

1. (a) Once formed, a star can have a stable life for billions of years.  
Describe the **two** main forces at work in the star during this period of stability.

1. ....

2. ....

(2)

- (b) What happens to a star once this stable period is over?

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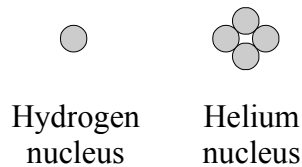
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(4)

(Total 6 marks)

2. At the very high temperatures in the sun, hydrogen is converted into helium. It takes four hydrogen nuclei to produce one helium nucleus.

The table shows the relative masses of hydrogen and helium nuclei.



| Nucleus  | Relative Mass |
|----------|---------------|
| hydrogen | 1.007825      |
| helium   | 4.0037        |

- (a) Use these figures to calculate what happens to the mass of the sun as hydrogen is converted to helium.

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(3)

- (b) Use your answer to part (a) to explain how the sun has been able to radiate huge amounts of energy for billions of years.

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(2)  
**(Total 5 marks)**

3. Explain, in as much detail as you can, the importance of gravity:

- (a) in keeping a satellite in orbit around the Earth.

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(3)

- (b) in enabling a star like the Sun to remain stable for several billion years.

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- (c) for what might happen to the Universe in the distant future.

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(3)  
**(Total 8 marks)**

4. Describe, in as much detail as you can, the life history of a star like our Sun.

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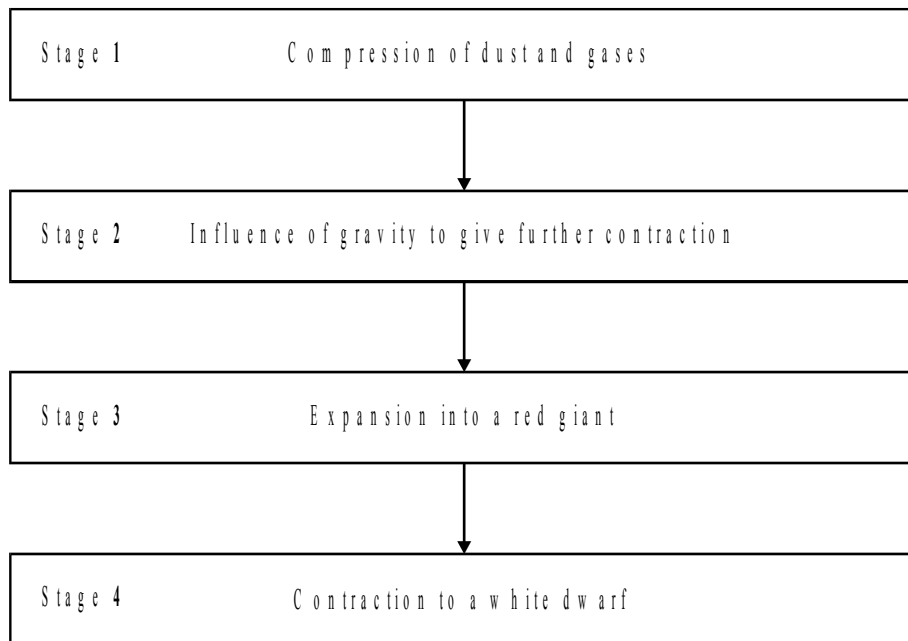
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**(Total 6 marks)**

5. The flowchart shows four stages thought to occur in the evolution of a star such as our Sun.



At a particular time a star might have reached one of these stages or be between stages or be at a further stage. What period in its evolution has our star, the Sun, reached?

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**(Total 1 mark)**

6. Our Sun is just one of many millions of stars in a galaxy called the Milky Way.

Our Sun is in the main stable period of a star's lifetime. The massive force of gravity draws its matter together. This force is balanced by the very high temperatures, from the fusion of hydrogen atoms, which tend to make the Sun expand. Describe and explain what will happen to the Sun as the hydrogen is eventually used up.

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**(Total 3 marks)**

7. Studying stars gives scientists evidence about the evolution of the Universe.

(a) (i) In astronomy, what is meant by a black hole?

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(2)

(ii) How is it possible to detect a black hole?

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(2)

(b) The changes which happen in stars result in new elements being formed.

Nuclei of the heaviest elements are found in the Sun.

Describe how these nuclei are formed.

