

Red Shift Big Bang

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Describe what is meant by red-shift and what it tells us about a galaxy. (3 marks)

Step 1 · Observation

The dark absorption lines in the spectrum of light from a galaxy are at longer wavelengths than the same lines measured on Earth.

Step 2 · Name

They are shifted towards the red end of the spectrum: red-shift.

Step 3 · Meaning

It shows that the galaxy is moving away from us.

Answer: Lines shifted to longer wavelengths; the galaxy is moving away

Check: The pattern of lines is the same, so we know which element made them.

2. Now try one with the steps

Explain how observations of red-shift provide evidence that the universe is expanding. (4 marks)

Step 1 · All directions

Step 2 · Distance

Step 3 · Speed

Step 4 · Conclusion

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Describe what is meant by red-shift. [2]

2. State what red-shift in the light from a galaxy tells us about the galaxy's motion. [1]

3. Galaxy A has a bigger red-shift than galaxy B. State which galaxy is further away. [1]
-
-
4. Describe the relationship between the distance of a galaxy and its red-shift. [2]
-
-
5. Explain how red-shift provides evidence that the universe is expanding. [3]
-
-
-
6. Describe the Big Bang theory. [2]
-
-
7. A hydrogen line measured at 486 nm in the laboratory appears at 496 nm in light from a galaxy. [1]
Calculate the shift in wavelength, in nm.
-
-
8. Explain why red-shift does not mean the Earth is at the centre of the universe. [2]
-
-
9. Explain why the Big Bang theory is accepted by most scientists. [2]
-
-
10. Describe what observations of supernovae since 1998 suggest about the expansion of the universe. [2]
-
-
11. Explain what is meant by saying there is 'dark mass' and 'dark energy' in the universe. [2]
-
-
12. Light from the Andromeda galaxy shows blue-shift (lines moved to shorter wavelengths). Suggest [1]
what this tells us.
-
-

13. A line at 656 nm in the lab is observed at 669 nm. Its speed of recession is roughly $(\text{shift} \div \text{original wavelength}) \times \text{speed of light}$. Estimate the speed in km/s to 2 significant figures. Speed of light = 300 000 km/s. [3]

14. Describe how cosmic microwave background radiation supports the Big Bang theory. [2]

4. Before you hand it in

"Red-shift means the galaxy is red."

The lines in the spectrum move towards longer (redder) wavelengths; the galaxy itself is not red.

"The Big Bang was an explosion in space."

The universe started from a tiny, extremely hot, dense region and space has been expanding since.

"Closer galaxies have bigger red-shifts."

More distant galaxies have bigger red-shifts and are moving away faster.

"Red-shift proves the Big Bang."

Say red-shift provides evidence for (supports) the Big Bang theory.