The Life Cycle of a Star **Mark Scheme**

Compare the life cycle of a star about the same size as the Sun and the life cycle of a star much more massive than the Sun, after the main sequence stage.

Extended writing questions are marked differently to other questions. There are three levels of response. First, you need to decide which level the answer fits into.

Level	Description	Marks
1	Relevant statements are made. For example, they have named a stage in the life cycle or given a correct statement about that stage.	1-2
2	Most stages of both life cycles (including either black hole **or** neutron star) are named and correctly sequenced. There is a simple description for most of the stages. For example, they have correctly named the main sequence star **and** said that nuclear fusion occurs here.	3-4
3	All stages of both life cycles (including either black hole **or** neutron star) are named and correctly sequenced. The life cycles are compared, including references to the mass of the stars **and** heavy elements. For example, they have explained that stars with a greater mass form a red super giant and produce heavier nuclei/nuclei to iron compared to a star with a lower mass, which forms a red giant and cannot produce heavier nuclei.	5-6

Next, you have to decide how many marks to award for that level of response.

Level 1

Give **1** mark if they have given one correct statement about a stage in the life cycle.

Give **2** marks if they have given two correct statements about a stage in the life cycle.

Level 2

Give **3** marks if they have correctly named and sequenced most of the stages **and** have given at least one correct statement to describe some of the stages mentioned.

Give **4** marks if they have correctly named and sequenced all of the stages **and** have given at least one correct statement to describe most of the stages **or** described multiple stages in detail.

Level 3

Give **5** marks if they have correctly named and sequenced all of the stages **and** have given at least one correct statement to describe most of the stages **and** have compared the mass and elements produced for each type of star.

Give **6** marks if they have correctly named and sequenced all of the stages **and** have given at least one correct statement to describe all of the stages **or** have described multiple stages in detail **and** have compared the mass and elements produced for each type of star.

Indicative Content

- mass of a star determines which life cycle/path the star will take
- fusion of larger nuclei (in the main sequence star)
- causes an increase in thermal energy
- which results in a rapid expansion

Star about the same size as the Sun:

- as it expands it cools
- to form a red giant
- smaller nuclei fuse here/nuclei up to carbon/iron is not formed here

- fusion stops
- the star collapses/contracts/shrinks inwards
- to form a white dwarf

- the star fades/dims/cools
- stops emitting energy/radiation
- and forms a black dwarf

Star much more massive than the Sun:

- as it expands it cools
- to form a red super giant
- nuclei as large as iron can fuse here

- the heavy elements cause a dense core
- the star collapses/contracts
- then explodes outwards
- in a supernova
- elements heavier than iron are produced

- most supernovas form neutron stars
- very dense core
- no fusion

- the largest supernovas form black holes
- strong gravity
- means nothing/not even light can escape