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Student number

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Name _____

Date _____

Attempt/Time taken _____

GCSE PHYSICS

Topic Paper: 4.4 & 8.1.2 Nuclear fission and fusion and The life cycle of a star
(Physics only)

Part 2

Time allowed: 40 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert (enclosed)
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

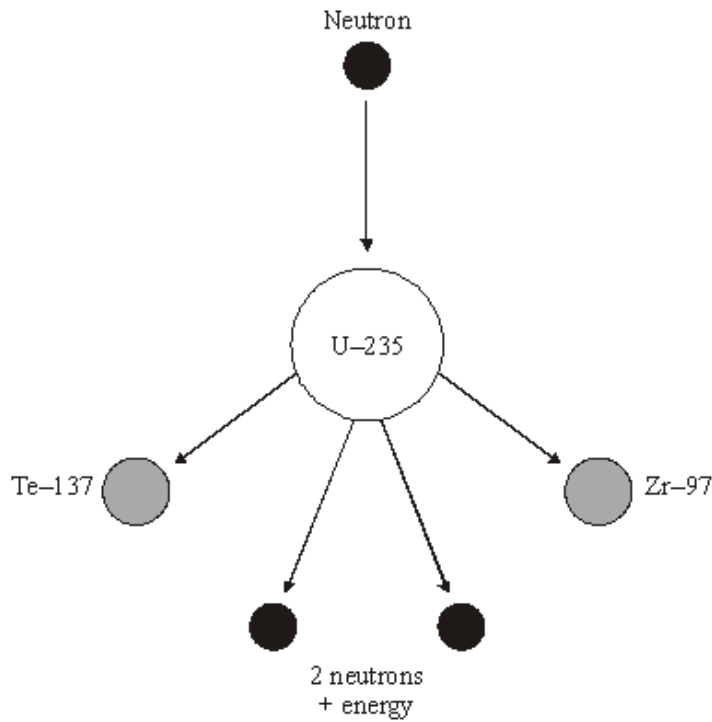
- The Periodic Table/Data Sheet is provided as in insert.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering questions you need to make sure that your answer:
 - is clear, logical, sensibly structured
 - fully meets the requirements of the question
 - shows that each separate point or step supports the overall answer.



34 Marks



- Q7.** (a) The diagram shows what can happen when the nucleus of a uranium atom absorbs a neutron.



- (i) What name is given to the process shown in the diagram?

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(1)

- (ii) Explain how this process could lead to a chain reaction.

You may wish to add further detail to the diagram to help your answer.

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(2)

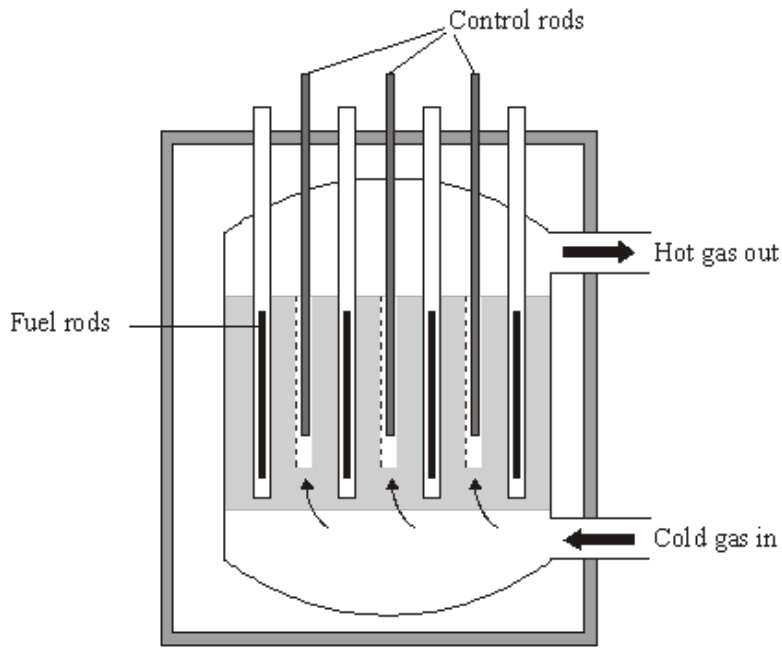
- (iii) How does the mass number of an atom change when its nucleus absorbs a neutron?

.....

(1)



(b) Uranium-235 is used as a fuel in some nuclear reactors.



Source: adapted from 'Physics Matters', by Nick England. Published by Hodder and Stoughton, 1989. Reproduced by permission of Hodder and Stoughton Ltd.

The reactor contains control rods used to absorb neutrons.

Suggest what happens when the control rods are lowered into the reactor.

