

8.2 Red shift and the Big Bang (P)

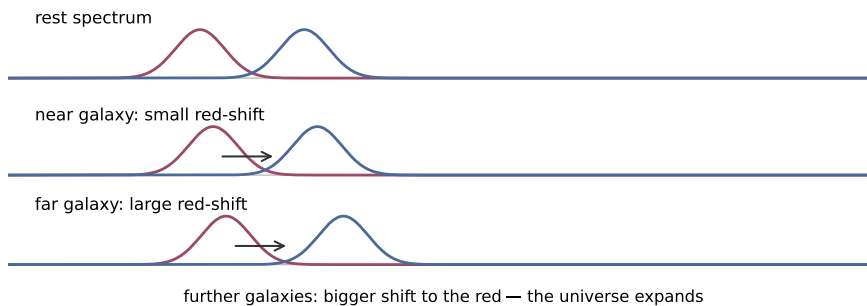
Name: _____ Class: _____ Date: _____ **Total: 13 marks**

Objective

Cover red shift and the expanding universe (3.8.3): the Doppler effect on wavelength and frequency, galaxy red-shift increasing with distance, the expanding universe and the Big Bang, and the cosmic microwave background. (P) Paper-2 content. Original OxfordAQA practice.

1 Key knowledge and worked examples

■ Shift, distance, beginning



Receding source → wavelength increases, frequency decreases. Red-shift grows with distance → space expands → Big Bang; the CMBR is its afterglow, about 14 thousand million years ago.

2 Practice

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]

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

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

3 Exam-style questions

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

Solutions

2.1 (P) It increases – red-shift.

2.2 (P) It increases (wavelength decreases).

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

2.4 (P) Space itself is expanding.

2.5 (P) About 14 thousand million years ago.

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.

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) 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.