Assessment Schedule – 2017

Earth and Space Science: Demonstrate understanding of stars and planetary systems (91192)

Evidence Statement

Expected Coverage	Achievement	Merit	Excellence
The features of the steps in the **life cycle** of Alpha Centauri A include: • giant molecular cloud (GMC) • GMC condensing under gravity • protostar • main sequence • red giant • planetary nebulae • white dwarf. The **birth stage** is explained: GMC condenses under gravity. As it condenses, the particles become hotter (due to friction), and eventually become hot enough to become a protostar. Star birth explained with associated energy changes: GMC collapsing changes gravitational potential energy into heat energy. When this heat energy temperature reaches about 1 000 000 K, nuclear fusion of hydrogen into helium occurs. Alpha Centauri A is a main sequence star; this is where Alpha Centauri A spends most of its **life**. Main sequence stars use hydrogen gas as their fuel. Hydrogen fuses together (by nuclear fusion) to form helium and release energy. As Alpha Centauri A **runs out** of hydrogen as the fuel source, the star becomes a red giant where Alpha Centauri A has enough mass to fuse helium to form carbon, but Alpha Centauri A does not have enough gravity (mass) to fuse carbon. The centre of Alpha Centauri A collapses under gravity and the outer layers are puffed off, forming a planetary nebulae, and the dying core eventually forms a white dwarf.	• Describes the steps in the life cycle of Alpha Centauri A.	• Explains the birth stage of Alpha Centauri A in terms of TWO of energy changes, mass, and gravity AND / OR • Explains the life stage of Alpha Centauri A in terms of TWO of energy changes, mass, fuel use and gravity AND / OR • Explains the death stage of Alpha Centauri A in terms of TWO of energy changes, mass, fuel use, and gravity.	• Comprehensively explains the birth, life and death of Alpha Centauri, with reference to TWO of energy changes, fuel source and use, mass, and gravity.

Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Describes ONE stage apart from Main Sequence in the life cycle of Alpha Centauri A	Describes TWO stages in the life cycle of Alpha Centauri A	Describes THREE stages in the life cycle of Alpha Centauri A	Describes FOUR stages in the life cycle of Alpha Centauri A	Explains in depth ONE stage of Alpha Centauri A's life in terms of TWO of energy changes, mass, fuel use, and gravity.	Explains in depth TWO stages of Alpha Centauri A's life in terms of TWO of energy changes, mass, fuel use, and gravity.	Comprehensively explains TWO stages of the life cycle of Alpha Centauri with reference to TWO of energy changes, fuel source and use, mass and gravity.	Comprehensively explains THREE stages of the life cycle of Alpha Centauri with reference to TWO of energy changes, fuel source and use, mass and gravity.

Question Two

Question Two has been deliberately removed

Question Three

Expected Coverage	Achievement	Merit	Excellence
As the star KOI-351 formed from a giant molecular cloud (GMC), there were leftover gas and dust particles. These particles rotate around the young star and flatten into a gaseous protoplanetary disc around the star that is a flattened disc shape. The protoplanetary disc contains rocky particles that condense together due to gravity. The disc is swirling (to conserve angular momentum), and so the particles begin to collide and form bigger masses. The bigger masses collect more particles due to their increasing gravitational field strength. There are two things that affect the formation of planets – temperature and the presence or absence of solar winds. The inner planets have formed in a higher temperature zone, and so are formed from the heavier higher melting point material found in the protoplanetary disc. This material is less abundant than the lighter gases, and so the inner planets will be smaller and rocky compared to the outer planets. They also contain less gas than outer planets because they had their gases blown off from the intense solar winds. These gases were blown further away from the inner planets towards the outer planets. The outer planets have formed further away from the central star in a lower temperature environment, and so will form from the lower melting point material, which is gaseous in nature. As there is far more gas in the protoplanetary disc than heavier elements, the outer planets will be bigger than the inner planets. They will also be able to form bigger planets that are probably gas giant in nature as they formed further away from KOI-351 and so didn't get affected by the solar winds. This is because the massive distance from the central star meant that the solar winds didn't affect them.	Describes with understanding: • formation of protoplanetary disc • formation of inner planets in terms of temperature, material, or solar winds • formation of outer planets in terms of temperature, material, or solar winds.	In depth explanation of: • the formation of protoplanetary disc in terms of particles rotating around star • formation of inner planets in terms of TWO of temperature, material, or solar winds • formation of outer planets in terms of TWO of temperature, material, or solar winds.	Comprehensively explains: • the relative sizes of the inner and outer planets in terms of location (presence or absence of solar winds) and formation material • formation of inner planets in terms of temperature, material, and solar winds • formation of outer planets in terms of temperature, material, and solar winds.

Not Achieved			Achievement		Achievement with Merit		Achievement with Excellence	
NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Partially describes ONE Achievement point.	Describes ONE Achievement point.	Describes TWO Achievement points	Describes THREE Achievement points.	Explains ONE Merit point.	Explains TWO Merit points.	Comprehensively explains TWO Excellence points.	Comprehensively explains and relates THREE Excellence points.