

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**TWENTY FIRST CENTURY SCIENCE**  
**PHYSICS A**

Unit 1 Modules P1 P2 P3 (Higher Tier)

**MONDAY 21 JANUARY 2008**

Afternoon  
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

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Candidate  
Number

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**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or 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.
- 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**

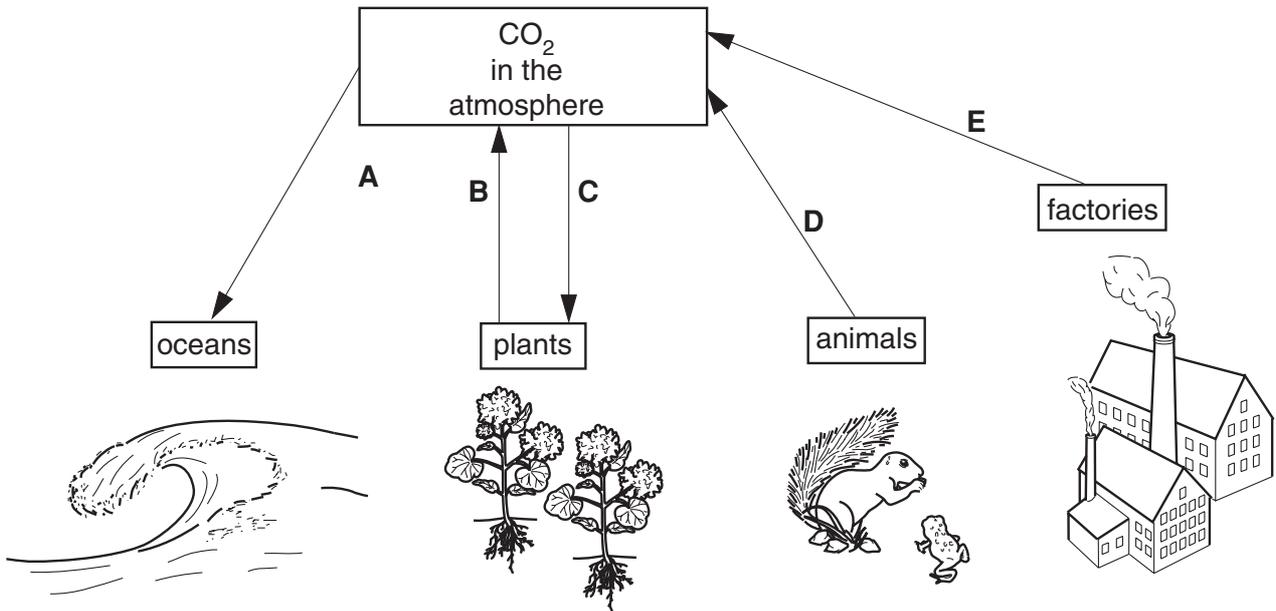
- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 42.

FOR EXAMINER'S USE		
Qu.	Max	Mark
1	9	
2	8	
3	6	
4	4	
5	5	
6	6	
7	4	
<b>TOTAL</b>	<b>42</b>	

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) There is concern over changes to the amount of carbon dioxide in the atmosphere.

(i) Before 1800 the amount of carbon dioxide was steady for thousands of years.

Which of the following statements explains why it was steady?

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

- The carbon dioxide going into the atmosphere was taken out again by plants and the oceans.
- There was no carbon dioxide produced before people built factories.
- The atmosphere was already full of carbon dioxide, so no more could fit in.
- Carbon dioxide was absorbed by forest fires.

[1]

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

Which of the following statements best explain the **rise** of carbon dioxide?

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

There are more factories now than in the past, as more countries have become developed.

Scientists have developed a way of storing carbon dioxide underground.

Environmental groups have been working to get more trees planted around the world.

Forests have been burnt down to clear land for farming and new buildings.

Scientists do not agree that the amount of carbon dioxide has risen over the last 200 years.

[2]

(c) There is evidence to show that global warming is taking place.  
Global warming could result in dramatic changes to our planet.

Which of the following could happen as a result of global warming?

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

More people could get skin cancer due to increased levels of UV.

Low lying lands could be at increased risk of flooding.

There will be an increased chance of earthquakes occurring.

Some parts of the world will find it more difficult to grow crops.

[1]

(d) 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]

[Turn over

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.

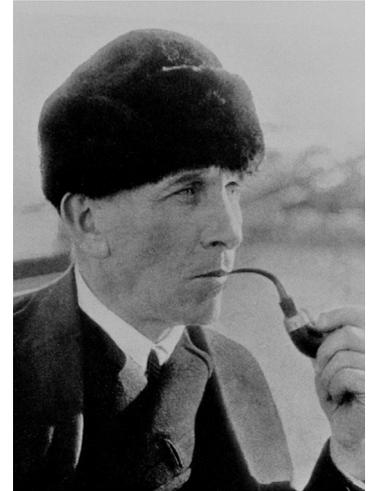
Alfred Wegener came up with a different idea to explain how mountains formed.

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 once have joined Africa to South America.

[2]

(c) What reasons did the geologists of Wegener's time have to reject his ideas?

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

He was an outsider to their group.

The evidence he provided was clearly wrong.

They did not know how the continents could be moved.

They agreed that similar fossils were found in Africa and South America.

[2]

(d) 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.

These sentences describing the process of mountain formation are not in the right order.

- A** Rocks on the upper plate buckle and fold.
- B** Two tectonic plates move towards each other.
- C** Tectonic plates are continually moving.
- D** When the plates collide, one slides under the other.
- E** This forces the land up, making a mountain chain.

