

- 0 2** . **1** Sketch a Hertzsprung–Russell diagram on the axes in **Figure 1**.
Label the position of the main sequence, white dwarf and giant stars.

[3 marks]

Figure 1

absolute
magnitude

temperature/K

- 0 2** . **2** Label the minimum and maximum values on the scale of each axis.

[2 marks]

0 2 . 3 Some of the properties of three stars are shown in Table 1.

Table 1

	Rigel	Omicron 2 Eridani	Regulus A
distance/light year	860	16.5	79
apparent magnitude	0.13	9.5	1.3
temperature/K	12 000	16 500	12 500

Identify the spectral class to which all three stars belong.

Tick (✓) the correct answer in the right hand column.

[1 mark]

	✓ if correct
A	
B	
F	
G	
K	
M	
O	

0 2 . 4 Explain your answer to Question 2.3.

[2 marks]

Question 2 continues on the next page

0 2 . **5** The three stars belong to different parts of the Hertzsprung–Russell diagram.

Deduce which star is a white dwarf.

[3 marks]

11

0 3

In 2013 a gamma-ray burst was detected from a region of space between the constellations of Leo and Ursa Major.

0 3

. 1

State the event that was the likely cause of this gamma-ray burst.

[1 mark]

0 3

. 2

Measurements of the optical remnant of the event revealed an object with a red shift z of 0.34.

Calculate, ignoring relativistic effects, the distance to this object in light year.
Give your answer to an appropriate number of significant figures.

[4 marks]

distance = _____ light year

0 3

. 3

The total energy of the gamma-ray burst was estimated to be 10^{47} J. Many scientists are concerned that a gamma-ray burst in the direction of the Earth could cause major problems.

Show that this is similar to the energy that would be released if the mass of the Sun were all converted to energy.

[2 marks]

Turn over ▶

0 4

Two methods involved in the detection of exoplanets are the radial velocity method and the transit method.

0 4

. 1

Explain what is meant by the transit method of detection.

[3 marks]

0 4

. 2

Explain why it is important that there is more than one method of detection.

[2 marks]

END OF QUESTIONS

5