SUPERVISOR'S USE ONLY

2

91192



Draw a cross through the box (☒) if you have NOT written in this booklet



Mana Tohu Mātauranga o Aotearoa New Zealand Qualifications Authority

Level 2 Earth & Space Science 2023

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 2–16 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (continue of the cut off when the booklet is marked.

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

RESOURCE





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

This page has been deliberately left blank. The assessment begins on the following page.

QUESTION ONE: RED STARS

Betelgeuse and Proxima Centauri are both red stars. Betelgeuse is easily seen in the constellation of Orion. Proxima Centauri is a star that forms part of the triple star system in the constellation of Centauri. Betelgeuse is 642.5 light years away from Earth, and has a mass of approximately 17 solar masses, while Proxima Centauri is only 4.2 light years away, and has a solar mass of 0.12.

(a) Using the HR diagram on page 2, complete the table comparing the properties of Betelgeuse and Proxima Centauri.

Star	Life Stage	Temperature	Absolute Magnitude	Luminosity
Betelgeuse				
Proxima Centauri				

(b)	Explain, in detail, using the information from the HR diagram and the star properties in part (a)
	the reason for the difference in absolute magnitudes of Betelgeuse and Proxima Centauri.

In your answer you should consider:

- the difference between luminosity and absolute magnitude
- surface temperature

•	surface area.

(c)

Explain, in detail, how the luminosity of Betelgeuse will change over its life stages, whereas the luminosity of Proxima Centauri will not change until the end of its life.
In your answer you should consider:
• star mass
• surface area
• surface temperature
• life stages.
An annotated diagram may assist your answer.

QUESTION TWO: MATARIKI



Source: www.sciencelearn.org.nz/images/697-matariki-pleiades-star-cluster

Matariki is a star cluster indicating the beginning of the New Year to many Māori iwi. It contains many young stars, the brightest of these being 14 young, blue, main-sequence stars that have formed in the associated stellar nebula. These stars have masses in the range of 3 solar masses to 6 solar masses for the largest.

_	Describe what is meant by the term "stellar nebula".	
Е	Explain, in detail, how these young blue stars would have formed.	
Iı	In your answer you should consider the role gravity plays in star format	ion.
A	An annotated diagram may assist your answer.	

Explain, in detail, the life cycle of the smallest (3 solar masses) of these young blue stars from main sequence to the end of its life.
In your answer you should consider:
• the role of gravity in the changing life stages
• fuel usage during the different life stages
 energy changes during the different life stages.
An annotated diagram may assist your answer.

QUESTION THREE: JUPITER AND THE SOLAR SYSTEM

	r system consists of eight planets, with Jupiter the largest.	m-m-70-year
)es	escribe the difference between a star and planet.	
Exp	plain, in detail, how gas giant planets like Jupiter are formed.	
n y	your answer you should consider:	
	the role of gravity	
	temperature	
	solar winds.	
1n	annotated diagram may assist your answer.	

Question Three continues
Question Three continues on the next page.

c)	The picture below shows Jupiter's three rings, and the four rocky moons that accompany the rings. The rings are mainly made up of very fine dust particles.				
٠					
۰					
٠					
٠					
	Source: https://upload.wikimedia.org/wikipedia/commons/thumb/b/b8/Jupiter_Rings_ca.svg/2560px-Jupiter_Rings_ca.svg.png				
	Explain, in detail, how Jupiter's four rocky moons and ring system could possibly have been formed.				
	In your answer you should consider:				
	• the planet's gravity				
	 how moons may have formed around Jupiter 				
	• the material making up Jupiter's rings.				
	An annotated diagram may assist your answer.				

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

QUESTION NUMBER	L	 	
NUMBER			