

STUDY GUIDE

Aerospace: The Flight of Discovery Chapter 3

Weather

1. Weather is best defined as the condition of the atmosphere at a given time and place.
2. Most of our weather occurs within the **troposphere**.
3. The atmosphere is composed of a mixture of gases. The composition of these gases is:
Nitrogen 78%
Oxygen 21%
CO₂ and other trace gases 1%
4. Scientists divide the atmosphere into **atmospheric regions** according to molecular composition or temperature.
5. The total energy of motion of all the molecules in a substance is called **heat**.
6. **Dew point** is the temperature at which the water vapor in the air condenses and becomes liquid.
7. Gravity tends to pull air downward producing the greatest **air density** near the Earth's surface. Air is a compressible gas and the weight of individual gas molecules in the air compresses the molecules beneath them closer together so that the number of gas molecules per unit volume is greater nearer the Earth's surface.
8. The boundary between air masses of different characteristics is called a **front**.
9. The three stages of a thunderstorm are: building, mature, and dissipating.
10. The "eye" of a hurricane is the calm center of a storm.
11. The greatest problem glaze ice poses to an aircraft is changing the shape of the airfoil (wing). The cross-sectional shape of the wing is critical to the production of lift. Any variation in this shape caused by a buildup of ice on the wing's surface can drastically reduce the wing's ability to produce lift.
12. **Cirrus clouds** are very high clouds composed of ice crystals with a curly, wispy appearance.
13. In the Northern Hemisphere, the **Coriolis effect** causes a large body of moving air to curve to the right of its direction of travel. The Coriolis effect is caused by the rotation of the Earth around its axis.

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14. The **jet stream** is a narrow current of strong wind moving west to east in the Northern Hemisphere in wavelike patterns and is usually strongest above 30,000 feet.
15. Temperature, winds, moisture, and pressure are the elements of weather.
16. The three general categories for classifying clouds are **cumulus** (piled up), **stratus**, (layered), and **cirrus** (wispy appearance).
17. Heat transfer by **radiation** transfers heat energy without changing the temperature of anything between the source of energy and the object heated.
18. The transfer of heat in liquids or gases by vertical currents caused by temperature density differences is called **convection**.
19. The process of lateral heat transfer caused by the horizontal movement of air (wind) is called **advection**.
20. Heat transfer caused by energy transfer between objects whose surfaces are in contact is called **conduction**.
21. While **fog** does have a separate classification, it is a cloud because it develops within the atmosphere.
22. **Relative humidity** is expressed as a percentage, and is the ratio of the amount of water vapor in the air compared to the maximum amount of water vapor that the same volume of air can hold when saturated at a given temperature and pressure.
23. Water can be found in the atmosphere as a gas, a solid, and a liquid.
24. **Insolation** is the rate at which the Earth's surface is heated by solar radiation.
25. The **jet stream** is a "river" of wind, which moves very rapidly (150-300 mph) in wavelike patterns, migrates with the seasons, and generally flows west to east.
26. A **hurricane** is a low-pressure area that goes through a period of building up force over equatorial ocean areas.
27. The phenomenon called the land-sea breeze is caused by convection air currents along shorelines. During the day, the land heats up faster than the water causing the air above the land to rise (convection). Cooler air from over the water moves toward the land to fill the void causing a wind (advection) from the water to the land. At night, the opposite effect occurs. The land cools faster than the water. The cooler air over the land is denser than the warmer air over the water. Therefore, as the warmer air rises, the cooler air moves from the land toward the water causing a wind from the land to the water.

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28. Earth's rotation causes polar air to be deflected toward the west and air moving from the Equator to be deflected toward the east. This phenomenon is called the **Coriolis effect**.
29. The development of a thunderstorm is categorized into the building cumulus stage, the mature stage, and the dissipating stage.
30. Frost, glaze, and rime-**icing** conditions pose a danger to flight by increasing the aircraft's weight and increasing the chances of an engine malfunction. However, the greatest danger to flight caused by icing is the decrease in the aircraft's lift factor caused by the ice changing the shape of the airfoil.
31. Temperature within the troposphere decreases at a fairly constant rate as altitude increases (approximately 2° C or 3.5° F decrease with each 1,000 ft. gain in altitude). This phenomena is known as the **standard lapse rate** or **temperature lapse rate**.
32. An **occluded front** develops when a warm air mass is "sandwiched" between two cold air masses.
33. The leading edge of a cold air mass is called a **cold front**.

