BrishLab

ES11C Air Pressure

Name:

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Did you know?

1 We usually can't feel the air around us. But air has the same basic properties as all other matter. For example, air has mass and volume – it is made of mater and takes up space.

2 Because air is made of mostly nitrogen and oxygen atoms, it pushes down on the planet. Think of it as small balls being stacked up – from the ground to outer space (See Fig 1).

3 Air has different pressures and temperatures at different heights from Earth's surface – but not the way you might expect!

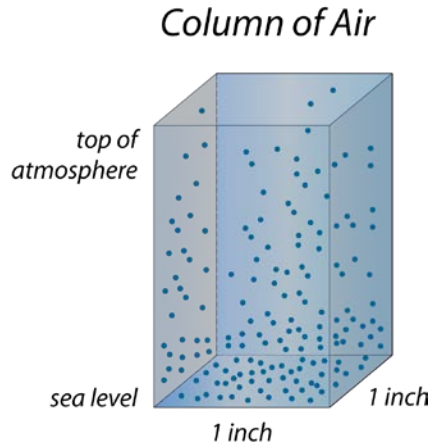

Figure 1 – Earth's atmosphere.

So, why is it important to me?

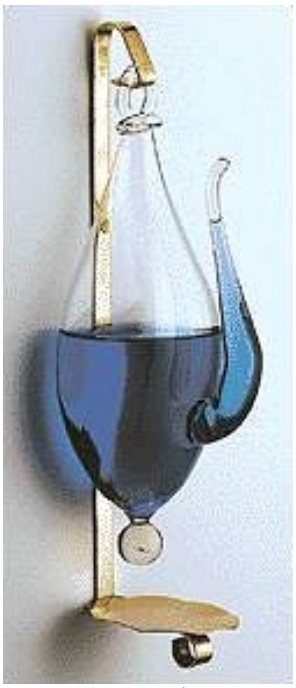
Figure 3 – Goethe's device is used to predict the weather.

4 Knowing the air pressure is essential to flying a plane. Aside from keeping the engines running at high efficiency – more miles to the gallon of fuel, knowing how high you are and how high the mountains are is a good thing! (See Fig 2).

5 Knowing the air pressure is also an important part of forecasting the weather. High pressure systems bring clear weather and low pressure systems bring rain and snow (See Fig 3).

Figure 2 – Kollsman-type barometric aircraft altimeter as used in North America displaying an altitude of 80 ft (24 m).

What are the big ideas I need to know?

6 Air pressure is the measure of the force of a column of air that starts on the Earth's surface and is "stacked up" to space – somewhere around 100 miles above the surface. It is measured in pounds per square inch (PSI). Air pressure is defined as the weight of the air pressing against a given area.

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7 At sea level, the atmosphere presses down with a force of about 1 kilogram per square centimeter (14.76 pounds per square inch). It you were at sea level, you would have more than a ton of air pressing against you. Why doesn't the pressure crush you? Air presses in all directions at once. Other molecules of air are pushing back.

8 In a mercury barometer, mercury is being pushed up a tube by the air pressure on the open area at the base(See Fig 4).

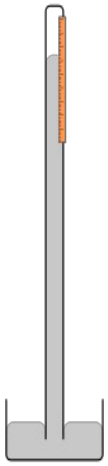

Figure 4 – A simple mercury barometer with vertical mercury column and reservoir at base.

9 An aneroid barometer, like the mercury barometer measures air pressure. Instead of using mercury, there are disks that are sealed at the edges. The higher the air pressure, the more the disks are pressed against each other. These disks are sometime stacked together and then connected to a needle to record the air pressure (See Fig 5).

Figure 5 –Barograph using five stacked aneroid barometer cells.

10 Density is a measure of how closely air molecules are packed together. The closer together they are, the greater the density. The density of air is its mass per unit of volume – the amount of "stuff" divided by the room it takes up.

11 The density of air varies from place to place. It depends on several factors – temperature and altitude. Warm air is less dense than cool air. Warm air molecules have more energy, so they are more active. They bounce off each other and spread apart.

12 Another factor that affects the density of air is the altitude. Altitude is the height above sea level. There are more air molecules at Earth's surface or at sea level so the air is more dense. There are almost no molecules in the vacuum of space. There is a difference as you go up in the atmosphere. In fact, most of the air is near the Earth's surface – from sea level to about 10 miles up

What about?

13 All the water vapor in the air, the humidity, is mixed in with the air molecules. All the rain, snow and sleet that falls was once in the air. It seems amazing that those heavy shovelfuls of snow were one time floating around in the atmosphere riding on the winds.

14 Water vapor is invisible - clouds are visible. Clouds are then not water vapor, but small drops of water held up by winds. Only when it is in contact with a very small piece of dust does water vapor change from a gas to either a liquid and form rain, or a solid to make a snowflake.