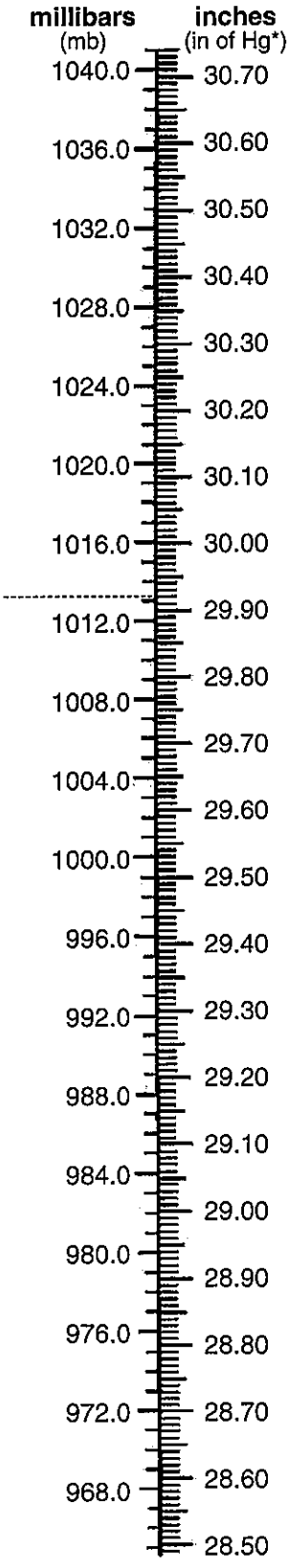
Air Pressure

Overview:

We live at the bottom of an "ocean" of air. Rarely do we ever feel the pressure it exerts upon us, but air has weight, producing pressure. Air pressure changes with changes in elevation and at times we feel this change as our ears "pop." Even without any change in elevation, air pressure changes slightly due to temperature and moisture changes. The instrument used to measure air pressure is the barometer. In the mercury barometer, the mercury (Hg – see bottom of the chart) is held up by the atmospheric pressure to a height of around 30 inches. This height, reflecting the atmospheric pressure, changes with changing air temperature and moisture content. Typically, if the air pressure is steadily dropping, it signifies that a low-pressure system (L) full of moisture, is moving in. A steadily rising barometer usually indicates a high-pressure system (H) is approaching, bringing in drier air. Extreme low-pressure readings are associated with hurricanes.



The Chart:

Pressure readings are recorded in either millibars (mb) or inches (in of Hg). Each line on the millibar scale represents 1 mb, while each line on the inches scale represents 0.01 inch. The "one atmosphere" reading is shown on this chart as 1013.2 mb, which closely equals 29.92 inches. What does 996.0 mb equal in inches? If done correctly the answer is 29.41 inches.

The millibar readings are often abbreviated by dropping the decimal and either the 9 or the 10 number found at the front of the pressure reading. Using this rule, 1013.6 mb becomes 136 and a reading of 998.4 mb becomes 984. To change an abbreviated number back to the actual pressure reading, use the 500 rule. If a number is lower than 500, add a 10 and replace the decimal. If a pressure reading is higher than 500, add a 9 and the decimal. For example, an abbreviated barometric reading of 348 is less than 500, add a 10 and replace the decimal, thus converts back to 1034.8 mb. For an abbreviated reading of 978, which is higher than 500, add a 9 and replace the decimal, thus converts to 997.8 mb.

Additional Information:

- Warm air rises, which often produces a lower barometric pressure reading.
- Cold air sinks, which often produces a higher barometric pressure reading.
- A strong air pressure gradient will produce windy conditions.
- Isobars connect areas of equal air pressure values.

