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91193



911930



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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.

Achievement

TOTAL

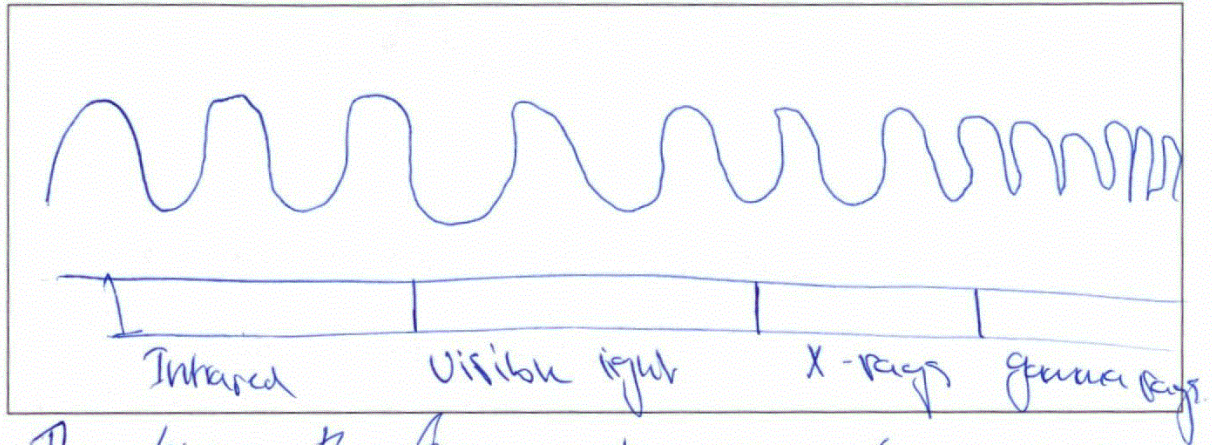
12

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.



The higher the frequency the more concentrated the different radiations become, for example our eyes can only detect a small percentage of radiation known as the visible light spectrum.

Earth

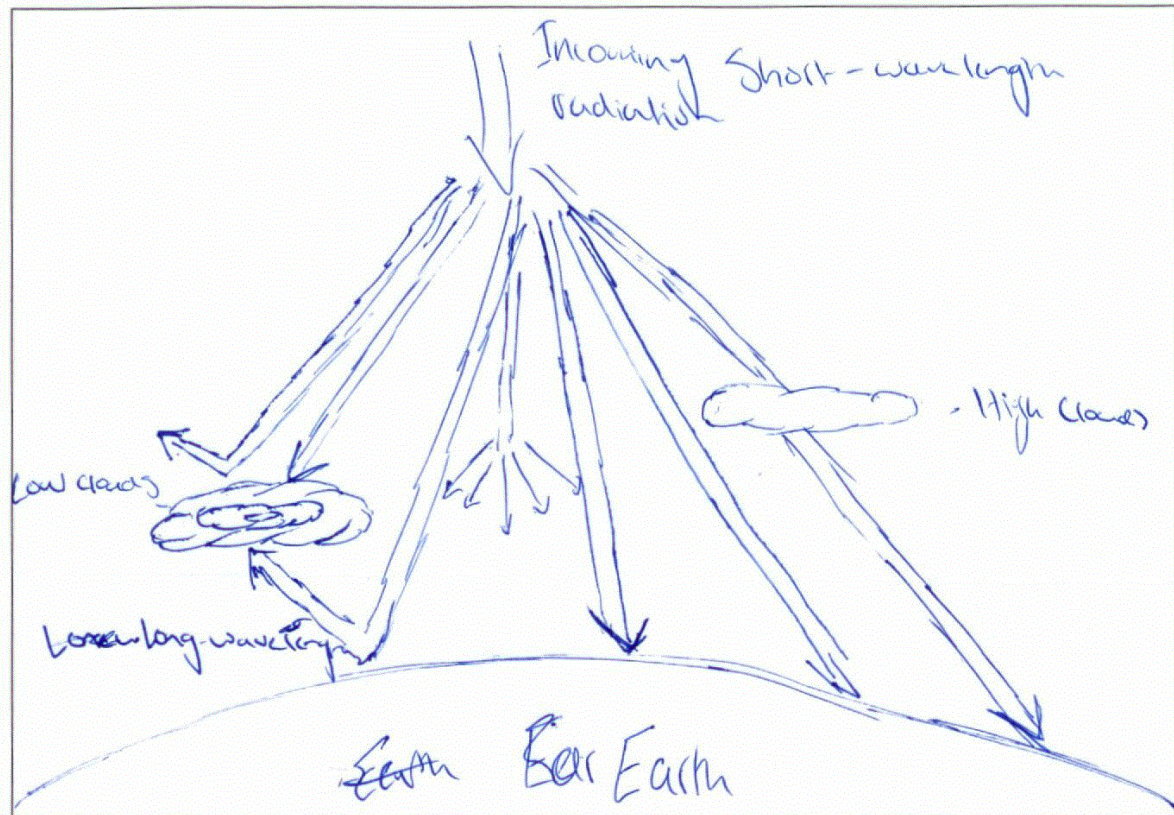
Earth

- (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.



