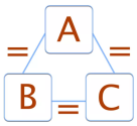
Chapter 2 Specific heat capacity and calorimetry. (Revision Questions page 106). Multiple Choice Answers

Q	Ans	Explanation
1	A	They must all be in thermal equilibrium (same temperature) with each other. This is just one form of the Zeroth Law of Thermodynamics (see Chapter 2.1 page 90).  You may see some statements that go further - to state the physical fact that a temperature value allows us to arrange objects in sequence from colder to hotter. Just learn it as I have written it on page 90.
2	A	If we calculate the amount of heat energy each substance gives up when it cools from 25°C to 0°C we find: $Q_{Pb} = m_{Pb}c_{Pb}\Delta T = \frac{75.0}{1000} \times 130 \times (0-25) = -243.75\,J$ $Q_{Pb} = m_{w}c_{w}\Delta T = \frac{75.0}{1000} \times 4180 \times (0-25) = -7837.5\,J$ Thus, water has more heat energy to give up so will melt more of the ice. Answer is (A). Actually, you can work out how much ice will be melted by both the lead and the water: $Q = mL_f$ $Q = m_{ice} \times 3.34 \times 10^5$ $For\ lead: 243.75 = m_{ice} 3.34 \times 10^5$ $m_{ice} = \frac{243.75}{3.34 \times 10^5} = 7.3 \times 10^{-4} kg = 0.73g$ $For\ water: 7837.5 = m_{ice} 3.34 \times 10^5$ $m_{ice} = \frac{7837.5}{3.34 \times 10^5} = 0.023kg = 23g$
3	C	$Q = mc\Delta T = 4.0 \times 1000 \times (40-30) = 40\,000\,J$
4	C	Energy is required to overcome the microscopic potential energy that is stored in the bonds. The kinetic energy does not change as the ice goes from a solid at 0°C to liquid water at 0°C. Note that the temperature doesn't change so the average kinetic energy of the molecules doesn't change either.

5	B	As the ice-block melts the water that forms is at 0°C. That is the most straightforward answer. However, if the ice water is left there in the air (which is at 23°C), once all of the ice melts the water will then rise in temperature from 0°C to a temperature lower than room temperature of 23°C. I suppose that eventually the water will reach room temperature as the air is such a huge 'sink' of thermal energy that it will be unaffected by the small amount of thermal energy transferred out of the cold water. So, the answer is more complicated than at first glance - as is life. The full answer would be that over a short time it is option (B), then as time goes by it becomes option (D), then after more time it becomes option (C). It can never be option (A) as water will not exist in its liquid form at a temperature less than 0°C. I think the question would be better if it read "Which one of the following can NEVER occur?". The answer would then be (A).