

MARK SCHEME

GCSE

PHYSICS

AQA - TRIPLE SCIENCE

P8 - TEST 3

SPACE PHYSICS

Intermediate

Mark schemes

- 1.** (a) gamma rays 1
- (b) can travel through the atmosphere 1
- (c) explosion of a red super giant
or
a supernova 1
- (d) 1.2×10^9 Hz 1
- (e) $3.0 \times 10^8 = 1.2 \times 10^9 \times \lambda$
an answer of 0.25 (m) scores 3 marks
allow ecf from (d) 1
- $$\lambda = \frac{3.0 \times 10^8}{1.2 \times 10^9}$$
- $\lambda = 0.25$ (m) 1
- (g) same as the radio wave 1
- (f) expansion due to fusion energy 1
- in equilibrium with gravitational collapse
forces acting inwards equal forces acting outwards gains 1 mark 1

(h)

Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3-4
Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1-2
No relevant content	0
Indicative content <ul style="list-style-type: none">• Sun goes from main sequence to red giant• then from red giant to white dwarf• when the Sun changes to a red giant the surface temperature will decrease• and the relative luminosity will increase• when changing from a red giant to a white dwarf the surface temperature increases• and the relative luminosity decreases	

4

[14]

2.

(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]

3.	(a)	hydrogen	1
	(b)	supernova	1
	(c)	red super giant	1
	(d)	any four from:	
		• fusion takes place within stars	
		• hydrogen formed into helium	
		• fusion continued and formed larger elements	
		• elements heavier than iron were formed in supernova	
		• (heavy) elements were scattered by the supernova explosion.	
		<i>accept light elements formed</i>	4
			[7]
4.	(a)	(i) C	1
		(ii) The speed of star B is less than the speed of star D .	1
	(b)	300 000 000	
		<i>allow 1 mark for correct substitution ie 200 000 × 1500 provided no subsequent step shown</i>	2
		m / s	
		<i>allow unit correctly indicated in list if not written in answer space</i>	1
			[5]
5.	(a)	wavelength correctly shown	1
	(b)	(i) increased	1
		decreased	1
	(ii)	17-18 inclusive	1
		evidence of measurement divided by 3 or mean of 3 separate measurements	1
		mm	
		<i>accept cm if consistent with answer</i>	1
	(c)	(i) red shift	1

- (ii) moving away 1
- (iii) the furthest galaxies show the biggest red shift 1
- (meaning that) the furthest galaxies are moving fastest 1
- (so the) Universe is expanding 1
- (extrapolating backwards this suggests that) the Universe started from an initial point 1
- (iv) cosmic microwave background radiation 1
- allow CMBR*

[13]

- 6.** (a) gravitational attraction (between the satellite and the Earth) 1
- allow gravity*
- allow weight of the satellite*

- (b) any **two** from: 2
- mass of satellite
 - speed / velocity (of satellite)
 - radius of orbit / circle
- allow height above the Earth*
- radius / height alone is insufficient*

- (c) (i) increasing the height (above the Earth's surface) increases the time (for one orbit) 1
- allow a positive correlation*
- allow as one gets bigger, the other gets bigger, or vice versa*
- ignore they are directly proportional*

- (ii) there is no relationship / correlation 1

- (d) Isaac Newton was a respected scientist who had made new discoveries before 1

[6]

- 7.** (a) forces (within the star) are balanced 1
- if specific forces are mentioned they must be appropriate*

(b) (i) bigger the mass (of the star) the shorter the 'main sequence' period
accept bigger the star the shorter the time

1

(ii) any **one** from:

- insufficient evidence
- do not know (exact) amount of hydrogen in star
accept do not know (exact) mass of star
- time too long (to measure directly)
- may be other factors (not yet known) that determine length of 'main sequence' period
- values are based on theory / calculation

1

(iii) faster than

1

larger stars have a shorter 'main sequence' period so they must have the faster (rate of) nuclear fusion

there must be a link between shorter 'main sequence' and nuclear fusion, this may be implied from the first marking point

1

the end of 'main sequence' happens as the hydrogen in (the core of) a star is used up

or

(since) they use up hydrogen at a faster (rate)

accept more massive stars (are brighter so) release energy faster

1

- (c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the [Marking guidance](#), and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a basic description of what happens to a star much larger than the Sun after the 'main sequence' period.

OR

Two stages are correctly named and are in the correct sequence.

Level 2 (3-4 marks)

There is a clear description of what happens to a star much larger than the Sun after the 'main sequence' period.

AND

At least two stages are correctly named and are in the correct sequence.

Level 3 (5-6 marks)

There is a detailed description of what happens to a star much larger than the Sun after the 'main sequence' period.

AND

At least three stages are named, in the correct sequence. There are no additional incorrect stages given.

Examples of the points made in the response:

extra information

- (the core of the) star runs out of hydrogen
- (the star) expands (to form)
- (the star) cools (to form)
 - *the core shrinks*
 - *helium starts to fuse to form other elements*
- a red supergiant
 - accept super red giant*
 - do **not** accept red giant*
 - (outer layers) explode
 - *fusion of lighter elements to form heavier elements (up to iron)*
- as a supernova
 - elements heavier than iron are formed
 - accept heaviest elements are formed*
 - core shrinks
- becoming a neutron star

- if mass large enough (core collapses)
- (to form) a black hole
if a correct description and sequence for a star the same size as the Sun and much bigger than the Sun given without clearly indicating which is which is limited to Level 2

6
[12]

8.

(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]

9.

(a) (i) towards the centre of the circle

accept inwards

accept a correct description

'along the string' is insufficient

1

- (ii) tension (in the string)
accept pull of the string
'the string' is insufficient
or
 weight (on the end of the string)
'the student' is insufficient
'turning action' is insufficient 1
- (b) (i) each may (also) affect the speed
accept results for speed 1
- so only one independent variable
accept only one variable affects dependent variable
'fair test' is insufficient
'they are control variables' is insufficient 1
- (ii) continuous
both required
 dependent 1
- (iii) reduces (absolute) timing error (for one rotation)
accept too fast to time one
or
 increases / improves reliability / accuracy (for one rotation)
ignore checking for anomalous results
to work out an average is insufficient 1
- (c) speed increases with centripetal force
accept positive correlation
*do **not** accept proportional* 1
- (d) (i) gravitational pull (of the Earth)
accept gravity 1
- (ii) **No**
both parts required – however this may have been subsumed within the reason
 geostationary orbits once every 24 hours
accept a correct comparative description 1