1. Clouds
    a. above 20,000 ft; releases precipitation
    b. above 23,000 ft; doesn't release
    c. above 20,000 ft; doesn't release
    d. 8,000-23,000 ft; releases
    e. 8,000-23,000 ft; doesn't release
    f. below 6,500 ft; releases
    g. below 8,000 ft; releases
    h. below 8,000 ft; releases
    i. below 6,000 ft; releases
    j. 6,000-60,000 ft; releases
2. El Nino and La Nina
    1. higher temperatures and higher amounts of precipitation
    2. answers may vary, example: dry in Florida, increased snowfall in Northwest US, dry in Indonesia and Australia.
    3. The warm and cold phases of ENSO are El Nino and La Nina
    a. La Nina
    b. El Nino
    c. La Nina
    d. La Nina
    e. El Nino
    f. La Nina
    4. The Southern Oscillation Index is a standardized index based on the observed sea level pressure differences between Tahiti and Darwin, Australia.
5. Since upwelling brings cold nutrient rich water up, marine life flourishes.
6. ENSO usually starts during December or January.
7. An SST anomaly means that temperatures are either higher or lower than average "normal". If the SSTs are positive, the temperatures are warmer than normal. If they are negative, it means that temperatures are lower than normal.

Matching

G
F
C
A
J
B
E
K
H
D
I

Modern Atmosphere

1. Eccentricity refers to how circular (vs. elliptical) the orbit of the Earth is. The earth goes through this cycle every 100,000 years. Today a difference of only about 3 percent occurs between the aphelion and perihelion.
   Axial tilt, the second of the three Milankovitch Cycles, is the inclination of the Earth's axis in relation to its plane of orbit around the Sun. Oscillations in the degree of Earth's axial tilt occur on a periodicity of 41,000 years from 21.5 to 24.5 degrees. Today, as you know we are at a tilt of 23.5 degrees.
   The third and final of the Milankovitch Cycles is Earth's precession. Precession is the Earth's slow wobble as it spins on axis. This wobbling of the Earth on its axis can be likened to a top running down and beginning to wobble back and forth on its axis. The precession of Earth wobbles from pointing at Polaris (North Star) to pointing at the star Vega. When this shift to the axis pointing at Vega occurs, Vega would then be considered the North Star. This top-like wobble, or precession, has a periodicity of 23,000 years. Currently, perihelion occurs during the southern hemisphere's summer.
2. Stratosphere and Thermosphere
3. Stratosphere (the inversion isn't what you think it means)
4. Water Vapor, Ozone, Carbon Dioxide, Methane
5. Argon is produced by the radioactive decay of Potassium-40, while the other noble gases have much rarer forms of emergence.

Analysis

1. Yes
2. An Occluded Front
3. Stationary
4. Station model
   a. 55
   b. Southwest
   c. Scattered
   d. Rising
   e. 37
   f. 13-17
   g. 1013.8
   h. Moderate Rain
5. F
6. C
7. A
8. E
9. ABCD
10. FGH
11. Weather is based on an infinitely complex and constantly changing system. The movement and behavior of large scale weather systems are somewhat understood, which is why factors such as wind, pressure, temperature, and possibility of precipitation, are all predictable a few days out. We can make a general prediction when we see something

very far away, but as the storm gets closer, more phenomena are distinguished, and increases understanding. With some weather system 365 days away, there is only so far you can extrapolate before your prediction holds no value.

12. **Between 1 and 2 C**: looking at the temp map, three color bands inside the 4-degree boundary, with the third band being the predominant color band. On the temp scale to the right of the July temp map, the third color band below the 4-degree line shows that band represents 1-2 C—this is above the freezing temp of fresh water.
13. **Between -31.5 and -29 C**: This is trickier in part because the colors used in the scale are the same as in summer, but the numbers associated with each color are vastly different: temps are lower and it's a 3 C delta between the values on the scale versus a delta of 2 C on the summer scale. Looking at the temp map, there is a more varied distribution of color bands on the map and the ice cap covers a greater area than in the summer, so estimating is trickier too. The continental outlines and the -28 C boundary seem to best estimate the ice extent. While the third color band in from the -28 C boundary is the predominant color, there is a fair amount of the first and second color band in from the -28 C boundary present as well, plus a few small areas of even colder ice. So, my estimate would be to use the second color band for a temperature average, which when read off the temperature scale, yields a temp value between -31.5 and -29 C.
14. Decreasing and accelerating
15. **The latent heat of the transition from solid to liquid is inhibiting the entire ice cap from melting.** While it takes approximately 1 calorie of energy to raise 1 g of water 1 C, it takes 80 calories of energy to change state from ice to liquid water (with no change in the 9 temperature of the just-melted ice). This means it takes 80 times as much energy to melt ice as it takes to heat the liquid water up 1 C. To get the unmelted portion of the ice cap to melt completely in the summer would thus require more than twice the energy/heat that raised the temperature of the winter ice from -30 C to 0 C.
16. Anything that brings additional heat energy to the north pole region:
    a. □ More warm water encroaching from the North Atlantic Current
    b. □ Warming of the atmosphere
    c. □ Increased solar radiation
    d. □ Decreased Albedo in the polar region
17. Zero. This is a trick question. Ice displaces exactly as much water as it would if it were liquid. Thus, if the entire polar sea ice cap were to melt, there would be no change in sea level solely due to the melting of the ice. You can try this experiment at home by putting water in a measuring cup and adding some ice to it (the ice must be floating and not piled such that the measuring cup is supporting the weight of the ice), mark the water level and then wait for the ice to melt. The water level will not change. The thermal expansion due to global warming in addition to the melting of sea ice is why sea level rise is still a prominent problem.