

GCSE Physics

Worksheet: Red-shift

TIME 25 min	TOTAL 26 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Red-shift

NAME	CLASS	DATE
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- 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.

01

Astronomers study the light from distant galaxies.

01.1

What is meant by **red-shift**?

[1 mark]

01.2

What does the red-shift of the light from a galaxy show about the motion of the galaxy?

[1 mark]

01.3

How does the red-shift of very distant galaxies compare with the red-shift of nearer galaxies?

Tick (✓) **one** box.

Very distant galaxies show a bigger red-shift.

Very distant galaxies show a smaller red-shift.

All galaxies show the same red-shift.

[1 mark]

0 1 . 4

Name the theory about the origin of the universe that is supported by red-shift.

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[1 mark]

0 2

0 2 . 1

What does the Big Bang theory suggest about the beginning of the universe?

Tick (✓) **one** box.

The universe began as a huge, cold cloud of dust and gas. ☐

The universe began from a very small region that was extremely hot and dense. ☐

The universe has always existed and has always been the same size. ☐

The universe began when the first stars exploded. ☐

[1 mark]

0 2 . 2

Scientists think that there is still much about the universe that is not understood.

Give **one** example of something about the universe that is not yet understood.

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[1 mark]

0 3

0 3 . 1

Red-shift is observed in the light from almost all distant galaxies.

What does this tell us about the universe?

Tick (✓) **one** box.

The universe is shrinking.

☐

The universe is expanding.

☐

The universe is a fixed, unchanging size.

☐

Only nearby galaxies are moving.

☐

[1 mark]

0 3 . 2

State whether the wavelength of light from a red-shifted galaxy is longer or shorter than it would be from a stationary source.

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.....

.....

[1 mark]

0 4

A student models the expanding universe with a balloon. The student draws dots on the balloon to represent galaxies, then blows the balloon up further. As the balloon expands, every dot moves away from every other dot.

0 4 . 1

Explain how the model shows that galaxies further away from us move away faster.

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[2 marks]

0 4 . 2

Give **one** way in which the balloon is not a good model of the universe.

.....

.....

[1 mark]

0 5

Table 1 shows the measured wavelength of the same spectral line from four galaxies. The wavelength of this line, measured from a stationary source in a laboratory, is 656 nm.

Table 1

Galaxy	Observed wavelength in nm
W	658
X	670
Y	690
Z	710

0 5 . 1

State which galaxy shows the smallest red-shift, and which shows the largest.

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.....

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[2 marks]

0 5 . 2

Suggest which of these four galaxies is likely to be furthest from Earth, and explain your reasoning.

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.....

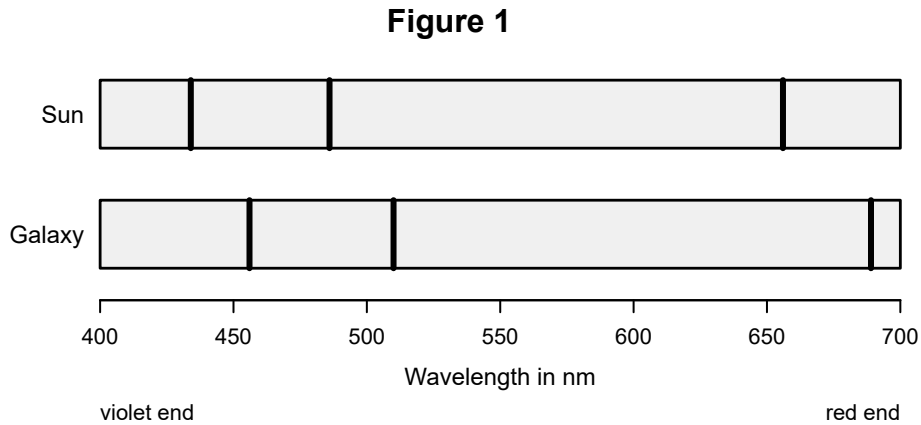
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[2 marks]

0 6

Figure 1 shows the dark lines in the spectrum of light from the Sun and in the spectrum of light from a distant galaxy.



0 6 . 1

Describe how the lines in the spectrum of the galaxy are different from the lines in the spectrum of the Sun.

