
| water vapour | <input type="checkbox"/> | (1) | | | | | | | | | | | | | | |
| | <input checked="" type="checkbox"/> | | | | | | | | | | | | | | | |
| | <input type="checkbox"/> | | | | | | | | | | | | | | | |
| methane | <input checked="" type="checkbox"/> | (1) | | | | | | | | | | | | | | |
| Total | | | 9 | | | | | | | | | | | | | |

| Question | | Expected Answers | Marks | Rationale | | | | |
|--------------|---|--|----------|--|-------|--|---|--|
| 2 | a | | 1 | If more than one link made, 0 marks . Accept any clear indication of correct link . | | | | |
| | b | <p>outlines appear to fit like a jigsaw fossils in Africa match South America</p> <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td> </td></tr> <tr><td>D (1)</td></tr> <tr><td>D (1)</td></tr> <tr><td> </td></tr> </table> | | D (1) | D (1) | | 2 | See guidance for examiners point 8, with D in place of ticks. Accept any clear indication of correct choice. |
| | | | | | | | | |
| D (1) | | | | | | | | |
| D (1) | | | | | | | | |
| | | | | | | | | |
| | c | <p>[3 marks] Candidate demonstrates a high level of understanding of the process of mountain formation, identifying all necessary components. The answer is expressed clearly and logically.</p> <p>[2 marks] Candidate demonstrates a good understanding of the process of mountain formation, identifying two of the necessary components. The answer is expressed clearly and logically.</p> <p>[1 mark] Candidate describes the relative movement (and collision) of tectonic plates, but does not identify the changes to the upper plate which produce mountains. The answer is expressed clearly.</p> | 3 | Necessary components – two tectonic plates move towards each other; when plates collide , one slides under the other; rocks on upper plate fold and buckle; this forces land up, making mountain chain; allow two marks if the candidate describes volcano idea. e.g. tectonic plate friction heating causing rising magma. | | | | |
| Total | | | 6 | | | | | |

| Question | | | Expected Answers | Marks | Rationale |
|--------------|---|-----|--|----------|---|
| 3 | a | i | 14 mSv (1) | 1 | Accept any clear indication of correct choice. |
| | | ii | 0.06 % (1) | 1 | Accept any clear indication of correct choice. |
| | b | i | [2 marks] Candidate shows understanding of the balance between protecting the worker and carrying out the risk bearing task. The candidate addresses all the necessary components [1 mark] Candidate shows a partial understanding of the ALARA principle, covering only 1 of the necessary components. | 2 | Necessary components – annual dose need not be zero / annual dose at a level that minimises health risks; allows the nuclear worker to carry out his job; as low as reasonably achievable/possible; |
| | | ii | 20 | 1 | . |
| | | iii | risk would still be very low <input type="checkbox"/> (1) owners continually measure dose <input checked="" type="checkbox"/> (1) | 2 | 2 marks for both second box and fourth box correct and no other ticks. 1 mark for second box or fourth box correct and <u>at least</u> three blanks. (Note: if three boxes ticked including the two correct boxes 1 mark scored). Accept any clear indication of correct choice |
| Total | | | | 7 | |

| Question | | Expected Answers | Marks | Rationale |
|--------------|---|--|----------|--|
| 4 | a | light pollution is interfering <input type="checkbox"/> (1) | 1 | No extra ticks allowed. |
| | b | takes time for light to reach us <input type="checkbox"/> (1) | 1 | No extra ticks allowed. |
| | c | <div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">galaxies that are closer</div> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">.....move at double the speed</div> </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">galaxies that are twice as far away</div> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">.....move more slowly</div> </div> <div style="border: 1px solid black; width: 100px; height: 20px; margin-bottom: 10px;"></div> <div style="border: 1px solid black; width: 100px; height: 20px;"></div> </div> | 2 | 1 mark for each correct line from a left hand box. If more than one line drawn from the left hand box 0 mark for that box. |
| Total | | | 4 | |

| Question | | Expected Answers | Marks | Rationale | | | | | |
|--------------|---|--|--|---|----------------------------------|--|--|---|-------------------------|
| 5 | a | microwaves (1) | 1 | Accept microwave radiation Accept phonetic spelling. | | | | | |
| | b | <p>[3 marks] Candidate shows a clear understanding of the two variables and correctly gives the direction of the correlation (positive / increasing). The answer is expressed clearly and logically.</p> <p>[2 marks] Candidate correctly identifies the two variables. The answer is expressed clearly.</p> <p>[1 mark] Candidate correctly identifies one of the two variables. The answer is expressed clearly.</p> | 3 | variables: use of mobile phones; (number of ear) cancers; | | | | | |
| | c | i | David (1) | 1 | Accept phonetic spelling. | | | | |
| | | ii | benefit outweighs the risk <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td></tr><tr><td>✓</td></tr><tr><td> </td></tr><tr><td> </td></tr></table> (1) | | ✓ | | | 1 | No extra ticks allowed. |
| | | | | | | | | | |
| ✓ | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Total | | | 6 | | | | | | |

| Question | | Expected Answers | Marks | Rationale | | | | | |
|--------------|---|--|----------|---|---|---|-----|---|--|
| 6 | a | <table border="1"> <tr> <td>D</td> <td>C</td> <td>B</td> <td>E</td> <td>(A)</td> </tr> </table> <p>D before C (1) C before B (1) B before E (1)</p> | D | C | B | E | (A) | 3 | |
| D | C | B | E | (A) | | | | | |
| | b | chain (1) | 1 | Accept phonetic spelling. | | | | | |
| | c | <p>need outweighs the risks <input checked="" type="checkbox"/></p> <p>new employment opportunities <input checked="" type="checkbox"/></p> <p>greenhouse gasses <input checked="" type="checkbox"/></p> | 2 | The third box must be blank for any marks. 2 marks for all three correct 1 mark for any two of first, second or fourth box. | | | | | |
| Total | | | 6 | | | | | | |

| Question | | Expected Answers | Marks | Rationale |
|--------------|---|--|----------|--|
| 7 | a | nucleus (1) | 1 | Accept phonetic spelling. Do not accept 'nuclear' or 'neutron'. |
| | b | protons (1) | 1 | Accept phonetic spelling Accept proton Do not accept protons with any thing else. |
| | c | <p>same number of particles in its core <input type="checkbox"/> true</p> <p>still be of the same element <input type="checkbox"/> false</p> <p>will have gained energy <input type="checkbox"/> false</p> <p>same number of neutrons in its core <input type="checkbox"/> false</p> | 2 | 2 marks for 4 correct 1 mark for 2 or 3 correct Accept 'T' for 'true' and 'F' for 'false' Ticks and crosses gain no marks. |
| Total | | | 4 | |

| | | | | |
|----------------------|--|--|-----------|--|
| Section total | | | 42 | |
|----------------------|--|--|-----------|--|