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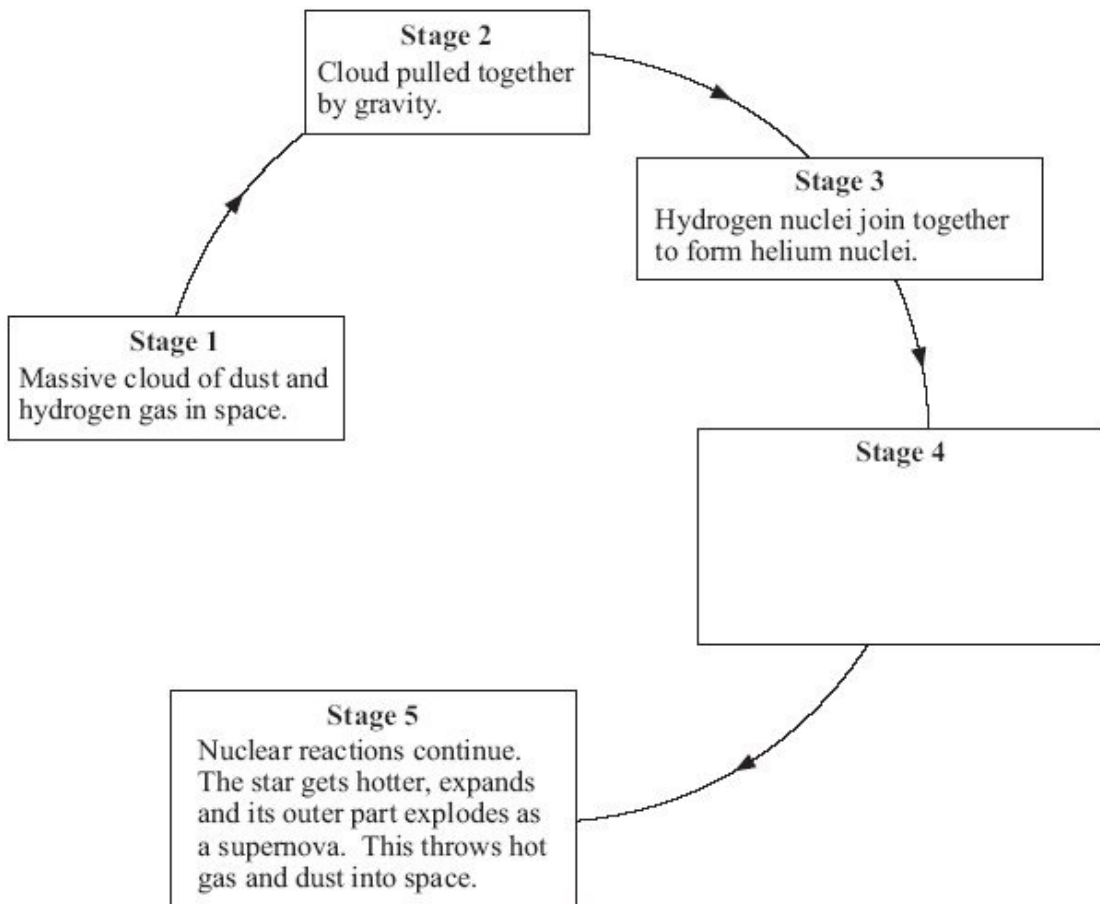
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(2)
(Total 6 marks)



Q8. The diagram shows part of the life cycle of a star which is much bigger than the Sun.



(a) (i) What is the relationship between the masses of the dust and gas in the cloud in **Stage 2** and the force of gravity between them?

.....
.....

(1)

(ii) What is the relationship between the distance apart of the dust and gas in the cloud in **Stage 2** and the force of gravity between them?

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.....

(1)



(b) In **Stage 3** the star remains stable for millions of years.

Explain why.

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.....

(2)

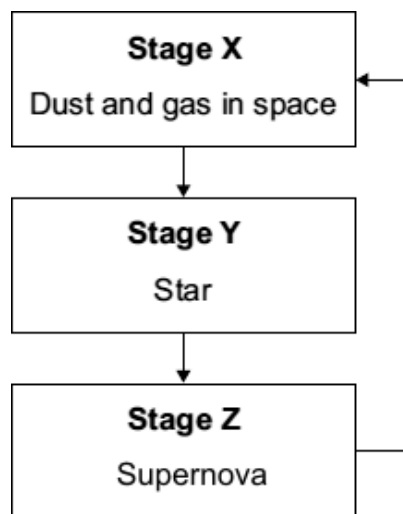
(c) What happens in **Stage 4**?

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(2)

(Total 6 marks)

Q9. The flowchart shows a simple version of the life cycle of a star that is much more massive than the Sun.



(a) What causes the change from **Stage X** to **Stage Y**?

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(1)



(b) For most of its time in **Stage Y**, the star is stable.

Explain why the star remains stable.

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.....

(2)

(c) (i) Explain how a star is able to produce energy in **Stage Y**.

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.....
.....

(2)

(ii) Why is a star in **Stage Y** able to give out energy for millions of years?

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(1)

(d) What happens to the elements produced in a supernova?

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(1)

(Total 7 marks)

Q10. This passage is from a web page.

Our nearest star, the Sun

The pie chart shows the proportions of chemical elements in the Sun.

Chemical Element	Proportion
Hydrogen	75%
Helium	23%
Other elements	2%

Most of the Sun's helium has been produced from the Sun's hydrogen by the process of nuclear fusion. This process also produces vast quantities of energy. The process takes place in the core of the Sun at a temperature of about 15 million °C and has been going on for about 4.5 billion years. During this period of time, the Sun has remained stable and scientists think that it will remain stable for several billion years into the future.

(a) Explain why the Sun remains stable.

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(3)

(b) A scientific opinion is expressed on this web page.

Identify this opinion and suggest how scientists could justify it.

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(2)
(Total 5 marks)



Q11. Read this statement from a website.

Immediately after the 'big bang', at the start of the Universe, there were only atoms of the element hydrogen (H).

Now there are over one hundred elements. Scientists think that all the elements on Earth are also present throughout the Universe.

(a) Explain how atoms of the element (He) are formed in a star.

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(2)

(b) Explain how atoms of very heavy elements, such as gold (Au), were formed.

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(2)

(c) Scientists have only examined a tiny fraction of the Universe.

What is the basis for scientists thinking that the elements found on Earth are present throughout the Universe?

.....
.....

(1)

(Total 5 marks)

Q12. (a) As part of its life cycle, a star changes from being a protostar to a main sequence star.

Explain the difference between a protostar and a main sequence star.

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(2)



- (b) The early Universe contained only atoms of hydrogen. The Universe now contains atoms of over one hundred different elements.

Explain how the different elements now contained in the Universe were formed.

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(3)
(Total 5 marks)