

REACTION ENERGY

The specific heat of any substance is the amount of heat required to raise the temperature of ____ gram of that substance by one degree Celsius. Because different substances have different compositions, each substance has its own specific heat.

Exothermic: Heat flows _____ of the system (to the surroundings). The value of 'q' is negative.

Endothermic: Heat flows _____ the system (from the surroundings). The value of 'q' is positive.

$$q = m C_p \Delta T$$

q = heat (J); m = mass (g); C_p = specific heat (J/(g·°C)); ΔT = change in temperature = $T_f - T_i$ (°C)

Heat changes that occur during chemical and physical processes can be measured accurately and precisely using a _____. A calorimeter is an insulated device used for measuring the amount of heat absorbed or released during a chemical or physical process. A coffee-cup *calorimeter* made of _____ Styrofoam cups.

Phase Changes Review

Solid → liquid _____

Liquid → solid _____

Liquid → gas _____

Gas → liquid _____

Solid → gas _____

Gas → solid _____

Energy and Phase Changes

$$q = m H_f$$

$$q = m H_v$$

H_f = latent heat of fusion (J/g) ; H_v = latent heat of vaporization (J/g)

Heat of vaporization (H_v) is the energy required to change one gram of a substance from _____ to gas. Heat of fusion (H_f) is the energy required to change one gram of a substance from _____ to liquid.

Specific Heat Problems

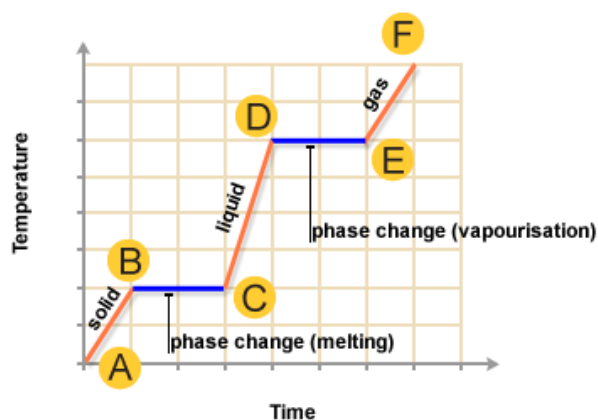
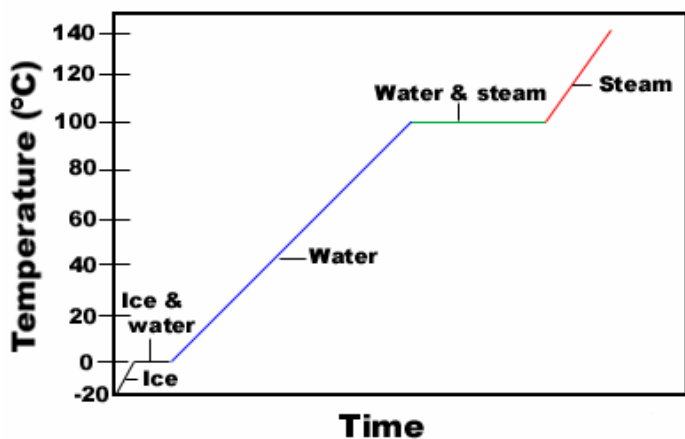
1. The temperature of a sample of iron with a mass of 10.0 g changed from 50.4°C to 25.0°C with the release of 114 J heat. What is the specific heat of iron?

- A piece of metal absorbs 256 J of heat when its temperature increases by 182°C. If the specific heat of the metal is 0.301 J/g°C, determine the mass of the metal.
- If 335 g water at 65.5°C loses 9750 J of heat, what is the final temperature of the water? The specific heat of water is 4.18 J/g°C.
- As 335 g of aluminum at 65.5°C gains heat, its final temperature is 300.°C. Determine the energy gained by the aluminum.

Latent Heat Problems

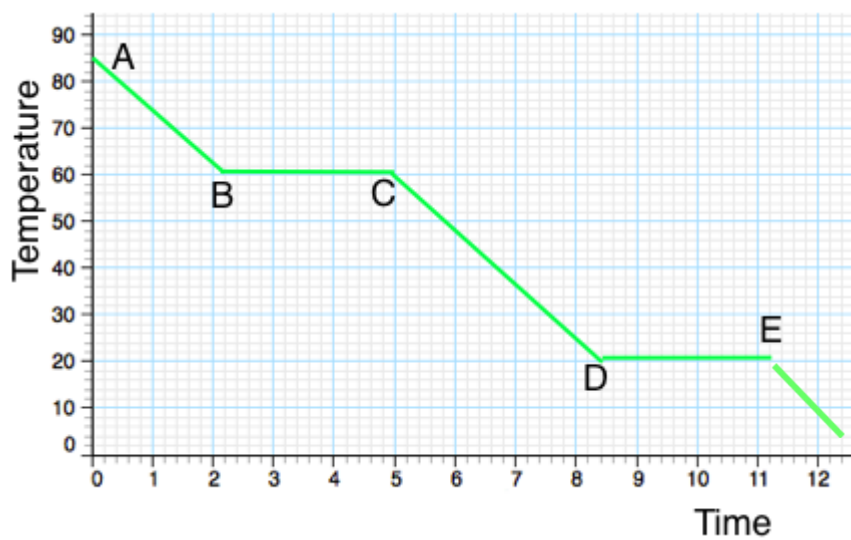
- How much heat does it take to melt 12.0 g of ice at 0 °C?
- How much heat must be removed to condense 5.00 g of steam at 100 °C?
- If 335 J of heat are added to melting 5.00 g of gold, what is the latent heat of fusion for gold in J/g?
- The latent heat of fusion for platinum is 119 J/g. Platinum absorbs 735 J of heat. What is the mass of platinum?

