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Chemistry *~ Ms. Hart* **Class:** Anions or Cations

Station Review – Midterm January 2014

STATION 1: Chemical/physical properties and change

Key Points:
• Physical changes are changes in matter in which the appearance of a substance changes but the identity of the compound remains the same • Chemical changes are changes in matter in which the identity is changed • Physical properties include color, smell, freezing point, boiling point, melting point, density, etc. • Chemical properties include reactivity • In all chemical and physical changes, mass, energy, and charge must always be conserved • Elements can NOT be broken down by a chemical change. Compounds CAN be broken down by a chemical change.

Questions:

1. How do you distinguish between an element, compound, and mixture looking at just the chemical formula?

2. Which type of matter can be separated by PHYSICAL MEANS?

3. Which type of matter can be separated by CHEMICAL MEANS?

4. What are three examples of physical properties?

5. What are three examples of chemical properties?

6. What is an example of a physical change?

7. What is an example of a chemical change?

8. Which two substances can *not* be broken down by chemical change?
(1) C and CuO
(2) C and Cu
(3) CO_2 and CuO
(4) CO_2 and Cu

9. Two substances, A and Z, are to be identified. Substance A can *not* be broken down by a chemical change. Substance Z can be broken down by a chemical change. What can be concluded about theses substances?
(1) Both substances are elements.
(2) Both substances are compounds.
(3) Substance A is an element and substance Z is a compound.
(4) Substance A is a compound and substance Z is an element.

10. Which substance can be broken down by a chemical change?
(1) antimony
(2) carbon
(3) hexane
(4) sulfur

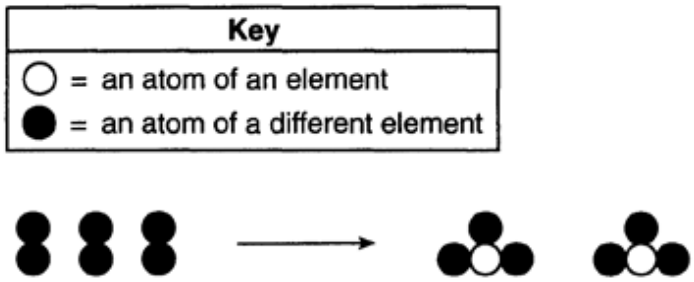
11. Which statement describes a chemical property of hydrogen gas?
(1) Hydrogen gas burns in air.
(2) Hydrogen gas is colorless.
(3) Hydrogen gas has a density of 0.00009 g/cm^3 at STP.
(4) Hydrogen gas has a boiling point of 20. K at standard pressure.

12. Which process is a chemical change?
(1) melting of ice
(2) boiling of water
(3) subliming of ice
(4) decomposing of water

13. Which statement describes a chemical property of silicon?
(1) Silicon has a blue-gray color.
(2) Silicon is a brittle solid at 20.°C.
(3) Silicon melts at 1414°C.
(4) Silicon reacts with fluorine.

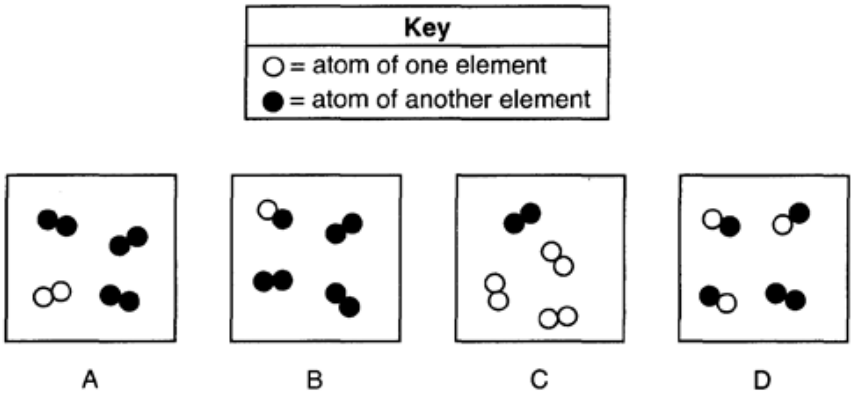
14. At STP, which physical property of aluminum always remains the same from sample to sample?
(1) mass
(2) density
(3) length
(4) volume

15. Given the balanced particle-diagram equation:



Which statement describes the type of change and the chemical properties of the product and reactants?
(1) The equation represents a physical change, with the product and reactants having different chemical properties.
(2) The equation represents a physical change, with the product and reactants having identical chemical properties.
(3) The equation represents a chemical change, with the product and reactants having different chemical properties.
(4) The equation represents a chemical change, with the product and reactants having identical chemical properties.

