

<b>Candidate Forename</b>		<b>Candidate Surname</b>	
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<b>Centre Number</b>						<b>Candidate Number</b>				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**A331/02**

**TWENTY FIRST CENTURY SCIENCE**

**PHYSICS A**

**UNIT 1: Modules P1 P2 P3  
Higher Tier**

**WEDNESDAY 20 JANUARY 2010: Morning**

**DURATION: 40 minutes**

**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 clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **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**

- **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 42.**



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Answer ALL the questions.

1 Scientists think that mountains must be forming all the time.

(a) Some of the statements below are used to explain this.

A Mountains are part of the Earth's crust.

B Erosion causes mountains to be worn down.

C The Earth is older than its oldest rocks.

D If no new mountains are formed the continents would be flat.

E Mountains exist today.

F Mountains are only formed on drifting continents.

THREE of the statements, when taken together, explain why mountains must be forming all the time.

Write down the letters of these three statements.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[3]

**(b) The explanation can only be correct if one of the following statements is also correct.**

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

**The rock processes seen today can explain changes in the past.**

**Wegener's theory of continental drift explained the jigsaw-fit of South America and Africa.**

**Asteroids colliding with the Earth in the past can explain how mountains form.**

**Mountains are over 1 km high.**

**[1]**

**[Total: 4]**

**2 Scientists have made many observations about the Universe.**

**(a) Scientists quantify their observations whenever they can.**

**Use the numbers in the list below to complete the following observations.**

**Each number may be used once, more than once, or not at all.**

**100**

**1000**

**4000**

**5000**

**14 000**

**The oldest rocks on Earth are about**

**\_\_\_\_\_ million years old.**

**The Earth is about \_\_\_\_\_ million years old.**

**The Sun is about \_\_\_\_\_ million years old.**

**The Universe is about \_\_\_\_\_ million years old.**

**The Sun has a diameter about \_\_\_\_\_ times bigger than the Earth's diameter.**

**[4]**

**(b) Read the following statements.**

**A there are difficulties in making observations**

**B the Universe started with a 'big bang'**

**C we do not know the mass of the Universe**

**D planets have been discovered around nearby stars**

**E the further away a galaxy is, the faster it is moving away**

**F stars take a long time to go through their life cycle**

**Write down the letters of the statements that best complete each of the sentences below.**

**(i) We know space is expanding because**

\_\_\_\_\_ . [1]

**(ii) It is difficult to predict the ultimate fate of the**

**Universe because \_\_\_\_\_ and \_\_\_\_\_ .**  
[1]

**[Total: 6]**

**3 Read the article.**

**EXTRASOLAR PLANETS FOUND?**

**Some astronomers claim to have found evidence for planets around nearby stars.**

**The evidence is small variations in the brightness of some stars and very small wobbles in the positions of stars.**

**Some of the results have been published in peer reviewed scientific journals, but only a few have been replicated by other astronomers.**

**Explain how peer review and repeating results can strengthen or weaken the astronomers' claims.**

**Your answer should include:**

- an explanation of what is meant by 'peer review'**
- an explanation of what is meant by 'replicated by other astronomers'**
- why these will strengthen or weaken the astronomers' claims.**

