

BIG CHEM: Unit 7 - Heat and Energy
Problem Set #7

Due: Wednesday, February 13th, 2008
Mr. Darlington

- 1 Write a summary paragraph on the article: "Are there upper and lower limits to temperature?"

- 2 **Energy Basics**
 - a Define energy and state its units.
 - b What important advancements were a direct result of the Physicist whom the units of energy are named after?
 - c Imagine you must generate electricity. At minimum, what objects do you need? What process makes this happen?

- 3 **Describe and provide examples of each of the following that were not given in the notes (this requires research):**
 - a Potential Energy
 - b Kinetic Energy
 - c Chemical potential energy
 - d Electrical potential energy
 - e Thermal potential energy
 - f Atomic potential energy
 - g Activation energy

- 4 Describe the difference between heat and temperature.

- 5 **Convert the following to degrees Celsius if given Kelvin, or to Kelvin if given degrees Celsius.**

a 273 K	j. 273°C
b 373 K	k. 373°C
c 15 K	l. 15°C
d 623 K	m. 623°C
e 80 K	n. 80°C
f 0 K	o. 0°C
g 500 K	p. 500°C
h 13 K	q. 13°C
i 157 K	r. 157°C

- 6 **Phase Basics**
 - a What happens to gases under pressure?
 - b What happens to liquids under pressure?
 - c What happens to the shape of a liquid as it is transferred from one container to another?
 - d What happens to the volume of a liquid as it is transferred from one container to another?
 - e How would a solid, such as a coin or a rock, behave under pressure or if its transferred to another container?

- 7 **In a room are a glass of water, air and a table. All three objects are at equal temperature.**

Explain why the table is a solid, the water is a liquid and the air is a gas.
Correctly use the terms intermolecular forces and kinetic energy in your explanation. Your answer should be at least one paragraph.

- 8 Vancouver, British Columbia is much further north than Fargo, North Dakota. Yet the weather in Fargo is much hotter in the summer and much colder in the winter. Using your knowledge of specific heat, explain why.

- 9 **Specific heat calculations**
 - a The specific heat of aluminum is 0.88 J/g°C. How many joules will it take to make the temperature of 50. g of Al go from 20.°C to 70.°C?
 - b What is the specific heat of silver if an 80.0 g sample is heated from 24.0°C to 49.0°C by adding 468 J?
 - c The specific heat of iron is 0.46 J/g°C. How many joules will it take to make the temperature of a 150. g bar go from 25°C to 60.°C?
 - d What is the specific heat of copper if a 75 g sample is heated from 20.°C to 24°C by adding 117 J?

- 10 **For each phase change, state the name of the process for each phase change and provide an example:**

Solid to liquid	Gas to solid.
Liquid to solid	Solid to gas.
Gas to liquid	Liquid to Gas

11 *Calculating joules: Round 1*

- a How many joules are needed to change the temperature of 100 g of water from 20°C to 40°C?
- b How many joules are needed to change the temperature of 15 g of water from 65°C to 95°C?
- c How many joules are needed to change the temperature of 40 g of water from 33°C to 23°C?
- d How many joules are needed to change the temperature of 25 g of water from 40°C to 100°C?
- e How many joules are needed to change the temperature of 22 g of water from 18°C to 33°C?

12 *Phase diagram. Refer to the 'Figure A' at the end of this problem set to answer the following questions.*

- a What is the temperature at which the substance can be both in the solid and the liquid phase?
- b During which lettered intervals is the internal potential energy of the substance increasing?
- c During which lettered intervals is the kinetic energy of the particles increasing?
- d How much heat is added to the substance from the time it stops melting to the time that it begins to boil?
- e What is the total heat needed to melt the substance (starting at time 0)?
- f What is the total heat needed to vaporize the substance (starting at time 0)?
- g What is the heat of vaporization of the substance?
- h During which lettered intervals is the substance solid?
- i During which lettered intervals is the substance in the liquid phase?
- j During which lettered intervals is the substance in the vapor phase?
- k What is the temperature at which the substance can be both in the liquid and the vapor phase?

13 *Calculating joules: Round 2*

Note: For part d, you will have to do research to find its density and then do some converting. Only factor label will be accepted.

