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**Monday 30 January 2012 – Afternoon**

**GCSE TWENTY FIRST CENTURY SCIENCE  
PHYSICS A**

**A331/02** Unit 1: Modules P1 P2 P3 (Higher Tier)

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)

**Duration:** 40 minutes



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**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 **12** pages. Any blank pages are indicated.

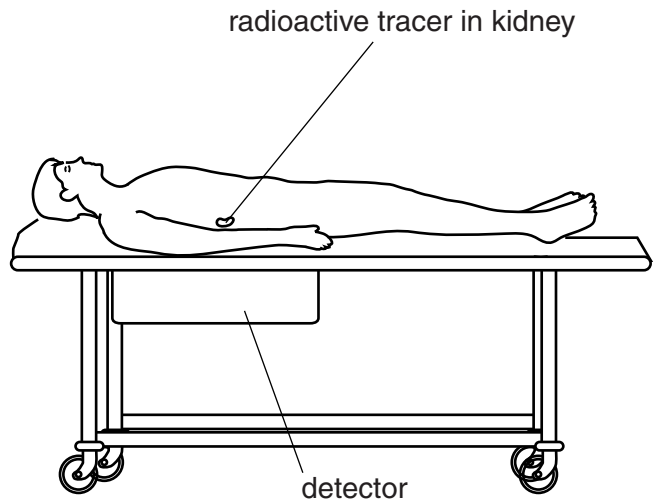
Answer **all** the questions.

1 A radioactive tracer can be used to test how well a patient's kidneys are working.

The tracer is a chemical which contains radioactive atoms.

The tracer is injected into the patient.

The radioactive tracer emits ionising radiation which is detected outside the body.



The best type of ionising radiation to use is gamma radiation.

Explain why gamma radiation is better to use than alpha or beta radiation.

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..... [4]

[Total: 4]

2 Nuclear power stations use nuclear fission as an energy source.

(a) Complete the sentences to explain how nuclear fission is controlled.

Use words from this list.

**beta reaction**

**chain reaction**

**coolant**

**control rod**

**fuel rod**

**fusion reaction**

**proton**

**turbine**

The fission reaction inside the ..... produces neutrons which can trigger more fission reactions. This is called a .....

This process can be slowed down by using a ..... to absorb the neutrons.

The heat produced by the fission is removed by a .....

[4]

(b) Here are some statements about the nuclear fission of a uranium nucleus.

Put ticks (✓) next to the correct statements.

energy is released from the electrons

two smaller nuclei of similar size are produced

fission of uranium produces more energy than a chemical reaction of uranium with oxygen

protons are given off

all the nuclei produced in the fission are non-radioactive

[2]

(c) Nuclear power stations produce nuclear waste.

There are three types of nuclear waste. These are high level, intermediate level and low level. The level depends on the activity of the waste.

(i) Draw straight lines between each **type of waste** and the **method of disposal**.

type of waste	method of disposal
high level	buried in landfill sites
intermediate level	mixed with concrete and stored in large containers
low level	stored carefully under water until it becomes less active

[1]

(ii) Use the idea of half-life to explain why, in general, **intermediate** level nuclear waste is a bigger long term problem than high level nuclear waste.

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.....

.....

..... [2]

(d) The ionising radiation from radioactive materials can damage living cells.

Which **two** of the following statements, when taken together, explain why?

<b>A</b>	Radiation comes from the nuclei of atoms.
<b>B</b>	Ions can change the chemical reactions that take place.
<b>C</b>	Ionising radiation is often electromagnetic radiation.
<b>D</b>	High energy electrons are beta radiation.
<b>E</b>	Ionising radiation causes ions to form.
<b>F</b>	Ions have lost or gained electrons.

statements ..... and .....

[2]

[Total: 11]

- 3 (a) John does voluntary work in a local hospital.

He visits patients in the cancer ward.

He has heard that using a mobile phone can cause cancer.

He asks the patients who have cancer if they use a mobile phone.

These are his results.

position of cancer	number of patients	number who use mobile phones
head	6	5
body	15	14
arms or legs	1	1

John thinks his data show that mobile phones do cause cancer.

Is John correct? Explain your answer.

.....

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.....

..... [3]

- (b) Mobile phones send signals using microwave radiation.

Mobile phones are unlikely to cause cancer.

All of the following statements are true, but only one explains why mobile phones are **unlikely** to cause cancer.

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

Microwaves are absorbed by water.

Microwaves are not ionising radiation.

Microwaves heat up cells.

Microwaves are electromagnetic radiation.

[1]

[Total: 4]

Turn over

## 4 Venus is a very hot planet.

The average surface temperature on Venus is approximately 480 °C. However, the Earth's average surface temperature is approximately 15 °C.

(a) One reason for this difference is the amount of radiation arriving from the Sun.

Why does more energy arrive at Venus than at the Earth?

