

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

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

Question number	Answer	Mark
1(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)

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"> • 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
2(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
2(c)(i)	B	(1)

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

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

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 two from the following improvements: <ul style="list-style-type: none"> • use wider aperture telescope/camera (1) • better quality objective lens (1) • use longer exposure time while telescope is locked onto star (1) • move telescope to better seeing conditions, e.g. dry desert, higher up a mountain, dark skies (1) 	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
4(a)(i)	D		(1)

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

Question Number	Answer	Acceptable answers	Mark
4(a)(iii)	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	(2)

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

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