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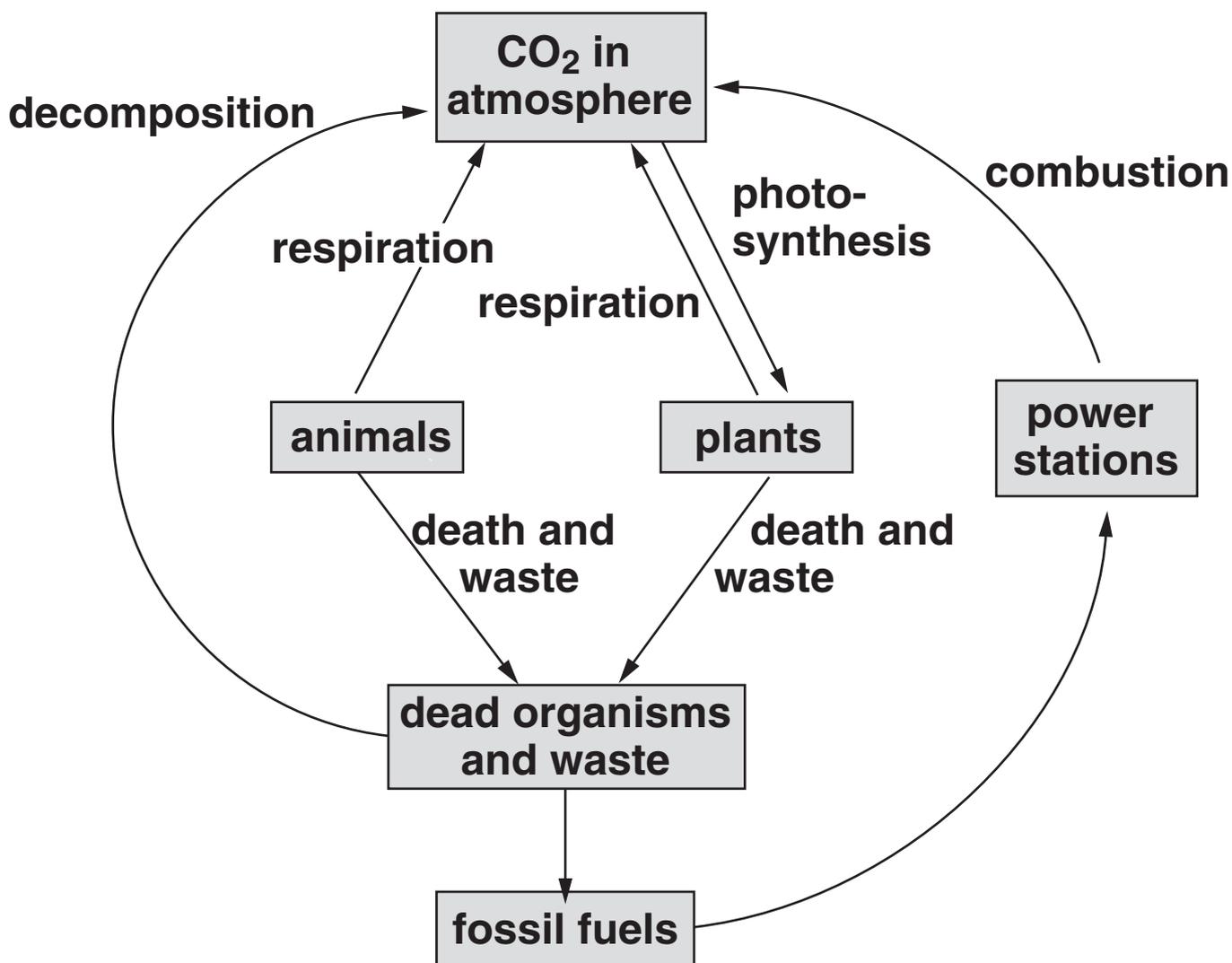
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**[3]**

**[Total: 3]**

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4 Look at the diagram below, which shows the carbon cycle.



(a) Use the carbon cycle to help explain how burning forests affects the amount of carbon dioxide in the atmosphere.

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[3]

**(b) Carbon dioxide in the atmosphere contributes to global warming.**

**Suggest TWO ways of reducing the risk of global warming, other than not burning forests.**

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**[2]**

**[Total: 5]**

**5 Ultraviolet radiation can be hazardous.**

**Read the article below.**

**BOY OF 13 BURNED BY SUNBED**

**A boy of 13 has severe burn blisters on his face after he used a tanning salon's ultraviolet sunbed three times in a day for a total of 21 minutes.**

**He repeatedly slipped into an unstaffed, coin-operated booth because he thought it would disguise his acne. The maximum safe tanning time at the salon is 6 minutes.**

**His mum said: "His lips swelled up and he couldn't swallow. He is quite vain. I am afraid he will develop cancer when he is older."**

**(a) What correlation is suggested by the article?**

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**[2]**

**(b) Why is the boy's mum right to be concerned about cancer?**

**Put ticks (✓) in the boxes next to the TWO best answers from the list below.**

**Ultraviolet light is invisible to the human eye.**

**Ultraviolet light has energetic photons.**

**Ultraviolet light is next to visible light in the spectrum.**

**Ultraviolet light is an ionising radiation.**

**Ultraviolet light can heat up skin cells.**

**[2]**

**(c) A letter to the newspaper said**

**'This just shows how dangerous sunbeds are. We should ban all sunbeds'.**

**Explain why this is not a good scientific conclusion.**

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**[2]**

**[Total: 6]**

6 (a) The Sun produces a lot of ultraviolet radiation.

The Earth's atmosphere blocks most of this ultraviolet radiation.

(i) Which gas in the atmosphere absorbs most of the ultraviolet radiation?

\_\_\_\_\_ [1]

(ii) What happens to the energy absorbed by this gas?

