



# **GCSE Physics**

## **Red Shift**

### **Mark Scheme**

**Time available: 45 minutes**

**Marks available: 38 marks**

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## Mark schemes

- 1.** (a) red-shift 1
- (b) the further away from the Earth, the faster a galaxy is moving 1
- (c) **strength**  
as the balloon expands the dots get further apart, representing the galaxies moving apart 1
- weakness**  
dots are only on the surface of the balloon, galaxies are throughout the universe  
**or**  
there is a limit to how far the balloon can expand 1
- (d) both theories suggest that the Universe is expanding 1
- (e) new evidence / observations that cannot be explained by Theory 1  
*accept specific example of new evidence ie CMBR* 1
- [6]
- 2.** (a) (i) C 1
- (ii) The speed of star **B** is less than the speed of star **D**. 1
- (b) 300 000 000  
*allow 1 mark for correct substitution ie 200 000 × 1500 provided no subsequent step shown* 2
- m / s  
*allow unit correctly indicated in list if not written in answer space* 1
- [5]
- 3.** (a) (i) red-shift  
*accept Doppler (effect)* 1
- (ii) the Universe is expanding 1
- (iii) N 1
- (b) Why was the Universe created? 1
- [4]

4.	<p>(a) (i) gamma <i>accept correct symbol</i></p>	1
	<p>(ii) any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>• (ultraviolet has a) higher frequency <i>ultraviolet cannot be seen is insufficient</i></li> <li>• (ultraviolet has a) greater energy</li> <li>• (ultraviolet has a) shorter wavelength <i>ignore ultraviolet causes cancer etc</i></li> </ul>	1
	<p>(b) <math>1.2 \times 10^7 / 12\ 000\ 000</math> <i>allow 1 mark for correct substitution, ie <math>3 \times 10^8 = f \times 25</math></i></p>	2
	<p>hertz / Hz / kHz / MHz <i>do not accept hz or HZ</i> <i>answers 12 000 kHz or 12 MHz gain 3 marks</i> <i>for full credit the numerical answer and unit must be consistent</i></p>	1
	<p>(c) (i) away (from each other) <i>accept away (from the Earth)</i> <i>accept receding</i></p>	1
	<p>(ii) distance (from the Earth) <i>accept how far away (it is)</i></p>	1
	<p>speed galaxy is moving</p>	1
	<p>(iii) (Universe is) expanding</p>	1
		<b>[9]</b>
5.	<p>(a) Y <i>accept cannot be X as size is increasing</i></p>	1
	<p>shows Universe expanding <i>this scores if Y or Z is chosen</i> <i>accept exploding outwards</i></p>	1

from a (very small) point

*this only scores if Y is chosen*

*accept from zero (size)*

*answers in terms of planets*

*negate the last two mark points*

1

(b) (i) both the 'big bang' and 'steady state' theories

1

(ii) (new) evidence that supports / disproves a theory

*accept proves for supports*

**or**

(new) evidence not supported by current theory

*accept there may be more evidence supporting one (theory) than the other (theory)*

*accept new evidence specific to this question eg measurement of CBR*

**or**

*some types of star only found in distant parts of Universe (steady state suggests should be same throughout Universe)*

1

**[5]**

**6.**

(a) (i) red shift

1

*accept Doppler effect*

(ii) the universe is expanding

1

(b) (i) big bang

1

(ii) at the moment it is the best way of explaining.....

1

**[4]**

7.

*ideas that: galaxies show a red-shift  
gains 1 mark*

**but** more distant galaxies show bigger red-shift  
*gains 2 marks*

galaxies moving away/Universe expanding  
*gains 1 mark*

**but** more distant galaxies moving away faster  
*gains 2 marks*

so all Universe once in one place  
*for 1 further mark  
(only if the previous 2 marks are also gained)*

[5]