Card, Oct. 23: White Dwarfs and Baked Potatoes (credit - David Weintraub)

Suppose you take a baked potato out of the oven when its temperature is 170 °F, and wait for it to cool down to 70 °F before eating it, which takes 100 minutes.

(a) How fast was it cooling, in °F per minute?

Now consider another potato that also came out of the oven at 170 °F, and now has a temperature of 120 °F.

(b) If it cooled at the same rate as potato (a), how long ago did it come out of the oven? Explain your reasoning.

Baked Potato Cooling Rates and Times

(a) The numbers were picked to make the calculations easy. If it takes 100 min to cool from 170°F to 70°F, a difference of 100°, the cooling rate is 1° per minute:

Rate = (170° – 70°)/100 min = 100°/100 min = 1°/1 min

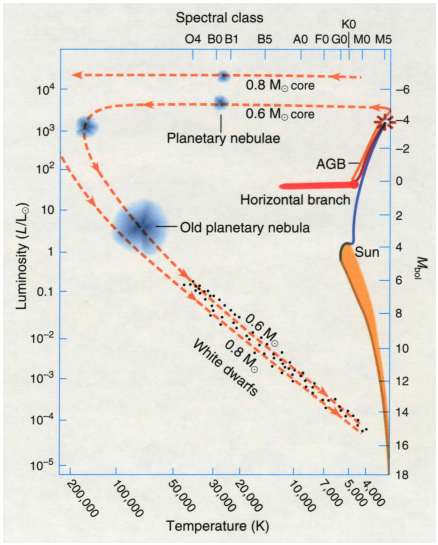
(b) Using that rate, a potato that started at 170° and is now 120° must have come out of the oven 50 minutes ago, because it has cooled by 170° − 120° = 50°.

Of the 60 groups who did this card, basically everyone got part (a) correct, but only 50 groups got the right answer for (b), with 10 groups giving incorrect answers or not giving a number for the time.

Explanations Given (red = wrong)

- "The question says that the second potato is cooling at the same rate, so the number of minutes is equal to the drop in temperature."
- "The second potato cooled twice as fast as the first potato … 50 minutes because it's half the rate." The question says the cooling rate is the same.
- "2 hours because it takes longer to cool." Why should it take longer to cool, if the starting temperature and cooling rates are the same?
- Unexplained calculations, e.g. 50 x 0.7 = 35 mins.

White Dwarf Cooling Tracks



Declining luminosity and temperature; so the white dwarf moves along a line of constant radius. The more time passes, the farther down the track it progresses (dots). If you know the cooling rate, you can calculate the white dwarf's age.