

MARK SCHEME

GCSE

PHYSICS

AQA - TRIPLE SCIENCE

P8 - TEST 5

SPACE PHYSICS

Advanced

Mark schemes

1.

- (a) (force of) gravity causes the satellite to accelerate (towards the Earth)

allow satellite is (constantly) accelerating

1

the acceleration causes a change in direction

acceleration causes a change in speed negates this

mark point

1

velocity changes because direction changes

1

- (b) length of orbit taken from graph = 42 100 (km)

1

$$42\,100 = 7.73 \times \text{time}$$

or

$$\text{time} = \frac{42\,100}{7.73}$$

allow

their distance = 7.73 × time

1

$$\text{time (1 orbit)} = 5446(\text{s})$$

allow a value consistent with their distance

1

$$\text{number of orbits} = \left(\frac{24 \times 3600}{5446} \right)$$

$$= 15.86$$

allow $\left(\frac{24}{1.51} \right) = 15.86$

allow a value consistent with their distance

1

$$\text{number of orbits} = 15$$

allow a value consistent with their distance

an answer of 16 scores 4 marks

1

or

length of orbit taken from graph = 42 100 (km) (1)

$$7.73 = \frac{\text{distance}}{24 \times 3600} \quad (1)$$

distance = 667 872 (km) (1)

$$\text{number of orbits} = \left(\frac{667872}{42100} \right)$$

= 15.86 (1)

allow a value consistent with their two distances

number of orbits = 15 (1)

*allow a value consistent with their two distances
up to full marks can be awarded for a method
calculating velocity in km/h and time in hours
an answer of 15 scores 5 marks*

(c) the predicted data is very close to the actual data

1

(d) supported the prediction (made by Bode)

allow predicted and actual values are very close

1

so provides evidence that the equation is true / correct / works / accurate

allow proves for provides evidence

1

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2.

(a) big bang theory – universe started at one point (then expanded)

1

steady state theory – universe has no origin / has always existed

*accept an answer in terms of mass
eg steady state theory mass is created*

1

(b) (i) wavelength (of light) increases

*accept answers in terms of frequency decrease
accept wavelength stretched but **not** wave stretched*

or wavelength / light moves to red end of spectrum

*do **not** accept galaxy moves to the red end of the spectrum
do **not** accept light becomes red / redder*

1

(ii) red-shift is evidence / supports idea of expanding universe

accept prove for support

1

both theories use the idea / accept / explain why the universe is expanding

1

(c) to find evidence to support one or both theories

accept prove for support

accept to gain more knowledge about the universe

or to find evidence to disprove one or both theories

1

(d) answer involves (religious) belief

accept it cannot be tested

or no / insufficient evidence

1

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3.

(i) an innumerable collection of galaxies

accept any word meaning a large number for innumerable

accept all the galaxies

*do **not** accept everything*

1

(ii) all matter concentrated at a (single) point

accept all matter part of a single 'superatom'

1

single (massive) explosion (sending matter outwards)

1

(iii) increasing or expanding

1

[4]

- 4.** (a) line shifts towards red end of spectrum
do not accept reference to 'red light'
do not accept 'red shift' as a stand alone response 1
- wavelength (appears) to increase 1
- galaxy is moving away (from the Earth)
do not accept universe expanding
- or** galaxy moving away from initial point
do not accept planet on its own 1
- (b) (i) light from A has a greater red shift
accept light from A is more red
do not accept reference to blue light 1
- (ii) 3600 (million light years)
allow 1 mark for showing that the line could be extended
or
allow 1 mark for the correct use of a point on the line 2

[6]

- 5.** (a) converted into helium
accept helium created
accept converted into heavier elements
accept used up in nuclear fusion / to produce energy
do not accept any reference to burning 1
- (b) turns / expands into a red giant
contradictions negate mark 1
- contracts **and** explodes **or** becomes a supernova 1
- may form a (dense) neutron star **or** (if enough mass shrinks to) form a black hole
accept forms a neutron star and (then) a black hole 1
- Quality of written communication**
correct points must be in sequence 1

- (c) (i) supernova **or** remains of an earlier star
ignore super nebula 1
- (ii) younger **or** not formed at the time of the Big Bang 1

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6.

