Mark schemes

1. (a) $g = \frac{750}{2.5}$

1

g = 300.0 (N/kg)

1

(b) electrostatic

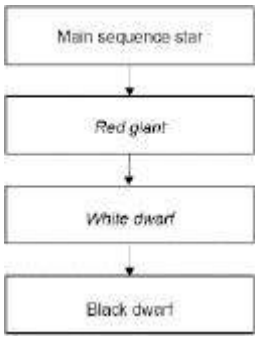
1

(c) red giant

this order only

1

white dwarf



1

(d) Z

reason only scores if Z chosen

1

only stars about the same/smaller size/mass as the Sun become Black dwarfs

allow converse

1

(e) supernova

1

[8]

2. (a) wavelength

allow a correct answer indicated in the box provided the answer space is blank

1

(b) C

1

(c) C

1

(d) Very dense and extremely hot

1

(e) Scientific evidence supports the theory

1

(f) Z

1

any **one** from
- (only one) shows the universe is expanding
- (only one) shows the universe began (very) small

only scores if Z is chosen

1

[7]

3. (a) (force of) gravity

*do **not** allow weight*

1

fusion

1

(b) distance = speed × time

allow a correct re-arrangement

or

s = vt

*do **not** allow d = st*

1

(c) $1.5 \times 10^{11} = 3.0 \times 10^{8} \times t$

1

$$t = \frac{1.5 \times 10^{11}}{3.0 \times 10^{8}}$$

1

t = 500 (s)

1

(d) **Level 3**: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

5–6

Level 2: Scientifically relevant facts, events or processes are identified and their relevance is clear. The account is not fully accurate.

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:

- fusion (processes in stars) produce new elements
- cloud of gas / hydrogen **and** dust **OR** nebula
- pulled together by gravity
- causing increasing temperature (to start the fusion process)
- (to become a) protostar
- hydrogen nuclei fuse to form helium nuclei
- and the star becomes main sequence
- hydrogen begins to run out
- helium nuclei fuse to make heavier elements
- up to iron
- the star expands (to become a)
- red super giant
- (the star collapses rapidly) and explodes
- called a supernova
- creating elements heavier than iron
- and distributing them throughout the universe
- leaving behind a neutron star
- or a black hole.

(e) Temperature

1

[13]

4. (a) Milky Way

1

(b) gravitational (force)

allow gravity

1

(c) it decreases

1

(d) answer between -60 and -160 (degrees Celsius)

1

(e) Three

1

(f) It orbits a planet. **1**

(g) Their orbits are circular. **1**

They do not emit visible light. **1**

(h) d = 13 000 × 110 **1**

d = 1 430 000 (km)

allow 1.4(3) × 10^6

allow a rounded answer (e.g. 1 400 000) **1**

[10]

5. (a) Milky Way **1**

(b) distance = 300 000 × 500 **1**

d = 150 000 000 (km) **1**

*an answer of 150 000 000 scores **2** marks*

(c) 3 **1**

(d) accept any number greater than 1.0 and less than 12.0 **1**

(e) $\frac{9}{0.6}$ **1**

15 **1**

*an answer of 15 scores **2** marks*

[7]

6. (a) dwarf planet **1**

(b) nebula

correct order only **1**

gravity **1**

(c) (becomes a) red giant **1**

(d) the greater the distance (from the Sun) the greater the time taken to orbit the Sun

1

(e) any value between 3 and 7 inclusive

1

(f) because some planets do not fit the pattern

1

named planet that does not fit pattern

eg Venus

1

reason why named planet does not fit pattern

its temperature is higher than expected

or

Uranus: its temperature is lower than expected

or

Neptune: its temperature is higher than expected

or

Mercury: its temperature is lower than expected

1

[9]

7. (a) any **one** from:

- Earth is at the centre (not the Sun)
- there are fewer planets

accept there is no asteroid belt shown

accept there are only 5 planets (and not 8)

accept other planets have no moons shown

1

(b) Shows the moon in orbit around the Earth

accept the planets have circular orbits

1

(c) circular

accept elliptical

1

(d) gravity

1

(e) Mira is much more massive

1

[5]

8. (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]