Adjacent land and ocean surfaces have the same temperature at sunrise on a clear, calm, summer day. Then the land and water are heated by the Sun for several hours. Which cross section shows the most likely direction of surface winds that will develop at this ocean shore?
Base your answers to questions 69 through 71 on data tables I and II and on the Hurricane Tracking Map below. Table I represents the storm track data for an Atlantic hurricane. Location, wind velocity, air pressure, and storm strength are shown for the storm’s center at 3 p.m. Greenwich time each day. Table II shows a scale of relative storm strength. The map shows the hurricane’s path.

<table>
<thead>
<tr>
<th>Latitude (°N)</th>
<th>Longitude (°W)</th>
<th>Date</th>
<th>Wind Velocity (knots)</th>
<th>Air Pressure (millibars)</th>
<th>Storm Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>37</td>
<td>Aug. 24</td>
<td>30</td>
<td>1006</td>
<td>Tropical depression</td>
</tr>
<tr>
<td>16</td>
<td>44</td>
<td>Aug. 25</td>
<td>70</td>
<td>987</td>
<td>Category-1 hurricane</td>
</tr>
<tr>
<td>19</td>
<td>52</td>
<td>Aug. 26</td>
<td>90</td>
<td>970</td>
<td>Category-2 hurricane</td>
</tr>
<tr>
<td>21</td>
<td>59</td>
<td>Aug. 27</td>
<td>80</td>
<td>997</td>
<td>Category-1 hurricane</td>
</tr>
<tr>
<td>23</td>
<td>65</td>
<td>Aug. 28</td>
<td>80</td>
<td>988</td>
<td>Category-1 hurricane</td>
</tr>
<tr>
<td>25</td>
<td>70</td>
<td>Aug. 29</td>
<td>80</td>
<td>988</td>
<td>Category-1 hurricane</td>
</tr>
<tr>
<td>27</td>
<td>73</td>
<td>Aug. 30</td>
<td>65</td>
<td>988</td>
<td>Category-1 hurricane</td>
</tr>
<tr>
<td>30</td>
<td>74</td>
<td>Aug. 31</td>
<td>85</td>
<td>976</td>
<td>Category-2 hurricane</td>
</tr>
<tr>
<td>32</td>
<td>72</td>
<td>Sept. 01</td>
<td>85</td>
<td>968</td>
<td>Category-2 hurricane</td>
</tr>
<tr>
<td>37</td>
<td>64</td>
<td>Sept. 02</td>
<td>70</td>
<td>975</td>
<td>Category-1 hurricane</td>
</tr>
<tr>
<td>44</td>
<td>53</td>
<td>Sept. 03</td>
<td>65</td>
<td>955</td>
<td>Category-1 hurricane</td>
</tr>
</tbody>
</table>

**Hurricane Tracking Map**

69. Describe two characteristics of the circulation pattern of the surface winds around the center (eye) of a Northern Hemisphere low-pressure hurricane. [2]

   counterclockwise and spirals toward the eye

70. The hurricane did not continue moving toward the same compass direction during the entire period shown by the data table. Explain why the hurricane changed direction. [1]

   The storm entered the prevailing southwesterly wind belt north of 30° N, which pushed it to the northeast.

   The hurricane moved into a different wind belt.

71. In the space provided in your answer booklet, calculate the average daily rate of movement of the hurricane during the period from 3 p.m. August 24 to 3 p.m. August 28. The hurricane traveled 2,600 kilometers during this 4-day period. Follow the directions given below.

   a. Write the equation used to determine the rate of change.
   b. Substitute data into the equation. [1]
   c. Calculate the rate and label it with the proper units. [1]

   rate of change = \( \frac{2,600 \text{ km}}{4 \text{ days}} = 650 \text{ km/day} \)
Base your answers to questions 67 and 68 on the cross section provided in your answer booklet, which represents a house at an ocean shoreline at night. Smoke from the chimney is blowing out to sea.

67 Label the two lines provided on the cross section in your answer booklet to show where air pressure is relatively "high" and where it is relatively "low." [1]

68 Assume that the wind blowing out to sea on this night is caused by local air-temperature conditions. Label the two lines provided on the cross section in your answer booklet to show where Earth's surface air temperature is relatively "warm" and where it is relatively "cool." [1]
The weather map below shows a typical midlatitude low-pressure system centered in Illinois.

\[ \text{Diagram of the weather map showing a low-pressure system centered in Illinois.} \]

a. On the weather map provided in your answer booklet, indicate which boxed area has the highest surface air temperatures by marking an X in one of the four boxes on the map.

b. On the weather map provided in your answer booklet, draw an arrow to predict the normal storm track that this low-pressure center would be expected to follow.

\[ \text{Diagram showing the predicted storm track.} \]

\[ \text{ANSWER:} \]
A weather station records the following data:
   Air pressure is 1,001.0 millibars.
   Wind is from the south.
   Wind speed is 25 knots.

