

MARK SCHEME

GCSE

PHYSICS

AQA - TRIPLE SCIENCE

P8 - TEST 4

SPACE PHYSICS

Intermediate

Mark schemes

1.

- (a) (i) (enough) dust and gas (from space) is pulled together

accept nebula for dust and gas

accept hydrogen for gas

accept gas on its own

dust on its own is insufficient

mention of air negates this mark

1

by:

gravitational attraction

or

gravitational forces

or

gravitaty

ignore any (correct) stages beyond this

1

- (ii) joining of two (atomic) nuclei (to form a larger one)

do not accept atoms for nuclei

1

- (iii) more sensitive astronomical instruments / telescopes

or

infrared telescopes developed

accept better technology

more knowledge is insufficient

1

- (b) (i) (other) planets / solar systems

do not accept galaxy

moons is insufficient

1

- (ii) provided evidence to support theory

accept proves the theory

1

- (c) elements heavier than iron are formed only when a (massive) star explodes

accept materials for elements

accept supernova for star explodes

accept stars can only fuse elements up to (and including) iron

1

[7]

- 2.** (a) fusion
do not credit any response which looks like 'fission' 1
- of hydrogen / H (atoms)
credit only if 1st mark point scores 1
- (b) fusion of other / lighter atoms / elements
reference to big bang nullifies both marks 1
- during supernova / explosion of star(s) 1
- (c) the (available) evidence: supports this idea
or
 does not contradict this idea
or
 can be extrapolated to this idea
or
 (electromagnetic) spectrum from other stars is similar to sun 1
- [5]**

- 3.** light from distant galaxies red shifted
accept longer wavelength for red shifted 1
- further galaxies display greater red shift 1
- the further away galaxies are the faster they are moving away from us (our galaxy) 1
- [3]**

- 4.** (i) the Universe might have started with
 an explosion/"Big Bang" 1
- (ii) light from galaxies is shifted to red end of spectrum
 the further away the greater the red shift all galaxies receding furthest fastest
 microwave background echo of big bang
for 1 mark each 2
- [3]**

- 5.** any **three** from
max 2 if stages but no explanation
- the star (Sun) expands because
 (inward) gravitational forces no longer balance (outward) force
accept the star collapses rapidly causing the core temperature to increase and the star to expand
accept it expands because the forces are unbalanced
 - to become a red giant
 - when the fusion stops it contracts / cools
accept (when hydrogen is used up) it collapses under gravity
accept when fusion stops it contracts and explodes
 - to become a white dwarf
accept to become a supernova / pulsar / neutron star / black hole
(only if red giant has exploded)

[3]

- 6.** (a) a protostar is at a lower temperature
or
 a protostar does not emit radiation /energy 1
- as (nuclear) fusion reactions have not started
accept heat or light for energy 1
- (b) by (nuclear) fusion
accept nuclei fuse (together)
nuclear fusion and fission negates this mark 1
- of hydrogen to helium 1
- elements heavier than iron are formed in a supernova
accept a specific example e.g. heavier elements such as gold are formed in a supernova
accept heavier elements (up to iron) formed in red giant/red super giant
reference to burning (hydrogen) negates the first 2 marks 1

[5]

- 7.** (a) gravitational attraction
for 1 mark 1

- (b) gravitational (in);
high internal temperature generates force (out)
for 1 mark each 2
- (c) star expands;
to form red giant;
then contracts/collapses;
to form white dwarf/neutron star/black hole/pulsar;
they may explode/become supernova
any four for 1 mark each 4
- (d) engulfed by red giant/blown up by star/hit by debris from star; sucked into black hole
for 1 mark 1

[8]

8.

- (a) *evidence of conclusion* 4×1.007825 or 4.0313
each gain 1 mark
- based on use of data that there is a (very small) loss of mass
or 0.0276 but a loss of mass of 0.0276 for every helium atom or 0.69%/0.7%
gains 3 marks* 3
- (b) *idea that* loss of mass results in release of energy
gains 1 mark
- but** small loss of mass results in huge energy release
gains 2 marks 2

[5]

9.

- (i) the nuclei
of hydrogen/smaller atoms
join to make helium/larger atoms
for 1 mark each 3
- (ii) the mass of the large nucleus (atom) is less than the mass of the smaller
nuclei (atoms)
for 1 mark
- mass loss converted into energy or small mass loss given a large amount of energy
for 1 mark 2

[5]

10.

- (a) (i) any **two** from
(matter from) exploded star / supernova
matter so dense / gravity so strong
that electromagnetic radiation / light cannot escape from it 2
- (ii) X-rays emitted 1
when gases or matter released from nearby stars spiral into it 1
- (b) fusion (of nuclei) 1
of lighter elements / hydrogen helium 1

[6]

11.

- (i) from a (giant) cloud of gas or hydrogen 1
condensed **or** pulled into a smaller volume by gravity 1
- (ii) any three from:
• fusion decreases or stops
• collapses rapidly causing the (core) temperature to rise
• (inward) gravitational forces no longer balance (outward) pressure
• expands
• and becomes a red giant
• it cools
• then becomes a white dwarf
• helium may fuse
if the sequence is incorrect deduct [1] therefore maximum 2 marks 3

[5]

12.

- (a) (enough) dust and gas (from space)
accept nebula for dust and gas
accept hydrogen for gas
mention of air negates this mark 1

pulled together by:

- gravitational attraction
or
- gravitational forces
or
- gravity

1

(b) forces (in the star) are balanced

accept equal and opposite for balanced

accept in equilibrium for balanced

1

forces identified as gravity and radiation pressure

both forces are required

*gravitational forces inwards balance / equal radiation pressure
outwards for 2 marks*

*accept for 2 marks an answer in terms of sufficient hydrogen to
keep the fusion reactions going*

*accept for 1 mark an answer in terms of sufficient fuel to keep the
fusion reactions going*

1

(c) (explodes as) a supernova

1

any **one** from:

- outer layer(s) thrown into space
*do **not** accept just 'thrown into space'*
- scatters dust and gas into space (for the formation of new stars)
*do **not** accept just 'dust and gas'*
- elements distributed throughout space
*do **not** accept just 'distributed'*
- matter left behind / core may form a neutron star
*do **not** accept just 'neutron star'*
- a black hole will form if the gravitational forces are enormous / sufficient mass is left behind
*do **not** accept just 'black hole'*
*do **not** accept any references to 'dark bodies' or 'black dwarfs'*
black hole forms if star is large enough is insufficient

1

[6]

13.

(a) (i) Universe began at a (very) small (initial) point

'it' refers to Universe

1

'explosion' sent matter outwards

or

'explosion' causing Universe to expand

accept gas / dust for matter

accept rapid expansion for explosion

1

(ii) light shows a red shift

owtte

the term red shift on its own does not score a mark

1

galaxies moving away (from the Earth)

'it' refers to light

'they' refers to galaxies

accept star for galaxy

*do **not** accept planet for galaxy*

1

(b) check reliability / validity of data

accept check data

accept collect more data

1

amend theory

or

discount the data

accept replace old theory with new theory

1

(c) answer involves (religious) belief

or

no / insufficient evidence

accept it cannot be tested

1

[7]