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Level 2 Earth and Space Science, 2015

91192 Demonstrate understanding of stars and planetary systems

9.30 a.m. Tuesday 10 November 2015
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of stars and planetary systems.	Demonstrate in-depth understanding of stars and planetary systems.	Demonstrate comprehensive understanding of stars and planetary systems.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

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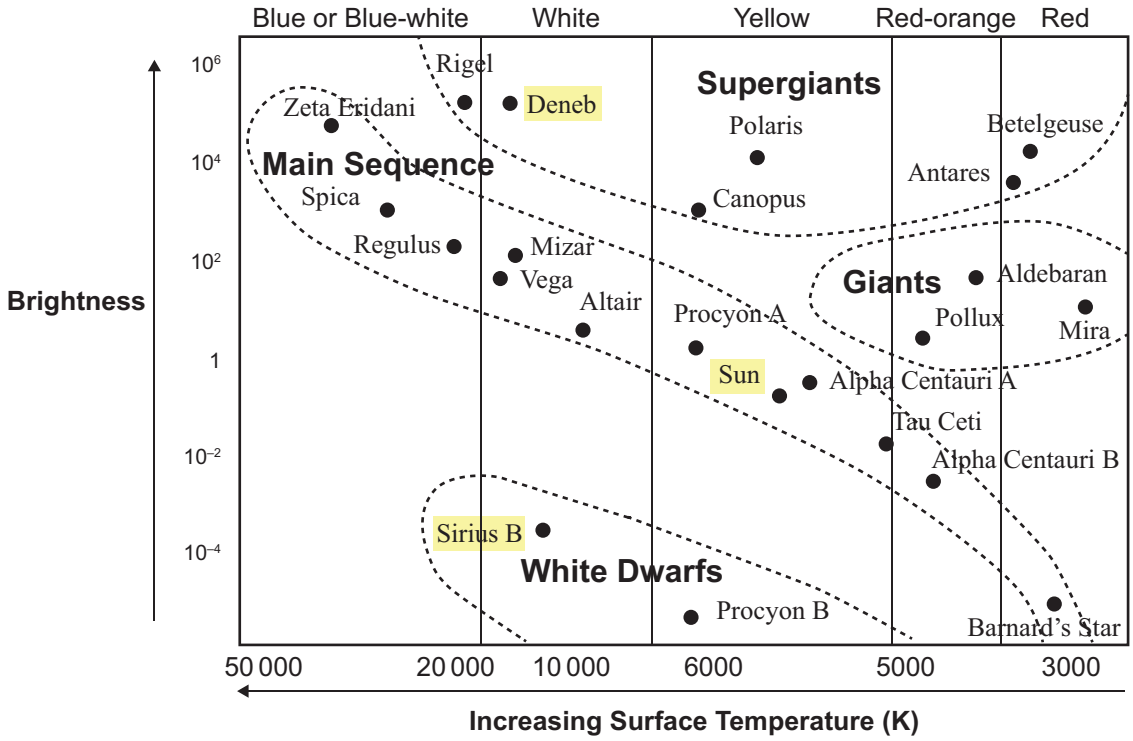
RESOURCE

The Hertzsprung-Russell (HR) Diagram



Source (adapted): http://www.slideshare.net/shayna_rose/hr-diagrams

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The examination continues on the following page.

QUESTION ONE: SAME TEMPERATURE DIFFERENT TYPE

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The stars Deneb and Sirius B have similar surface temperatures, despite the fact that they differ in their luminosity (the total amount of energy the star emits) and their brightness.

Complete the table below using the Hertzsprung-Russell (HR) diagram on page 2, and then use this information to explain in detail why one star is of the white dwarf type and the other is of the supergiant type, despite having similar surface temperatures.

	Colour	**Brightness**	**Type of Star**
Deneb			
Sirius B			

In your answer, you should:

- describe the characteristics of each type of star
- explain how the stars differ in luminosity
- explain how the stars differ in brightness
- explain how the size of the star affects luminosity
- compare the two stars to relate energy output to star type.

An annotated diagram may assist your answer.

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QUESTION TWO: FORMATION OF A SOLAR SYSTEM

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Source: http://earthsky.org/favorite-star-patterns/pleiades-star-cluster-enjoys-worldwide-renown

Pleiades is known to us as Matariki, and is an open star cluster of over 1400 stars. Its appearance in the early morning sky marks the dawn of the Māori New Year.

In this cluster there is a star named HD 23514, which has been observed with dust particles around it that are thought to be the beginning of a solar system that will eventually orbit this star.

Explain in detail how a solar system could form over time around the star HD 23514.

You should refer in your answer to:

- the factors that affect planet formation
- the stages, including the protoplanetary disk stage, in the formation of planets
- the relative sizes and composition of inner and outer planets and how this relates to the material from which they formed.

An annotated diagram will assist your answer.

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QUESTION THREE: ORIGIN OF A BLACK HOLE

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Black holes are the final stage in the life cycle of some stars. They are zones of extreme gravity which by capturing light become an area in the night sky where light is absent.

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Source: http://aguidetoherenorthere.com/black-holes-leitrim/heic0211h/

Explain in detail the life cycle (birth, life, and death) of a huge (massive) star that becomes a black hole.

In your answer, you should include:

- the mass of the original material in the giant molecular cloud (GMC)
- fuel type and use
- gravity
- energy changes.

An annotated diagram will assist your answer.

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Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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