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(2)

**(Total 6 marks)**

8. One theory of the origin of the Universe was that billions of years ago all matter was in one place, then it exploded ('big bang'). Describe, in as much detail as you can, how our star (the Sun) formed from the time when there was just dust and gas (mostly hydrogen) up to now when it is in its main stable period.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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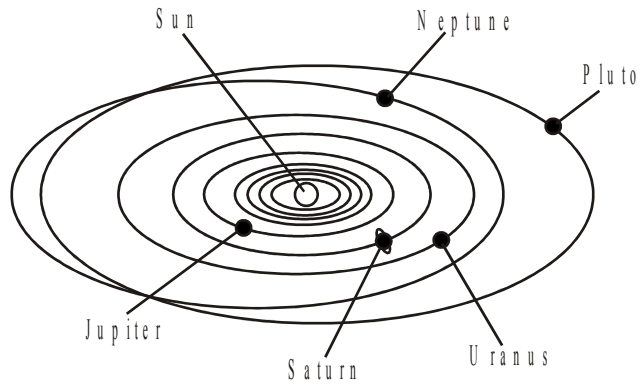
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**(Total 5 marks)**

9. The Sun at the centre of our solar system is a star.



(a) The Sun contains nuclei of the heaviest elements. Atoms of these heaviest elements are also present in the planets of the solar system. What does this suggest about the material from which the solar system is formed?

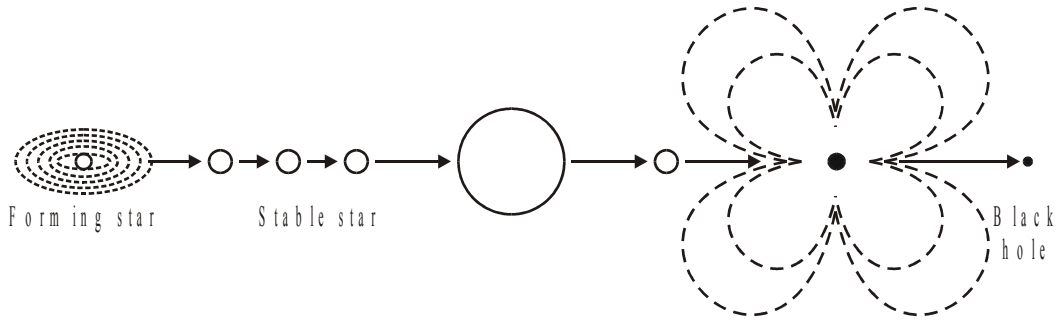
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(1)

(b) Stars form from gas (mostly hydrogen) and dust.



Describe, in as much detail as you can, what forces allow a stable star to exist and how the star may eventually form a black hole.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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(6)  
(Total 7 marks)



10. Stars are formed from massive clouds of dust and gases in space.

(a) What force pulls the clouds of dust and gas together to form stars?

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(1)

(b) Once formed a star can have a stable life for billions of years. Describe the **two** main forces at work in the star during this period of stability.

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(2)

(c) What happens to this star once this stable period is over?

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(4)

(d) Suggest what might then happen to a planet close to this star.

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(1)

(Total 8 marks)

11. (a) The Sun is at the stable stage of its life.

Explain, in terms of the forces acting on the Sun, what this means.

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(3)

(b) At the end of the stable stage of its life a star will change.

Describe and explain the changes that could take place.

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(6)  
(Total 9 marks)

12. To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

(a) The Sun is at the stable stage of its life.

Explain, in terms of the forces acting on the Sun, what this means.

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(3)

(b) At the end of the stable stage of its life a star will change.

Describe and explain the changes that could take place, for a star:

(i) to become a white dwarf;

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(ii) to become a black hole.

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(3)

(Total 9 marks)

13. (a) Explain how stars produce energy.

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(2)

(b) What evidence is there to suggest that the Sun was formed from the material produced when an earlier star exploded?

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(1)

(c) It is thought that gases from the massive star Cygnus X-1 are spiralling into a black hole.



(i) Explain what is meant by the term *black hole*.

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(2)

(ii) What is produced as the gases from a star spiral into a black hole?

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(1)

**(Total 6 marks)**

**14.** Stars do not stay the same forever.

(a) Over billions of years the amount of hydrogen in a star decreases. Why?

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(1)

(b) Describe how a massive star (at least five times bigger than the Sun) will change at the end of the main stable period.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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(c) The inner planets of the solar system contain atoms of the heaviest elements.

(i) Where did these atoms come from?

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(1)

- (ii) What does this tell us about the age of the solar system compared with many of the stars in the Universe?

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(1)

**(Total 7 marks)**