SUPERVISOR'S USE ONLY

2

91193

911930

Draw a cross through the box (☒) if you have NOT written in this booklet

+

NZQA | Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Earth and Space Science 2024

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 will be cut off when the booklet is marked.

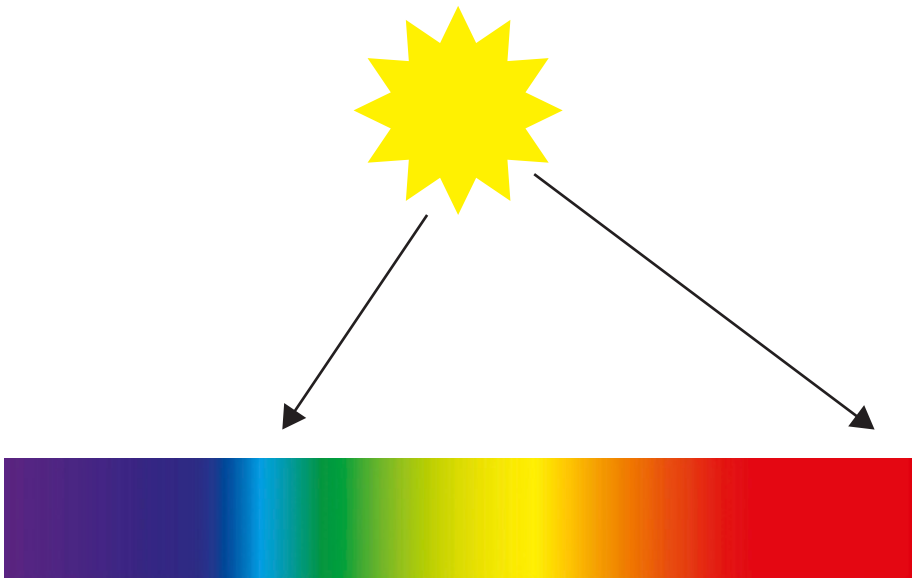
YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE: COLOURED WATERS

The visible spectrum is one part of the electromagnetic radiation that is emitted from the Sun. It is made up of several component wavelengths that give visible light its white appearance.

(a) Complete the table below the diagram to show the properties of blue and red light.

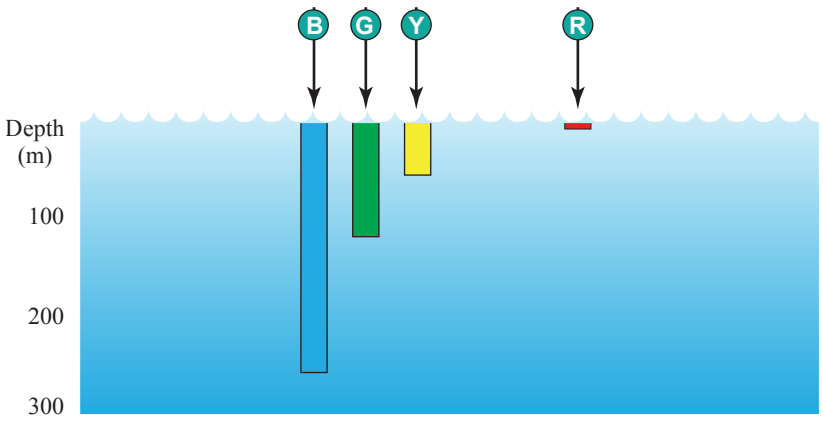
In your answer use terms such as: Long, Short, High, and Low.



Energy	
Frequency	
Wavelength	

Energy	
Frequency	
Wavelength	

(b) Explain, in detail, the possible behaviour of visible light when it enters water during the day.



Penetration depth of different coloured light in water

Adapted from: https://oceanbites.org/size-matters-the-power-of-particles-in-determining-ocean-color/

In your answer you should consider:

- transmission, absorption, and scattering
- the diagram above.

An annotated diagram may assist your answer.