Using the proper weather map symbols, place this information in the correct locations on the weather station model provided in your answer booklet.

ANSWER:
Base your answers to questions 39 and 40 on the graph below. The graph shows air temperature and relative humidity at a single location during a 24-hour period.

39 What was the approximate change in relative humidity from 12 noon to 4 p.m.?

- (1) 10%
- (2) 15%
- (3) 20%
- (4) 30%

40 At which time would the rate of evaporation most likely be greatest?

- (1) 11 p.m.
- (2) 6 a.m.
- (3) 10 a.m.
- (4) 4 p.m.
Which graph best shows the relationship between the probability of precipitation and the difference between air temperature and dewpoint?

(1)

(2)

(3)

(4)
The station model below shows the weather conditions at Massena, New York, at 9 a.m. on a particular day in June.

What was the barometric pressure at Massena 3 hours earlier on that day?

(1) 997.1 mb  \rightarrow  (3) 1003.3 mb
(2) 999.7 mb  \rightarrow  (4) 1009.1 mb
The following weather data was collected at Boonville, New York.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Air temperature</td>
<td>65°F</td>
</tr>
<tr>
<td>Dewpoint</td>
<td>64°F</td>
</tr>
<tr>
<td>Visibility</td>
<td>2 miles</td>
</tr>
<tr>
<td>Present weather</td>
<td>drizzle</td>
</tr>
<tr>
<td>Wind direction</td>
<td>from the west</td>
</tr>
<tr>
<td>Wind speed</td>
<td>5 knots</td>
</tr>
<tr>
<td>Amount of cloud cover</td>
<td>100%</td>
</tr>
<tr>
<td>Barometric pressure</td>
<td>996.2 millibars</td>
</tr>
</tbody>
</table>

On the station model provided, using the proper format, record:

- the amount of cloud cover
- the barometric pressure
- the symbol for the present weather
The flowchart below shows part of Earth’s water cycle. The question marks indicate a part of the flowchart that has been deliberately left blank.

- Precipitation → Runoff → Ocean → ??? → Water vapor

Which process should be shown in place of the question marks to best complete the flowchart?

- (1) condensation
- (2) deposition
- (3) evaporation
- (4) infiltration
Which graph best shows the general effect that differences in elevation above sea level have on the average annual temperature?

(1) \[ \text{Temperature} \quad \text{Elevation} \]

(2) \[ \text{Temperature} \quad \text{Elevation} \]

(3) \[ \text{Temperature} \quad \text{Elevation} \]

(4) \[ \text{Temperature} \quad \text{Elevation} \]
A map view of surface air movement in a low-pressure system is shown below.

The air near the center of this low-pressure system usually will rise and form clouds.
Lake-Effect Snow

During the cold months of the year, the words “lake effect” are very much a part of the weather picture in many locations in New York State. Snow created by the lake effect may represent more than half the season’s snowfall in some areas.

In order for heavy lake-effect snow to develop, the temperature of the water at the surface of the lake must be higher than the temperature of the air flowing over the water. The higher the water temperature and the lower the air temperature, the greater the potential for lake-effect snow.

A lake-effect storm begins when air flowing across the lake is warmed as it comes in close contact with the water. The warmed air rises and takes moisture along with it. This moisture, which is water vapor from the lake, is turned into clouds as it encounters much colder air above. When the clouds reach the shore of the lake, they deposit their snow on nearby land. A typical lake-effect storm is illustrated in the diagram below.

The area most likely to receive snow from a lake is called a “snowbelt.” Lake Ontario’s snowbelt includes the counties along the eastern and southeastern ends of the lake. Because the lake runs lengthwise from west to east, the prevailing westerly winds are able to gather the maximum amount of moisture as they flow across the entire length of the lake. There can be lake-effect snowfall anywhere around the lake, but the heaviest and most frequent snowfalls occur near the eastern shore.

In parts of the snowbelt, the lake effect combines with a phenomenon known as orographic lifting to produce some very heavy snowfalls. After cold air has streamed over the length of Lake Ontario, it moves inland and is forced to climb the slopes of the Tug Hill Plateau and the Adirondack Mountains, resulting in very heavy snowfall.