Topic 4.8 Space physics Revision Booklet

AQA GCSE Physics 8463 · Foundation & Higher



Name _____ Class _____ Target grade _____

4.8
Space physics

Work through a topic, then come back to it on the dates in your planner. Little and often beats one long cram.

Revise like a scientist

This booklet uses six revision techniques that research shows work best. Every activity is labelled with the technique it uses and the grade it targets.

Retrieval practice

Pulling ideas out of your memory makes them stick far better than re-reading. Brain dumps, quizzes and cover-and-recall tasks.

Spaced practice

Revisit each topic after 2 days, 1 week and 3 weeks. Forgetting a little, then remembering again, strengthens memory.

Interleaving

Mixed-topic questions train you to spot which idea a question needs, just like the real exam.

Dual coding

Words plus diagrams: graphs, ray diagrams and labelled apparatus give your memory two routes in.

Elaboration

Asking 'why?' and 'how?' and linking ideas together turns facts into understanding.

Worked examples

I do → We do → You do: study a full solution, finish a half-done one, then do one alone.

KEY

Grade pathways

GRADE 4

Secure the basics: recall definitions and units, pick the right equation from the equation sheet, and do one-step calculations.

GRADE 5

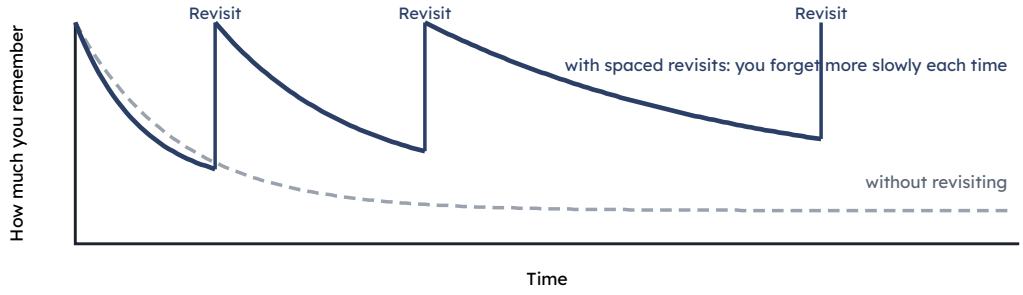
Rearrange equations, convert units, describe practicals and explain in two linked steps.

GRADE 7+

Multi-step calculations, evaluate methods and data, and write logical 6-mark answers.

SPACED PRACTICE DUAL CODING

Why spacing works



SPACED PRACTICE

My spaced revision planner

Write the date you'll do each session. Tick it off when it's done.

Topic	First go	+2 days	+1 week	+3 weeks	Before the mock
4.8 Space physics					
Final review					

What's inside

Topic 8 · Space physics (4.8)

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Final review

Final review: mixed questions	16

ROUTINE

The routine for every page

1. Try it cold. Answer from memory first, without notes. Struggling a bit is good: it's what makes learning stick.

2. Check and correct. Mark it with the answer booklet in a different colour pen. Fix every mistake.

3. Come back later. Redo anything you got wrong on your next spaced session.

ONLINE

Use it with mrsullyphysics.com

Flashcards for retrieval practice: cards you get wrong come back until you get them right.

Quizzes and Aim higher for extra Grade 5+ and 7+ questions with mark schemes.

Animations to see the physics move (dual coding).

Extra practice

Retrieval · answers in the answer booklet

1 Grade 7+ Describe what happens to a star much more massive than the Sun after its main sequence, and explain how it produces elements heavier than iron. [4]

2 Grade 7+ A satellite moves in a circular orbit at a constant speed. Explain why it is accelerating. [3]

3 Grade 5 Give two pieces of evidence that the universe is expanding. [2]

Brain dump and checklist

RETRIEVAL PRACTICE · GRADE 4 · GRADE 5 · GRADE 7

Brain dump

Set a timer for 5 minutes. Write or draw everything you remember about space physics. No notes! Afterwards, add anything you missed in a different colour.

Prompts if you get stuck: solar system? · nebula → ? · main sequence? · supernova? · orbits? · red-shift? · Big Bang? · dark mass and dark energy?

METACOGNITION

How confident am I?

Rate each statement now (before) by shading R, A or G. Rate again at the end of the topic (after).

