

Name of the Student: \_\_\_\_\_

Max. Marks : 18 Marks

Time : 18 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  $d = \frac{v}{H} = \frac{1 \times 10^5}{65} = 1\,600 \text{ Mpc} \checkmark$

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

$$= 5.1 \times 10^9 \text{ yr} \checkmark$$

2sf  $\checkmark$

*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

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

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

2

[7]