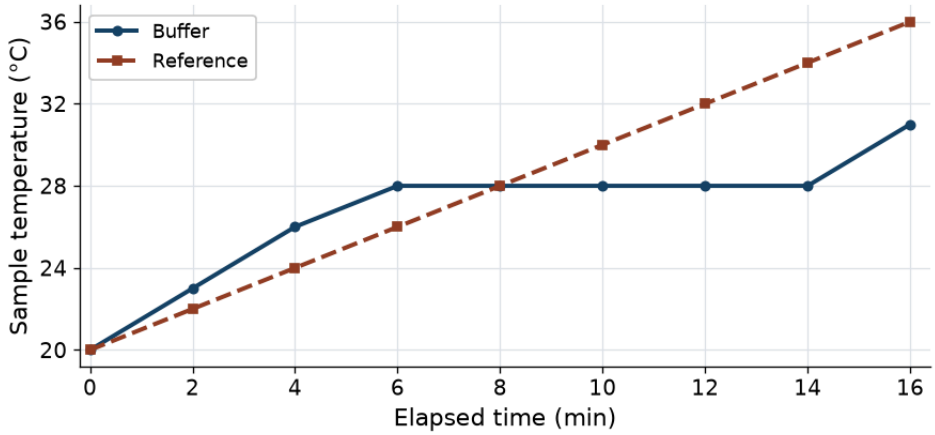
A Melting Buffer for a Model Display

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A museum class tests two model samples for a display. One is a solid that melts near 28 °C and the other remains liquid over the test. Each sample gains energy at the same constant rate of 40 J per minute. The graph shows the temperature of each sample. The display’s test limit is 30 °C.



Warming curves for the buffer and the liquid reference.

1 At which plotted time is the reference above the limit while the buffer is still below it?

(1) 4 min

(2) 8 min

(3) 12 min

(4) 16 min

2 Explain why the buffer can receive energy from minute 6 to minute 14 without a measured rise in temperature. [1]

Answer and work

3 A student claims that the reference gains more energy than the buffer between minutes 6 and 14 because its temperature rises. Calculate the energy gained by each sample in that interval and evaluate the claim. [1]

Answer and work

The display needs a sample that stays near 28 °C for at least 12 minutes after melting begins. The class considers using twice the mass of the same pure buffer. It uses the same energy input rate and assumes that the energy needed to melt each gram is unchanged.

4 Would twice the original mass meet the 12-minute requirement in this model? Use the graph and the energy needed per gram to explain. [1]

Answer and work