Assessment Schedule – 2025

Scholarship Earth and Space Science (93104)

Evidence Statement

Question One: Volcanoes under the ice

Evidence	1–2	3–4	5–6	7–8
Eruption types Due to this being a rift valley, most of the volcanism would be non-explosive basaltic magmas. If there was a significant amount of melt water from a nearby volcano or the rising magma, there might be an explosive reaction. Any of the more complex magmas mentioned in the question could be more explosive and have larger eruptions. If an eruption did occur that was of significance, then the heat could cause widespread melting; this could cause a chain reaction where, because of the reduced pressure, there would be more eruptions as the ice melted. The reduced pressure means that there is less force acting to keep rising magma down; however, when the ice melts on top of the crust, there is now a vacuum where the magma moves into, this allows magma to expand and rise more easily. As there is rifting, there is now very little stopping the magma rising and causing eruptions. Because the ice has been preventing the rising magma, there might be larger-than-expected eruptions as the pressure is removed. This would be more likely in areas where the ice sheet is already unstable, as full melting would be unlikely, whereas destabilising a large mass of ice that might become an iceberg is more likely. In a more explosive eruption like the volcano near Pine Island Glacier, it appears to have spread large amounts of ash and tephra over the area, and therefore we can assume is not purely basaltic. **Implications** As ice caps continue to melt, the potential for increased volcanic activity poses significant challenges for global climate stability. Further research is needed to fully grasp the implications and develop strategies to mitigate the impact of these natural phenomena. Increased volcanic activity can release large amounts of greenhouse gases, such as carbon dioxide (CO_2), into the atmosphere, further contributing to global warming. This creates a feedback loop where climate change accelerates ice melt, leading to more volcanic activity, which in turn exacerbates climate change. Melting ice would also decrease the albedo (water absorbs more sunlight than	• Very little understanding of question, with very little development of ideas. • Resource booklet copied only.	• Shows some understanding of question, with only some development of ideas. • Some synthesis and integration of the processes.	• Good understanding of question, with good development of ideas. • Good analysis, synthesis, and integration of the context, exhibiting well-developed understanding of the context. • Must show a sense of scale and impacts of global changes.	• Thorough understanding of question, with excellent development of ideas. • Sophisticated analysis, synthesis, and integration of the concept, showing perception and insight applied to the context. Reflection on the answer, resulting in extrapolation. • All aspects of answer expressed with convincing communication. • Must show integration of ideas, e.g. flow-on effects etc.

ice), so this would exacerbate climate change and reduce the pressure on the volcanoes, leading to more volcanic activity. With a large covering of ash or similarly dark material, this would change the albedo index of a large area significantly, and as the light that would be reflected would now be very dark and absorb a lot of light, this could also cause an increase in melting in the region. A huge sea level rise will make low lying areas and coastal areas become unliveable. *Should be mentioned but not a focus.*				

Question Two: Warming ocean

Evidence	1 – 2	3 – 4	5 – 6	7 – 8
South Pacific gyre formation Trade winds (east to west) at the Equator blow over the surface of the water, causing the water to move, due to friction. Coriolis effect causes warm water to deflect left down the eastern coast of Australia; strong westerly winds move across the Pacific Ocean, moving water towards the west coast of South America. **Shifting subtropical front** As temperatures increase off Australia's east coast, heat transfer toward the North Island weakens and gets stronger towards the South Island. The biggest amount of warming will be seen off the South Island's east coast (Chatham Rise). Increased westerly winds means that warmer waters are being pushed towards New Zealand, which pushes the STF down. Increased westerly winds increase result in a stronger Antarctic Circumpolar Current. Such a change would push waters away from the Campbell Plateau and Chatham Rise. However, any increased warmth may be offset locally by wind-induced upwelling of cooler subsurface water, as there will be competition between the warmer waters and the Antarctic Circumpolar Current as to which direction the Subtropical Front moves. The migration of the westerly winds to higher latitudes will cause the Subtropical Front to move south. **Atmospheric patterns** La Niña occurs when the easterly trade winds around the Equator strengthen, which pushes warm surface water from the eastern Pacific to the western Pacific. Warmer surface waters increase stratification, preventing the mixing of cold, nutrient-dense waters from deeper ocean layers with the warmer surface layers. This reduction in vertical mixing is detrimental to the base of the marine food chain, as fewer nutrients reach the surface where phytoplankton can thrive. **Effects** In the Chatham Rise, a decline in nutrient availability could have effects throughout the ecosystem, reducing fish populations and threatening the sustainability of fisheries. Rising greenhouse gas emissions are contributing to an increase in global sea surface temperatures.	• Limited understanding of question, with very little development of ideas. • Resource booklet not referenced or sections copied.	• Shows some understanding of question, with some development of ideas. • Some synthesis and integration of the processes.	• Good understanding of question, with good development of ideas. • Good analysis, synthesis, and integration of the processes, exhibiting well-developed understanding of the context.	• Thorough understanding of question, with excellent development of ideas. • Sophisticated analysis, synthesis, and integration of the processes, showing perception and insight applied to the context. • Reflection on the answer, resulting in extrapolation. • All aspects of answer expressed with convincing communication.

