

GCSE Physics

Worksheet: The life cycle of a star

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: The life cycle of a star

NAME _____ **CLASS** _____ **DATE** _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

0 1 . 1 Which of these correctly gives the order of stages for a star like the Sun?

Tick (✓) **one** box.

Nebula → protostar → main sequence → red giant → white dwarf

☐

Nebula → red giant → protostar → main sequence → white dwarf

☐

Protostar → nebula → main sequence → supernova → black hole

☐

Main sequence → protostar → nebula → red giant → white dwarf

☐

[1 mark]

0 1 . 2 State what eventually happens to a white dwarf.

.....

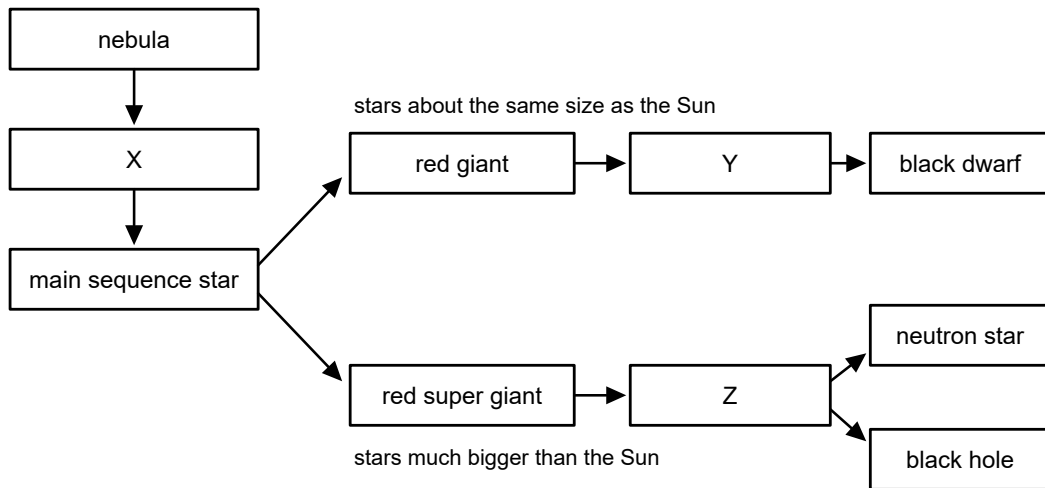
.....

[1 mark]

0 2

Figure 1 shows the life cycles of stars of different sizes. Three of the stages have been replaced by the letters X, Y and Z.

Figure 1



0 2 . 1

Name the stages X, Y and Z.

.....

.....

.....

.....

.....

.....

[3 marks]

0 2 . 2

What decides which life cycle a star follows?

Tick (✓) **one** box.

Its age

Its colour

Its distance from the Earth

Its size (mass)

☐

☐

☐

☐

[1 mark]

0 3

The Sun is a main sequence star.

0 3 . 1

What will the Sun become after its red giant stage?

Tick (✓) **one** box.

A black hole

☐

A neutron star

☐

A supernova

☐

A white dwarf

☐

[1 mark]

0 3 . 2

Which element is fused in the core of a main sequence star?

.....

.....

.....

[1 mark]

0 3 . 3

Which element is produced by this fusion?

.....

.....

.....

[1 mark]

0 3 . 4

Elements heavier than iron are produced in one stage of the life cycle of a massive star.

Name this stage.

.....

.....

.....

[1 mark]

0 4

0 4 . 1

Name the heaviest element that can be produced by nuclear fusion inside a normal star (before it explodes).

.....

.....

.....

.....

[1 mark]

0 4 . 2

Name the event that produces elements heavier than iron.

.....

.....

.....

.....

[1 mark]

0 5

The life cycle of a star depends on its size.

0 5 . 1

Describe how the life cycle of a star much bigger than the Sun is different from the life cycle of the Sun, after the main sequence stage.

.....

.....

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.....

.....

.....

.....

.....

[4 marks]

0 5 . 2

Explain why a white dwarf eventually becomes a black dwarf.

[2 marks]

0 6

A star with 20 times the mass of the Sun has a much shorter main sequence stage than the Sun, even though it starts with far more hydrogen to fuse.

The rate of fusion in the core of a star increases greatly as the temperature of the core increases.

0 6 . 1

Suggest why the much more massive star has a shorter main sequence stage, even though it has more hydrogen.

[3 marks]

0 7

Table 1 gives approximate data for the Sun at two different stages of its life.

