

Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Mark Schemes

Q1.

- (a) Main sequence shown correctly ✓
Dwarf star region shown correctly ✓
(red) giant star region shown correctly ✓ 3
- (b) Temperature scale 50 000 to 2 500 ✓
Absolute magnitude scale 15 to -10 ✓ 2
- (c) B ticked ✓ 1
- (d) Temperature of stars used as discriminator ✓
class B is in range 11 000 K to 25 000 K ✓ 2
- (e) The white dwarf must have the lowest (dimpest) absolute magnitude due to position on HR diagram (or ref to size) ✓
Omicron 2 has the dimpest apparent magnitude, and is the closest so must have dimpest absolute magnitude (or ref to m-M) ✓
Hence Omicron 2 is the white dwarf ✓ 3

[11]

Q2.

- (a) The collapse of a (super) massive star into a neutron star or black hole ✓
Allow lowering in value of absolute magnitude 1
- (b) Use of $z = \frac{v}{c}$ to give
 $v = 0.34 \times 3 \times 10^8$
 $= 1.0 \times 10^8 \text{ m s}^{-1} = 1 \times 10^5 \text{ km s}^{-1}$ ✓
Use of $v = Hd$

To give $d = \frac{v}{\dots} = \frac{1 \times 10^5}{\dots} = 1\,600 \text{ Mpc}$ ✓

$= 1\,600 \times 1 \times 10^6 \times 3.26$

$= 5.1 \times 10^9 \text{ yr}$ ✓

2sf ✓

1 mark for calculating v

1 mark for calculating d in Mpc

1 mark for converting to l yr

1 mark for 2 sf

4

- (c) Use of $E = mc^2$

To give

$E = 2 \times 10^{30} \times (3 \times 10^8)^2$ ✓

$= 2 \times 10^{47}$ which is the correct order of magnitude ✓

2

[7]

Q3.

- (a) Apparent magnitude of star is measured over a long period of time ✓

When planet passes in front of star (as seen from Earth), some of the light from star is absorbed and therefore the amount of light reaching Earth reduced ✓

This produces a light curve showing constant value with a dip periodically as the planet passes in front of the star ✓

3

- (b) Dip in light curve can be caused by other effects ✓

Except for planets very close to star, periods likely to be very long and may take many years of observation using transit method alone ✓

2

[5]