

Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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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)**

**MONDAY 22 JUNE 2009: 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 John's class is discussing the solar system.

(a) The teacher explains that we live in a solar system, made up from the Sun, planets and other bodies such as moons and asteroids.

Look at the list below.

Put the objects in the list in order of size, from largest to smallest.

- A the Moon
- B the Sun
- C planets
- D asteroids

Fill in the boxes to show the right order.

largest 

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 smallest

[2]

**(b) The solar system was formed over a long period.**

**How long ago did this happen?**

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

**about 4000 million years ago**

**exactly 4000 million years ago**

**about 5000 million years ago**

**exactly 5000 million years ago**

**about 14 000 million years ago**

**exactly 14 000 million years ago**

**[1]**

**(c) The teacher says the Sun is a star because of the way it generates its energy.**

**Put ONE tick (✓) in the correct box to complete the sentence below.**

**The Sun generates its energy by ...**

**... the fusion of hydrogen.**

**... the fission of hydrogen.**

**... the fusion of helium.**

**... the fission of helium.**

**[1]**

(d) During the discussion the teacher makes four statements about the composition of the Sun.

Here are the statements.

**A** A high percentage of the material in the Sun is hydrogen and helium.

**B** The nuclear reactions in the Sun are only making helium.

**C** The Sun contains elements which could only have been made in earlier stars.

**D** The Sun contains a small percentage of elements that are heavier than helium.

Put the letters **A**, **B**, **C** and **D** into the correct column in the table below to show which statements only contain **DATA**, and which statements contain an **EXPLANATION** of the data.

<b><u>DATA</u></b>	<b><u>EXPLANATION</u></b>

[3]

[Total: 7]

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**2 This question is about distant stars.**

**(a) How do scientists know so much about very distant stars?**

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

**They have sent probes to these stars.**

**They have visited these stars.**

**They have studied the radiation from these stars.**

**All of the three statements above are correct.**

**[1]**

**(b) The Universe contains galaxies. Each galaxy contains stars.**

**How many stars are there in one galaxy?**

**Put a ring around the best answer in the list below.**

**$10^2$  to  $10^3$**

**$10^5$  to  $10^6$**

**$10^9$  to  $10^{11}$**

**$10^{15}$  to  $10^{17}$**

**[1]**



**(c) The Sun is a star in one of these galaxies.**

**What is the name of the galaxy that contains the Sun?**

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

**[Total: 3]**

**3 Visible light is part of a family of radiations.**

**(a) This family is made up of different types of radiation.**

**Which type of radiation carries the LEAST energy in one of its photons?**

**Put a ring around the correct answer in the list below.**

**GAMMA**

**INFRARED**

**MICROWAVES**

**RADIO WAVES**

**ULTRAVIOLET**

**[1]**

**(b) List THREE types of radiation in this family that are non-ionising.**

\_\_\_\_\_ and \_\_\_\_\_

and \_\_\_\_\_

**[1]**

- (c) Ionising and non-ionising radiations can damage living cells in different ways.

Look at the table below.

Put ticks (✓) in the boxes to show which type of damage is caused by each type of radiation.

<u>TYPE OF RADIATION</u>	<u>DAMAGE CAUSED BY HEATING</u>	<u>DAMAGE CAUSED BY BREAKING UP MOLECULES</u>	<u>DAMAGE CAUSED BY BOTH</u>
ionising radiation			
non-ionising radiation			

[2]

- (d) Which of the following units is used to measure the possible harm done to the body by a radiation dose?

Put a ring around the correct answer in the list below.

BECQUEREL

COUNTS PER SECOND

HERTZ

SIEVERT

WATT

[1]

**(e) X-rays are another type of ionising radiation.**

**Ionising radiation can damage living cells.**

**X-rays are used to take photographs of broken bones in hospitals.**

**Which of the statements below would reduce the risk to THE PATIENT?**

**Put a tick (✓) in the boxes next to the TWO correct statements.**

<b>Patients are recommended only to have a certain number of X-ray images taken each year.</b>	
<b>X-ray machines are only used in large hospitals.</b>	
<b>Usually only small areas of the body are exposed to X-rays.</b>	
<b>Patients must not leave the hospital for 2 hours after having an X-ray.</b>	

**[2]**

**[Total: 7]**

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- 4 Read the information below and use it to help you answer the following questions.

In 2007 there was a proposed new law to stop young people from using sunbeds.

### SHOULD YOU USE A SUNBED?

Exposure to sunlight gives an increase in vitamin D in the skin. But the World Health Organization says young people who get sunburn have a greater risk of skin cancer than adults.

Research has made a direct link between the use of sunbeds and cancer. There are 132 000 cases of one type of skin cancer globally each year and 66 000 people die from it worldwide.

In the UK, there are around 9500 cases of this skin cancer diagnosed each year and around 1800 deaths.

A rise in the use of sunbeds with high-powered lamps, due to the fashion for a tan, is the main reason for the increase in skin cancers.

- (a) From the information in the article, the percentage of people IN THE UK with this skin cancer who die from it can be calculated.