I can...	Before			After		
	R	A	G	R	A	G
Describe our solar system and the Milky Way	○	○	○	○	○	○
Explain how a star forms from a nebula	○	○	○	○	○	○
Explain why a main sequence star is stable	○	○	○	○	○	○
Describe the life cycle of a star the size of the Sun	○	○	○	○	○	○
Describe the life cycle of a star much more massive than the Sun	○	○	○	○	○	○
Explain how fusion and supernovas produce the elements	○	○	○	○	○	○
Explain how gravity keeps planets and satellites in orbit	○	○	○	○	○	○
Explain why orbiting objects accelerate and how speed affects orbit radius (Higher)	○	○	○	○	○	○
Describe red-shift and what it shows	○	○	○	○	○	○
Explain the evidence for the Big Bang and what is still not understood	○	○	○	○	○	○

Extra practice

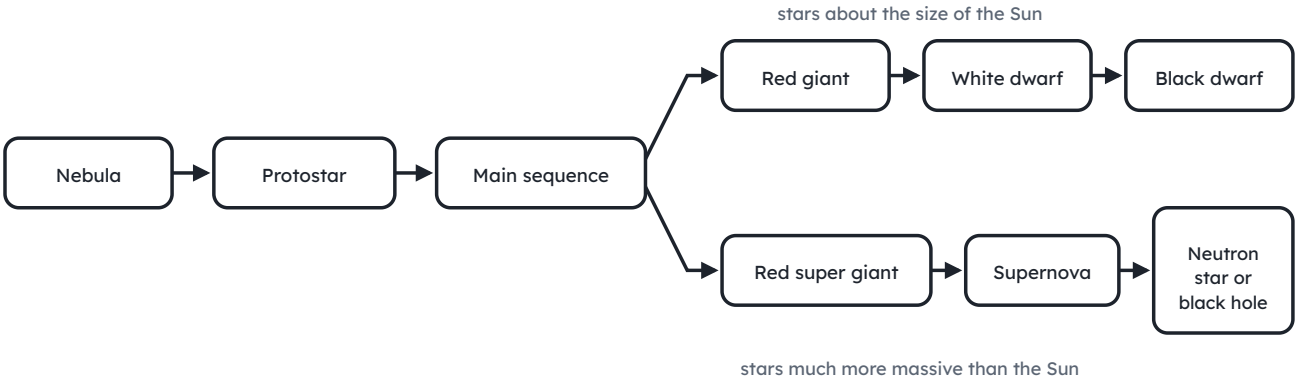
Retrieval · answers in the answer booklet

1 Grade 5 What is red-shift? [2]

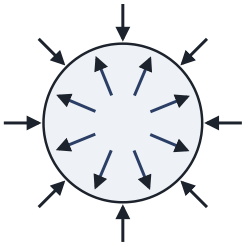
Knowledge organiser

DUAL CODING | GRADE 4 | GRADE 5 | GRADE 7

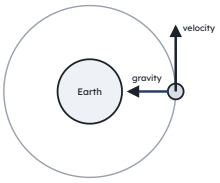
LIFE CYCLE OF STARS



STABLE STARS AND ORBITS



Main sequence star is stable:
inward gravity balances the outward force from fusion energy (equilibrium)



Gravity provides the force towards the centre, so speed stays the same but direction (velocity) changes: the satellite is accelerating (Higher)

Smaller orbit → must move faster to stay in orbit (stable orbit: if speed changes, radius changes)

RED-SHIFT



Red-shift: lines move to longer wavelengths → galaxy moving away. Further away = bigger red-shift → universe is expanding → evidence for the Big Bang

BIG IDEAS

Fusion makes elements up to iron; elements heavier than iron are made in supernovas, which distribute them through the universe.
The universe began from a very small region that was extremely hot and dense (Big Bang).
Dark mass and dark energy are still not understood.

TURN OVER

Key words, misconceptions, required practicals and Grade 7+ links are on the next page.

Knowledge organiser: key words, misconceptions, practicals

ELABORATION GRADE 4 GRADE 5 GRADE 7

KEY WORDS: LEARN THESE WORD FOR WORD (SAME AS SIDE 2 OF YOUR KNOWLEDGE ORGANISER)

Nebula: a cloud of dust and gas where stars form.
Main sequence star: a stable star: inward gravity balances the outward force from fusion energy.
Supernova: the explosion of a massive star; produces elements heavier than iron and distributes them through the universe.
Satellite: an object that orbits a larger body; moons are natural, others artificial.
Red-shift: an observed increase in the wavelength of light from most distant galaxies.
Big Bang theory: the universe began from a very small region that was extremely hot and dense.
Dark mass and dark energy: proposed to explain observations; not yet understood.

