

Exercise walk-through

8.2

Red shift and the Big Bang (P)

OxfordAQA · International GCSE · Physics

1. Space physics

Space physics

Gravity gathers dust into stars, stars fuse the elements, and the red-shift of distant galaxies tells us the whole universe is expanding from a beginning 14 thousand million years ago

OxfordAQA's final topic closes the course with stellar life cycles, orbits and the Big Bang evidence

3. Solar system and orbital motion

Solar system and orbital motion

The solar system: eight planets orbiting the Sun, plus moons, asteroids, dwarf planets and comets

The Milky Way is one of thousands of millions of galaxies, each with thousands of millions of stars

4. Red shift and the expanding universe (P)

Red shift and the expanding universe (P)

A moving wave source changes the observed wavelength (the Doppler effect): receding sources stretch waves — longer wavelength, lower frequency

The further a galaxy, the faster it recedes and the bigger the red-shift — space itself is expanding, pointing back to a very small beginning: the Big Bang

Exercises 2.1·2.3

2.1 (P) What happens to observed wavelength when a source recedes? [1]

2.2 (P) What happens to observed frequency when a source approaches? [1]

2.3 (P) State the link between a galaxy's distance and its red-shift. [1]

Exercises 2.1·2.3

2.1 (P) What happens to observed wavelength when a source recedes? [1]

2.1 (P) It increases – red-shift.

2.2 (P) What happens to observed frequency when a source approaches? [1]

2.2 (P) It increases (wavelength decreases).

2.3 (P) State the link between a galaxy's distance and its red-shift. [1]

2.3 (P) The further the galaxy, the bigger the red-shift (they recede faster).

Exercises 2.4·3.1

2.4 (P) What does red-shift suggest about space? [1]

2.5 (P) How long ago was the Big Bang? [1]

3.1 (P) Explain how increasing red-shift with distance supports the Big Bang model. [3]

Exercises 2.4·3.1

2.4 (P) What does red-shift suggest about space? [1]

2.4 (P) Space itself is expanding.

2.5 (P) How long ago was the Big Bang? [1]

2.5 (P) About 14 thousand million years ago.

3.1 (P) Explain how increasing red-shift with distance supports the Big Bang model. [3]

3.1 (P) Red-shift means the galaxies recede; red-shift growing with distance means the further away, the faster the recession – exactly what expansion of space produces from any vantage point; tracing the expansion backwards gives a very small initial point – the Big Bang.

Exercises 3.2-3.3

3.2 (P) Explain what the cosmic microwave background is and why only the Big Bang theory predicts it. [3]

3.3 (P) A police siren passes you at speed. Describe the pitch change, naming the effect. [2]

Exercises 3.2-3.3

3.2 (P) Explain what the cosmic microwave background is and why only the Big Bang theory predicts it. [3]

3.2 (P) Electromagnetic (microwave) radiation filling the universe, arriving from every direction; it is the stretched, cooled remnant of the radiation present shortly after the beginning; only a hot, dense beginning – the Big Bang – produces such background radiation, so it is the theory's second pillar.

3.3 (P) A police siren passes you at speed. Describe the pitch change, naming the effect. [2]

3.3 (P) As the siren approaches, the pitch is high (bunched wavefronts); as it passes and recedes, the pitch falls (stretched wavefronts); this is the Doppler effect.