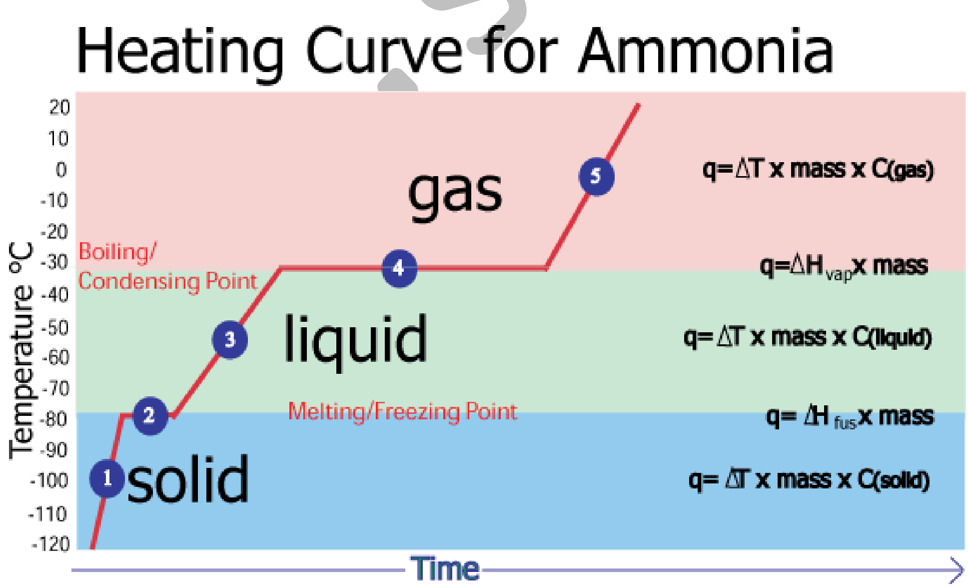
Name ______________________ **Honors Chemistry** ___/___/___

Understanding Phase Changes - Answers

1. **2 -** Which number represents the freezing point?
2. **2 -** Which number represents the melting point?
3. **4 -** Which number represents the vaporization of a liquid?
4. **4 -** Which number represents the condensation point?
5. **1 -** Which number represents the warming of a solid?
6. **2 -** Which number represents the crystallization?
7. **1 -** Which number represents the solid state?
8. **2 -** Which number represents the melting of a solid?
9. **3 -** Which number represents the liquid state?
10. **5 -** Which number represents the gaseous state?
11. **5 -** Which number represents the warming of a vapor?
12. **3 -** Which number represents the warming of a liquid?
13. **4** - Which number represents the boiling point?
14. **2 & 4 -** Which numbers show a change in potential energy?
15. **1, 3 & 5 -** Which numbers show a change in kinetic energy?
16. **q = mass x C x ΔT** What formula is used when there is a change in kinetic energy?
17. **q = H_{fus} x mass** What formula is used at the melting point of a substance?
18. **q = H_{vap} x mass** What formula is used at the boiling point of a substance?
19. Draw a heating curve for ammonia between -120°C & 20°C. Label: solid, liquid, gas, boiling point, freezing point, melting point, condensing point and the formula that would be used at each stage. Boiling point (NH_3): -33.5°C, Melting point (NH_3): -77.9°C.



20. Calculate the amount of heat (in Calories) needed to raise the temperature of 500.0 grams of water from -20°C to 120°C. Important constants for H_2O: Melting point: 0°C, Boiling point: 100°C, C(solid): 2.09 J/g°C, C(liquid): 4.184 J/g°C, C(gas): 2.01 J/g°C, ΔH_{fus}: 335.0 J/g, ΔH_{vap}: 2259.0 J/g.

Stage 1: q = mass x C x ΔT
q = (0°C – (-20°C)) x (500 g) x (2.09 J/g°C)
q = 20900 J
Stage 2: q = ΔH_{fus} x mass
q = (335 J/g) x (500 g)
q = 167500 J
Stage 3: q = mass x C x ΔT
q = (100°C - 0°C) x (500 g) x (4.184 J/g°C)
q = 209200 J
Stage 4: q = ΔH_{vap} x mass
q = (2259 J/g) x (500 g)
q = 1129500 J
Stage 5: q = mass x C x ΔT
q = (120°C - 100°C) x (500 g) x (2.01 J/g°C)
q = 20100 J
ΔH_{total} = 1547200 joules = 1550 kilojoules = 370.Calories

21. Calculate the amount of heat (in Calories) released as 1.0 liter of water at 80°C is frozen to -3°C. Important constants for H_2O: Melting point: 0°C, Boiling point: 100°C, C(solid): 2.09 J/g°C, C(liquid): 4.184 J/g°C, C(gas): 2.01 J/g°C, ΔH_{fus}: 335.0 J/g, ΔH_{vap}: 2259.0 J/g.

Stage 1: q = mass x C x ΔT
q = (0°C - 80°C) x (1000 g) x (4.184 J/g°C)
q = -334720 J
Stage 2: q = ΔH_{solid} x mass
q = (-335 J/g) x (1000 g)
q = -335000 J
Stage 3: q = mass x C x ΔT
q = (-3°C – 0°C) x (1000 g) x (2.09 J/g°C)
q = -6270 J
q_{total} = -675990 joules = -676 kilojoules = -162 Calories

22. Calculate the amount of heat (in Calories) burned if you eat 300.0 grams of ice at -5°C? (body temp = 37°C). Important constants for H_2O: Melting point: 0°C, Boiling point: 100°C, C(solid): 2.09 J/g°C, C(liquid): 4.184 J/g°C, C(gas): 2.01 J/g°C, ΔH_{fus}: 335.0 J/g, ΔH_{vap}: 2259.0 J/g.

Stage 1: q = mass x C x ΔT
q = (0°C – (-5°C)) x (300 g) x (2.09 J/g°C)
q = 3135 J
Stage 2: q = ΔH_{fus} x mass
q = (335 J/g) x (300 g)
q = 100500 J
Stage 3: q = mass x C x ΔT
q = (37°C - 0°C) x (300 g) x (4.184 J/g°C)
q = 46442.4 J
q_{total} = 150077.4 joules = 150. kilojoules = 35.9 Calories

23. Draw and label a cooling curve for water and calculate the amount of heat (in Calories) released as 750 mL H_2O cools from 200°C to -100°C. Important constants for H_2O: Melting point: 0°C, Boiling point: 100°C, C(solid): 2.09 J/g°C, C(liquid): 4.184 J/g°C, C(gas): 2.01 J/g°C, ΔH_{fus}: 335.0 J/g, ΔH_{vap}: 2259.0 J/g.

Stage 1: q = mass x C x ΔT
q = (100°C - 200°C) x (750 g) x (2.01 J/g°C)
q = -150750 J
Stage 2: q = ΔH_{cond} x mass
q = (-2259 J/g) x (750 g)
q = -1694250 J
Stage 3: q = mass x C x ΔT
q = (0°C - 100°C) x (750 g) x (4.184 J/g°C)
q = -313800 J
Stage 4: q = ΔH_{solid} x mass
q = (-335 J/g) x (750 g)
q = -251250 J
Stage 5: q = mass x C x ΔT
q = (-100°C – 0°C) x (750 g) x (2.09 J/g°C)
q = -156750 J
q_{total} = -2566800 joules = -2570 kilojoules = -613.5 Calories