MISCONCEPTIONS: SPOT THE MISTAKE

× Common mistake	✓ What's actually true
× The Sun will become a black hole.	✓ It isn't massive enough: it becomes a white dwarf, then a black dwarf.
× Red-shift means the galaxy looks red.	✓ It means the wavelength of its light has increased.
× Satellites at constant speed aren't accelerating.	✓ Their direction changes, so velocity changes: they accelerate (Higher).

AIM FOR GRADE 7+

- Explain the life cycle of a star as a sequence of linked steps.
- Link red-shift to distance and speed, then to an expanding universe.
- Explain why orbiting objects accelerate at constant speed (Higher).

Extra practice

Retrieval · answers in the answer booklet

1 Grade 7+ Explain how red-shift provides evidence for the Big Bang theory. [4]

2 Grade 7+ Explain what is meant by 'dark mass' and 'dark energy', and why they are unanswered questions. [3]

3 Fill the gap: The explosion of a massive star is called a _____. [1]

RETRIEVAL PRACTICE GRADE 4 GRADE 5

Order it: from a cloud of dust to the Sun

Put the stages in order to describe how a star like the Sun forms and lives.

fusion of hydrogen begins · gravity pulls dust and gas together · stable main sequence star · protostar heats up · nebula (cloud of dust and gas)

RETRIEVAL PRACTICE GRADE 4 GRADE 5

Fill the gaps

Use the AQA key words. No word bank: that's the point.

1. Our solar system is in the _____ galaxy.
2. A main sequence star is stable because the outward force from fusion _____ gravity.
3. Elements heavier than iron are produced in a _____.
4. Light from distant galaxies is shifted towards the _____ end of the spectrum.
5. For a stable orbit, a satellite that moves faster must orbit at a smaller _____. (Higher)

ELABORATION GRADE 5

Odd one out

Circle the odd one out in each row and explain why.

1. planet · dwarf planet · moon · galaxy
2. white dwarf · black dwarf · neutron star · red giant
3. red-shift · Big Bang · dark energy · plum pudding

Extra practice

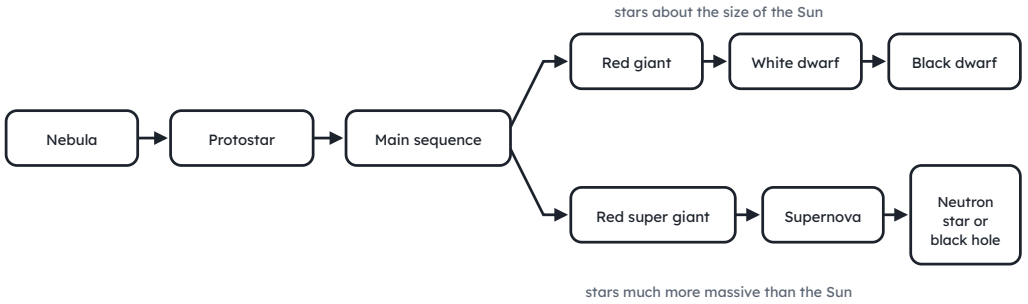
Retrieval · answers in the answer booklet

1 Grade 7+ A satellite in a stable circular orbit speeds up. Explain what must happen to its orbit. [3]

2 True or false? Fusion in a supernova produces elements heavier than iron. Explain. [2]

DUAL CODING GRADE 4 GRADE 5 GRADE 7

The life cycle of a star



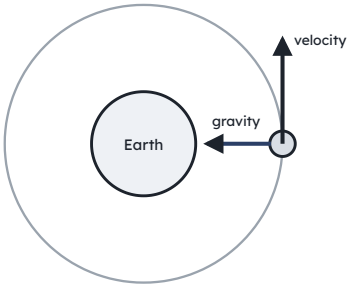
a What will happen to the Sun at the end of its main sequence? [1]

b What decides whether a star becomes a white dwarf or explodes in a supernova? [1]

c Explain why a supernova is important for life on Earth. [2]

