Calculating Hc with insulation for Woolly Mammoth:

From Figure 5-5 in Withers (pg. 130), we can see that the highest insulation value for mammal fur is about i=12 for white fox with about 5cm fur or Dall sheep with about 7cm fur. So that's a good place to start.

Insulation (i) is defined as the reciprocal of heat transfer per meter squared per degree C per sec, so i is given in units of   C m^2 sec /J

Therefore, we an calculate the rate of heat transfer (Hc) here in a new way with insulation by:

$$Hc\_i = (1/i) * SA * dt$$

Which will have units:

$$(J / (C * m^2 * sec)) * m^2 * C = J / sec$$

Therefore, with the following values:

SA = 15.73 m^2
dt = 36.6 - -50 C = 86.6C
i = 12 C m^2 sec /J

We get

$$Hc\_i = (1/12) * 15.73 * 86.6 = 113.52 \text{ J/sec}$$
$$= 113.52 \text{ J/sec} * (60\text{sec/min}) * (60\text{min/hr})$$
$$= 408.68 \text{ kJ/hr}$$

Which is significantly less than the Hc value calculated with no insulation using the scaling equation for C for mammals (Hc = C m dt = 12,526 kJ/hr, where C = 20 m^-0.426).

Fat provides less insulative value than fur, as you can see from Fig. 5-5. Even for a whopping 9cm of fat, you get an i value of only about 5. For 3 cm of fat the i value is about 1.5, etc. Probably the easiest way to include both fat and fur is to add together the i values and redo the calculation above (so if you have fur i = 12, and fat i = 2, then both i = 14, etc).

It is a good idea when you're doing a lot of calculations to use a spreadsheet or otherwise program a computer to do the final calculations after you've figured out how to do it on paper. Then all you have to do is check that you've inputted the formulas correctly and you don't have to worry about finger punching errors. I've included a spreadsheet below. Let me know if you have any questions. If you put in different i values it should update the formulas for you.