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91414



914140



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Level 3 Earth and Space Science 2022

91414 Demonstrate understanding of processes in the atmosphere system

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of processes in the atmosphere system.	Demonstrate in-depth understanding of processes in the atmosphere system.	Demonstrate comprehensive understanding of processes in the atmosphere 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.

Merit

TOTAL

15

QUESTION ONE: THE WATER CYCLE

The water cycle is the movement of water through the environment. While the atmosphere contains only a small amount of water, it enables water to cycle and heat energy to flow around the globe.

Explain the role of the atmosphere in transporting water and heat energy around the Earth.

In your answer, you should:

- add detailed annotations to the following diagram of the water cycle, showing water and energy entering and leaving the atmosphere during the water cycle
- explain, in detail, the processes that add water to the atmosphere
- explain, in detail, the processes that remove water from the atmosphere
- explain, in detail, the role of latent heat and sensible heat in transporting energy through the atmosphere.



Source: www.sutori.com/en/story/the-water-cycle--RD4v8GKWCwg6FpiUAHpb1KWe

A Process that adds water, H_2O to the atmosphere is the evaporation of H_2O liquid into H_2O gas. This occurs when solar radiation (SR) is radiated from the sun to the mass of water, of lakes, rivers and oceans. This SR caused the heating of the H_2O liquid, this caused a change of state to form H_2O gas, Because the gas state of H_2O means the molecules are less dense,

and therefore lighter they will rise up from the large body of water and up into the atmosphere, where they will most likely form clouds.

The process that causes the removal of H_2O from the atmosphere is the condensing of H_2O from gas to a liquid state. This condensation is occurring in the mass of H_2O gas of clouds, and it is happening because, the solar radiation that heated the liquid to form the gas state, has decreased in its energy strength, therefore change of state occurs, this condensed water as liquid state, will ~~be~~ be removed from the atmosphere as rain and will fall back down to the masses of H_2O liquid it once was apart of. The reason that the strength of solar radiation changes is ~~because~~ because of the Hadley, Ferrel and Polar circulation cells, this is because at the equator, In the Hadley cell the strength of solar radiation is at its strongest point out of all the areas in all the circulation cells. This causes more evaporation, this H_2O gas now ~~travels~~ travels across the earth's surfaces and condenses as rain where there is less solar radiation occurring. For example this occurs at ~~to~~ the 30°S latitude at the Amazon rain forest.

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

QUESTION TWO: AUSTRALIAN BUSHFIRES AND CLIMATE

Source: www.theage.com.au/national/victoria/victoria-bushfires-live-homes-lost-as-town-s-defence-breached-20191231-p53ns1.html

The 2019–20 bushfires in Australia injected huge amounts of carbon dioxide and dark-coloured carbon aerosols into the atmosphere. Scientists have recently been studying the effect of these bushfires on the atmosphere.

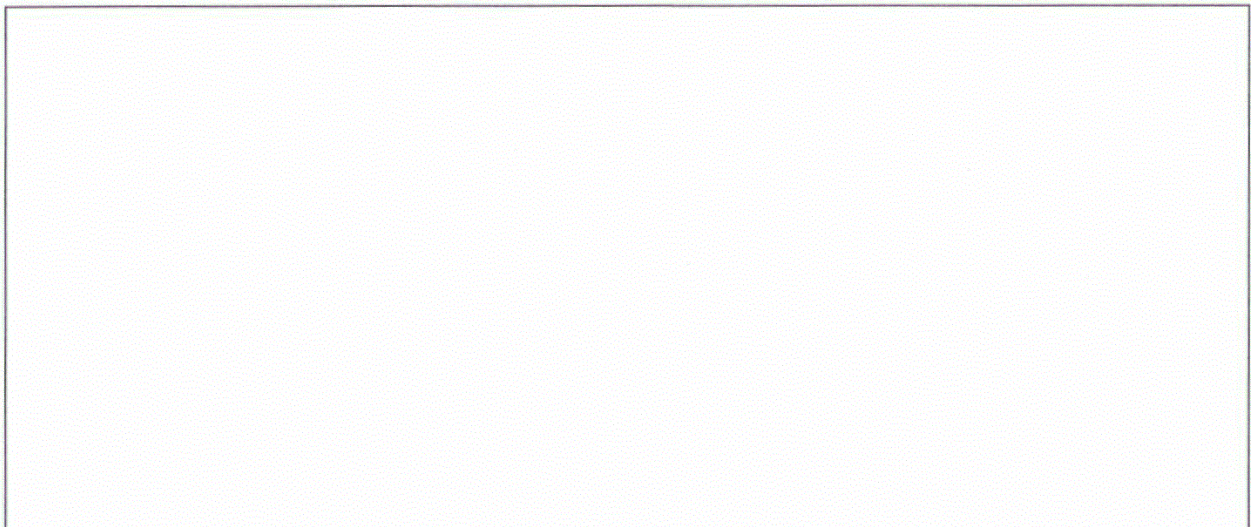
Discuss the effects that both carbon dioxide and dark-coloured carbon aerosols could have on the troposphere.

Your answer should focus on processes within the troposphere only.

