

- 7** (a) Scientists no longer accept the geocentric model of the universe but it was the accepted theory for hundreds of years.

Explain why the evidence available at the time supported the geocentric model.

(3)

- (b) The Big Bang theory and the Steady State theory are two theories about the origin of the universe.

The discovery of CMB led scientists to accept only one of the theories.

Explain why redshift supports both theories but CMB supports only one of them.

(3)

(c) (i) A star with a mass very much larger than the Sun

(1)

- A** has a longer main sequence than the Sun and ends as a white dwarf
- B** has a longer main sequence than the Sun and ends as a black hole
- C** has a shorter main sequence than the Sun and ends as a white dwarf
- D** has a shorter main sequence than the Sun and ends as a black hole

(ii) Which row has two correct statements about black holes?

(1)

the gravitational field of a black hole	a black hole is formed when
<input type="checkbox"/> A allows only electromagnetic radiation to escape	a nebula collapses
<input type="checkbox"/> B allows nothing to escape	a very large star collapses
<input type="checkbox"/> C allows nothing to escape	a nebula collapses
<input type="checkbox"/> D allows only electromagnetic radiation to escape	a very large star collapses

- (d) Figure 9 shows some lines in the absorption spectra from four different galaxies (A, B, C, and D) and from a laboratory source.

All the spectra are aligned and to the same scale.

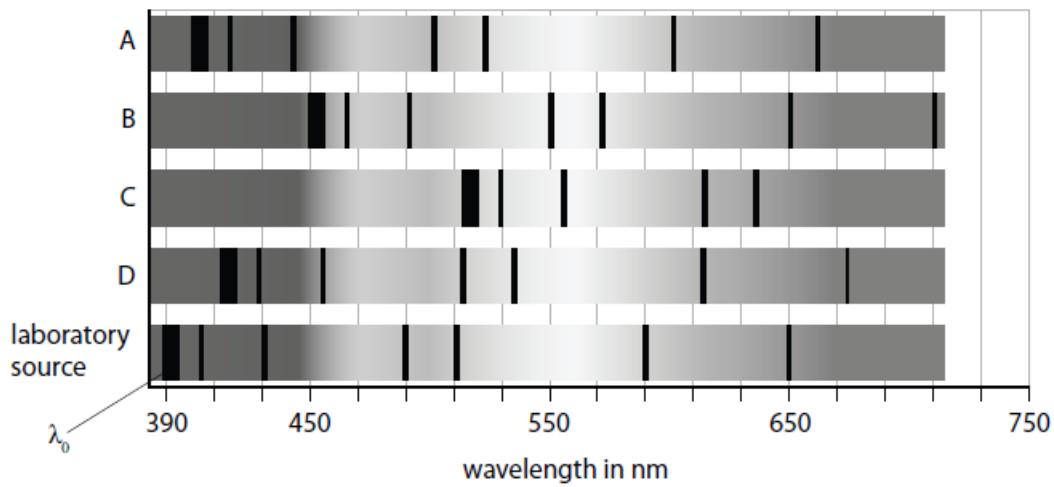


Figure 9

Explain, using Figure 9, which galaxy is furthest away from us.

(3)

(Total for Question 7 = 11 marks)

Question number	Answer	Additional guidance	Mark
7(a)	<p>An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (2 marks):</p> <ul style="list-style-type: none"> • at the time, there was only naked eye evidence (1) • which indicated Sun/Moon/planets appear to move across the sky (1) • in the same direction, same motion each day (1) 	allow valid alternatives, e.g. references to comets	(3)

Question number	Answer	Additional guidance	Mark
7(b)	<p>An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (2 marks):</p> <ul style="list-style-type: none"> • both theories predict an expanding universe and the Big Bang theory also predicts that the universe had a beginning (1) • the red shift theory indicates that the universe is expanding so supports both theories (1) • whereas CMB also indicates that the universe had a beginning, so supports Big Bang theory (1) 	provided evidence that the steady state theory was incorrect	(3)

Question number	Answer	Mark
7(c)(i)	B	(1)

Question number	Answer	Mark
7(c)(ii)	B	(1)

Question number	Answer	Mark
7(d)	<p>An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (2 marks):</p> <ul style="list-style-type: none"> • galaxy C is furthest away (1) • because it has the greatest red shift (1) • and therefore it has the greatest speed (1) 	(3)

