

Star Cycle Mark Schemes

QUESTION 1

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	forces (within the star) are balanced		1
b)i)	bigger the mass (of the star) the shorter the 'main sequence' period	accept bigger the star the shorter the time	1
b)ii)	any one from: <ul style="list-style-type: none"> insufficient evidence do not know (exact) amount of hydrogen in star time too long (to measure directly) may be other factors (not yet known) that determine length of 'main sequence' period values are based on theory / calculation 	accept do not know (exact) mass of star	1
b)iii)	faster than larger stars have a shorter 'main sequence' period so they must have the faster (rate of) nuclear fusion the end of 'main sequence' happens as the hydrogen in (the core of) a star is used up or (since) they use up hydrogen at a faster (rate)	there must be a link between shorter 'main sequence' and nuclear fusion, this may be implied from the first marking point accept more massive stars (are brighter so) release energy faster	1 1 1

c)	<table border="1"> <thead> <tr> <th>0 marks</th> <th>Level 1 (1–2 marks)</th> <th>Level 2 (3–4 marks)</th> <th>Level 3 (5–6 marks)</th> </tr> </thead> <tbody> <tr> <td>No relevant content.</td> <td>There is a basic description of what happens to a star much larger than the Sun after the 'main sequence' period. OR Two stages are correctly named and are in the correct sequence.</td> <td>There is a clear description of what happens to a star much larger than the Sun after the 'main sequence' period. AND At least two stages are correctly named and are in the correct sequence.</td> <td>There is a detailed description of what happens to a star much larger than the Sun after the 'main sequence' period. AND At least three stages are named, in the correct sequence. There are no additional incorrect stages given.</td> </tr> </tbody> </table>				0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	No relevant content.	There is a basic description of what happens to a star much larger than the Sun after the 'main sequence' period. OR Two stages are correctly named and are in the correct sequence.	There is a clear description of what happens to a star much larger than the Sun after the 'main sequence' period. AND At least two stages are correctly named and are in the correct sequence.	There is a detailed description of what happens to a star much larger than the Sun after the 'main sequence' period. AND At least three stages are named, in the correct sequence. There are no additional incorrect stages given.
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<p>Examples of the points made in the response:</p> <ul style="list-style-type: none"> • (the core of the) star runs out of hydrogen • (the star) expands (to form) • (the star) cools (to form) <ul style="list-style-type: none"> • a red supergiant <ul style="list-style-type: none"> • (outer layers) explode • as a supernova <ul style="list-style-type: none"> • elements heavier than iron are formed • core shrinks • becoming a neutron star <ul style="list-style-type: none"> • if mass large enough (core collapses) 		<p>extra information</p> <ul style="list-style-type: none"> • the core shrinks • helium starts to fuse to form other elements <p>accept super red giant do not accept red giant</p> <ul style="list-style-type: none"> • fusion of lighter elements to form heavier elements (up to iron) <p>accept heaviest elements are formed</p>										
<ul style="list-style-type: none"> • (to form) a black hole 		<p>if a correct description and sequence for a star the same size as the Sun and much bigger than the Sun given without clearly indicating which is which is limited to Level 2</p>										
Total marks			12									

QUESTION 2

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	a protostar is at a lower temperature or a protostar does not emit radiation / energy as (nuclear) fusion reactions have not started	accept heat or light for energy	1
b)	by (nuclear) fusion of hydrogen to helium elements heavier than iron are formed in a supernova	accept nuclei fuse (together) nuclear fusion and fission negates this mark accept a specific example e.g. heavier elements such as gold are formed in a supernova accept heavier elements (up to iron) formed in red giant/red super giant reference to burning (hydrogen) negates the first 2 marks	1 1 1
Total marks			5

QUESTION 3

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)i)	protostar red giant black dwarf	correct order only	3
a)ii)	Alpha Centauri A stars (about) same size as Sun form white/black dwarfs or very large stars form red super giants / supernova/black hole	accept any correct indication, eg alpha, centauri, A reason only scores if Alpha Centauri A is chosen it is the same size as the Sun is insufficient same life cycle as the Sun is insufficient	1 1
b)	Atomic nuclei inside the star join		1

	together.		
Total marks			6

QUESTION 4

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	J (only) stars (about) the same/smaller size/mass as the Sun become black dwarfs	reason only scores if J is chosen accept smaller than the Sun accept it is the smallest accept (only) small stars become black dwarfs	1 1
b)i)	become a supernova or it will explode	ignore subsequent correct stages	1
b)ii)	cannot take measurements needed or do not have the technology	do not accept cannot measure mass	1
b)iii)	advances in (measuring) techniques / technology / knowledge		1
c)	any five from: <ul style="list-style-type: none"> • star expands (to become) • a red giant • heavier elements are formed (by fusion) • star shrinks (to become) • a white dwarf <ul style="list-style-type: none"> • star cools / fades • star stops emitting energy/ radiation 	ignore any information up to the end of the main sequence Apply the list rule if more than 5 points are made red supergiant is incorrect elements heavier than iron are formed is incorrect supernova, neutron star, black hole are incorrect star loses all energy is insufficient	5

Total marks			10
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QUESTION 5

QUESTION	ANSWER	EXTRA INFORMATION	MARKS
a)	main sequence star supernova	correct order only	1 1
b)	balanced by		1
Total marks			3