16. Which two particle diagrams represent mixtures of diatomic elements?



(1) A and B
(2) A and C
(3) B and C
(4) B and D

17. Which substance can be broken down by chemical means?
(1) CO
(2) Ce
(3) Ca
(4) Cu

18. Which statement describes a chemical property of the element magnesium?
(1) Magnesium is malleable.
(2) Magnesium conducts electricity.
(3) Magnesium reacts with an acid.
(4) Magnesium has a high boiling point.

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STATION 2: Heating/Cooling curves

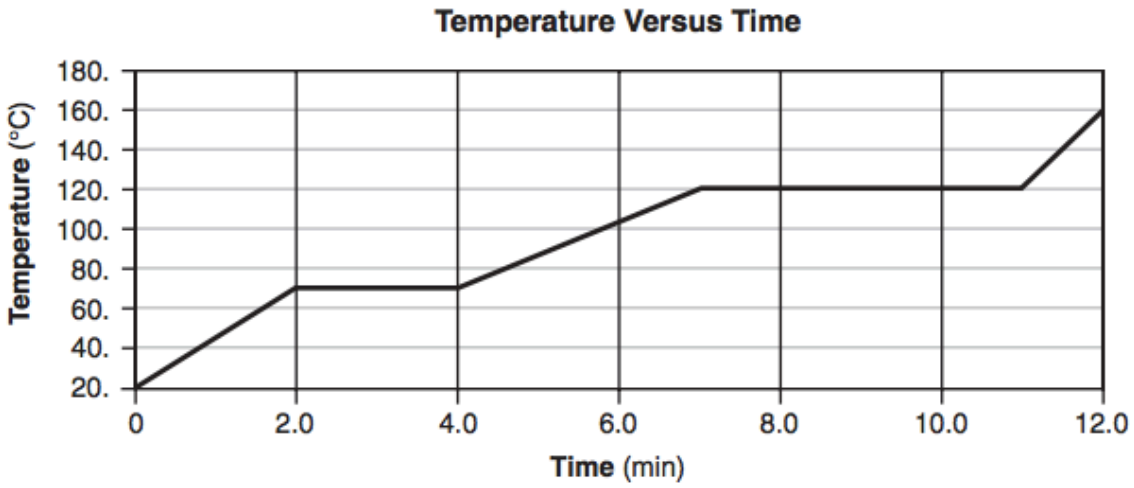
Key Points:
• Heating/Cooling curves are used to represent the change in average kinetic energy versus time/heat input. • Average kinetic energy is the same thing as temperature. • During a PHASE CHANGE, the average kinetic energy is constant (the graph is FLAT) and the potential energy is increasing on a heating curve and decreasing on a cooling curve. • While a substance is a specific state of matter (no phase change is occurring), the kinetic energy is increasing on a heating curve and decreasing on a cooling curve. • Melting point is between solid, liquid • Boiling point is between liquid and gas

Questions:

1. What is another phrase for temperature?

2. Describe what the temperature is like for a substance in the solid phase.

The temperature of a sample of a substance is increased from 20.°C to 160.°C as the sample absorbs heat at a constant rate of 15 kilojoules per minute at standard pressure. The graph below represents the relationship between temperature and time as the sample is heated.



3. What is the boiling point of this sample? [1]

4. Draw at least nine particles in the box, showing the correct particle arrangement of this sample during the first minute of heating. [1]

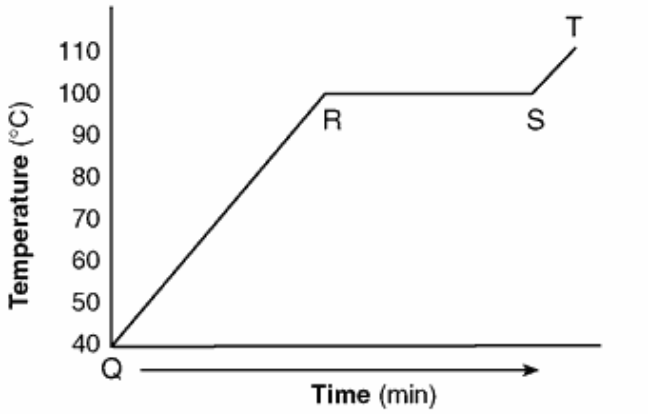
5. What is the total time this sample is in the liquid phase, only? [1]