(c) Deep water lakes, such as Lake Rotorua, appear blue in colour, while South Island lakes, such as Lakes Tekapo and Pukaki, are a lighter shade of blue/green. These lakes are glacial, and contain large quantities of very fine silt that is very slowly sinking.

Lake Rotorua
Source: www.rotoruafamilypark.co.nz/policies-rotorua-family

Lake Pukaki
Source: www.thewildlifediaries.com/lake-pukaki-to-queenstown/

Explain, in detail, why these lakes have different colours when viewed from above.

In your answer you should consider:

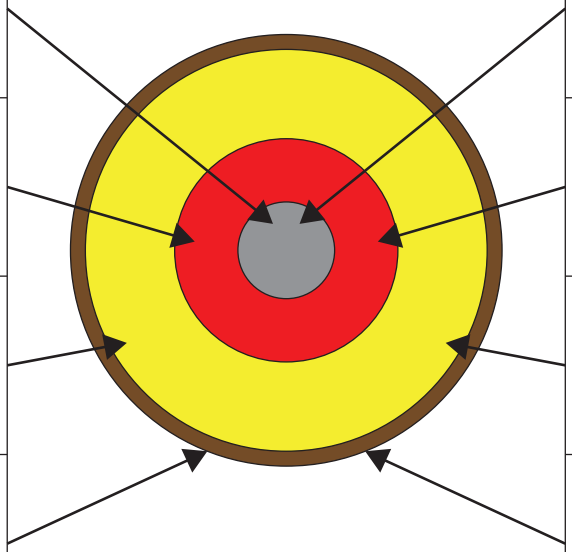
- the wavelengths of the different colours of light
- absorption of different wavelengths
- scattering of different wavelengths.

An annotated diagram may assist your answer.

QUESTION TWO: MOUNT RUAPEHU CRATER LAKE

Aotearoa New Zealand is home to many volcanic warm-water lakes and geothermal springs. These are heated from the Earth's interior.

(a) In the diagram below, identify the different sections of the Earth's interior and the heat transfer processes taking place within each section.

Name of the section		Heat transfer processes taking place
a		a
b		b
c		c
d		d

(b) The Earth's interior temperature is approximately 6000 °C at the centre cooling to 500 °C closer to the surface.

Explain, in detail, the processes that are taking place within the Earth's interior that generate heat energy.

In your answer you should consider:

- the different sections of the Earth's interior
- the processes that can generate heat energy in the interior.

An annotated diagram may assist your answer.

(c) Mount Ruapehu's crater lake is closely monitored to give an indication of likely volcanic activity. Temperatures of the lake fluctuate, depending on the amount of heat reaching the lake water directly from below.

Adapted from: www.gns.cri.nz/news/science-takes-centre-stage-at-active-mount-ruapehu/

Explain, in detail, using the image above, how the heat energy can reach the lake water.

In your answer you should consider:

- the different methods by which heat can be transferred to the crater lake
- the nature of the materials below the crater lake.

An annotated diagram may assist your answer.

QUESTION THREE: CENTRAL OTAGO CLIMATE

Central Otago is known for its climate extremes. Summers can be hot, with the average temperature between 15 °C at night to 25 °C during the day, while in winter, the average temperature is between –1 °C at night and 10 °C during the day.

Central Otago in summer
Source: https://chrisgin.com/product/lindispass_1412/

Central Otago in winter
Source: https://hikingscenery.com/double-peak-lindis-pass/

(a) Describe how the Earth's surface is heated by the Sun.

You should refer to wavelength in your answer.

(b) Explain, in detail, the reasons for the difference in heating between the summer and winter months.

In your answer you should consider:

- the Earth's orbit around the Sun
- the Earth's tilt.

An annotated diagram may assist your answer.

Question Three continues on the next page.

(c) Explain, in detail, how the white snow will affect the day and night-time temperatures in the winter months, compared with the summer months, when the darker mountains are exposed.

In your answer you should consider:

- absorption of energy
- reflection of energy
- radiation of energy.

An annotated diagram may assist your answer.

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

QUESTION NUMBER

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

QUESTION NUMBER

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

QUESTION NUMBER