Set 1 — Air Pressure

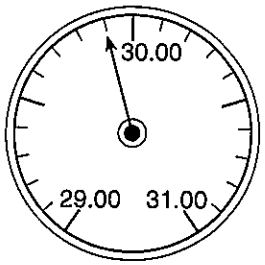
1. A pressure of 1036.0 mb when converted to inches would equal

   (1) 30.50 in (3) 30.60 in
   (2) 30.59 in (4) 30.55 in 1 _____

2. A pressure reading of 29.50 inches when converted to millibars would equal

   (1) 996.3 mb (3) 999.9 mb
   (2) 996.6 mb (4) 999.0 mb 2 _____

3. The diagram below represents an aneroid barometer that shows the air pressure, in inches of mercury.



   When converted to millibars, this air pressure is equal to

   (1) 1009.0 mb
   (2) 1012.5 mb
   (3) 1015.5 mb
   (4) 1029.9 mb 3 _____

4. Students wish to study the effect of elevation above sea level on air temperature and air pressure. They plan to hike in the Adirondack Mountains from Heart Lake, elevation 2,179 feet, to the peak of Mt. Marcy, elevation 5,344 feet. Which instruments should they use to collect their data?

   (1) anemometer and psychrometer
   (2) anemometer and barometer
   (3) thermometer and psychrometer
   (4) thermometer and barometer 4 _____

5. A dedicated Earth Science student using an aneroid barometer measures the air pressure at the base of Slide Mountain as 1016.0 mb. At the same time another dedicated Earth Science student measures the pressure at the top of the mountain. Which pressure reading could be correct at the top of Slide mountain?

   (1) 1016.0 mb
   (2) 988.5 mb
   (3) 1025.7 mb
   (4) 1040.0 mb 5 _____

6. Explain what would happen to the barometric reading if more moisture was entering into the surrounding air.

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Set 2 — Air Pressure

7. Which set of air pressure readings are the same?

   (1) 1004.0 mb and 29.90 inches
   (2) 992.0 mb and 29.29 inches
   (3) 1016.0 mb and 30.10 inches
   (4) 1000.5 mb and 29.95 inches 7 _____

Note: Question 8 has only 3 choices.

8. At 9:00 a.m. the atmospheric pressure was 1002.6 mb and air temperature was 63°F. Four hours later the temperature rose to 93°F. If there was no change in elevation and in the atmospheric moisture level, the expect barometer reading should have

   (1) increased
   (2) decreased
   (3) remained the same 8 _____

9. The moon lacks an atmosphere. Of the following statements, which is correct?

   (1) Air pressure would still exist since the moon has gravity.
   (2) Air pressure would still exist since the Earth's atmosphere extends to the moon.
   (3) Air pressure would not exist on the moon.
   (4) Air pressure on the moon equals the Earth's air pressure. 9 _____

10. An abbreviated air pressure reading of 058 would convert to

    (1) 905.8 mb (3) 1005.8 mb
    (2) 105.8 mb (4) 10005.8 mb 10 _____

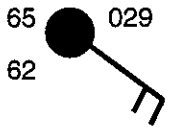
11. An abbreviated air pressure reading of 996 would convert to

    (1) 996.0 mb (3) 1099.6 mb
    (2) 999.6 mb (4) 9990.6 mb 11 _____

12. An air pressure of 1003.6 mb would be abbreviated to

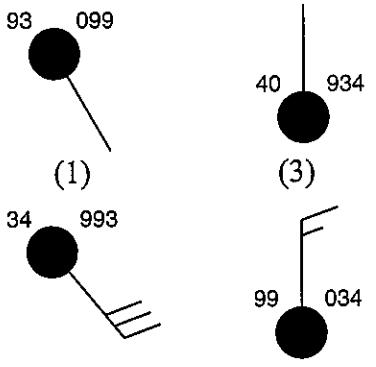
    (1) 1003 (3) 03.6
    (2) 100 (4) 036 12 _____

13. A station model is shown to the right. What is the air pressure at this location?



    (1) 902.9 mb (3) 1029.0 mb
    (2) 1002.9 mb (4) 9029.0 mb 13 _____

14. Which weather-station model shows an air pressure of 993.4 millibars.

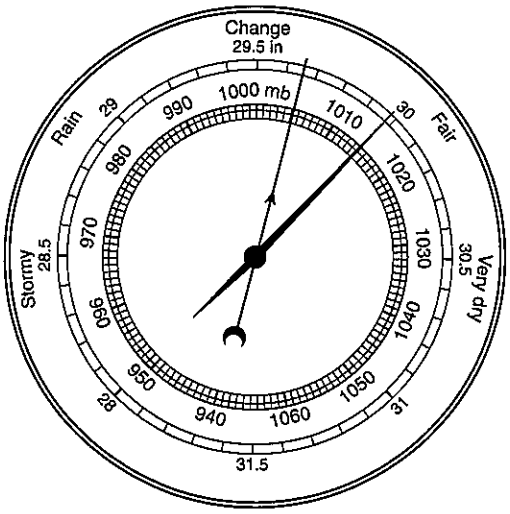


14 _____

15. Close spacing of isobars on a weather map is a good indicator of

    (1) low visibility
    (2) low dewpoint temperatures
    (3) high air temperatures
    (4) high wind velocity 15 _____

