Wind chill?

Our weather reporter spoke last night about the incredible wind chill factor that we would experience today.

1. What do you think that means? Please explain.

I found this chart of wind chill temperatures.

National Weather Service Wind Chill

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

2. If the temperature tomorrow was expected to be 15 degrees Fahrenheit and we are expecting continuous winds of 20 miles per hour, what would that feel like on our exposed skin (wind chill)?

3. If the temperature tomorrow was expected to be 35 degrees F and there was expected to be a continuous wind of 30 miles per hour, would the puddle near my front door be frozen?

When the wind blows across exposed skin (your face, nose, or whatever isn't covered), it draws heat away from our bodies. When the wind picks up speed, it draws more heat away, so if your skin is exposed to the wind, your body will cool more quickly than it would have on a calm day. This might be why your parent tells you not to wear shorts to school in February.

4. I just saw on the news that the wind chill is currently -22. What could the actual temperature and wind speed be?

But there are a lot of temperatures and wind speeds missing from that chart.

5. Make a guess as to what the wind chill feel would be if it were -8° F with a constant wind of 32 miles per hour.

6. What do you think is the best idea for gauging the wind chill equivalent for winds speeds that are not on the chart, for temperatures that are not spot-on, or both?

7. As you observe the data of the wind chill chart by increasing the wind speeds how do the wind chill temperatures change? Do you see a pattern? Do the wind chill temps go down linearly, irregularly, exponentially, or something else? Please describe any pattern that you see.

8. As you observe the data on the wind chill chart by decreasing the temperatures how do the wind chill temperatures change? Do you see a pattern? Do the wind chill temps seem to go down linearly, irregularly, exponentially, or something else? Please describe any pattern that you see.

At NOAA (National Oceanic and Atmospheric Administration), I found this formula for calculating the apparent wind chill temperature for different temperatures Fahrenheit (T) and wind speeds in miles per hour (V) is the following:

$$\text{Wind chill in degrees Fahrenheit} = 35.74 + 0.6215 \cdot \mathrm{T} - 35.75 \cdot (\mathrm{V}^{0.16}) + 0.4275 \cdot \mathrm{T} \cdot (\mathrm{V}^{0.16})$$

9. Use this formula to try to calculate (with your calculator) the apparent wind chill temperature for a day with a 32 mph wind and -8° F.

10. Is this the same answer that you got for problem #6?

11. Now try using this same data on an online wind chill calculator http://www.srh.noaa.gov/ssd/html/windchil.htm

12. Using the same formula, if you know that the wind chill temperature is -42°F and it is very windy = 20mph, what must the actual temperature have been?

Extension for high school students

13. If the wind chill is -50 degrees and the actual temperature is -18°F, what must the wind velocity be?

Sources: http://mentalfloss.com/article/26730/how-wind-chill-calculated
http://www.nws.noaa.gov/om/winter/windchill.shtml
http://www.pbs.org/teachers/mathline/concepts/weather/activity2.shtm