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[2 marks]

0 6 . 2

What does this tell you about the galaxy?

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[1 mark]

0 6 . 3

The spectrum of a second galaxy shows the same pattern of lines, shifted even further towards the red end.
What can you conclude about the second galaxy, compared with the first galaxy?

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.....

[2 marks]

0 7

Most scientists accept the Big Bang theory of the origin of the universe.

0 7 . 1

Describe what the Big Bang theory suggests about the beginning of the universe.

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[2 marks]

0 7 . 2

Observations show that the further away a galaxy is, the faster it is moving away from us.
Explain how this supports the idea that the universe is expanding.

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[2 marks]

0 7 . 3

Nobody observed the beginning of the universe.
Suggest why scientists accept the Big Bang theory.

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[2 marks]

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: Red-shift · 26 marks

Question 1 (4 marks)

01.1 [1 mark]

Answer: An increase in the observed wavelength of the light from a galaxy.

- an observed increase in the wavelength of light from (distant) galaxies (1)
-

01.2 [1 mark]

Answer: It is moving away from us.

- the galaxy is moving away from us / from the Earth (1)
-

01.3 [1 mark]

Correct: Very distant galaxies show a bigger red-shift.

01.4 [1 mark]

Answer: The Big Bang theory

- the Big Bang theory (1)
-

Question 2 (2 marks)

02.1 [1 mark]

Correct: The universe began from a very small region that was extremely hot and dense.

02.2 [1 mark]

Answer: Dark mass (dark matter) or dark energy.

- dark mass (dark matter) / dark energy (1)
-

Question 3 (2 marks)

03.1 [1 mark]

Correct: The universe is expanding.

03.2 [1 mark]

Answer: Longer.

- longer (1)
-

Question 4 (3 marks)

04.1 [2 marks]

Answer: Every part of the balloon stretches, so dots that are further apart separate by a bigger distance in the same time — they move apart faster, like more distant galaxies.

- as the balloon expands, the distance between every pair of dots increases (every part of the surface stretches) (1)
- dots that are further apart move apart by a bigger distance in the same time, so they move apart faster — just as more distant galaxies recede faster (1)

04.2 [1 mark]

Answer: The balloon's surface is two-dimensional, but the universe is three-dimensional (or: the dots grow, but galaxies do not).

- the balloon's surface is two-dimensional but the universe is three-dimensional / the balloon has a centre (and an inside), but the universe has no centre / the dots (galaxies) themselves get bigger as the balloon stretches, but galaxies do not / the balloon expands into the air around it (1)

Question 5 (4 marks)

05.1 [2 marks]

Answer: Smallest: W. Largest: Z.

- smallest: W (1)
- largest: Z (1)

05.2 [2 marks]

Answer: Galaxy Z: greater red-shift generally means a greater distance, and Z's red-shift is the largest.

- galaxy Z (1)
 - the more distant a galaxy is, the greater its speed of recession and so the greater its red-shift; Z shows the greatest red-shift (its wavelength has increased the most) (1)
-

Question 6 (5 marks)

06.1 [2 marks]

Answer: Same pattern of lines, but all shifted towards the red end (longer wavelengths).

- the lines are in the same pattern (1)
- but they are all shifted towards the red end of the spectrum / to longer wavelengths (1)

06.2 [1 mark]

Answer: It is moving away from us.

- it is moving away from us / from the Earth (1)

06.3 [2 marks]

Answer: It is moving away faster and is further away.

- it is moving away faster (1)
- it is further away (1)

Question 7 (6 marks)

07.1 [2 marks]

Answer: The universe began from a very small region that was extremely hot and dense.

- the universe began from a very small region (1)
- that was extremely hot and dense (1)

07.2 [2 marks]

Answer: Galaxies in every direction are receding, faster the further they are, which is what happens if space itself is expanding.

- (almost) all distant galaxies are moving away from us (1)
- the more distant galaxies moving faster is what is expected if space itself is expanding (everything is moving apart from everything else) (1)

07.3 [2 marks]

Answer: It explains the evidence, such as red-shift, which has been confirmed by many independent observations.

- the theory explains the observations (e.g. the red-shift of distant galaxies) (1)
 - the observations have been checked / repeated by many scientists, and predictions made by the theory have been confirmed (1)
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