Table 1

Stage	Approximate diameter compared with today	Approximate surface temperature
Main sequence (now)	1 ×	5800 K
Red giant (future)	150 ×	3500 K

0 7 . 1

Describe how the Sun’s diameter and surface temperature will change as it becomes a red giant.

.....

.....

.....

.....

[2 marks]

0 7 . 2

When the Sun becomes a red giant, its surface will be much cooler than it is now.
Use ideas about the radiation emitted by hot objects to explain why the Sun will then look redder.

.....

.....

.....

.....

[2 marks]

.....

0 8

Fusion processes in stars produce all of the naturally occurring elements.

0 8 . 1

Explain how fusion processes in stars produce new elements.

[3 marks]

0 8 . 2

Explain how elements made inside stars can become part of a planet such as the Earth.

[2 marks]

0 8 . 3

Gold is an element that is heavier than iron.
Where was the gold found on the Earth produced?

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Physics · Worksheet: The life cycle of a star · 31 marks

Question 1 (2 marks)

01.1 [1 mark]

Correct: Nebula → protostar → main sequence → red giant → white dwarf

01.2 [1 mark]

Answer: It slowly cools and becomes a black dwarf.

- it cools down (over a very long time) and becomes a black dwarf (1)
-

Question 2 (4 marks)

02.1 [3 marks]

Answer: X protostar, Y white dwarf, Z supernova

- X: protostar (1)
 - Y: white dwarf (1)
 - Z: supernova (1)
-

02.2 [1 mark]

Correct: Its size (mass)

Question 3 (4 marks)

03.1 [1 mark]

Correct: A white dwarf

03.2 [1 mark]

Answer: Hydrogen

- hydrogen (1)
-

03.3 [1 mark]

Answer: Helium

- helium (1)
-

03.4 [1 mark]

Answer: Supernova

- supernova (1)
-

Question 4 (2 marks)

04.1 [1 mark]

Answer: Iron

- iron (1)
-

04.2 [1 mark]

Answer: A supernova

- a supernova (1)
-

Question 5 (6 marks)

05.1 [4 marks]

Answer: Sun: red giant → white dwarf → black dwarf. Much bigger star: red super giant → supernova → neutron star or black hole.

- the Sun will become a red giant, but a much bigger star becomes a red super giant (1)
- the Sun will become a white dwarf (1)
- a much bigger star explodes as a supernova (1)
- a much bigger star ends as a neutron star or a black hole, whereas the Sun's white dwarf cools to become a black dwarf (1)

05.2 [2 marks]

Answer: With no fusion, it cools as it radiates until it no longer emits visible light.

- there is no fusion in a white dwarf, so it cools down as it emits radiation (1)
- eventually it is too cool to emit (significant) visible light (1)

Question 6 (3 marks)

06.1 [3 marks]

Answer: Stronger gravity squeezes the core to a much higher temperature, so fusion is much faster and the (larger) supply of hydrogen is used up sooner.

- a more massive star has stronger gravity, which squeezes its core more (1)
- so its core is at a much higher temperature (and pressure) (1)
- so fusion happens at a much greater rate, and the hydrogen is used up in a shorter time even though there is more of it (1)

Question 7 (4 marks)

07.1 [2 marks]

Answer: The diameter increases hugely, while the surface temperature falls.

- the diameter increases greatly (the Sun swells up) (1)
- the surface temperature decreases (1)

07.2 [2 marks]

Answer: The spread of wavelengths emitted depends on temperature; a cooler surface emits relatively more of its light at longer, redder wavelengths.

- the wavelengths (and intensity) of the radiation emitted by an object depend on its temperature (1)
 - a cooler surface emits a greater proportion of its radiation at longer (redder) wavelengths, so the Sun will look redder (1)
-

Question 8 (6 marks)

08.1 [3 marks]

Answer: Hydrogen fuses to helium in main sequence stars; heavier elements up to iron form in later stages; elements heavier than iron form in supernovae.

- in main sequence stars, hydrogen nuclei fuse to form helium (1)
- in red giants and red super giants, helium and other nuclei fuse to form heavier elements (e.g. carbon, oxygen), up to iron (1)
- elements heavier than iron are produced in supernovae (1)

08.2 [2 marks]

Answer: Supernovae scatter the elements into space, where they become part of the nebulae that form new stars and planets.

- the explosion of a massive star (supernova) distributes the elements throughout space / the universe (1)
- new stars and planets form from clouds of dust and gas (nebulae) that contain these elements (1)

08.3 [1 mark]

Answer: In a supernova

- in a supernova (1)
-