DUAL CODING GRADE 5 GRADE 7

Orbits (Physics only)



Gravity provides the force towards the centre, so speed stays the same but direction (velocity) changes: the satellite is accelerating (Higher)

Smaller orbit → must move faster to stay in orbit (stable orbit: if speed changes, radius changes)

a What force keeps the Moon in orbit around the Earth? [1]

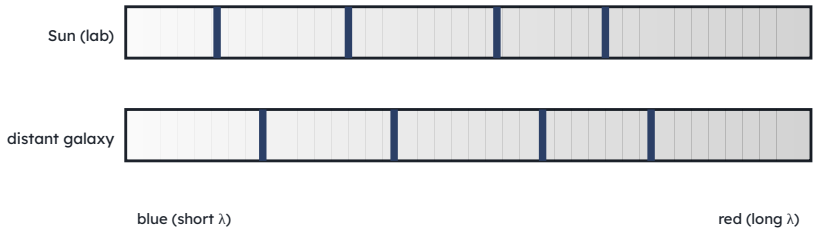
b Explain why a satellite moving at a constant speed is accelerating. (Higher) [2]

c What is a natural satellite? [1]

Picture it (continued)

DUAL CODING GRADE 5 GRADE 7

Red-shift



Red-shift: lines move to longer wavelengths → galaxy moving away. Further away = bigger red-shift → universe is expanding → evidence for the Big Bang

a What is red-shift? [1]

b How does red-shift change with distance to a galaxy? [1]

c What does this tell us about the universe? [1]

Extra practice

Retrieval · answers in the answer booklet

1 Grade 5 Name, in order, the stages a star like the Sun goes through after the main sequence. [3]

2 Grade 7+ Explain how fusion in stars and supernovas produce the elements found on Earth. [4]

3 Grade 5 What is red-shift, and what does it tell us about distant galaxies? [2]

WORKED EXAMPLES GRADE 5 GRADE 7

Using evidence: red-shift

A student compares light from three galaxies.

Galaxy	Distance (million light years)	Red-shift (change in λ ÷ λ)
A	100	0.0075
B	300	0.0225
C	500	

a Predict the red-shift of galaxy C if the pattern continues. [1]

b What relationship do the data show? [1]

c Explain how these data support the Big Bang theory. [3]

ELABORATION GRADE 7

Evidence and theory (Grade 7+)

1 Since 1998, observations of supernovae show that distant galaxies are receding ever faster. Explain what this suggests and why scientists are uncertain about it. [4]

Extra practice

Retrieval · answers in the answer booklet

1 Grade 7+ Explain why a satellite in a circular orbit is accelerating, even though its speed is constant. [4]

ELABORATION GRADE 4 GRADE 5 GRADE 7

Build an explanation

Answer each question in two steps. Use the starter, then push yourself with the Grade 7+ extension.

1 Explain why a main sequence star stays the same size for billions of years.

Grade 4–5 starter: "Gravity pulls the star inwards, while…"

Grade 7+ extension: "Link to equilibrium:…"

2 Explain how red-shift provides evidence for the Big Bang theory.

Grade 4–5 starter: "Light from distant galaxies is…"

Grade 7+ extension: "Link the size of the red-shift to distance:…"

3 Explain why the Moon stays in orbit around the Earth instead of falling to Earth. (Physics only)

Grade 4–5 starter: "The Moon is moving at high speed, so…"

Grade 7+ extension: "Link to gravity changing the direction of motion:…"

ELABORATION GRADE 5

True or false? Justify it.

Saying why is worth more marks than saying true or false.

4 "The Sun will end its life as a black hole." [2]

5 "The universe is getting smaller." [1]

ELABORATION GRADE 5 GRADE 7

Data skills: planets

The table shows data for planets in our solar system.