As Short-wavelength radiation from the Sun enters our atmosphere, a number of things can happen to it, firstly low, dense clouds are quite absorbant, and so a lot of radiation is absorbed, by these clouds, also these clouds can reflect a fair amount of the radiation, they can also absorb, long-wavelength radiation, that is reflected from earth, meanwhile, light, high clouds tend to let alot more radiation through, which therefore can hit the earth, the other thing that can happen is

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

Scattering which can happen when these wave-lengths come into contact with dust and gas particles, causing them to break up and scatter into the atmosphere. This is what can happen to visible light, as it is a part of the short-wave radiation from the Sun.

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



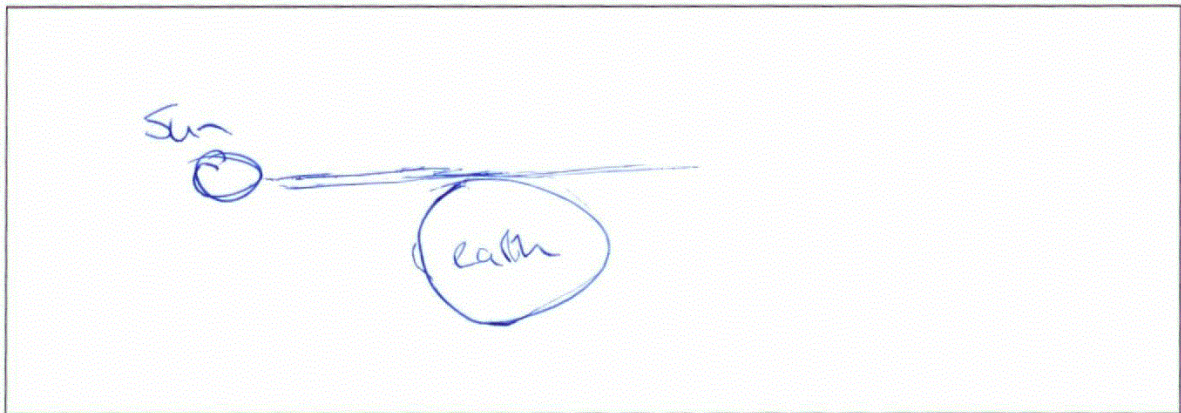
<https://www.heletranz.co.nz/red-sunset-auckland/>

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.



As the Sun sets it becomes almost parallel with the horizon. Because of this angle, light and radiation scatter through the atmosphere. According to the visible light spectrum, red the red color has the longest wavelength.

Means that red, is the only color to reach our eyes, as all the other colors do not have longer wave-lengths, this is what makes the sky turn red as that is the only radiation that can pass through the atmosphere at that angle. Also due to that angle a lot of light gets scattered, also meaning that red, is the only color to penetrate through the atmosphere, due to its longer wave-length.

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	Good	Poor
Water	Good	Poor

- (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.



The Sun heats the earth via short-wavelength radiation, a lot of the Sun's radiation, is absorbed by the earth, mainly by the land, and places of low albedo. The earth also heats up due to long-wavelength radiation reflecting off the greenhouse gases. However Ice and snow have a much higher albedo, meaning they are much more reflective, than land. Due to the ice being higher albedo and more reflective.

it reflects alot more radiation. And absorbs a bit less, this regulated the temperature because since the ice does not absorb the radiation and instead reflects it, it does not heat up the earth making it significantly cooler, than if it absorbed it.

- (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.



September 1979

September 2019

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.

Due to people inhabiting the arctic, and putting up buildings, this could ~~increase~~ decrease the albedo, making it less reflective, also due to water's high heat capacity, the waters surrounding the arctic, could be slowly melting them, due to climate change, and an increase in greenhouse gases. These greenhouse gases could trap a lot of the reflected radiation from the arctic and make it warmer, ~~be~~ slowly reducing the size of it. Over the 40 years more greenhouse gases have been introduced into the atmosphere, potentially ~~be~~ warming it up further.

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.

- (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.

in the earth core

radioactive isotopes are

slowly decaying releasing vast amounts of heat, such as Uranium-235. Residual heat is heat left over from the formation of earth, and latent heat of fusing as layers of the core start to cool off, all these combined create the heat source for the earth's core.

