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 the life cycle 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 the life cycle are named and correctly sequenced. The transition between most of the stages is explained. For example, they have explained that as heavier nuclei fuse together in the main sequence star, there is an increase in energy, causing a rapid expansion to form a red giant.	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 stages 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 explained (by talking about changes in energy/forces/mass/density/fusion) why the star moves from some stages to the next ones.

Give **6** marks if they have correctly named and sequenced all of the stages **and** have explained (by talking about changes in energy/forces/mass/density/fusion) all of the transitions between stages.

Indicative Content

nebula

- formed from dust/gases
- gravity pulls them together
- so, the cloud gets hotter and denser

protostar

- the particles cause friction when they brush past each other
- increasing the thermal energy store
- starts to emit light

main sequence star

- hydrogen nuclei have enough energy
- to fuse/for nuclear fusion to start
- energy/heat/temperature causes the star to expand
- expansion forces are equal to gravitational forces
- stable

red giant

- larger nuclei fuse to form heavier elements
- causes an increase in thermal energy (in the core)
- rapid expansion
- as it expands it cools (and glows red)

white dwarf

- no more fusion
- collapses inwards/contracts/shrinks
- bright and hot
- because energy is condensed into a small area

black dwarf

- energy/radiation is emitted to the surroundings
- gets dimmer/fades and cools
- eventually stops emitting radiation/energy