

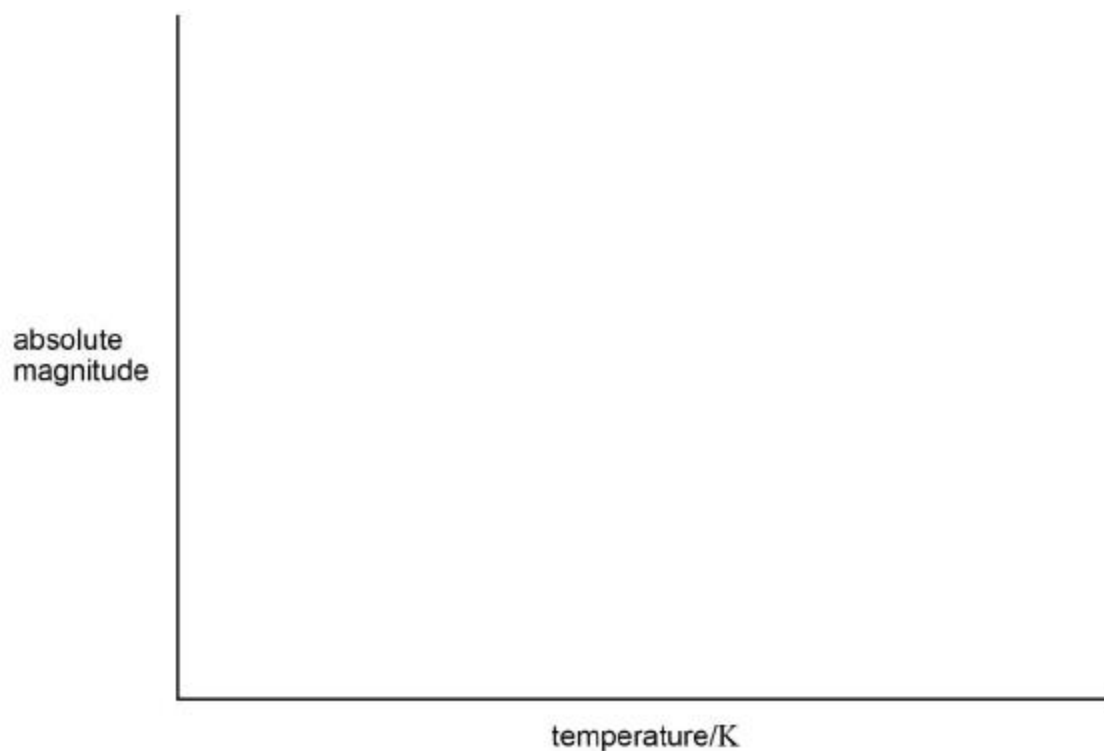
Name of the Student: \_\_\_\_\_

Max. Marks : 18 Marks

Time : 18 Minutes

**Q1.**

- (a) Sketch a Hertzsprung–Russell diagram on the axes on the graph below. Label the position of the main sequence, white dwarf and giant stars.



(3)

- (b) Label the minimum and maximum values on the scale of each axis.

(2)

- (c) Some of the properties of three stars are shown in the table below.

|                     | <b>Rigel</b> | <b>Omicron 2 Eridani</b> | <b>Regulus A</b> |
|---------------------|--------------|--------------------------|------------------|
| 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.

|   |              |
|---|--------------|
|   | ✓ if correct |
| A |              |
| B |              |
| F |              |
| G |              |
| K |              |
| M |              |
| O |              |

(1)

(d) Explain your answer to part (c).

(2)

(e) The three stars belong to different parts of the Hertzsprung–Russell diagram.

Deduce which star is a white dwarf.

(3)

(Total 11 marks)

Q2.

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

and Ursa Major.

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

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(1)

- (b) 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.

distance = \_\_\_\_\_ light year

(4)

- (c) 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)

(Total 7 marks)