

# MARK SCHEME

# GCSE

## PHYSICS

### AQA - TRIPLE SCIENCE

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P8 - TEST 6

SPACE PHYSICS

Advanced

## Mark schemes

- 1.** (a) (i) origin of the Universe  
*accept (why) the Universe is expanding*  
*do **not** accept origin of the Earth* 1
- (ii) provided more evidence to support the 'Big Bang' theory 1
- (b) (i) red-shift  
*accept Doppler (shift)* 1
- (ii) (at the point in time shown the observed spectrum from) star A (shows it) is moving away from the Earth  
*accept star A is moving away*  
*star A shows red-shift is insufficient* 1
- light from star B shows a decrease in wavelength  
*accept light from star B shows blue-shift*  
*accept light from star B shows an increase in frequency* 1
- so star B is moving towards Earth 1
- [6]
- 2.** (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*
- 1
- (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]

3.

(a) any **three** from:

- red-shift shows galaxies are moving away (from each other / the Earth)
- more distant galaxies show bigger red-shift

**or**

more distant galaxies show a greater increase in wavelength

accept *correct reference to frequency in place of wavelength*

- (in all directions) more distant galaxies are moving away faster  
accept *(suggests) universe is expanding*
- suggests single point of origin (of the universe)

3

(b) (i) (radiation produced shortly after) 'Big Bang'

accept *beginning of time / beginning of the universe for 'Big Bang'*

1

(ii) any **one** from:

- can only be explained by 'Big Bang'
- existence predicted by 'Big Bang'
- provides (further) evidence for 'Big Bang'  
*ignore proves 'Big Bang' (theory)*  
*ignore reference to red-shift*

1

- (iii) increase  
*accept becomes radio waves* 1
- universe continues to accelerate outwards  
*accept as universe continues to expand*
- or**
- greater red-shift 1

[7]

4.

- (a) wavelength (of light appears to) increase  
*accept frequency (appears to) decrease*  
*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* 1
- (b) (i) **M** is closer (to the Earth) than **N** 1
- M** is moving (away from the Earth) slower than **N** 1
- (ii) 520  
*an answer between 510 and 530 inclusive gains 1 mark* 2
- (iii) more recent  
*no mark for this but must be given to gain reason mark*
- data more reliable  
*accept data is more accurate*  
**or**  
 improved equipment / techniques  
*more technology is insufficient*  
**or**  
 data obtained from more (distant) galaxies  
*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 1

frequency is increased

1

[8]

5.

(a) any **two** from:

- nuclei / atoms of light elements fuse  
*accept hydrogen or helium for light elements*  
*accept join for fuse*  
*accept for 1 mark, by nuclear fusion*  
*answers about fission negates a mark*
- each (fusion) reaction releases energy / heat / light
- lots of reactions occur

2

(b) presence of nuclei of the heaviest / heavy / heavier elements

*accept atom for nuclei*

1

(c) (i) (matter / mass) with such a high density / strong gravitational (field)

1

electromagnetic radiation / light is pulled in

*accept nothing can escape*

*do **not** accept answers in terms of an empty void*

1

(ii) X-rays

*accept e-m radiation / e-m waves*

1

[6]

6.

(a) fusion

*accept fussion*

1

energy producing process

*accept heat and/or light for energy*

*accept fussion*

1

(b) up to 2 points from:

*3 marks for 3 points in sequence with no contradiction*

- expands

*2 marks for 2 points in sequence with no contradiction*

- cools

- forms a red giant

*1 mark for a correct point which is not contradicted*

up to 2 points from:

*do **not** accept 'it turns red'*

- contracts
- increases in temperature
- forms a white dwarf

*ignore further reference to black dwarfs, black holes, nebulae, supernovae*

3

[5]

7.

- (a) the Sun is subject to two balancing forces / 2 forces in equilibrium  
the forces are: gravity making it contract **or** inward force due to gravity  
and a force due to temperature / heat / energy / radiation pressure making it  
expand **or** outward force due to temperature / heat / energy / radiation pressure  
*for 1 mark each*

3

- (b) Read all the answer first. Stop after 6 marks.

hydrogen / fuel used up owtte the star will expand and become a red giant  
it will contract under gravity become a white dwarf  
it may explode and become a supernova throwing dust and gas into space  
leaving a dense neutron star / black hole

*(no mark for contradiction)*

*any six for 1 mark each*

6

[9]

8.

(a) it use  $E = mc^2$

mass in kg i.e.  $0.001 \times \frac{0.7}{100}$

*each gains 1 mark*

**but** 000007

*gains 2 marks*

$2.1 \times 10^3$

*gains 3 marks*

evidence of 0.000007

mass in kg (i.e. 0.0007 **or** 0.7/100000)

*each gains 1 mark*

squaring the speed of light

**but**  $6.3 \times 10^{11}$  (*credit alternative ways of stating this*)

*gains 3 marks*

units J/joule

*for 1 further mark*

(N.B credit kJ, MJ, GJ but check power of 10 for full credit)

4

(b) (i) *idea that* the bigger the mass the shorter the life

*gains 1 mark*

**but** *idea that* decrease in life is much more than proportional to increase in mass

**or** more than proportional to mass<sup>2</sup>

*gains 2 marks*

2

(ii) *ideas that:*

greater mass means greater **core** temperature/pressure

greater core temperature/pressure means greater rate of fusion

increase in mass produces a proportionally much greater increase in the rate of fusion

*each for 1 mark*

3

[9]

9.

(a) *answer includes items:*

B D G

*each for 1 mark*

3

(b) *answer includes items:*  
A E F [allow H here for a further mark]  
*each for 1 mark*

3

(c) *answer includes items:*  
C H\* I J  
*each for 1 mark [\*unless already credited in (b)]*

4

(d) *ideas that:*

- lucky in the sense that they weren't initially looking for the background radiation [others were!!!]
- more than just lucky in that they investigated it and didn't just ignore it  
*each for 1 mark*

[NB Reference to letters only, not a prose answer, gain only ½ mark each.  
Total rounded down]

2

**[12]**