There are animals adapted to live on the warm northern side and others adapted to the cold southern side, so when warm waters encroach, you'd expect the species that favour the warmer conditions to increase, and those that favour cold conditions to move away or disappear. However, it might take a few years, or a few fish generations, for the scale of the changes to become clear. Changes in circulation patterns affect the distribution of marine nutrients, essential for maintaining marine productivity. Where the fish go might be a difficult question to answer. It would require finding them, or the possibility that the species might not find another place like the Chatham Rise, and therefore face extinction, especially with continued fishing.				

Question Three: Seasons in our solar system

Evidence	1 – 2	3 – 4	5 – 6	7 – 8
Earth Earth is on a 23.4° tilt, which means it experiences uneven amounts of solar radiation, which results in seasons. Its eccentricity is more elliptical than Neptune's, which means it experiences variations in its distance from the Sun. Earth experiences four seasons which are all three months each. **Mars** Solar energy striking Mars is absorbed by the surface and re-emitted as infrared / heat, but this heat would be radiated away from Mars because the atmosphere is too thin to retain it. The axial tilt of Mars (which is similar to Earth's) means that the equatorial region will absorb the most solar energy because the Sun's rays will be more direct, and the solar energy focused onto a smaller area. Mars's orbit is more elliptical than Earth's so when it is at perihelion it is a lot closer to the Sun. The southern hemisphere's summer gets warmer than that of the northern hemisphere, because it tilts towards the Sun at the perihelion. However, the southern hemisphere's winter is colder than that of the northern hemisphere, because it tilts away from the Sun at the aphelion. Mars's orbit is about twice as long as Earth's, so its seasons will also be about twice as long. **Uranus** Even though Uranus has an extreme tilt, it still experiences seasons. When it is summer, the entire southern hemisphere will be facing the Sun, while the northern half of the planet remains in darkness experiencing winter. Its orbit is more circular than Saturn or Mars, so it will still experience differences in solar radiation during its perihelion and aphelion, but not as greater differences as seen with Mars or Saturn. During spring and autumn, the equatorial region is facing the Sun, and thus the polar regions are not. Also, during this time the day / night cycle is about 17 hours, which means that the equatorial region is experiencing day and night which does not happen during summer and winter. Instead, one part of the planet is in complete darkness, while the other part is in complete light. The seasons on Uranus will last 21 years each, since its orbit is approximately 84 years. Uranus receives less solar radiation than Saturn. **Neptune** Neptune's orbit is more circular than Earth's. This means that its perihelion	• Limited understanding of question, with very little development of ideas. • Resource booklet not referenced or sections copied.	• Shows some understanding of question, with some development of ideas. • Some synthesis and integration of the processes.	• Good understanding of question, with good development of ideas. • Good analysis, synthesis, and integration of the processes, exhibiting well-developed understanding of the context.	• Thorough understanding of question, with excellent development of ideas. • Sophisticated analysis, synthesis, and integration of the processes, showing perception and insight applied to the context. • Reflection on the answer resulting in extrapolation. • All aspects of answer expressed with convincing communication.

and aphelion do not differ greatly, and it experiences less variation in its solar radiation. It receives the least amount of solar radiation, since it is the furthest planet from the Sun, but has a larger tilt than Earth, which means that it will experience more marked seasons. When it is spring on Neptune, it has increased clouds, which shows that vapour is being produced. This shows that the amount of solar radiation it is receiving does affect the planet. Its seasons will last approximately 41 years each, which means that we will not see it experiencing summer till 2044.				

Cut Scores

Scholarship	Outstanding Scholarship
14 – 18	19 – 32