Put a ring around the correct calculation below.

$$\frac{132\,000}{66\,000} \times 100$$

$$\frac{9500}{1800} \times 100$$

$$\frac{66\,000}{132\,000} \times 100$$

$$\frac{1800}{9500} \times 100$$

[1]

**(b) The article mentions high-power lamps.**

**Complete the sentences below about ultraviolet light from these lamps.**

**The intensity of the ultraviolet light hitting the skin is the energy arriving**

**each \_\_\_\_\_**

**The intensity decreases as the \_\_\_\_\_**

**from the source increases.**

**The ultraviolet light is made up of photons.**

**Two factors ABOUT PHOTONS that affect the**

**energy arriving at the skin are the**

**\_\_\_\_\_ and \_\_\_\_\_**

**of PHOTONS.**

**[4]**

**(c) Some friends were discussing the article.**

**ANDREW**

**“The more you use a sunbed, the greater your risk of skin cancer. When the tan fades, the damage remains.”**

**AMY**

**“Nothing is going to stop me from using a sunbed. I like to have a good tan to look nice.”**

**JEFF**

**“I get a tan just from being outside on holiday, but I always use a high factor sun cream, so I don’t get sunburned.”**

**EDWIN**

**“More and more people in the UK are getting skin cancer.”**

**CLARISSA**

**“I would never use a sunbed because I don’t know what the risk of developing skin cancer is.”**

**(i) Which of the friends is describing a correlation?**

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

**(ii) Which of the friends’ statements BEST shows the precautionary principle?**

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

**(iii) Which of the friends think that the benefits of using a sunbed outweigh the risks.**

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

**[Total: 8]**



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**5 Paul is researching into radioactive materials.**

**(a) He finds there are three types of ionising radiation from radioactive materials, each with different penetration properties.**

**Which of these ionising radiations in the list below do NOT come from a radioactive material?**

**BETA**

**ALPHA**

**X-RAY**

**GAMMA**

**ULTRAVIOLET**

---

**[1]**

**(b) Background radiation is also ionising radiation.**

**Which of the following are sources of background radiation?**

**Put a ring around the best answers in the list below.**

**ROCKS**

**THE SEA**

**COSMIC RADIATION**

**TELEVISION SIGNALS**

**MICROWAVES**

**MOBILE PHONES**

**[2]**

**(c) Paul also found information about the half-life of a radioactive material.**

**(i) Finish the sentence below by putting a tick (✓) in the box next to the correct ending.**

**Half-life is ...**

**... half the time it takes for the material to stop being radioactive.**

**... the time it takes for the activity of the material to fall by a half.**

**... the time it takes for the material to become safe.**

**... half the amount of the radioactive material.**

**[1]**

**(ii) Which of the following in the list below will change the half-life of a radioactive material?**

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

**heating up the material**

**passing electricity through the material**

**chemically reacting the material with oxygen**

**none of the above**

**[1]**

(d) He also finds that some radioactive elements are used to help people.

Look at the list below.

Put a ring around the TWO helpful uses of radioactive elements.

TREAT CANCER

BLEACH HAIR

IN SOLAR CELLS

STERILISE FOOD

TO MAKE LED LIGHTS WORK

TO DETECT FORGED BANK NOTES

[2]

(e) The table below shows some information about useful radioactive materials.

<u>NAME</u>	<u>HALF-LIFE</u>	<u>RADIATION EMITTED</u>
technetium 99	6 hours	gamma
strontium 90	28.9 years	beta
americium 241	432 years	alpha

The properties of each material determine its use.

Draw ONE straight line from each SOURCE AND USE to the best REASON.

**SOURCE AND USE**

**REASON**

americium 241  
used in  
smoke alarms

long half-life  
and medium  
penetration

technetium 99 used  
to image the inside  
of humans

long half-life  
and short  
range radiation

strontium 90  
used to  
measure thickness

short half-life  
and very  
penetrating  
radiation

short half-life  
and short  
range radiation

[3]

[Total: 10]

**6 This question is about different ways of generating electricity.**

**(a) Some ways of generating electricity use renewable sources.**

**Look at the list below.**

**Put a ring around each way of generating electricity that is renewable.**

**COAL**

**HYDROELECTRIC**

**NUCLEAR**

**WAVE**

**WIND**

**[1]**



**(b) Nuclear power has been suggested as the best way to generate more electricity in the UK.**

**There are arguments for and against the use of nuclear power stations to generate electricity.**

**Look at the table below.**

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

	<b><u>FOR NUCLEAR POWER</u></b>	<b><u>AGAINST NUCLEAR POWER</u></b>	<b><u>NEITHER FOR NOR AGAINST</u></b>
<b>Nuclear power stations produce huge amounts of energy from a small amount of fuel.</b>			
<b>Nuclear power stations need a turbine to produce electricity.</b>			
<b>Nuclear power stations use water for cooling.</b>			
<b>Nuclear power stations produce nuclear waste which lasts for a very long time.</b>			

**[3]**

**(c) A local community is considering what type of power station to have built nearby.**

**Here are two points of view from local people about nuclear power.**

**TUNDE**

**“I don’t want a nuclear power station but we need the output. It might replace 2 or 3 coal power stations or 500 wind turbines but it would make our excellent beach less attractive.”**

**KELLY**

**“I think we should have the power station, as we need more electricity and it will also employ lots of local people.”**

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

	<u>TUNDE</u>	<u>KELLY</u>	<u>BOTH TUNDE AND KELLY</u>	<u>NEITHER TUNDE NOR KELLY</u>
Who made a comment about power output?				
Who made a comment about economic factors?				
Who made a comment about environmental cost?				

[3]

[Total: 7]

**END OF QUESTION PAPER**



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