

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. (a) (i) gamma
accept correct symbol 1
- (ii) any **one** from:
- (ultraviolet has a) higher frequency
ultraviolet cannot be seen is insufficient
 - (ultraviolet has a) greater energy
 - (ultraviolet has a) shorter wavelength
ignore ultraviolet causes cancer etc
- (b) $1.2 \times 10^7 / 12\ 000\ 000$
allow 1 mark for correct substitution, ie $3 \times 10^8 = f \times 25$ 2
- hertz / Hz / kHz / MHz
do not accept hz or HZ
answers 12 000 kHz or 12 MHz gain 3 marks
for full credit the numerical answer and unit must be consistent 1
- (c) (i) away (from each other)
accept away (from the Earth)
accept receding 1
- (ii) distance (from the Earth)
accept how far away (it is) 1
- speed galaxy is moving 1
- (iii) (Universe is) expanding 1

[9]

5. (a) Y
accept cannot be X as size is increasing 1
- shows Universe expanding
this scores if Y or Z is chosen
accept exploding outwards 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]