

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

A331/02

PHYSICS A

Unit 1: Modules P1 P2 P3
(Higher Tier)

**Monday 22 June 2009
Morning**

Duration: 40 minutes

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)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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MODIFIED LANGUAGE

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.
- Do **not** write in the bar codes.
- 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**.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 John's class is discussing the solar system.

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

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

Fill in the boxes to show the right order.

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

largest

--	--	--	--

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 box to complete the correct sentence.

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.

- 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 of the table to show which statements only contain **data**, and which statements contain an **explanation** of the data.

data	explanation

[3]

[Total: 7]

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.

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]

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Question 3 starts on page 6.

PLEASE DO NOT WRITE ON THIS PAGE

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.

gamma **infrared** **microwaves** **radio waves** **ultraviolet** [1]

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

.....andand[1]

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

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

type of radiation	damage caused by heating	damage caused by breaking up molecules	damage caused by both
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.

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 these statements would reduce the risk to **the patient**?

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

Patients are recommended only to have a certain number of X-ray images taken each year.

X-ray machines are only used in large hospitals.

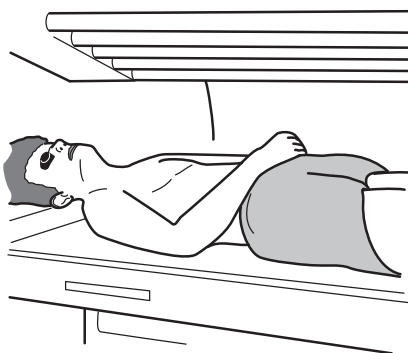
Usually only small areas of the body are exposed to X-rays.

Patients must not leave the hospital for 2 hours after having an X-ray.

[2]

[Total: 7]

- 4 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.

The main reasons for the increase in skin cancers are a rise in the use of sunbeds with high-powered lamps, and the fashion for a tan.

- (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.

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

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

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

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

[1]

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

Complete the sentences about ultraviolet light from these lamps.

The intensity of the ultraviolet light hitting the skin is the energy arriving each.....

The intensity decreases as thefrom 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]

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.

beta

alpha

X-ray

gamma

ultraviolet

Which of these ionising radiations do **not** come from a radioactive material?

..... [1]

(b) Background radiation is also ionising radiation.

Which of the following are sources of background radiation?

Put a **(ring)** around the best answers.

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 this sentence 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 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.

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) Here is some information about useful radioactive materials.

name	half-life	radiation emitted
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]

Question 6 starts on page 14.

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6 This question is about different ways of generating electricity.

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

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.

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

	for nuclear power	against nuclear power	neither for nor against
Nuclear power stations produce huge amounts of energy from a small amount of fuel.			
Nuclear power stations need a turbine to produce electricity.			
Nuclear power stations use water for cooling.			
Nuclear power stations produce nuclear waste which lasts for a very long time.			

[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.

	Tunde	Kelly	both Tunde and Kelly	neither Tunde nor Kelly
Who made a comment about power output?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Who made a comment about economic factors?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Who made a comment about environmental cost?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

[3]

[Total: 7]

END OF QUESTION PAPER

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