

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Mark Schemes

Q1.

Question Number	Answer	Mark
	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.	(6)

AO1 strand 1 (6 marks)

evidence for expansion

- red shift
- light from distant galaxies/stars
- shifted to red side of em spectrum
- (observed) wavelength of light is longer
- showing source moving away
- (nearly) all galaxies show this
- Doppler effect
- (expanding at an increasing rate / dark energy)

evidence for beginning at a point

- CMBR
- microwave radiation left over from beginning
- the increase of recessional velocities with distance - (extrapolating)
- microwaves because of cooling
- detected from all over the sky

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	• Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3-4	• Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Summary for guidance

Level	Mark	Additional Guidance	General additional guidance – the decision within levels
	0	No rewardable material.	e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
Level 1	1–2	<u>Additional guidance</u> some element of physics about the expansion / single point origin	<u>Possible candidate responses</u> red shift shows expansion or CMBR connected with beginning
Level 2	3–4	<u>Additional guidance</u> more detail about one piece of evidence or basic detail about two pieces of evidence	<u>Possible candidate responses</u> red shift connected with galaxies moving away (from earth observer) CMBR to do with release of radiation at the beginning
Level 3	5–6	<u>Additional guidance</u> Understanding is detailed and fully developed. includes detail about both pieces of evidence (one may be stronger than the other but both should feature for level 3)	<u>Possible candidate responses</u> red shift connected with galaxies moving away (from earth observer) with the further they are away the faster they are moving away CMBR to do with release of (leftover) radiation at the beginning □ microwaves because of cooling – detected from all over the sky

Q2.

Question number	Answer	Additional guidance	Mark
	A description to include: wavelength (of the light) (1) appears to increase (1) [increase must be linked with wavelength]	Red shift/Doppler effect (Red shift) shows galaxy moving away accept answers in terms of frequency	(2) AO1

Q3.

	Answer	Additional guidance	Mark
	(there is) an increase in wavelength (of light) (1) shows <u>galaxies</u> are moving away (from Earth) (1)	allow wavelength stretches allow red shift ignore shift to red end of spectrum ignore objects / stars / planets	(2) AO1

Q4.

Question number	Answer	Additional guidance	Mark
	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (2 marks): • 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	Indicative content	Mark
*	The indicative content below is not prescriptive and candidates are not required to include all of the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. A01 (6 marks) • force needed to keep an object moving in a circle • when moving in a circle, direction of velocity changes • must be an acceleration • moving in a straight line with no resultant force at constant velocity A02 (6 marks) • the woman changing direction while circling the man • she is changing velocity (but not changing speed) • therefore she is accelerating • this requires a force towards the centre of her orbit • this is a centripetal force • when the man releases the woman, the centripetal force ceases • there is no resultant force on the woman (if friction from the ice can be ignored) • the woman therefore continue in a straight line • she is now travelling at a constant velocity	(6)