- a How many joules of heat are needed to change 23 grams of ice into liquid water at its melting point?
- b How many joules of heat must be removed from 56 grams of steam to change it into liquid water at its condensing point?
- c How many joules of heat must be removed from 2.00 kilograms of liquid water to turn it into ice at its freezing point?
- d How many joules of heat must be added to 10.00 liters of liquid water to boil it if its at its boiling point.

14 *Calculating joules Round 3. For all calculations, temperature is given in degrees Celcius.*

- a How many joules of heat are needed to change 96 grams of ice at -32 degrees into liquid water at 54 degrees?
- b How many joules of heat must be removed from steam at 121 degrees to change it into liquid water at 2.00 degrees?
- c How many joules of heat must be added to liquid water at 10.0 degrees to turn it into steam at 142 degrees?

15 *Calculating joules Round 4 - The final round. For all calculations, temperature is given in degrees Celcius.*

- a How many joules of heat must be removed from steam at 111 degrees to turn it into ice at -41 degrees?
- b How many joules of heat are required to turn ice at -8.00 degrees into steam at 117 degrees?
- c How many joules of heat are needed to heat ice at 0.00 degrees into steam at 132 degrees?
- d How many joules are involved in changing steam at 100 degrees into ice at 0.00 degrees? Does heat need to be added or removed?

16 Explain why sweating cools you off. Correctly use the following terms in your explanation:

17 *Vapor pressure. Refer to the 'Figure B' at the end of this problem set to answer the following questions.*

- a Which of the substances above has the lowest boiling point?
- b Which of the substances above has a boiling point of 100°C?
- c Which of the substances above has the highest boiling point?
- d Which of the substances above has the highest vapor pressure at 40°C?
- e Which of the substances above will boil at 79°C?
- f At what temperature will alcohol boil when the atmospheric pressure is 50 kPa?
- g At what atmospheric pressure will propanone boil at 20°C?
- h At what atmospheric pressure will water boil at 90°C?
- i Which of the substances above has the lowest vapor pressure at 70°C?
- j As the pressure decreases, the boiling point of water (a) increases, (b) decreases, (c) remains the same.
- k What is the vapor pressure of water at 60°C?

Figure A

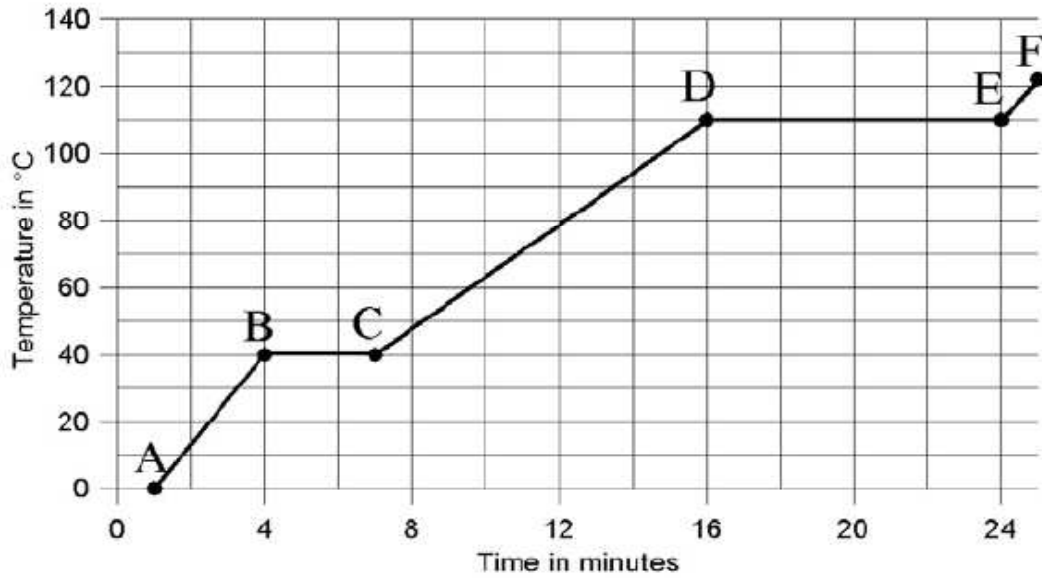


Figure B

