

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

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

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

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

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

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

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

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

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

Question number	Answer	Mark
<b>3(a)(i)</b>	<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"><li>• galaxy C has the greatest red shift (1)</li><li>• so this galaxy has the greatest speed (1)</li><li>• since the galaxy with the greatest speed will be furthest away, then galaxy C is at the furthest distance(1)</li></ul>	<b>(3)</b>

Question number	Answer	Additional guidance	Mark
3(a)(ii)	20 (nm)	Allow answers in the range 19 to 25	(1)

Question number	Answer	Additional guidance	Mark
3(a)(iii)	Substitution (1) $v = \frac{(3 \times 10^8) \times (20 \times 10^{-9})}{(390 \times 10^{-9})}$ Answer (1) = 15 400 000 (m/s)	allow ecf from (c)(i)  power of 10 error = max 1  accept 15 384 615 (m/s)  award full marks for correct numerical answer without working	(2)

Question number	Answer	Additional guidance	Mark
3(b)	Any <b>two</b> from the following improvements: <ul style="list-style-type: none"> <li>• use wider aperture telescope/camera (1)</li> <li>• better quality objective lens (1)</li> <li>• use longer exposure time while telescope is locked onto star (1)</li> <li>• move telescope to better seeing conditions, e.g. dry desert, higher up a mountain, dark skies (1)</li> </ul>	allow  improvements from photography, e.g. use longer exposure time  use a satellite telescope  ignore use pc to adjust the sharpness of the image	(2)

Question Number	Answer	Acceptable answers	Mark
<b>4(a)(i)</b>	D		<b>(1)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(a)(ii)</b>	moons (1) heliocentric (1)	must be in correct order	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(a)(iii)</b>	A description including two of the following points  Reflecting telescope has mirror(s) (1)  Galilean telescope has only lenses (1)  Reflecting telescope can gather more light / can have a larger objective (1)  Image viewed from the side of reflecting telescope (1)  Image viewed from end of Galilean telescope. (1)	refracting telescope  reverse argument	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(b)(i)</b>	5 (cm) (1)  8 (cm) (1)	+ -  0.08 m 80 mm	<b>(2)</b>

Question Number	Answer	Acceptable answers	Mark
<b>4(b)(ii)</b>	B		<b>(1)</b>