Put a tick (✓) in the box next to the best answer from the list below.

It is radiated as violet light.

It produces photons.

It causes chemical reactions.

It makes the sky blue.

[1]

(b) Other gases in the atmosphere absorb the infrared and microwave radiation that the EARTH emits.

One of these gases is water vapour.

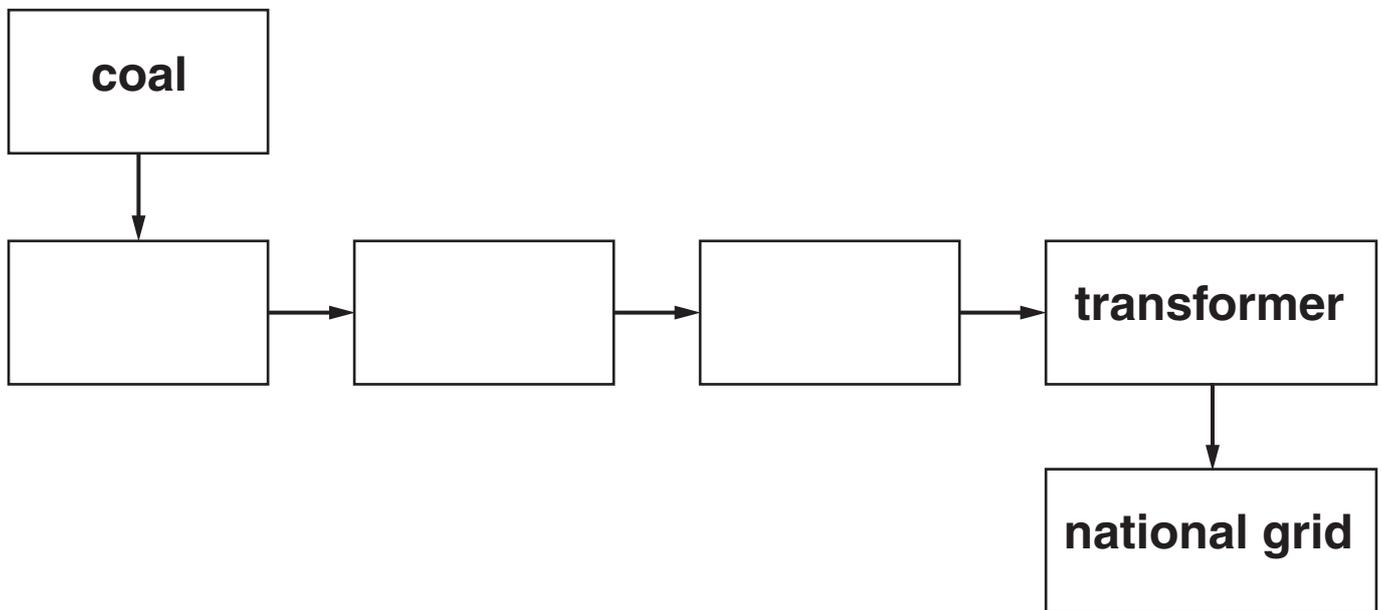
Name TWO other gases in the atmosphere that strongly absorb INFRARED radiation.

\_\_\_\_\_ and \_\_\_\_\_ [2]

[Total: 4]

7 This question is about electricity generation in coal-fired power stations.

Complete the block diagram below showing how a coal-fired power station produces electricity.