Space

34. **Cislunar** space is the space between the Earth and the moon.
35. The moon's surface is filled with craters and has many rugged ridges and mountains. It is less dense than the Earth and the temperature on the surface changes greatly between night and day.
36. Basalt and anorthosite are the moon's most common rocks.
37. The Mariner and the Viking probes visited Mars.
38. Jupiter is the largest planet in our solar system.
39. Saturn is composed mainly of hydrogen gas, has at least 17 moons, and possesses huge rings of ice, metals, and rock.
40. The space between one solar system and another is called **interstellar space**.
41. The hottest stars are blue in color, while the coolest are red.
42. An **ion** is an atom that carries either a positive or negative electrical charge as a result of losing or gaining one or more electrons.

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43. A **supernova** is an explosion on a star that increases its brilliance to many thousands of times brighter than normal.
44. The **solar wind** is a continuous stream of charged particles from the sun that strikes the Earth's magnetosphere with considerable force.
45. A **comet** is a body of dust and ice that revolves around the sun in a highly elliptical and erratic orbit. A comet frequently forms a tail that points away from the sun and which grows in length the closer it gets to the sun.
46. The temperature on the surface of the moon can range from -250 degrees to 250 degrees F.
47. The **asteroid belt** consists of millions of pieces of rock orbiting between Mars and Jupiter.
48. **Spicules** are spike-like, short-lived prominences within the chromosphere of the sun.
49. **Dark nebulae** are vast clouds of matter that have not yet formed into stars.
50. The **Van Allen belts** are filled with charged particles caused by ionizing radiation. The concentrations of radiation within the Van Allen belts can be a hazard to astronauts. The hazard is avoided by keeping the orbits of manned spacecraft beneath the internal Van Allen belt (600 miles) and avoiding polar orbits where the radiation belts dip downward toward the surface of the earth at the north and south poles.
51. **Novae** are stars that flare, subside, and flare again and thus are not stable.
52. The portion of the sun that gives light is a very thin shell called the **photosphere**. The photosphere exists in a gaseous form and is composed mostly of hydrogen and helium.
53. If a **meteor** can penetrate the atmosphere and land on Earth, it is called a **meteorite**.
54. Two stars that orbit a common center of gravity is the name given to **binary stars**. A **pulsar** is a very dense form of stellar matter that flashes electromagnetic emissions (radio and other waves) in a set pattern.
55. A **meteoroid** becomes a **meteor** when it enters Earth's outer atmosphere.
56. The rings of Saturn are composed of small grain-sized particles; while Uranus' rings are made up of larger, boulder-size chunks.
57. The impact of **magnetic storms** on Earth is especially apparent in radio transmission interference. Magnetic storms interfere with the reflectivity of the ionosphere and cause it actually to absorb radio transmissions rather than reflect them.

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58. **Interplanetary space** is measured from the center of the sun to the orbit of its outermost planet (Pluto).
59. **Uranus** is the "oddball" of the solar system because it lies on its side, its poles alternately face the sun, and its magnetic field does not have the usual north-south axis.
60. The higher layers of the **ionosphere** reflect radio signals farther because more of the Earth's curvature is bypassed.
61. The planet **Jupiter** is the largest planet in the solar system and makes up about 70 percent of the mass of all the planets.
62. **Asteroids** are "starlike" pieces of rocks, which may be the remains of a planet that used to orbit between Mars and Jupiter.
63. The effect of the **solar wind** on the **magnetosphere** is not known precisely, but we know that it sweeps the magnetosphere beyond the orbit of the moon. This effect is currently being studied via satellites.
64. The origin of **moon dust** is attributed to meteoroids striking the surface pulverizing lunar matter and cosmic dust picked up from space as it comes within the moon's gravitational influence.
65. Meteoroids impact the Moon's surface without ever going through the meteor and meteorite stages as with Earth because the Moon has no atmosphere to protect it.