Assessment Schedule – 2014

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

Evidence Statement

QUESTION ONE			
Expected Coverage	**Achievement**	**Merit**	**Excellence**
Procyon A is a main sequence star and Procyon B is a white dwarf star. **Procyon A** • Temperature 6000 K • Colour Yellow • Brightness: 1. **Procyon B**: • Temperature 6000 K • Colour Yellow • Brightness: $1 \times 10^{-5} – 1 \times 10^{-6}$ Procyon B is a white dwarf star and Procyon A is a main sequence star. Procyon A is a main sequence star that is lower in mass than Procyon B, but both stars are around the same temperature. Procyon A is fusing hydrogen to form helium as its fuel source. As the available hydrogen runs out, the star will increase in size with a cooler surface to become a red giant. Procyon B is at the white dwarf stage so is further along in its life cycle than the main sequence Procyon A, which means that Procyon B was initially larger than Procyon A. Procyon B is the leftover hot core of planetary nebula that does not have a fuel source. As larger stars tend to use their fuel faster because the star is hotter, and both stars are assumed to have formed at the same time, it is reasonable to assume that Procyon B was initially larger than Procyon A.	Describes THREE characteristics (star type, temperature, brightness, and fuel use) of BOTH stars from the HR diagram.	• Explains the position of BOTH of the stars on the HR diagram in terms of characteristics, eg star type, size, mass, brightness, and fuel usage. • Explains why Procyon B was initially larger.	• Compares the characteristics of both stars. • Links these to their positions on the HR diagram. • Justifies which star was initially larger.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Has ONE correct aspect of each star from HR diagram.	Describes TWO characteristics of each star from the HR diagram.	Describes THREE characteristics of EACH star from the HR diagram.	Describes THREE characteristics of EACH star from the HR diagram AND describes Procyon B was initially larger.	ONE point	TWO points	THREE points addressed.	Comprehensively addresses THREE points.

QUESTION TWO			
Expected Coverage	**Achievement**	**Merit**	**Excellence**
Saturn's inner moons are large and circular in shape, like planets. For this reason, it is believed that they formed in much the same way as planets formed in the solar system. This means they formed in the leftover material from the formation of Saturn. This material began to rotate around Saturn and flattened into a protoplanetary disk. As the material rotated, it collided and formed larger masses which, due to gravity, attracted more particles and the masses became larger. The outer moons were not formed in this manner. They have been captured from passing asteroids due to Saturn's large mass, meaning that Saturn has a large gravitational pull. Saturn is also close to the Kuiper belt. There is evidence for capture occurring because the asteroids are irregular in shape and have an irregular orbit around Saturn.	• Describes inner moons formed around the same time / place as planet. • Describes outer moons being captured.	• Explains that inner moons formed leftover material in formation of Saturn (protoplanetary) disk. • Explains that outer moons are captured material (asteroids).	• Explains in detail how inner moons formed from leftover material in formation of Saturn (protoplanetary disk). • Explains in detail how outer moons are captured asteroids probably from the Kuiper belt.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Gives a feature of the formation of inner or outer moons.	Gives a feature of the formation of both the inner or outer moons.	ONE point.	TWO points	ONE point.	TWO points	ONE point	TWO points

QUESTION THREE			
Expected Coverage	**Achievement**	**Merit**	**Excellence**
The star did not use all of the gas and dust in the giant molecular cloud and so there were leftover materials. These particles began to orbit around the very young Sun due to gravity and flattened into a disk shape called a protoplanetary disk. Inside this disk the particles began to collide and form bigger masses. These bigger particles attracted more particles due to their increasing gravitational field strength (gravity). As these large masses called planetesimals collided with each other, the planets were formed and so a young Kepler-62f was formed. Because it was close to the Sun, it was composed of rarer materials like carbon and iron, which formed from nuclear fusion in the developing Sun, which are heavier and not gaseous like the more abundant hydrogen and helium. These elements have higher melting points than the gaseous hydrogen and helium, which meant that Kepler-62f could form so close to the star. So, Kepler-62f is an Earth-like planet due to its rocky nature and distance from its star. This distance means that water is likely to be liquid and gravity is around the same as Earth's, so Kepler-62f is an Earth-like planet. Because water is likely to be liquid and gravity is similar to Earth, Kepler-62f could be considered to be in the habitable zone for life in this solar system.	• Described that Kepler-62f was formed from leftover material from its star's formation that had flattened into a disk shape called a protoplanetary disk OR description of how planetesimals formed from masses colliding. • Description how Kepler-62f is in habitable zone with regards to several of the following: gravity, water, temperature, atmosphere.	• Explained how planetesimals formed due to gravity. • Explained that Kepler-62f formed of rare, heavier elements that are not gaseous. • Explained why Kepler-62f likely to be in habitable zone.	• Explains in detail that Kepler-62f formed from heavy rare elements due to gravity. • Explains in detail how Kepler-62f is an Earth-like planet in the habitable zone for life.

NØ	N1	N2	A3	A4	M5	M6	E7	E8

No response; no relevant evidence.	Partial description of Kepler-62f forming from Sun's leftover material.	Partial description of Kepler-62f forming in protoplanetary disk.	ONE point	TWO points	TWO points	THREE points	ONE point	TWO points