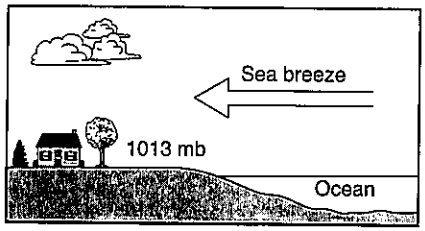
16. A weather instrument is shown below.



Which weather variable is measured by this instrument?

(1) wind speed (3) cloud cover
(2) precipitation (4) air pressure 16 _____

17. The cross section below shows a sea breeze blowing from the ocean toward the land. The air pressure at the land surface is 1013 millibars.

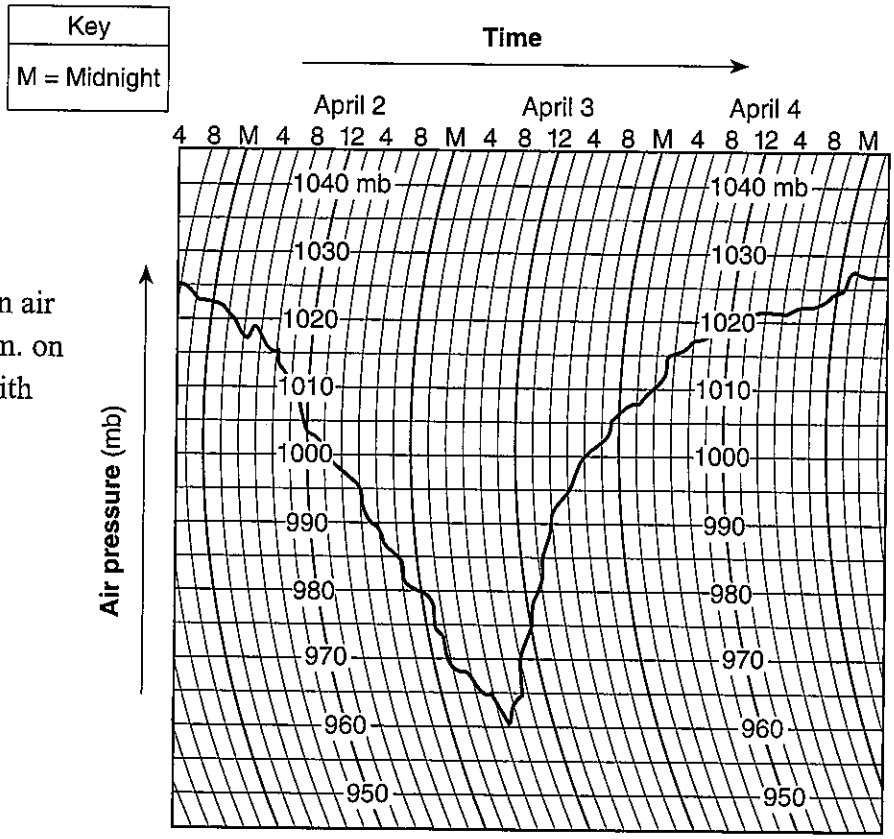


(Not drawn to scale)

The air pressure at the ocean surface a few miles from the shore is most likely

(1) 994 mb (3) 1013 mb
(2) 1005 mb (4) 1017 mb 17 _____

Base your answers to questions 18*a* and *b* on the accompanying barogram, which shows air pressure recorded in millibars at Green Bay, Wisconsin, from April 2 through April 4, 1982.



18. *a*) Calculate the rate of change in air pressure from 10 a.m. to 8 p.m. on April 3. Label your answer with the correct units.

b) What most likely caused the changes in air pressure for the period of time shown on the graph?
