THE PHYSICS QUESTION BANK · AQA GCSE PHYSICS

You Are Stardust – The Life Cycle of a Star

A one-hour lesson (Separate Physics only). Follow a star from birth to death and find out how the elements in your body were made.

Name: _____ Class: _____ Date: _____

How to use this worksheet: work through the steps in order and write your answers in your exercise book. Copy every blue 📝 box neatly – these are your revision notes. When you have finished a step, check your work against the **Answers** at the end and correct anything in a different colour.

📝 COPY INTO YOUR BOOK

By the end of this lesson I will be able to:

1. describe the life cycle of a star like the Sun and of a much bigger star

2. explain why a main sequence star is stable

3. explain where the elements come from.

Step 1: Starter (5 minutes)

The astronomer Carl Sagan said we are all made of "star stuff". **What do you think he meant?**

📝 COPY INTO YOUR BOOK

Nuclear fusion: small nuclei join together to make a bigger nucleus, releasing energy. This is how stars make energy – and new elements.

Step 2: Read and write (8 minutes)

Copy these three questions into your book. Then read the text and answer them in full sentences.

1. What is a nebula, and what pulls it together?
2. What happens in the core of a main sequence star?
3. How does the life of a massive star end?

📖 READ

The life of a star

Every star begins as a **nebula**, a huge cloud of dust and gas (mostly hydrogen). **Gravity** slowly pulls the cloud together. As it collapses it gets hotter and denser, forming a **protostar**. When the core is hot enough, hydrogen nuclei join to form helium. This is **nuclear fusion**, and it releases huge amounts of energy.

The star is now a **main sequence star**, like our Sun. It stays stable for billions of years, because the outward pressure from fusion balances the inward pull of gravity. When its hydrogen starts to run out, the star swells. A star about the size of the Sun becomes a **red giant**, then a **white dwarf**, which slowly cools to a **black dwarf**. A much more massive star becomes a **red super giant**, then explodes in a **supernova**, leaving a **neutron star** or, for the biggest stars, a **black hole**.

📝 **COPY AND COMPLETE**

A star forms from a _____, a cloud of dust and gas pulled together by _____. In a main sequence star, _____ nuclei fuse to form _____.

Step 3: Stage cards (8 minutes)

Your task: write one key sentence about each stage in your book.

Nebula – a cloud of dust and gas; gravity slowly pulls it together.

Protostar – as the cloud collapses it gets hotter and denser; when hot enough, hydrogen nuclei start to fuse into helium.

Main sequence star – stable for billions of years because the outward pressure from fusion balances the inward pull of gravity. Our Sun is one.

Red giant / red super giant – when hydrogen runs out the star swells; heavier elements are made by fusion, up to iron.

White dwarf → black dwarf (Sun-sized stars) – the red giant sheds its outer layers, leaving a small hot white dwarf that slowly cools and fades.

Supernova → neutron star or black hole (massive stars) – the red super giant explodes, making elements heavier than iron and scattering them through the universe.

📝 **COPY INTO YOUR BOOK**

A main sequence star is STABLE because the outward pressure from fusion energy BALANCES the inward force of gravity.

Step 4: Put them in order (5 minutes)

Draw a flow chart that splits into two paths: one for a star about the size of the Sun, one for a much bigger star. Both start at the nebula. Check against the box, then copy it.

📝 **COPY INTO YOUR BOOK**

Sun-sized star: nebula → protostar → main sequence star → red giant → white dwarf → black dwarf

Much bigger star: nebula → protostar → main sequence star → red super giant → supernova → neutron star OR black hole

Step 5: Main task – Diary of a Star (14 minutes)

You are a star! Choose to be a Sun-sized star or a massive star. Write five short diary entries, one for each stage of your life. Use all of these words correctly: **gravity · fusion · hydrogen · helium · balance · elements** – and, if you're a massive star, **supernova**.

Start with: "Day 1: I'm just a cloud of dust and gas, drifting through space…"

✅ Tick off each key word as you find it in your diary.

Step 6: Exam practice (12 minutes)

📝 **COPY INTO YOUR BOOK**

Fusion in stars makes elements up to iron. Elements HEAVIER than iron are made in a SUPERNOVA, and the explosion scatters them throughout the universe.

Q1 (2 marks) Explain why a main sequence star is stable.

Q2 (3 marks) Explain how elements heavier than iron are formed and how they come to be found throughout the universe.

Q3 (6 marks) Describe the life cycle of a star the size of the Sun, from its formation to the end of its life.

✅ Add up your marks out of 11.

Step 7: Exit ticket (8 minutes)

- A star stays stable because…
- I am made of stardust because…
- One thing I'm still not sure about is…

Answers

Only look at these once you have written your own answer!

Step 1: Starter (5 minutes)

Stars make new elements by nuclear fusion. When a massive star explodes as a supernova, it makes even heavier elements and scatters them through space. They formed new stars, planets – and us.

Step 2: Read and write (8 minutes)

(1) A cloud of dust and gas, pulled together by gravity. (2) Hydrogen nuclei fuse to form helium, releasing energy. (3) Red super giant → supernova → neutron star or black hole.

Gaps: nebula · gravity · hydrogen · helium

Step 5: Main task – Diary of a Star (14 minutes)

Model (massive star): 1. I'm a nebula – gravity is slowly pulling me together. 2. I'm a protostar, getting hotter; my hydrogen nuclei have started to fuse into helium. 3. I'm a main sequence star – fusion pressure pushing out balances gravity pulling in, so I'm stable. 4. My hydrogen is running out; I'm a red super giant, fusing heavier elements up to iron. 5. BOOM – a supernova! I've made elements heavier than iron and scattered them across the universe. My core is left as a black hole.

Step 6: Exam practice (12 minutes)

Q1: Outward pressure from fusion energy (1) balances the inward force of gravity (1).

Q2: Formed in a supernova (1) when a massive star explodes at the end of its life (1); the explosion scatters them throughout the universe (1).

Q3: Nebula pulled together by gravity → protostar, getting hotter → hydrogen fuses to helium, becoming a main sequence star → stable for billions of years as fusion pressure balances gravity → hydrogen runs out, it swells into a red giant → becomes a white dwarf, which cools to a black dwarf.