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

7. Which sample of water contains particles having the highest average kinetic energy?
(1) 25 mL of water at 95°C
(2) 45 mL of water at 75°C
(3) 75 mL of water at 75°C
(4) 95 mL of water at 25°C

8. A sample of water is heated from a liquid at 40°C to a gas at 110°C. The graph of the heating curve is shown below.

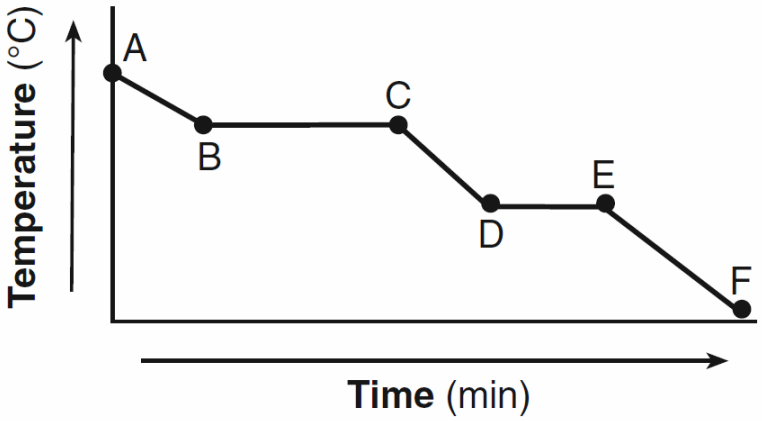
a. On the heating curve diagram provided below, label each of the following regions:
Liquid, only
Gas, only
Phase change



b. For section QR of the graph, state what is happening to the water molecules as heat is added.

c. For section RS of the graph, state what is happening to the water molecules as heat is added

9. 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

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STATION 3: Heat equations

Key Points:
• A phase change is when a substances goes from one state of matter to another state of matter • The three states of matter are solid, liquid and gas • There are two heat equations: one for the heat of a phase change ($q=mH_f$ or $q=mH_v$) and the other for the heat of a temperature change ($q = mC\,\Delta T$). • The two heat equations are located in Table T on your reference sheets • M is the mass of the substance • C is the specific heat capacity • H_f and H_v will either be given, or you can find them in Table B.

Questions:

1. Which heat equation will you use for a temperature change?

2. Give an example of a phase change water could undergo.

3. 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) 6,680 J
(4) 45,200 J

4. What amount of heat is required to completely melt a 29.95-gram sample of H2O(s) at 0°C?

(1) 334 J
(2) 2260 J
(3) 1 × 103 J
(4) 1 × 104 J

5. How much heat energy must be absorbed to completely melt 35.0 grams of H2O(s) at 0°C?

(1) 9.54 J
(2) 146 J
(3) 11 700 J
(4) 79 100 J

6. At 1 atmosphere of pressure, water and ice can exist in equilibrium at a temperature of

(1) 212°C
(2) 100°C
(3) 32°C
(4) 0°C

7. When 200 grams of water cools from 50.°C to 25°C, the total amount of heat energy released by the water is
(1) 42 kJ
(2) 21 kJ
(3) 34 J
(4) 17 J

8. What is the total number of Joules of heat energy absorbed by 15 grams of water when it is heated from 30.°C to 40.°C?
(1) 42 J
(2) 63 J
(3) 130 J
(4) 630 J

9. What is the total number of kiloJoules required to boil 100. grams of water at 100°C and 1 atmosphere?
(1) 22.6 kJ
(2) 33.4 kJ
(3) 226 kJ
(4) 334 kJ

10. 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

11. The temperature of a sample of water changes from 10°C to 20°C when the sample absorbs 418 joules of heat. What is the mass of the sample?
(1) 1 g
(2) 10 g
(3) 100 g
(4) 1000 g

12. An 80.0-gram sample of water at 10.0°C absorbs 1680 Joules of heat energy. What is the final temperature of the water?
(1) 50.0°C
(2) 15.0°C
(3) 5.00°C
(4) 4.00°C

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THE URBAN ASSEMBLY SCHOOL FOR CRIMINAL JUSTICE

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STATION 4: Isotope

Key Points:

