

# Red Shift and Big Bang 2 MS

## QUESTION 1

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	S S		1 1
b)	big bang (theory)		1
c)	CMBR comes from all parts of the Universe		1
d)	At the moment it is the best way of explaining our scientific knowledge		1
Total marks			5

## QUESTION 2

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	wavelength (of light) increases or light moves to red end of spectrum	accept frequency decreases accept redder but do not accept red alone	1
a)ii)	it is the star (detected) furthest from the Earth or it is moving away the fastest	accept galaxy for stars  ignore reference to universe expanding	1
b)i)	all matter compressed to / starts at / comes from a single point  (massive) explosion sends matter outwards	do not accept increasing gravitational pull accept everything / the universe for all matter accept explosion causes universe to expand ignore explosion creates the universe	1  1

		or further reference to star / Earth formation	
b)ii)	check validity / reliability of the evidence or change the theory to match the new evidence	accept comparison of new and old evidence	1
Total marks			5

### QUESTION 3

	ANSWERS	EXTRA INFORMATION	MARKS
(a)	(a) supernova (explosion)		1
(b)	solar system contains heavy elements / elements heavier than hydrogen <u>and helium</u> (1)  these (heavy) elements are / were formed by (nuclear) <u>fusion</u> (1)	accept minor misspellings for fusion but <b>not</b> anything which could also be fission	3

### QUESTION 4

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	fusion (1)  of hydrogen/H (atoms)(1)	do not credit any response which looks like 'fission' or the 'word' 'fussion' credit only if a nuclear reaction	2
b)	explosion of star(s)/super nova  at the end of the 'life' of star(s)	reference to big bang nullifies both marks reference to the star	2

	/ when they 'die' (1)	running out of energy/material nullifies both marks	
Total marks			4

### QUESTION 5

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	gravitational force(s) (1) balanced by (force(s) due to radiation pressure (1)	accept 'gravity' accept equal	2
b)	by (nuclear) fusion (1)  of hydrogen to helium (other light elements) (1)  heavy element / elements heavier than iron are only produced (by fusion) in a supernova (1)	allow 'low density' for light accept hydrogen nuclei / atoms form helium response must clearly link one element(s) producing others fusion to produce helium (2)  allow dense for heavy ignore any reference to elements undergoing radioactive decay (to form other elements)	3
Total marks			5

### QUESTION 6

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	wavelength (of light appears to) increase	accept frequency (appears to) decrease	1

		accept light moves to the red end of the spectrum do not accept it moves to the red end of the spectrum do not accept light becomes redder	
b)i)	M is closer (to the Earth) than N M is moving (away from the Earth) slower than N		1 1
b)ii)	520	an answer between 510 and 530 inclusive gains 1 mark	2
b)iii)	more recent  data more reliable or improved equipment / techniques or data obtained from more (distant) galaxies	no mark for this but must be given to gain reason mark accept data is more accurate  more technology is insufficient accept a wider range of data  accept data closer to the line of  best fit or data less scattered accept no anomalous result(s) accept all data fits the pattern	1
c)	wavelength is decreased frequency is increased		1 1
Total marks			8

### QUESTION 7

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
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a)	any three from: <ul style="list-style-type: none"> <li>• red-shift shows galaxies are moving away (from each other / the Earth)</li> <li>• more distant galaxies show bigger red-shift</li> </ul> or more distant galaxies show a greater increase in wavelength <ul style="list-style-type: none"> <li>• (in all directions) more distant galaxies are moving away faster</li> <li>• suggests single point of origin (of the universe)</li> </ul>	accept correct reference to frequency in place of wavelength accept (suggests) universe is expanding	3
b)i)	(radiation produced shortly after) 'Big Bang'	accept beginning of time / beginning of the universe for 'Big Bang'	1
b)ii)	any one from: <ul style="list-style-type: none"> <li>• can only be explained by 'Big Bang'</li> <li>• existence predicted by 'Big Bang'</li> <li>• provides (further) evidence for 'Big Bang'</li> </ul>	ignore proves 'Big Bang' (theory) ignore reference to red-shift	1
b)iii)	increase universe continues to accelerate outwards or greater red-shift	accept becomes radio waves accept as universe continues to expand	1 1
Total marks			7

### QUESTION 8

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	origin of the Universe	accept (why) the Universe is expanding	1

		do not accept origin of the Earth	
a)ii)	provided more evidence to support the 'Big Bang' theory		1
b)i)	red-shift	accept Doppler (shift)	1
b)ii)	(at the point in time shown the observed spectrum from) star A (shows it) is moving away from the Earth light from star B shows a decrease in wavelength  so star B is moving towards Earth	accept star A is moving away  star A shows red-shift is insufficient accept light from star B shows blue-shift accept light from star B shows an increase in frequency	1  1
Total marks			6

### QUESTION 9

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	C		1
a)ii)	The speed of star B is less than the speed of star D.		1
b)	300 000 000 m/s	allow 1 mark for correct substitution ie 200 000 x 1500 provided no subsequent step shown allow unit correctly indicated in list if not written in answer space	2 1
Total marks			5

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
<b>10</b>	a distant galaxy                      3 a satellite                              1 the Earth                                2		

	the Universe	4		
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**TOTAL MARKS=53**