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

<b>C</b>				
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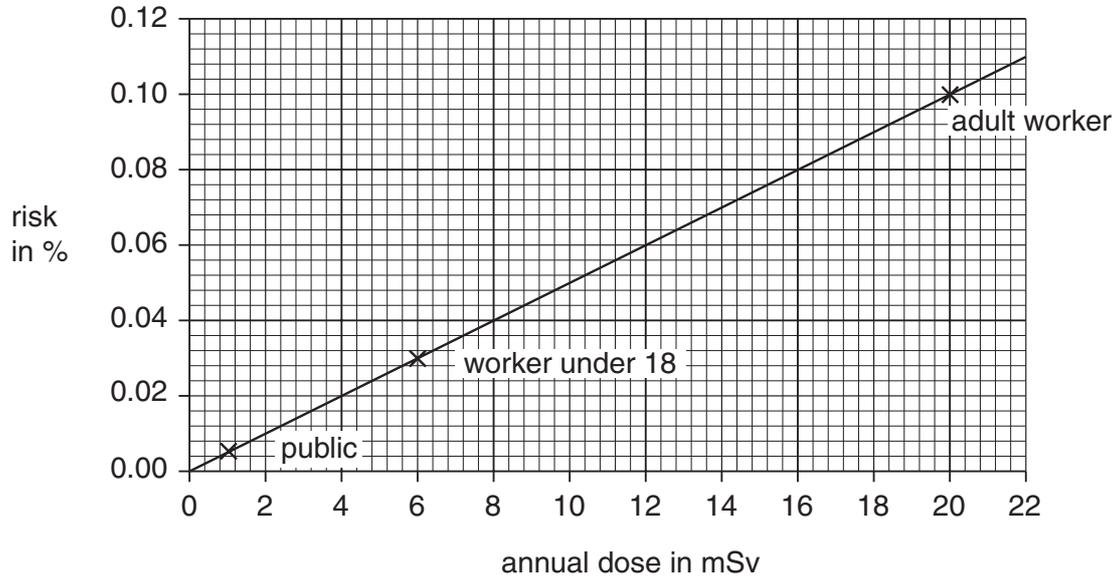
[3]

[Total: 8]

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**

**16 mSv**

[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 does the ALARA principle mean?

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

The risk is eliminated completely.

The risk is assessed and recorded.

The risk is reduced to a reasonable level.

The risk is decided by the Government.

[1]

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

Put a ring around the correct answer.

3

6

10

20

40

[1]

(iii) Why might this increased dose 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]

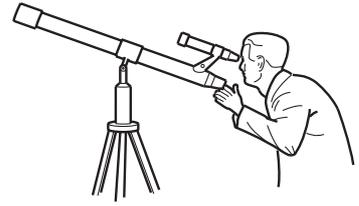
[Total: 6]

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 make correct sentences.

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]

## 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.

Draw **two** straight lines to make the correct correlation.

**first factor**

**second factor**

If mobile phone usage

the number of cases of ear cancer increases.

If the number of children

decreases

the amount of street crime increases.

If parental guidance

increases

there is no proven health risk.

the phone is probably safe to use.

[2]

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

**Paul**  
Like all my friends I have a phone. I worry about using it, but I love new gadgets.

**David**  
I decided not to have a mobile phone. I am not prepared to take any chances with my health.

**Roger**  
I only use it in an emergency. It costs too much to use all the time.

**Tom**  
I am always calling my friends. I don't know what I would do without my phone.

**Greg**  
I had my old phone stolen when I was waiting for a bus. Now that's a real risk if you ask me!

(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 a 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.

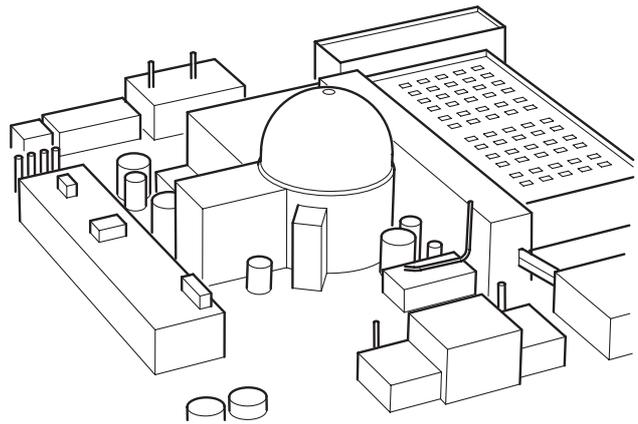
[1]

[Total: 5]

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.

				<b>A</b>
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[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.

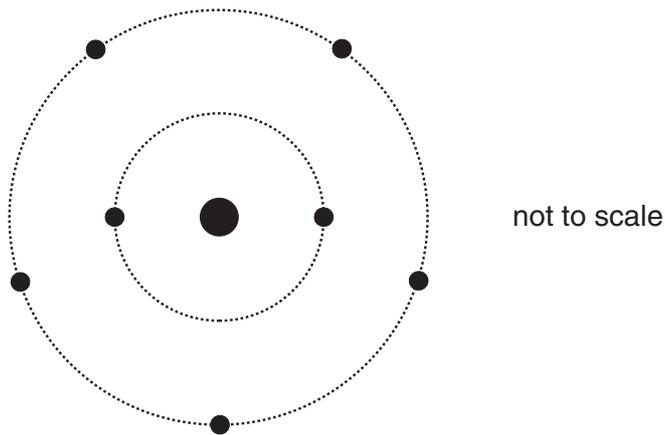
There is a problem with storing nuclear waste safely for as long as necessary.

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.

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

[2]

[Total: 4]

**END OF QUESTION PAPER**

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