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Level 2 Earth and Space Science 2022

91193 Demonstrate understanding of physical principles related to the Earth System

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of physical principles related to the Earth System.	Demonstrate in-depth understanding of physical principles related to the Earth System.	Demonstrate comprehensive understanding of physical principles related to the Earth System.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (▨). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE: VISIBLE LIGHT IN THE ATMOSPHERE

Visible light travels through space to Earth from the Sun.

(a) Describe the visible light spectrum in terms of wavelength, frequency and colour.

An annotated diagram may assist your answer.

(b) Explain, in detail, the possible behaviour of visible light as it travels through the atmosphere during the middle of the day.

In your answer, you may wish to consider:

- transmission, absorption, reflection, and scattering
- high / low clouds
- gases and particles in the atmosphere.

An annotated diagram may assist your answer.

There is more space for your answer to this question on the following page.

Question One continues on page 6.

This page has been deliberately left blank.
The examination continues on the following page.

(c) The picture below shows a typical sunset over Auckland city.

https://www.heletranz.co.nz/red-sunset-auckland/

Explain why visible light from the Sun is seen as a red colour at sunset.

In your answer, you should consider:

- the angle of the Sun relative to the Earth's surface at sunset
- the colours and relative wavelengths of visible light
- what scattering of light depends on.

An annotated diagram may assist your answer.

QUESTION TWO: EARTH'S CLIMATE REGULATOR:

Earth's climate is partially regulated by the Antarctic and Arctic ice sheets. This is due to the ice sheet's high reflective ability (high albedo).

(a) Complete the table below to compare how well solar radiation is reflected and absorbed by ice and water. You should use the words (descriptors) GOOD or POOR.

	Reflection	Absorption
Ice		
Water		

(b) Explain, in detail, how the high reflective ability (high albedo) of ice sheets regulates the temperature of the atmosphere.

In your answer, you should consider:

- how the Earth's surface is heated by the Sun
- behaviour of solar radiation on ice.

An annotated diagram may assist your answer.

(c) Scientists monitoring Earth's climate have a major concern over the gradual reduction in the size of the Arctic ice sheet. The image below shows the change in the extent of the ice sheet at the end of the Arctic summer over the last 40 years.

Source: www.sciencealert.com/arctic-sea-ice-could-vanish-in-the-summer-even-before-2050-new-simulations-predict

Explain, in detail, the effect on the Earth's climate of any reduction in the Arctic ice sheet.

In your answer, you should consider:

- changes in the reflective ability of the Arctic
- changes in the ice sheet's extent over the 40 years
- the role of the heat capacity of water.

QUESTION THREE: NGAWHA HOT SPRINGS

Located near Kaikohe, in the Far North of New Zealand, Ngawha Springs is a geothermal hot pool complex with long historical and cultural links to local Māori.

www.ngawha.nz/uploads/3/2/1/2/32123857/image-file-formats-1-8_orig.jpeg

(a) The source of heat for the hot pools is the Earth's core.

Describe the origins of the heat in the Earth's core.

(b) Explain, in detail, how heat energy from the Earth's core is transferred to the mantle.

In your answer, you should consider:

- methods by which heat is transferred
- the inner core, the outer core, the lower and upper mantle
- how heat is transferred through the layers.

An annotated diagram may assist your answer.

Question Three continues on the following page.

(c) The water source for geothermal springs is rainwater or groundwater that seeps into the crust through cracks.

Explain, in detail, how the water in the geothermal springs becomes heated.

In your answer, you should consider:

- the source of the heat in the crust
- how the heat is transferred from the mantle to the crust
- the role of heat transfer in the water reaching the surface.

An annotated diagram may assist your answer.

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER