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**METEOROLOGY FOR AUSTRALIA**

## **CHAPTER 1 – COMPOSITION OF THE ATMOSPHERE**

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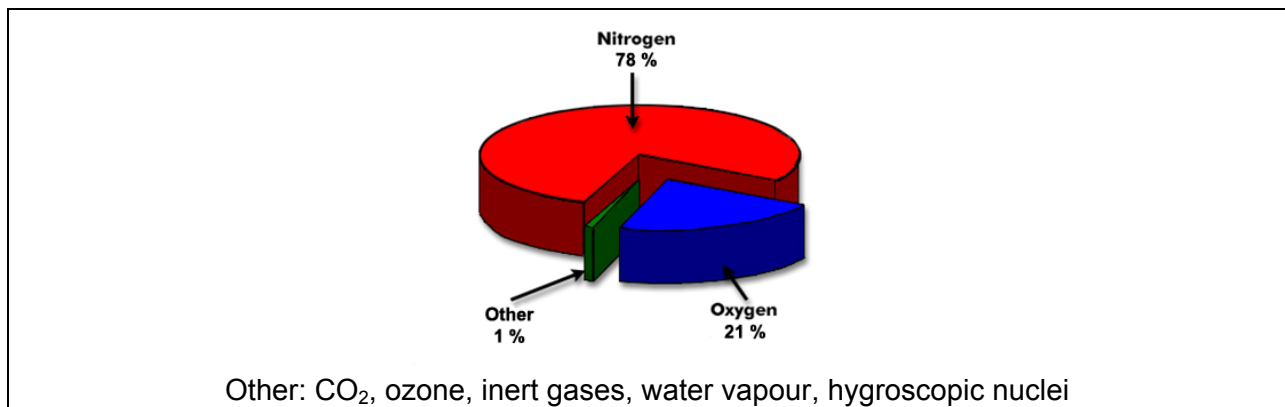
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## COMPOSITION OF THE ATMOSPHERE

### GENERAL

The atmosphere is a continuously moving sea of air around the earth. Dry air is a mixture of nitrogen (about 78%), oxygen (about 21%), and small quantities of many other gases. None of these gases changes its state within the normal temperature range of the atmosphere so dry air remains invisible. Air, however, is never usually completely dry because it contains water. If the water is in its vapour form then the air is still invisible and can still be considered as dry. Interestingly, 50% of the earth's atmosphere, by weight, is contained in the first 18,500 ft.



1.a. Composition of the Atmosphere

### OXYGEN

Oxygen is essential for the sustenance of life and the combustion of materials. In the context of aviation, oxygen is required for the combustion of fuel. A deficiency of oxygen results in incomplete burning and reduced engine efficiency.

### WATER VAPOUR

Water vapour is present in the atmosphere in varying proportions, and is responsible for the weather around the earth, which in turn effects aircraft operations and performance.

### HYGROSCOPIC NUCLEI (CONDENSATION NUCLEI)

Water vapour needs a "solid" on which to condense (salt, smoke, dust etc). These solid particles are known as hygroscopic nuclei. Hygroscopic literally means "water attracting".

## OZONE (O<sub>3</sub>)

Ozone is a form of oxygen which is found in a layer in the upper atmosphere. This layer shields and absorbs ultra violet (UV) radiation. Without the ozone layer, then the extra short wave radiation would slowly increase the surface temperature of the earth, a process known as "Global Warming". It is also known that there is a link between UV radiation and skin cancer.

Ozone is concentrated mainly between 15km. and 35km. above the surface. The upper layers of the atmosphere are irradiated by ultraviolet radiation from the sun which causes a break up of oxygen molecules at altitudes above 30km. ( $O_2 \rightarrow O + O$ ). These separate atoms may then collide with other oxygen molecules to create ozone ( $O_2 + O \rightarrow O_3$ ). These collisions are rare above 80km. because of the very low density of the atmosphere, while below 35km. most of the incoming ultraviolet radiation has already been absorbed at higher levels. Therefore ozone is mainly formed between 30km. and 60km. where collisions between O and O<sub>2</sub> are more likely.

However ozone is unstable. It is easily destroyed by oxygen, hydrogen, nitrogen, chlorine, photochemical cycles, etc. This results in the ozone mixing ratio being at a maximum at 35km. whereas maximum ozone concentration occurs lower down; between 20 – 25km at low latitudes and between 10 – 20km in high latitudes. This is the results of a circulation mechanism transporting ozone downwards to levels where its destruction is less likely, allowing an accumulation of the gas to occur.

