3.25 Red-shift and the Expanding Universe: 10-minute Pack

Total Marks

AQA 8463 · Calculator allowed · about 10 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A similar effect happens with light from distant galaxies, called red-shift.

(a) State what happens to the observed wavelength of light from most distant galaxies, compared with light from a stationary source. **(1)**

(b) State the direction, in terms of colour, that this shift moves the light towards within the visible spectrum. **(1)**

(c) Explain what this observation tells us about the motion of most distant galaxies relative to the Earth. **(2)**

(Total for Question 1 is 4 marks)

2 Astronomers have observed red-shift in light from many galaxies at different distances from Earth.

(a) State how the amount of observed red-shift changes as the distance to a galaxy increases. **(1)**

(b) State what this tells us about the recession speed of more distant galaxies compared with closer galaxies. **(2)**

(Total for Question 2 is 3 marks)

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3 A small number of nearby galaxies, such as Andromeda, show blue-shift rather than red-shift.

(a) State what blue-shift indicates about the motion of a galaxy, relative to red-shift. **(1)**

(b) Suggest why the existence of a small number of blue-shifted, nearby galaxies does not contradict the overall theory that the universe is expanding. **(1)**

(Total for Question 3 is 2 marks)

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Mark scheme · 3.25 Red-shift and the Expanding Universe: 10-minute Pack

Question 1

(a) the observed wavelength is increased (longer) **B1**

(a) Answer: It is increased.

(b) towards the red end of the spectrum **B1**

(b) Answer: Towards the red end.

(c) by comparison with the Doppler effect, an increase in wavelength (red-shift) shows the source is moving away from the observer **B1**

(c) therefore, most distant galaxies are moving away from the Earth, oe **B1**

(c) Answer: Most distant galaxies are moving away from the Earth.

Question 2

(a) red-shift increases (gets greater) as distance increases **B1**

(a) Answer: Red-shift increases with distance.

(b) more distant galaxies have a greater observed red-shift **B1**

(b) which means more distant galaxies are moving away from Earth at a greater (recession) speed than closer galaxies, oe **B1**

(b) Answer: More distant galaxies are moving away faster.

Question 3

(a) blue-shift indicates the galaxy is moving towards the Earth, rather than away from it as with red-shift **B1**

(a) Answer: The galaxy is moving towards the Earth.

(b) the large-scale expansion of the universe is only clearly observed over very large distances; nearby galaxies can have their own local gravitational motion (e.g. towards each other) that outweighs the much smaller expansion effect at short range, oe **B1**

(b) Answer: Local gravitational effects between nearby galaxies can outweigh the small expansion effect over short distances.

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