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Level 2 Earth and Space Science 2022

91192 Demonstrate understanding of stars and planetary systems

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.

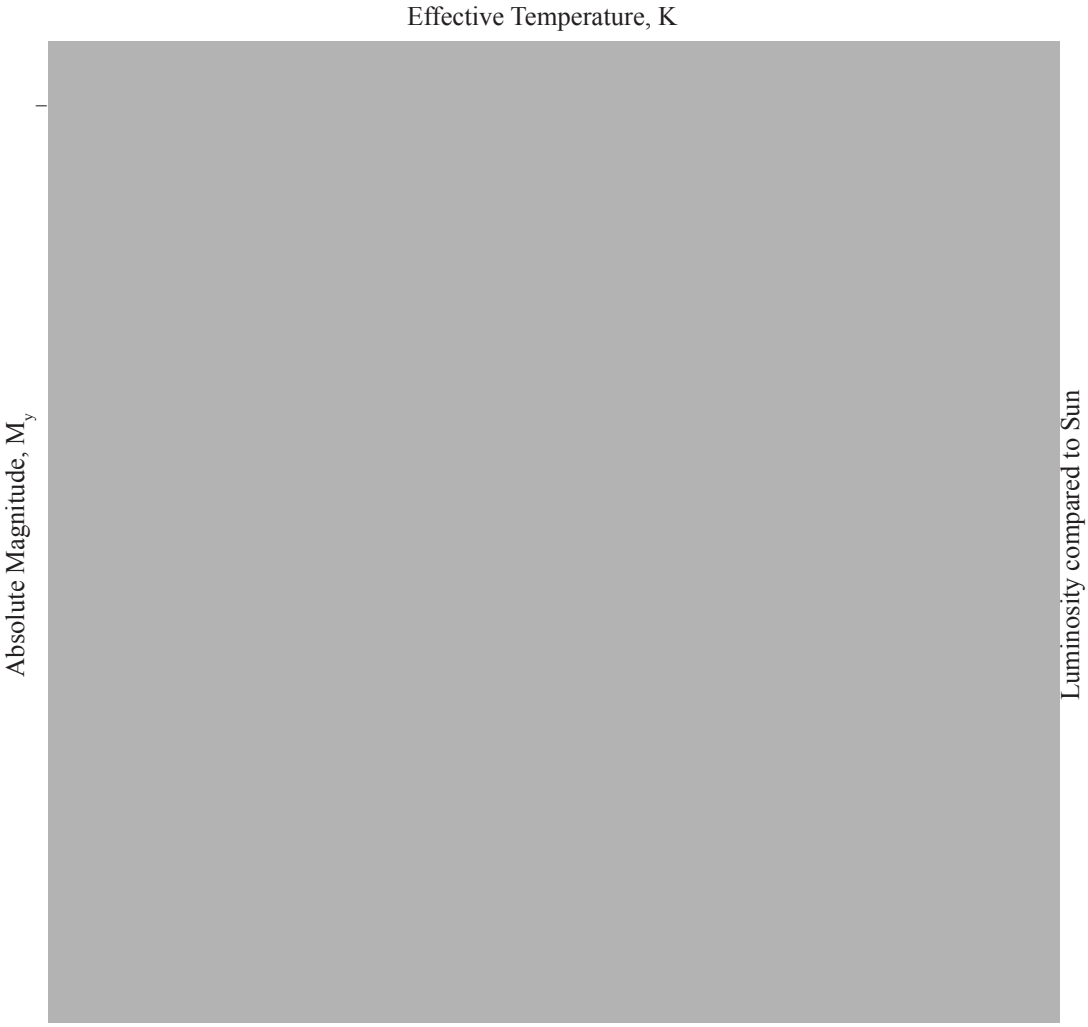
Check that this booklet has pages 2–15 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (▨). This area may be cut off when the booklet is marked.

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

RESOURCE

Hertzsprung-Russell (HR) diagram



Adapted from: http://www.atnf.csiro.au/outreach/education/senior/cosmicengine/stars_hrdiagram.html

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The examination continues on the following page.

QUESTION ONE: VEGA AND RIGEL

Prominent in the winter night sky are the stars Rigel and Vega. Rigel is 20 times the mass of the Sun, whereas Vega is approximately twice the mass of the Sun.

(a) Using the HR diagram on page 2, complete the table below to list the properties of Vega and Rigel.

Star	Luminosity	Temperature	Colour
Rigel			
Vega			

(b) Explain the difference in fuel use of Rigel and Vega, by relating it to luminosity and mass.

In your answer, you should consider the rate at which the fuel is being used.

(c) Compare the likely outcome of BOTH stars as they end their life cycle. (Note: you do not need to explain the various stages of each star's life cycle.)

In your answer, you should consider:

- the mass of the stars
- the role of gravity.

An annotated diagram may assist your answer.

QUESTION TWO: NEPTUNE'S SATELLITES

Neptune is the outermost planet of our solar system. It is a giant planet with 14 natural satellites.

The largest of the satellites is Triton. Its orbit is retrograde (rotates in the opposite direction to the planet), and it contains 99% of the total mass of all the satellites.

Adapted from: https://upload.wikimedia.org/wikipedia/commons/1/16/Orbits_of_inner_moons_of_Neptune_including_S_2004_N_1.jpg

(a) Describe what is meant by the term natural 'satellite'.

There are a number of different theories about how satellites are formed.

(b) Scientists think Triton may have been captured.

With reference to the diagram above and the information provided, explain why scientists may think this.

In your answer, you should consider:

- the capture theory of moon formation
- the mass of Triton
- the position of Triton's orbit and its motion around Neptune.

An annotated diagram may assist your answer.

(c) Explain, in detail, ONE theory of satellite formation, other than the capture theory, that may explain the formation of Neptune's other satellites.

In your answer, you should consider:

- the influence of gravity
- the mass of the satellites
- the orbits of the satellites.

An annotated diagram may assist your answer.

QUESTION THREE: NEUTRON STAR OR BLACK HOLE

Astronomers estimate that the Milky Way has anywhere from 10 million to one billion black holes, and around one billion neutron stars.

(a) With reference to the HR diagram on page 2, state where you would expect to find stars in the main sequence that will become neutron stars or black holes, and explain why they are found there.

(b) Explain, in detail, the life cycle of stars that lead to the formation of neutron stars from the main sequence.

In your answer, you should explain:

- energy changes during the different life stages
- fuel use during the different life stages.

An annotated diagram may assist your answer.

Question Three continues on the following page.

(c) Explain why some dying stars form neutron stars, while others form black holes.

In your answer, you should consider the effects of mass and gravity.

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QUESTION NUMBER

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