**Regents Chemistry Extra Review Packet for Midterm Exam 2015-2016**

**Name:**

**Atomic Structure**

1. What is the definition of each of the following terms:
   1. Atomic number **= number of protons**
   2. Mass number **= number of proton plus number of neutrons**
   3. Isotope **= two (or more) atoms of the same element with different # neutrons (so have different mass numbers) examples: 146C and 136C and 126C**
   4. Nucleon **= term used to collectively indicate the protons and neutrons in the nucleus**
2. The number of electrons in a neutral atom is equal to the number of \_\_**protons**\_\_\_\_
3. Complete the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Atom** | **# of protons** | **# of neutrons** | **# of electrons** | **Atomic #** | **Mass #** |
| **126C** | **6** | **6** | **6** | **6** | **12** |
| **73Li** | **3** | **4** | **3** | **3** | **7** |
| **2311Na** | **11** | **12** | **11** | **11** | **23** |
| **31H** | **1** | **2** | **1** | **1** | **3** |
| **42He** | **2** | **2** | **2** | **2** | **4** |

1. Describe Rutherford’s famous experiment. What were the two results of the experiment and what conclusion did Rutherford draw from each result?

**1. positively charged part of atom is very small and is located in the center of the atom**

**2. majority of the atom is empty space**

1. What is the difference between an isotope and an ion?

**Isotopes are 2+ same atoms with different # neutrons**

**Ions are atoms that are charged due to losing/gaining electrons**

1. Given that chlorine is 75% Cl-35 and 25% Cl-37, calculate the average atomic mass of chlorine.

(.75)(35) + (.25)(37) = 35.5 amu

1. What radioactive isotope is used to date organic material (wool, linen, wood, bones, etc)?

**C-14**

1. What is the absolute temperature scale?

**Kelvin**

1. In the Bohr model of the atom, describe the type of electron transition which will result in the production of a spectral line. Is this transition endothermic or exothermic?

**electrons transitioning from higher energy levels to lower energy levels emit wavelengths of light (bright line spectra) - this is an exothermic process since energy is emitted**

1. How many atoms are represented in the formula (NH4)2SO4?

**2 atoms of N, 8 atoms of H, 1 atom of S, 4 atoms of O for a total of 15 atoms**

1. What are two common substances that sublime?

**CO2(s) [carbon dioxide] and I(s)**

**Periodic Table**

1. What is nuclear charge? What is effective nuclear charge?

* **Nuclear charge is the charge of the nucleus = positive sign with # protons in nucleus**

**- example: nuclear charge of K is +19**

* **Effective nuclear charge: charge felt by valence electrons** 
  + **Calculate: # protons minus # kernel electrons**

1. What is ionization energy?

**amount of energy needed to remove the most loosely held electron (valence)from an atom**

1. What is electronegativity?

**ability of an atom to hold onto its own electrons & attract its neighbor’s electrons**

1. What are the trends for atomic size, ionization energy, & electro negativity in the Periodic Table?

* **Atomic size ↑ as go down a column from top to bottom and ↓ as go left to right across a row**
* **electro negativity increases from bottom left (Fr) to upper right (F)**
* **ionization energy ↓ as go down a column from top to bottom and ↑ as go left to right across a row**