In your answer, you should:

- explain what an aerosol is.
- explain, in detail, two possible effects that dark-coloured carbon aerosols could have on the troposphere
- explain the effect of excessive amounts of carbon dioxide being released into the troposphere
- explain, comprehensively, the relative length of time that the effects of carbon dioxide and aerosols are likely to last.

An annotated diagram may assist your answer.



An aerosol is an ~~object~~ ~~object~~ object in ~~either~~ a liquid or solid state that is suspended in the atmosphere due to it being so small and light that gravity can't pull it back to earth, so it remains in the atmosphere.

One possible effect ~~for~~ that the dark coloured carbon aerosols could have on the troposphere environment is that, it reduced the amount of infrared radiation that could be absorbed by the troposphere as the infrared radiation was released by the earth's surface, this is because rather than the troposphere absorbing the ~~sun~~ infrared radiation, it is absorbed by the carbon aerosols. Not only is the infrared radiation not being absorbed by the troposphere but the solar radiation that is emitted by the sun to ~~the~~ earth is unable to ~~be~~ occur as the dark coloured carbon ~~are~~ aerosols are blocking its path to earth's surface. With the lack of infrared radiation being emitted into the troposphere it would cause great amounts of cooling for the troposphere,

With ~~at~~ all this ~~extra~~ extra carbon dioxide being released into the atmosphere it ~~can~~ creates some effects for the troposphere, one effect of this is that it will cause to continued heating of the earth's atmosphere because the CO₂ being emitted

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

into the atmosphere is causing an increase in ozone ~~layer~~ layer strength, ~~this~~ this is increasing the rate of global warming and climate change.

With all this excess carbon now emitted into the troposphere it takes a much longer period of time for all these aerosols to be dispersed from the atmosphere and back into the land and ocean environments they once were apart of. This is likely to take a decent amount of time, perhaps about 100 - 10000 years, approximately give or take a few years.

QUESTION THREE: ATMOSPHERE LAYERS

The Earth's atmosphere can be divided into distinct layers, shown in the diagram below. Temperature, air pressure, and density all vary within and between these layers.



Adapted from: www.visionlearning.com/en/library/Earth-Science/6/Composition-of-Earths-Atmosphere/107

Explain the reasons for the differences in temperature, air pressure, and density between and within the layers of the atmosphere.

In your answer, you should:

- define temperature, air pressure, and density in relation to the layers of the atmosphere
- explain, comprehensively, the reason for the changes in temperature, air pressure, and density with increasing altitude
- compare and contrast the differences within and between the layers of the atmosphere shown in the diagram.

An annotated diagram may assist your answer.

Temperature is the quantity of heat that an aerosol, liquid, solid or gas has contained within its self and can be measured in degrees celcius. The temperature of the earths atmosphere varies depending on which area within ~~the~~ the atmosphere you are in. the reason for this variation is ~~because~~ because each different area has a different source that it gets its heat energy ~~from~~ from. For example, the troposphere gets its heat energy from the radiation ~~of~~ of infrared heat through infrared radiation, which comes from the ground and surface of the earth. And the higher altitude in the troposphere it is the lower the temperature will be, this is because as the heat energy source ~~is~~ is the ground the further one travels away from it the weaker the strength of the heat energy ~~is~~ is. When looking at the temperature of the stratosphere the temperature increases with increasing altitude, this is because the heat energy source for the ~~stratosphere~~ stratosphere is the sun and as you increase altitude within it you get closer to it.

When looking at the air pressure differences between the different layers we can see that the highest pressure is in the troposphere with decreasing pressure the higher the altitude. At the top of the troposphere the atmospheric pressure is approximately 200 mb. Where as at the bottom of the troposphere

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

The air pressure is approximately 100 mb, that's half the pressure of the ~~top~~ troposphere. Air pressure is the pressure occurring from the force of the particles being pushed down ~~to~~ due to gravity.

The density changes between the different layers is very similar to the pressure changes. As altitude increases, the air density decreases with the troposphere having the highest density and the thermosphere having the ~~top~~ least.

Air density is the amount of air particles per area, as shown in the graph on page 10 there is far more air particles in the troposphere layer of the atmosphere than any other atmospheric layer. The reason for higher density in the troposphere is due to, there being much more mass and general particles. It is also as because, there is more mass the density is higher, therefore heavier and sinks lower in the atmosphere.

Extra space if required.

Write the question number(s) if applicable.

QUESTION
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Standard	91414	Display ID		Total score	-15-M
Q	Grade score	Annotation			
1	5	Candidate explains evaporation in detail for the merit mark, linking heat, phase change and rising process. They do not meet the merit explanation for condensation, as adiabatic cooling is not explained			
2	4	Candidate explains effect of dark aerosols on cooling of troposphere well for merit, however, doesn't explain any other effects and therefore insufficient detail for merit. Answer also missed the explanation of greenhouse effect and link to increased carbon dioxide.			
3	6	Explanation for temperature gradient of troposphere sufficient for merit, while the explanation linking pressure and density and contrasting troposphere and stratosphere is sufficient to award another merit mark. No E mark as three layers of atmosphere not explained in detail			