Planet	Distance from Sun (million km)	Time to orbit (Earth years)
Mercury	58	0.24
Venus	108	0.62
Earth	150	1.00
Mars	228	1.88
Jupiter	778	11.9

a Describe the relationship between distance and time to orbit. [2]

b Suggest why planets further from the Sun move more slowly. (Higher) [2]

c Saturn is 1430 million km from the Sun. Predict whether its orbit takes more or less than 11.9 years. [1]

d Why is a table of data not enough to prove a relationship? [1]

Extra practice

Retrieval · answers in the answer booklet

1 Grade 5 State two differences between a planet and a moon. [2]

2 Grade 7+ Explain why a satellite in a smaller orbit must travel faster than one in a larger orbit. [3]

3 Red-shift is evidence that the universe is... [1]

A shrinking **B** expanding **C** cooling down **D** not changing

Exam practice

GRADE RADE 4

Secure the basics

1 Name the force that pulls a nebula together. [1]

2 What is the Milky Way? [1]

3 Name the type of star the Sun is now. [1]

4 What is an artificial satellite? [1]

5 Which process releases energy in stars? [1]

GRADE RADE 5

Apply and rearrange

6 Describe the life cycle of a star much more massive than the Sun. [3]

7 What is dark mass, and why do scientists think it exists? [2]

8 Give one difference between a planet and a moon. [1]

Extra practice

Retrieval · answers in the answer booklet

1 Grade 5 What is a nebula, and why is it important in the life cycle of a star? [2]

2 What keeps a main sequence star stable? [1]

A Gravity balanced by outward pressure from fusion **B** Constant cooling **C** Its magnetic field **D** Burning oxygen

GRADE RADE 7+

Stretch

9 Explain how fusion in stars produces elements and why the heaviest elements need a supernova. (Physics only) [4]

10 Describe the evidence for the Big Bang theory and explain why scientists still have unanswered questions. [6]

Total: _____ / 21

RETRIEVAL PRACTICE SPACED PRACTICE GRADE 4

Quick-fire retrieval: Space physics

Cover everything. Answer in under 3 minutes. Redo it on your next spaced session.

1 Star stage after protostar?

2 Biggest stars end as?

3 Red-shift is evidence for?

4 Natural satellite of the Earth?

5 What balances gravity in a star?

6 Galaxies moving away show?

Extra practice

Retrieval · answers in the answer booklet

1 How many planets are there in our solar system? [2]

Reflect and plan

METACOGNITION

Re-rate yourself

Go back to the checklist at the start of this topic and fill in the 'After' column.

METACOGNITION GRADE 4 GRADE 5 GRADE 7

Exam wrapper: why did I drop marks?

After marking the exam practice, write the question numbers you got wrong in the right row.

Reason I lost marks	Question numbers	What to do next
I didn't know or remember it (knowledge gap)		Flashcards and brain dumps
I knew it but misread the question or command word		Underline command words
Maths slip: units, rearranging, standard form		Redo the "we do / you do" pages
I ran out of time or didn't finish		Timed practice: 1 mark per minute

METACOGNITION

Two things I'm now confident about

METACOGNITION

One thing I still need to work on, and how I'll fix it

e.g. 'Rearranging equations → redo the Grade 7+ questions and use the website's Aim higher section.'

SPACED PRACTICE

Book my next spaced sessions

Write the dates in the planner at the front: +2 days, +1 week, +3 weeks.

Extra practice

Retrieval · answers in the answer booklet

1 True or false? Moons are natural satellites. Explain. [2]

RETRIEVAL PRACTICE | SPACED PRACTICE | GRADE 4 | GRADE 5 | GRADE 7

Final review: test yourself on the whole topic

Do these without your notes, a week after finishing the booklet. Mark them with the answer booklet and add any you got wrong to your 'still to learn' list on the reflect page.

Each question shows its target grade. Aim to get every Grade 4 and 5 question right before moving on to Grade 7+.

Extra practice

Retrieval · answers in the answer booklet

1 What will the Sun eventually become? [1]

A A black dwarf (after being a white dwarf) **B** A black hole **C** A neutron star **D** A supernova

2 A satellite moves into a smaller stable orbit. Its speed must... [1]

A increase **B** decrease **C** stay the same **D** fall to zero

3 Put the life cycle of a star much bigger than the Sun in order. [2]

A Nebula
B Protostar
C Main sequence star
D Neutron star or black hole
E Red super giant
F Supernova

4 Put the life cycle of a Sun-sized star in order. [2]

A Red giant
B Main sequence star
C Protostar
D Black dwarf
E White dwarf
F Nebula

5 What provides the force that keeps planets in orbit? [1]

A Gravity **B** Magnetism **C** Friction **D** Fusion

6 Our solar system is part of which galaxy? [1]

A The Milky Way **B** Andromeda **C** The Big Bang **D** The Sun