- (a) stars / galaxies / sources emit all / different types of electromagnetic waves / radiation
accept two or more named electromagnetic waves
accept answers in terms of frequencies / wavelengths 1

- (b) (i) wavelength (of light) increases
accept frequency decreases
or
light moves to red end of spectrum
*accept redder but do **not** accept red alone* 1

- (ii) it is the star (detected) furthest from the Earth
accept galaxy for stars
or
it is moving away the fastest
ignore reference to universe expanding 1

- (c) (i) all matter compressed to / starts at / comes from a single point
*do **not** accept increasing gravitational pull*
accept everything / the universe for all matter 1

- (massive) explosion sends matter outwards
accept explosion causes universe to expand
*ignore explosion creates the universe **or** further reference to star / Earth formation* 1

- (ii) check validity / reliability of the evidence
or
change the theory to match the new evidence
accept comparison of new and old evidence 1

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7.

- (a) (a) supernova (explosion) 1

(b) solar system contains heavy elements / elements heavier than hydrogen and helium (1)

these (heavy) elements are / were formed by (nuclear) fusion (1)

*accept minor misspellings for 'fusion'
but **not** anything which could also be 'fission'*

(at the very high temperature(s)) in a super nova / when stars explode (1)

3

[4]

8. any **one** of

* between (stage) 2 and (stage) 3

* (in) the main sequence

* (in) the main stable period

* (it is a) yellow dwarf

[1]

9. (a) gravitational force(s) (1)

accept 'gravity'

balanced by (force(s) due to) radiation pressure (1)

accept equal

2

(b) by (nuclear) fusion (1)

of hydrogen to helium (other light elements) (1)

allow 'low density' for light

accept hydrogen nuclei / atoms form helium

response must clearly link one element(s) producing others

fusion to produce helium (2)

heavy element / elements heavier than iron are only produced (by fusion) in a supernova (1)

allow dense for heavy

ignore any reference to elements undergoing radioactive decay (to form other elements)

3

[5]

10. (a) (i) the bigger the masses (of the dust and gases then) the bigger the force / gravity (between them)

accept the converse

1

(ii) the greater the distance (between the dust and gases then) the smaller the force / gravity (between them)

accept the converse

1

- (b) radiation 'pressure' and gravity / gravitational attraction
these are balanced / in equilibrium

1

*must be in correct context
do **not** accept are equal*

or there is sufficient / a lot of hydrogen / fuel to last a very long time
second mark consequent on first

1

- (c) any **two** from:

- hydrogen runs out / is used up
- nuclei larger than helium nuclei formed
*accept bigger atoms are formed however do **not** accept any
specific mention of an atom with a mass greater than that of iron*
- (star expands to) / become(s) a red giant

2

[6]

11.

- (a) fusion (1)

of hydrogen/H (atoms)(1)

*do **not** credit any response which looks like 'fission' **or** the 'word'
'fussion'
credit only if a nuclear reaction*

2

- (b) fusion of other/lighter atoms/elements (1)

reference to big bang nullifies both marks

during super nova/explosion of star(s) (1)

2

- (c) explosion of star(s)/super nova (1)

*reference to big bang nullifies both marks reference to the star
running out of energy/material nullifies both marks*

at the end of the 'life' of star(s) / when they 'die' (1)

2

[6]

12.

- (a) runs out of hydrogen (in its core)

*accept nuclear fusion slows down
do **not** accept fuel for hydrogen
do **not** accept nuclear fusion stops
ignore reference to radiation pressure / unbalanced forces*

1

(b) temperature decreases / (relative)luminosity increases as it changes to a red giant

if both temperature and luminosity are given both must be correct

1

temperature increases / (relative) luminosity decreases as it changes to a white dwarf

if both temperature and luminosity are given both must be correct

1

correct change in temperature **and** (relative) luminosity as Sun changes to a red giant and then to a white dwarf

an answer changes to a red giant and then white dwarf with no mention or an incorrect mention of temperature or (relative) luminosity change gains 1 mark only if no other marks awarded ignore correct or incorrect stages given beyond white dwarf

1

[4]

13.

(i) bigger the red-shift, further the galaxy is from the Earth

accept red-shift and distance are directly proportional

accept there is a positive correlation

1

(ii) origin / start / beginning / creation

accept expansion

1

[2]