- The atom is made up of two parts: the nucleus and the electron cloud
- There are three subatomic particles that make up the atom: protons, electrons, neutrons
- Every element is defined solely by the number of protons
- The atomic number and atomic mass can be found on the periodic table
- The atomic number is the number of protons in an atom and the atomic mass is the weighted average of the masses of the isotopes (atomic mass also equals the number protons plus the number of neutrons).
- Isotopes are atoms of the same element that have different number of neutrons

1. What is the mass of 1 proton?

2. What is the mass of 1 neutron?

3. What is the mass of 1 electron?

4. How do you count the number of protons in an atom?

5. How do you count the number of neutrons in an atom?

6. What is an isotope?

7. Which subatomic particle has no charge?
(1) neutron
(2) electron
(3) alpha particle
(4) beta particle

8. The atomic number of an atom always equal to the number of its
(1) protons, only
(2) protons plus electrons
(3) neutrons, only
(4) protons plus neutrons

9. Which two particles each have a mass approximately equal to one atomic mass unit?
(1) electron and neutron
(2) proton and electron
(3) proton and neutron
(4) electron and positron

10. What is the total charge of the nucleus of a carbon atom?
(1) 0
(2) +12
(3) -6
(4) +6

11. The nucleus of an atom of K-42 contains
(1) 20 protons and 19 neutrons
(2) 23 protons and 19 neutrons
(3) 19 protons and 23 neutrons
(4) 19 protons and 42 neutrons

12. Which statement best describes the nucleus of an aluminum atom?
(1) It has a charge of -13 and is surrounded by a total of 10 electrons.
(2) It has a charge of -13 and is surrounded by a total of 13 electrons.
(3) It has a charge of +13 and is surrounded by a total of 10 electrons.
(4) It has a charge of +13 and is surrounded by a total of 13 electrons.

13. Which list consists of elements that have the most similar chemical properties?
(1) Mg, Ca, and Ba
(2) K, Al, and Ni
(3) K, Ca, and Ga
(4) Mg, Al, and Si

14. Which two elements have the most similar chemical properties?
(1) Be and Mg
(2) Cl and Ar
(3) Na and P
(4) Ca and Br

15. Which quantity identifies an element?
(1) atomic number
(2) mass number
(3) total number of neutrons in an atom of the element
(4) total number of valence electrons in an atom of the element

16. Chlorine-37 can be represented as
(1) $^{17}_{35}Cl$
(2) $^{20}_{37}Cl$
(3) $^{35}_{20}Cl$
(4) $^{37}_{17}Cl$

17. What is the total number of neutrons in an atom of Cl-37
(1) 17
(2) 37
(3) 20
(4) -17

26.

Naturally Occurring Isotopes of Silicon

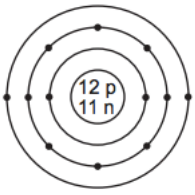
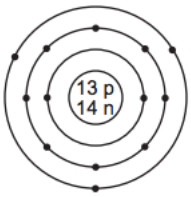
Isotope	Atomic Mass (atomic mass units)	Percent Natural Abundance (%)
Si-28	27.98	92.22
Si-29	28.98	4.69
Si-30	29.97	3.09

a) Determine the total number of neutrons in an atom of Si-29.

27.

Atomic Diagrams of Magnesium and Aluminum

Key
• = electron

Element	Lewis Electron-Dot Diagram	Electron-Shell Diagram
magnesium	Mg:	
aluminum	Al:	

a) Identify one piece of information shown in the electron-shell diagrams that is not shown in the Lewis electron-dot diagrams.

b) Determine the mass number of the magnesium atom represented by the electron-shell diagram.

31. Explain, in terms of subatomic particles, why K-37 and K-42 are isotopes of potassium.

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STATION 5: Average Atomic Mass

Key Points:
• The mass of an atom comes from the protons and neutrons. Electrons have very little mass. All of the mass is in the nucleus • The atomic mass is the weighted average of the masses of the isotopes. We can find it by knowing the mass and percent abundance of each of the isotopes of an element. • To find the average atomic mass, we simply take the percent abundance and move the decimal place over two places to the left to change the percentage to a decimal. Then we multiple this decimal by the mass of that particular element. Finally, we add up these relative masses of each isotope and our final answers it the average atomic mass.

