

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.

Duration: 40 minutes

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, 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.

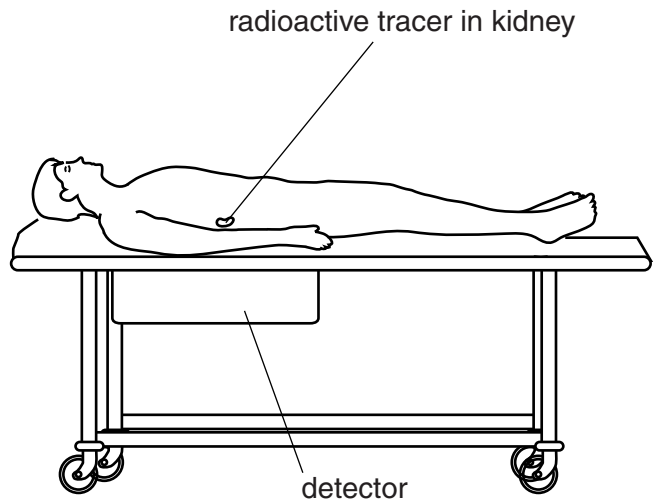
Answer **all** the questions.

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

The tracer is a chemical which has radioactive atoms in it.

The tracer is injected into the patient.

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



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

Explain why it is better to use gamma radiation 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. The neutrons 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. A higher level means that the waste is more radioactive.

(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) Why is **intermediate** level nuclear waste usually a bigger long term problem than high level nuclear waste? Use the idea of half-life in your explanation.

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..... [2]

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

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

A	Radiation comes from the nuclei of atoms.
B	Ions can change the chemical reactions that take place.
C	Ionising radiation is often electromagnetic radiation.
D	High energy electrons are beta radiation.
E	Ionising radiation causes ions to form.
F	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 in the cancer ward 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 not likely to cause cancer.

All of the following statements are true. Only one statement explains why mobile phones are **not likely** 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.

On Venus, the average surface temperature is about 480 °C. The Earth’s average surface temperature is about 15 °C.

(a) One reason for the difference in surface temperature 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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..... [3]

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

Put a (ring) around the correct answer.

- J/m²** **J/s** **m/s²** **W/m²** **Ws²**

[1]

[Total: 6]

- 5 This question is about the processes that affect the CO₂ concentration in the air.

The following sentences are about human activity and carbon dioxide concentrations in the atmosphere. Complete the sentences. Write in the correct **processes**.

For thousands of years, the concentration of carbon dioxide in the Earth's atmosphere did not change much. This is because plants and animals give out carbon dioxide

by Plants also take carbon dioxide out of the atmosphere

by

Human activity such as reduces the amount of

carbon dioxide 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 the best theory was that an asteroid impact 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 are usually outside the orbit of Neptune. Some move into the inner Solar System.

They are usually made of rock. Most of them are 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, put together, support the idea that an asteroid impact caused the extinction of the dinosaurs?

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

A layer of material found in asteroids is found all over the world in rocks. The 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.

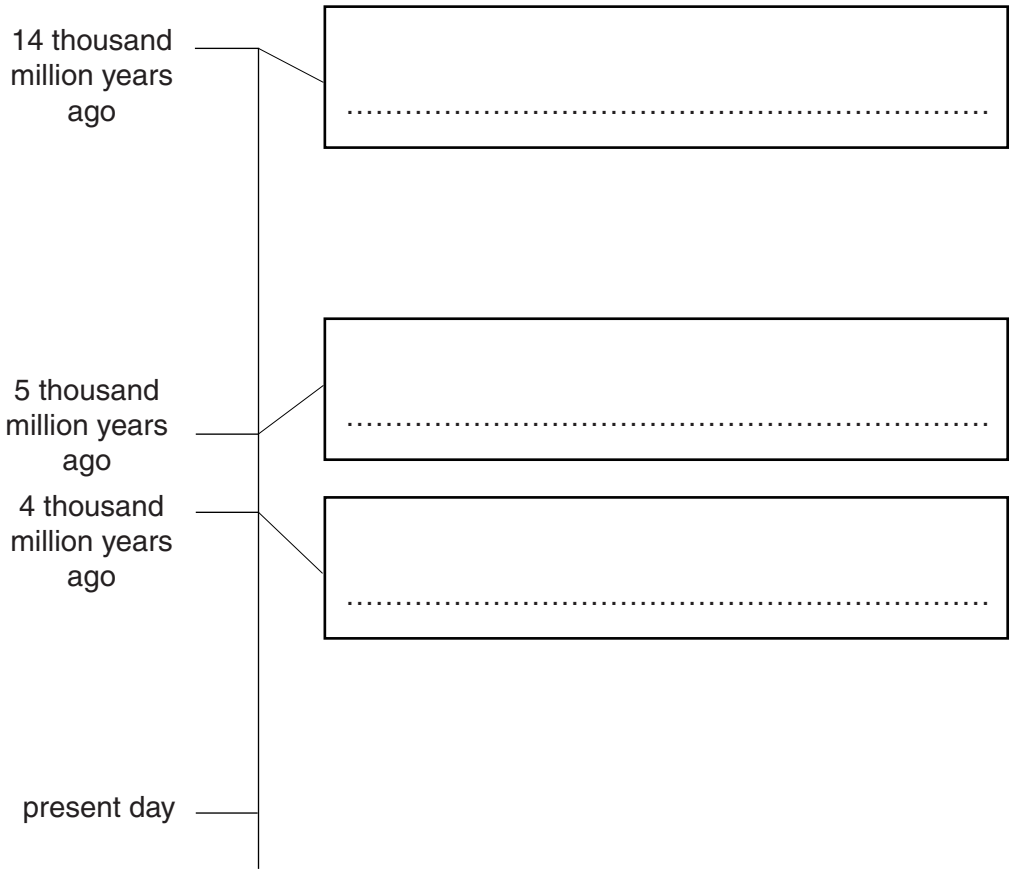
[3]

[Total: 4]

7 About 5000 years ago, writing was invented. Written records of human history started.

But from our studies of the Earth and space we have evidence for events before 5000 years ago.

(a) Complete the labels on the timeline. 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.

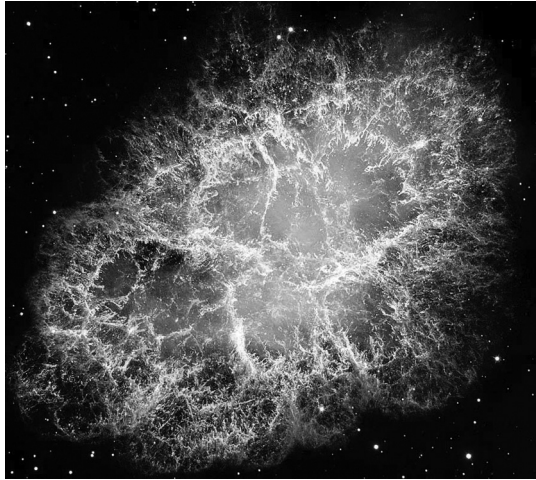


[2]

[Total: 5]
Turn over

- 8 In 1054, Arabic and Chinese astronomers observed the supernova that formed the Crab nebula.

The distance to the nebula is 6500 light years.



- (a) How long ago did this supernova happen?

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

958

1054

6500

7458

7554

[1]

- (b) (i) The nearest star to our Sun is about 4 light years away. 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 astronomers find the distance to a star near to the Crab nebula?

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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