Phase Change & Latent Heat

Name _____

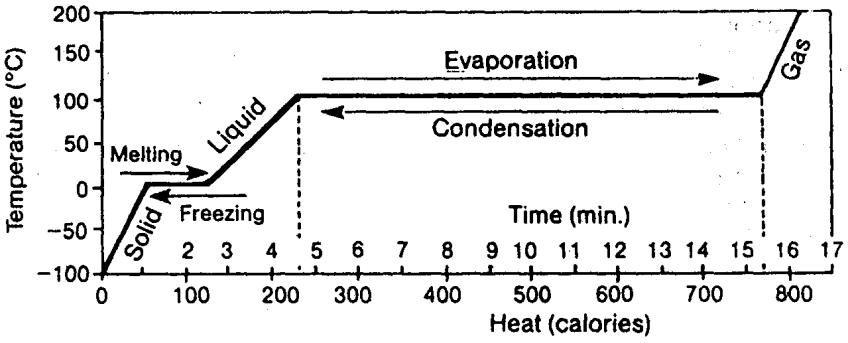
Partners _____

Directions: Give the best answer to the following questions.

1. When something melts, freezes, vaporizes, condenses or sublimates, we say it has undergone a "change in state." Another way of saying "change in state" is "_____ change."
2. What happens to the temperature of a substance during a phase change?

   _____

3. Ice can get *very* cold. Let's say we have some ice cubes at –25^{0}C (good for *very* cold drinks!). Let's say we add heat to the ice. As we add heat, the temperature of the ice starts to rise. Eventually, the ice reaches 0^{0}C. As we continue to add heat, the ice will start to _____.



Heating/cooling curve for water. The graph is a heating curve when read from left to right, a cooling curve when read from right to left.

4. As long as the ice is still melting, we can add all the heat we want but the temperature will be _____^{0}C (see the above heating/cooling curve).
5. While the ice is melting (changing phase), the heat we're adding is <u>not</u> changing the temperature of the ice. But the added heat energy must be doing <u>some</u> kind of work. Instead of raising the temperature, the heat is _____ the ice. While this is happening, the heat energy is being stored in the liquid water as _____ (stored) heat.
6. While a substance is changing phase, the temperature of that substance always (rises / falls / stays the same).
7. We're still adding heat to our sample. After all the ice is melted, the temperature of the liquid water will _____.
8. When the temperature of the water reaches 100^{0}C, the water starts to _____ or "vaporize."
9. Compare the length of the heating/cooling curve during melting to that during vaporization (evaporating). Which is longer? _____ Which takes more energy, melting or vaporization? _____
10. Which has more latent heat (stored or potential energy), liquid water or water vapor? _____
11. Where do you think much of the energy for storms and hurricanes comes from? _____
12. *Sublimation* is when a substance changes directly from the _____ to the _____ phase, or vice-versa.
13. During melting and vaporization, latent heat is (gained / lost). During condensation and freezing, latent heat is (gained / lost).
14. The amount of latent heat we need to add to 1g of ice in order to melt it is _____ calories. This is called the heat of _____ (see ESRT p.16).

15. The latent heat needed to change 1g of liquid water at 100^{0}C to water vapor is _____ calories. This is called the heat of _____ (see ESRT p.16).

HEAT of FUSION

Example: how much heat is needed to change 200g of ice at 0^{0}C to water at 0^{0}C?

Q = mass x heat of fusion (80cal/g) = 200g x 80cal/g = **16,000 calories**

16. How many calories of latent heat are needed to change 10g of liquid water at 100^{0}C to water vapor at 100^{0}C?

17. How many calories of heat energy are released by 20g of liquid water at 0^{0}C as it changes to ice at 0^{0}C?

18. How many calories of heat are needed to change 30g of liquid water to ice at 0^{0}C?

HEAT of VAPORIZATION

Example: how much heat is needed to change 200g of water at 100^{0}C to water vapor at 100^{0}C?

Q = mass x heat of vaporization (540cal/g) = 200g x 540cal/g = **108,000 calories**

19. How many calories are released when 10g of water vapor condenses?

20. How many calories of heat energy are needed to change 30g of liquid water to water vapor at 100^{0}C?