Put ticks (✓) in the boxes next to the correct answers.

the photons arriving at Venus have a higher energy

Earth's gravity is greater

more photons are arriving at Venus

Venus is covered in clouds all the time

the intensity of electromagnetic radiation decreases with increasing distance from the Sun

[2]

(b) The composition of Venus's atmosphere also makes a very big difference to the temperature.

gas in atmosphere	Earth	Venus
nitrogen	78%	3.5%
oxygen	21%	less than 0.05%
carbon dioxide	less than 0.05%	96%

Explain how atmospheric composition makes Venus so much hotter than the Earth.

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.....

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..... [3]

(c) Which of these units is a unit of radiation intensity?

Put a (ring) around the correct answer.

**J/m<sup>2</sup>**

**J/s**

**m/s<sup>2</sup>**

**W/m<sup>2</sup>**

**Ws<sup>2</sup>**

[1]

[Total: 6]

- 5 This question is about the processes that affect the CO<sub>2</sub> concentration in the air.

Complete the following sentences about human activity and carbon dioxide concentrations in the atmosphere by writing in the correct **processes**.

For thousands of years, the concentration of carbon dioxide in the Earth's atmosphere was

nearly constant. This is because plants and animals give out carbon dioxide

by ..... and plants also take carbon dioxide out of the atmosphere

by .....

Human activity such as ..... reduces the amount of

carbon dioxide being taken out of the atmosphere and releases carbon dioxide as wood is burnt.

The human demand for energy has also led to the release of large amounts of carbon dioxide

from the ..... of fossil fuels for energy.

[4]

[Total: 4]

- 6 In 2010 a conference of scientists looked at all the evidence about the extinction of the dinosaurs. They said that, overall, the evidence supported the theory that an asteroid impact had caused the extinction of the dinosaurs.

(a) Which statement best describes asteroids?

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

They are large and orbit the Sun.

They are usually made of rocks and ice. They spend most of their time outside the orbit of Neptune, but some visit the inner Solar System.

They are usually made of rock and most of them are found between Mars and Jupiter.

They can be large or small, but they always orbit planets.

[1]

(b) The following statements are all **true**.

Which three statements, when taken together, support the idea that an asteroid impact could have led to the extinction of the dinosaurs?

Put ticks (✓) in the boxes next to these **three** statements.

A layer of material found in asteroids is found all over the world in rocks formed about the time the dinosaurs disappeared.

Fossils suggest the dinosaur numbers were decreasing for hundreds of thousands of years.

There are the remains of a very large crater in the Gulf of Mexico.

Fossils of the same type of dinosaur are found on different continents.

A large amount of dust thrown into the atmosphere could have caused the whole world to have a winter that lasted for hundreds of years.

There have been many other extinctions during the history of the world.

[3]

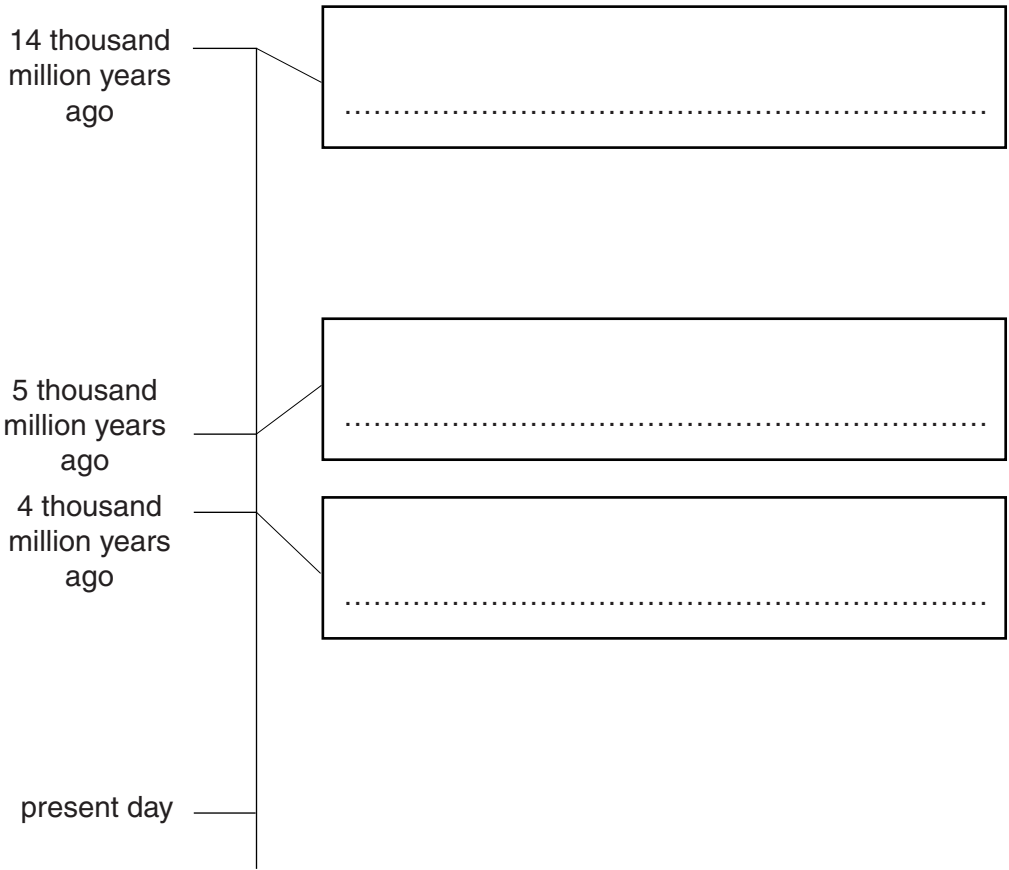
[Total: 4]