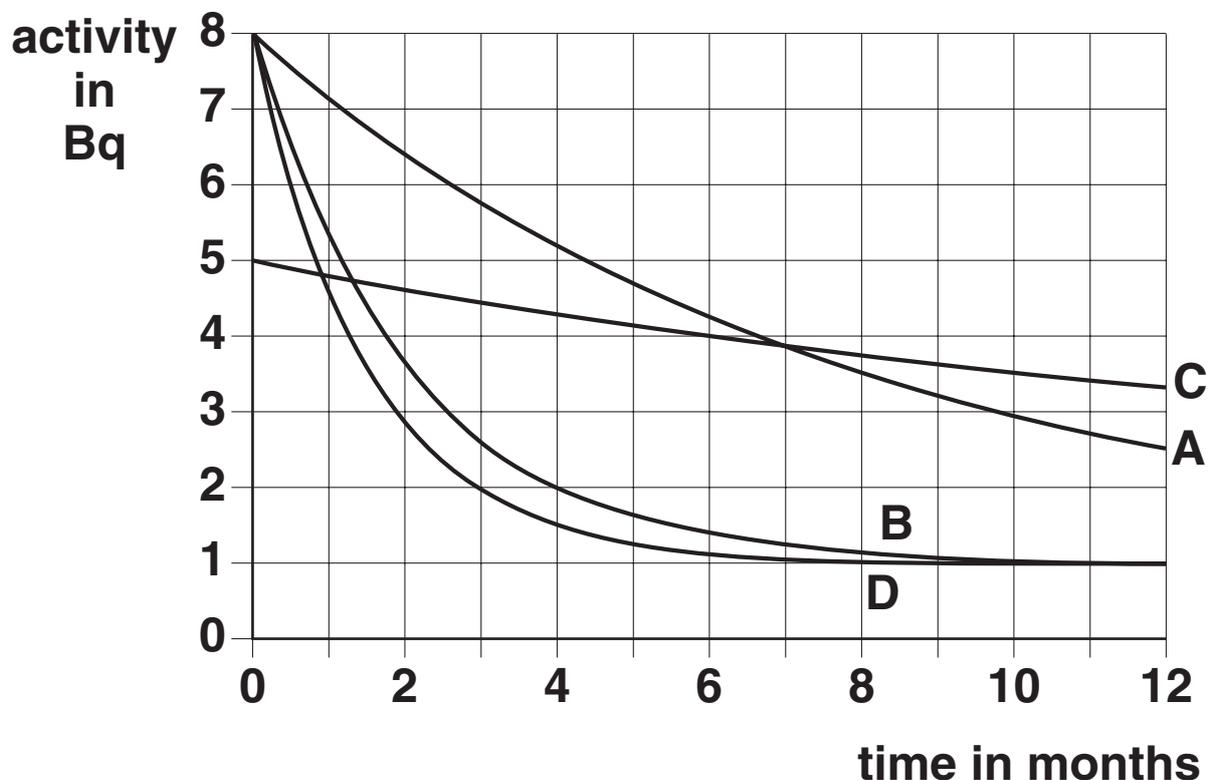


[4]

[Total: 4]

**8 Different radioactive sources are used in hospitals for different purposes.**

**The graph below shows the activity over time of four different radioactive sources.**



**(a) (i) Which radioactive source, A, B, C or D, has the shortest half-life?**

**answer \_\_\_\_\_ [1]**

**(ii) Which radioactive source, A, B, C or D, has the most activity after 10 months?**

**answer \_\_\_\_\_ [1]**

**(iii) Which two sources are least likely to be a long term storage problem?**

**answer \_\_\_\_\_ and \_\_\_\_\_ [1]**

- (b) Use information from the graph to find a value for the activity of the background radiation.

activity = \_\_\_\_\_ Bq [1]

- (c) The graph does not provide enough information to assess the risk associated with each material when used in a hospital.

What additional information is needed?

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

Type of radiation.

Name of radioactive source.

Amount of radioactive source.

Length of time exposed to radioactive source.

Number of protons and neutrons in nucleus of radioactive source.

[2]

**(d) Here is some information about people who have contact with the sources in the hospital.**

<b>doctor</b>	<b>decides on use of sources</b>
<b>radiographer</b>	<b>prepares and uses sources</b>
<b>nurse</b>	<b>helps patients treated with sources</b>
<b>patient</b>	<b>treated with a source</b>
<b>porter</b>	<b>moves patients around hospital</b>

**If not specially protected, who is likely to receive the largest life-time dose?**

**answer \_\_\_\_\_ [1]**

- (e) The doctor tells the patient that they always apply the ALARA principle when treating a patient with radioactive sources.

Which of the following statements best explains why the doctor does NOT use the precautionary principle?

Put a tick (✓) in the box next to the BEST explanation.

The hospital must keep some money for treating emergency patients.

The doctor understands the risks and benefits.

The patient does not need to take precautions, because the doctor will take the precautions.

The risk is too small to worry about.

[1]

**(f) There are three types of radiation produced by radioactive sources.**

**A alpha radiation**

**B beta radiation**

**C gamma radiation**

**Look at the table below.**

**Which type of radiation, A, B, or C, would be best for each of the following hospital uses?**

**You may use each type of radiation once, more than once, or not at all.**

<b>USE</b>	<b>TYPE OF RADIATION</b>
<b>irradiating surgical instruments</b>	
<b>tracking the movement of chemicals <u>INSIDE</u> the body</b>	
<b>treating a cancer on the surface of the skin</b>	

**[2]**

**[Total: 10]**

**END OF QUESTION PAPER**