Heating Curves



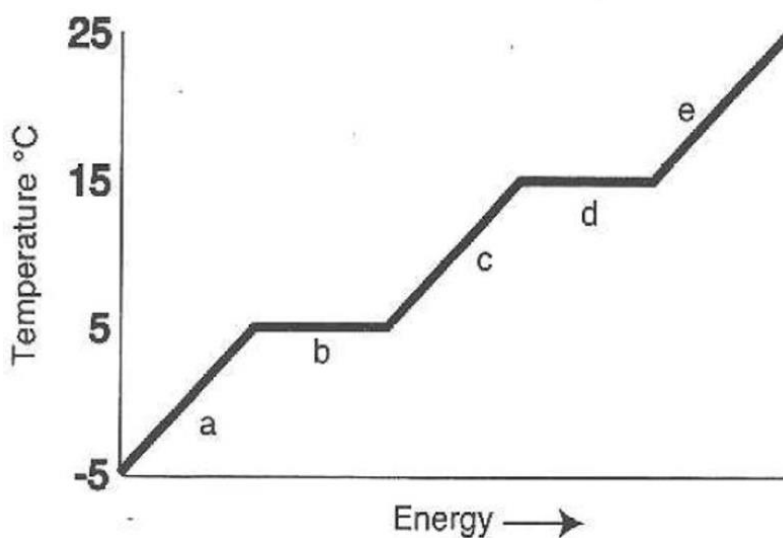
The heating curve has ____ distinct regions. The horizontal lines are where _____ changes occur. During any phase change, temperature is _____. Kinetic energy _____ on any diagonal line, and potential energy increases on any horizontal line. The melting point temperature is _____ to the freezing point temperature. The boiling point is the same as the temperature where _____ takes place. Use $Q = m C_p \Delta T$ for all _____ lines. Use $Q = m H_f$ for _____ and $Q = m H_v$ for boiling.

Cooling Curves

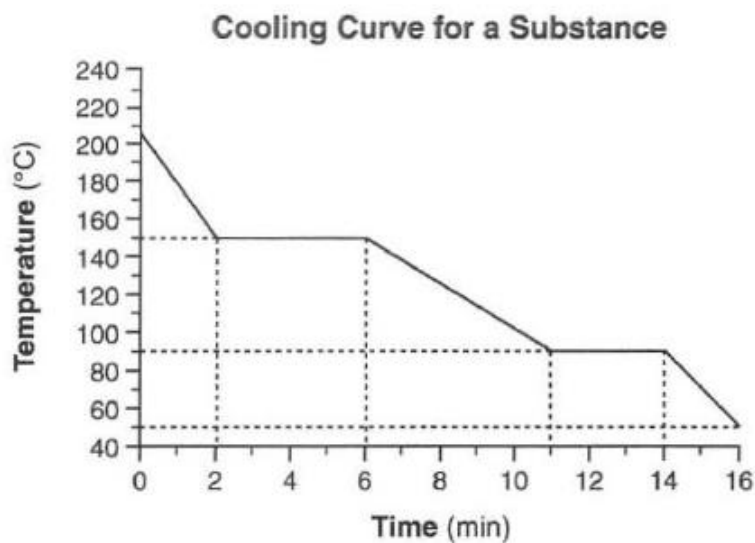


A cooling curve also has ____ distinct regions. For a cooling curve, kinetic energy decreases on any _____ line, and potential energy decreases on any horizontal line.

Heating and Cooling Curve Questions



9. What is the freezing point of the substance?
10. What is the melting point of the substance?
11. What is the boiling point of the substance?
12. What letter represents the temperature where the solid is being heated?
13. What letter represents the temperature where the vapor is being heated?
14. What letter represents the temperature where the liquid is being heated?
15. What letter represents the melting of the solid?
16. What letters show a change in kinetic energy?
17. What letter represents condensation?



18. What is the freezing point of this substance?

19. At what time do the particles of this sample have the *lowest* average kinetic energy?

20. How many minutes does it take the substance to condense?

21. What is the temperature range for the substance to be a vapor?

HONORS ONLY: Specific Heat and Latent Heat Problems

22. How much heat does it take to heat 12 g of ice at -6°C to 25°C water? Round to a whole number.
23. How much heat does it take to heat 35 g of ice at 0°C to steam at 150°C ? Round to a whole number.
24. How much heat does it take to convert 16.0 g of ice to water at 0°C ?
25. How much heat does it take to heat 21.0 g of water at 12.0°C to water at 75.0°C ?
26. How much heat does it take to heat 14.0 g of water at 12.0°C to steam at 122.0°C ?

All Students

For calorimetry problems, use the equation: $-m C_p \Delta T = m C_p \Delta T$, which is based on the law of conservation of energy. Heat _____ equals heat gained.

Calorimetry Problems

- 27) 125 g of water at 25.6°C is placed in a foam-cup calorimeter. A 50.0 g sample of the unknown metal is heated to a temperature of 115.0°C and placed into the water. Both water and metal attain a final temperature of 29.3°C . Determine the specific heat of the metal.
28. You put 352 g of water into a foam-cup calorimeter and find that its initial temperature is 22.0°C . What mass of 134°C lead can be placed in the water so that the equilibrium temperature is 26.5°C ?
29. You put water into a foam-cup calorimeter and find that its initial temperature is 25.0°C . What is the mass of the water if 14.0 grams of 125°C nickel can be placed in the water so that the equilibrium temperature is 27.5°C ?