7 Records of human history started about 5000 years ago when writing was invented.

But from our studies of the Earth and space we have evidence for events much earlier than that.

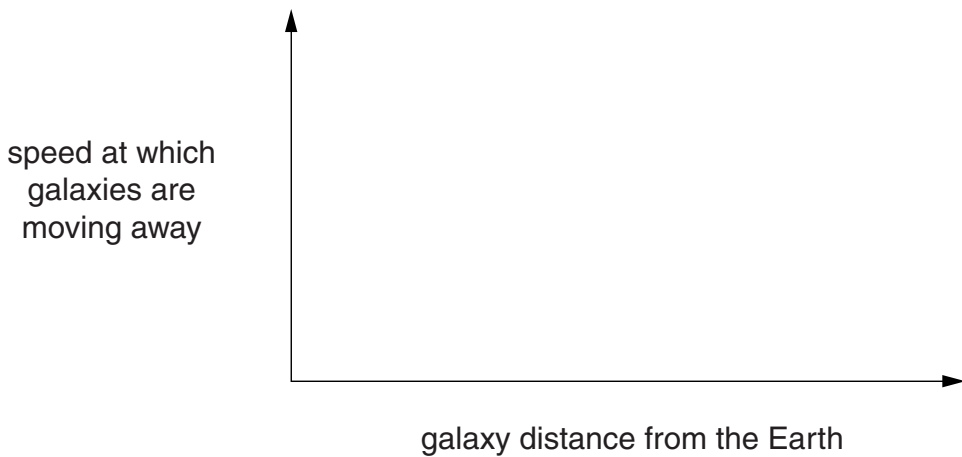
(a) Complete the labels on the timeline to suggest the major event that happened at each time point.



[3]

(b) Edwin Hubble found the relationship between the speed at which galaxies are moving away and their distance from the Earth.

Complete the sketch graph to show Hubble's relationship.

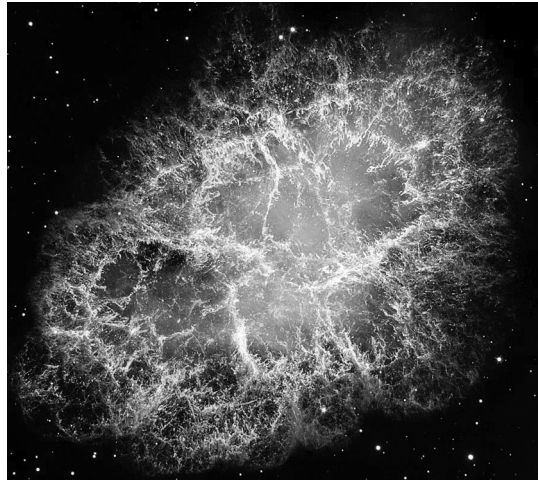


[2]

[Total: 5]  
Turn over

- 8 The supernova that formed the Crab nebula was observed by Arabic and Chinese astronomers in the year 1054.

The distance to the nebula is 6500 light years.



- (a) How long ago did the supernova that formed the Crab nebula happen?

Put a **ring** around the correct number of years.

958

1054

6500

7458

7554

[1]

- (b) (i) The nearest neighbouring star to our Sun is about 4 light years away and a typical galaxy is 100 000 light years in diameter.

Which of the following best describes the position of the Crab nebula?

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

in the Solar System

outside the Solar System but closer than the nearest stars

outside the Solar System but inside the Milky Way

outside the Milky Way, but not as far as nearby galaxies

as far as very distant galaxies

[1]

(ii) How can the distance to a star near to the Crab nebula be found?

Put ticks (✓) in the boxes next to the correct answers.

measure how long it takes for light to get to the Earth

use the Hubble relationship

use the brightness of the star

use parallax

measure how long it takes for a radar signal to return

[2]

[Total: 4]

**END OF QUESTION PAPER**

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