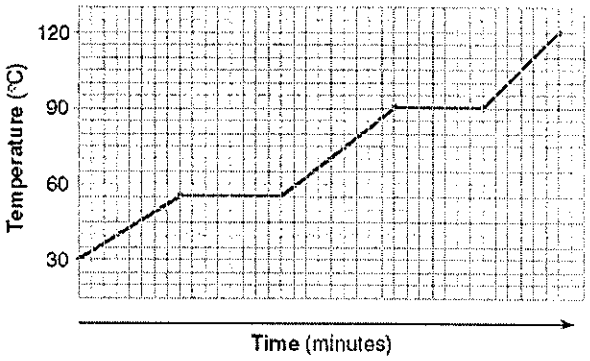
Regents Chemistry: Temperature, Heat, & Heating/Cooling Curves **Name:** KEY

1.) The temperature of a sample of matter is a measure of the
(1) average potential energy of the particles of the sample
(2) average kinetic energy of the particles of the sample
(3) total nuclear energy of the sample
(4) total thermal energy of the sample

2.) Which sample of ethanol has particles with the highest average kinetic energy?
(1) 10.0 mL of ethanol at 25°C
(2) 10.0 mL of ethanol at 55°C
(3) 100.0 mL of ethanol at 35°C
(4) 100.0 mL of ethanol at 45°C

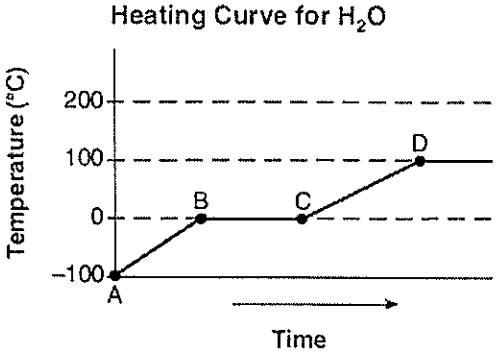
3.) The graph below represents the heating curve of a substance that starts as a solid below its freezing point.

What is the melting point of this substance?
(1) 30°C
(2) 55°C
(3) 90°C
(4) 120°C

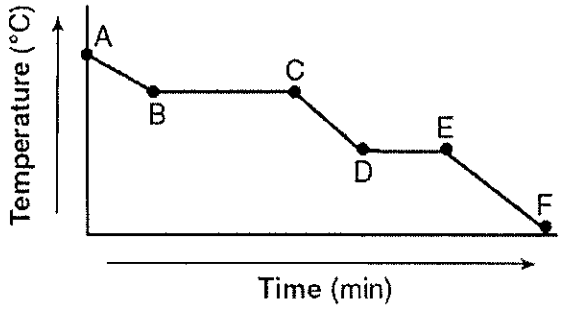


4.) The graph represents the relationship between temperature and time as heat is added to a sample of H_2O.

Which statement correctly describes the energy of the particles of the sample during interval *BC*?
(1) Potential energy decreases and average kinetic energy increases.
(2) Potential energy increases and average kinetic energy increases.
(3) Potential energy increases and average kinetic energy remains the same.
(4) Potential energy remains the same and average kinetic energy increases.



5.) Given the cooling curve of a substance:



During which intervals is potential energy decreasing and average kinetic energy remaining constant?
(1) *AB* and *BC*
(2) *AB* and *CD*
(3) *DE* and *BC*
(4) *DE* and *EF*

6.) What is the amount of heat energy released when 50.0 grams of water is cooled from 20.0°C to 10.0°C?
(1) 5.00×10^2 J
(2) 2.09×10^3 J
(3) 1.67×10^5 J
(4) 1.13×10^6 J

→ -q!

$q = mC\Delta T = (50)(4.18)(10-20)$
$= -2090$ J

7.) A 36-gram sample of water has an initial temperature of 22°C. After the sample absorbs 1200 joules of heat energy, the final temperature of the sample is

(1) 8.0°C (2) 14°C (3) 30.°C (4) 55°C

gets warmer!

$q = mC\Delta T$

$1200 = (36)(4.18)(x-22)$

$7.97 = x - 22$

$x = 29.97°C$

8.) What is the total amount of heat required to vaporize 1.00 gram of $H_2O(\ell)$ at 100.°C and 1 atmosphere?

(1) 4.18 J (2) 334 J (3) 373 J (4) 2260 J

$q = mH_v$

$= (1g)(2260 J/g)$

9.) What is the minimum amount of heat required to completely melt 20.0 grams of ice at its melting point?