1. What subatomic particles have mass in an atom?

2. How do you convert a percentage to a decimal?

3. Why is the atomic mass given in the reference table a decimal?

4. Explain the steps required to calculate the average atomic mass of an element?

5. The atomic mass of an element is calculated using the
(1) atomic number and the ratios of its naturally occurring isotopes
(2) masses and the half-lives of each of its isotopes
(3) atomic number and half-lives of each of its isotopes
(4) masses and the ratios of its naturally occurring isotopes

6. The atomic masses and the natural abundances of the two naturally occurring isotopes of lithium are shown in the table below.

Lithium Isotopes

Isotope	**Atomic Mass** (u)	**Natural Abundance** (%)
Li-6	6.02	7.5
Li-7	7.02	92.5

Which numerical setup can be used to determine the atomic mass of lithium?
(1) (0.075)(6.02 u) + (0.925)(7.02 u)
(2) (0.925)(6.02 u) + (0.075)(7.02 u)
(3) (7.5)(6.02 u) + (92.5)(7.02 u)
(4) (92.5)(6.02 u) + (7.5)(7.02 u)

7. The atomic mass of titanium is 47.88 atomic mass units. This atomic mass represents the
(1) total mass of all the protons and neutrons in an atom of Ti
(2) total mass of all the protons, neutrons, and electrons in an atom of Ti
(3) weighted average mass of the most abundant isotope of Ti
(4) weighted average mass of all the naturally occurring isotopes of Ti

Naturally Occurring Isotopes of Silicon

Isotope	Atomic Mass (atomic mass units)	Percent Natural Abundance (%)
Si-28	27.98	92.22
Si-29	28.98	4.69
Si-30	29.97	3.09

8. In the space below, show a correct numerical setup for calculating the atomic mass of Si.

9. A scientist calculated the percent natural abundance of Si-30 in a sample to be 3.29%. Determine the percent error for this value.

10. Base your answer to the next 4 questions on the table below.

Naturally Occurring Isotopes of Copper

Isotope Notation	Percent Natural Abundance (%)	Atomic Mass (atomic mass units, u)
Cu-63	69.17	62.930
Cu-65	30.83	64.928

Show a correct numerical setup for calculating the atomic mass of copper.

11. Base your answer to the next 3 questions on the data table below, which shows three isotopes of neon.

Isotope	Atomic Mass (atomic mass units)	Percent Natural Abundance
^{20}Ne	19.99	90.9%
^{21}Ne	20.99	0.3%
^{22}Ne	21.99	8.8%

Based on natural abundances, the average atomic mass of neon is closest to which whole number?

Based on the atomic masses and the natural abundances shown in the data table show a correct numerical setup for calculating the average atomic mass of neon.

In terms of atomic particles, state one difference between these three isotopes of neon.

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STATION 6: Ions

Key Points:
• Electrons have a negative charge, protons have a positive charge, neutrons have no charge • When an atom is neutral, it has an equal number of protons (positive) and electrons (negative) • If an atom loses an electron, there are more protons then electrons and the atom becomes positive or has a positive charge (cation) • If an atom gains an electron, there are more electrons then protons and the atom becomes negative or has a negative charge (anion)

Questions:

1. What is the charge of an electron?
2. What is the charge of a proton?
3. An atom gains two electrons. What will be the overall charge of the atom?
4. An atom loses one electron. What will be the overall charge of the atom?
5. How do you count the number of protons in an atom?
6. How do you count the number of electrons in an atom?

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Questions:

1. What is the charge of an electron?
2. What is the charge of a proton?
3. An atom gains two electrons. What will be the overall charge of the atom?
4. An atom loses one electron. What will be the overall charge of the atom?
5. How do you count the number of protons in an atom?
6. How do you count the number of electrons in an atom?

7. How is an atom different from an ion?

8. Which statement best describes the nucleus of an aluminum atom?
   (1) It has a charge of -13 and is surrounded by a total of 10 electrons.
   (2) It has a charge of -13 and is surrounded by a total of 13 electrons.
   (3) It has a charge of +13 and is surrounded by a total of 10 electrons.
   (4) It has a charge of +13 and is surrounded by a total of 13 electrons.

9. What kind of ion (anion or cation) will form if an atom loses one electron?

10. What kind of ion (anion or cation) will form if an atom gains one electron?

11. When metals combine with nonmetals, the metallic atoms tend to
(1) lose electrons and become positive ions
(2) lose electrons and become negative ions
(3) gain electrons and become positive ions
(4) gain electrons and become negative ions

7. How is an atom different from an ion?

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   (1) It has a charge of -13 and is surrounded by a total of 10 electrons.
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(4) gain electrons and become negative ions