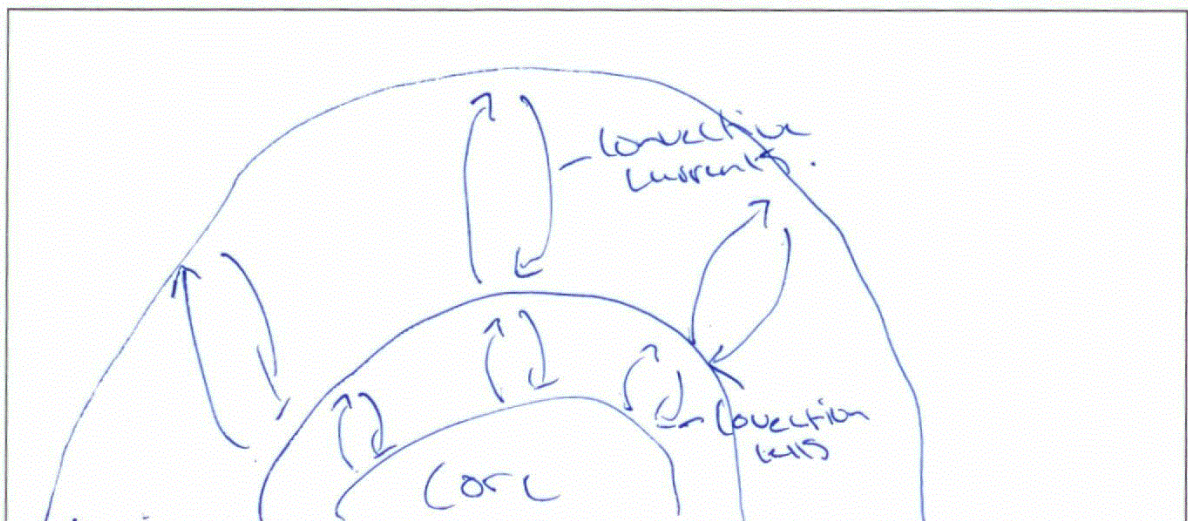
www.ngawha.nz/uploads/3/2/1/2/32123857/image-file-formats-1-8_orig.jpeg

- (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.



Heat is transferred to the core to the outer core by conduction, heat then moves from the outer core to the mantle, through convection, and moves through the upper mantle via convection as well.

Question Three continues
on the following page.

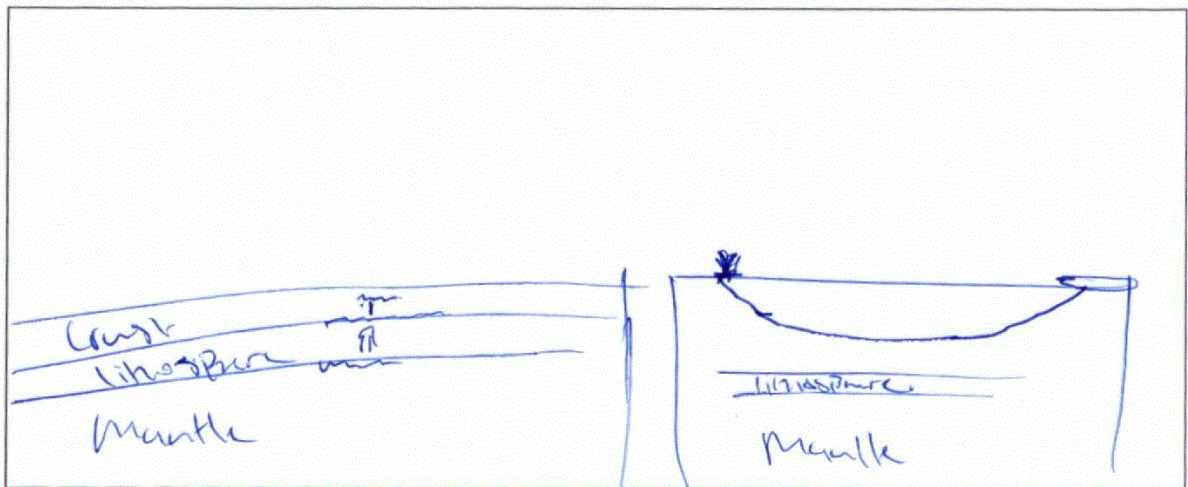
- (c) The water source for geothermal springs is rainwater or groundwater that seeps into the crust through cracks.

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.



The source of heat from the crust comes from the mantle, ~~the~~ from the mantle, heat is transferred by conduction to the lithosphere, then from the lithosphere to the crust. Deep, as deep underground water ways get too close to the mantle, they start to boil and heat up, this causes the water to quickly shoot up, to release steam, and hot water, this is what causes hot springs, or geothermal springs. This event also creates geysers and other geothermal activity.

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

QUESTION
NUMBER

91193

Standard	91193	Display ID	Script 6158425 NSN 137965362	Total score	12 = A
Q	Grade score	Annotation			
1	A4	<p>The candidate has effectively used diagrams to supplement their answer. The behaviour of solar radiation as it travels through the atmosphere is described with reference to reflection, scattering and transmission. There are errors but some key ideas are described.</p> <p>In part c the candidate describes the red sunset in relation to light scattering.</p>			
2	A4	<p>Reference is made to solar radiation and absorption by Earth's surface and the reflection of radiation by ice due to its high albedo. This is extended to the idea that this reflection of radiation acts to control Earth's climate through reduced heating.</p> <p>A statement is made about water melting the ice cap. The effect of this on the atmosphere is incorrect.</p>			
3	A4	<p>The candidate states the causes of interior heating in the Earth and states how heat is transferred from the core to the mantle.</p> <p>The process of heating of groundwater is described.</p>			