(1) 20.0 J (2) 83.6 J (3) 6680 J (4) 45 200 J

$q = mH_f = (20)(334)$

10.) At standard pressure, the total amount of heat required to completely vaporize a 100.-gram sample of water at its boiling point is

(1) 2.26×10 J (2) 2.26×10^2 J (3) 2.26×10^3 J (4) 2.26×10^5 J

$q = mH_v = (100)(2260) = 226{,}000$ J

Base your answers to questions 11 through 13 on the information below.

Heat is added to a 200.-gram sample of $H_2O(s)$ to melt the sample at 0°C. Then the resulting $H_2O(\ell)$ is heated to a final temperature of 65°C.

11.) Determine the total amount of heat required to completely melt the sample.

$q = mH_f$

$= (200)(334)$

66,800 J

12.) Show a numerical setup for calculating the total amount of heat required to raise the temperature of the $H_2O(\ell)$ from 0°C to its final temperature.

$q = mC\Delta T$

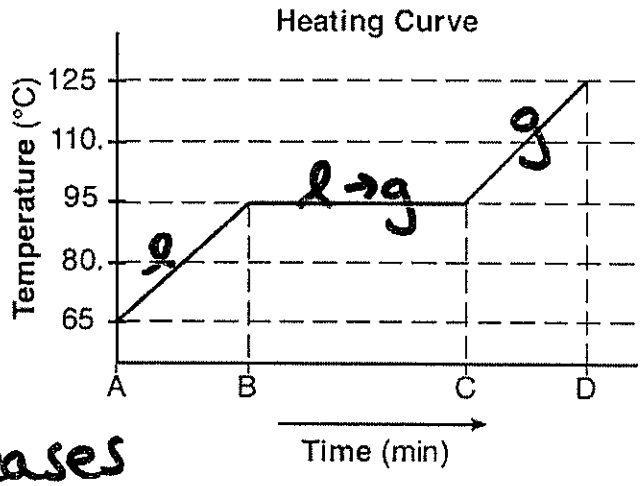
$= (200)(4.18)(65-0)$

13.) Compare the amount of heat required to vaporize a 200.-gram sample of $H_2O(\ell)$ at its boiling point to the amount of heat required to melt a 200.-gram sample of $H_2O(s)$ at its melting point.

The heat required to vaporize (2260 J/g) is greater than the heat required to melt (334 J/g).

Base your answers to questions 14 and 15 on the information below and on your knowledge of chemistry.

A sample of a substance is a liquid at 65°C. The sample is heated uniformly to 125°C.
The heating curve for the sample at standard pressure is shown to the right.



14.) Determine the boiling point of the sample at standard pressure.

95 °C

15.) State what happens to the potential energy of the particles of the sample during time interval BC.

potential energy increases

Base your answers to questions 16 through 18 on the information below.

A student investigated heat transfer using a bottle of water. The student placed the bottle in a room at 20.5°C. The student measured the temperature of the water in the bottle at 7 a.m. and again at 3 p.m. The data from the investigation are shown in the table to the right.

Water Bottle Investigation Data

7 a.m.		3 p.m.	
Mass of Water (g)	Temperature (°C)	Mass of Water (g)	Temperature (°C)
800.	12.5	800.	20.5

16.) Compare the average kinetic energy of the water molecules in the bottle at 7 a.m. to the average kinetic energy of the water molecules in the bottle at 3 p.m.

12.5°C 20.5°C
The ave. KE at 3pm is greater than at 7 am

17.) State the direction of heat transfer between the surroundings and the water in the bottle from 7 a.m. to 3 p.m.

Heat flows from the surroundings to the water in the bottle.

18.) Show a numerical setup for calculating the change in the thermal energy of the water in the bottle from 7 a.m. to 3 p.m.

heat!
$q = mC\Delta T$
$= (800)(4.18)(20.5 - 12.5)$

Base your answers to questions 19 and 20 on the information below.

The boiling point of a liquid is the temperature at which the vapor pressure of the liquid is equal to the pressure on the surface of the liquid. The heat of vaporization of ethanol is 838 joules per gram. A sample of ethanol has a mass of 65.0 grams and is boiling at 1.00 atmosphere.

19.) Based on Table *H*, what is the temperature of this sample of ethanol?

1 atm = 101.3 kPa

~78-79 °C (accept 78-80)

20.) Calculate the minimum amount of heat required to completely vaporize this sample of ethanol. Your response must include *both* a correct numerical setup and the calculated result.

$q = mH_v$
$= (65)(838) =$

54,470 J