**Intermolecular Forces**

1. What are the three IMF? Which force is weakest? Which force is strongest?

**Dispersion (weakest), diploe-dipole, H-bonds (strongest)**

1. Describe the kind of molecule that exhibits each kind of intermolecular force (ex: polar, non-polar, etc)

**Dispersion: monatomic elements, diatomic elements, non-polar molecules (symmetrical)**

* **Ca, Ni, H2, O2, CH4, CO2**

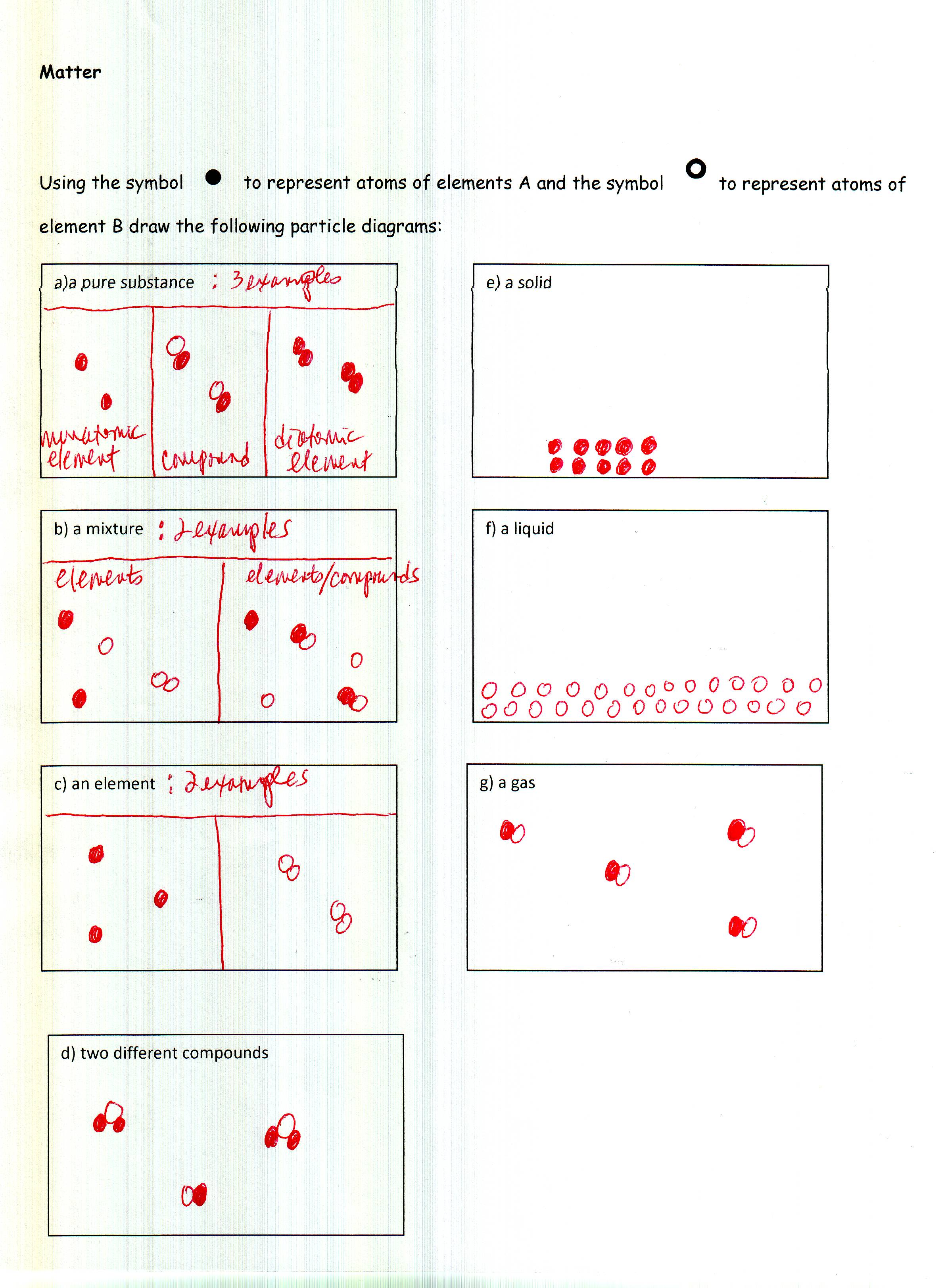
**Dipole-dipole: polar molecules (asymmetrical)**

* **CH3Cl, HCl**

**H bonds: H bonded to F, O, N**

* **HF, H2O, NH3**

1. Why does water have a high boiling point? **has H bonds (strongest IMF)**
2. What kind of IMF exists between each of the following molecules?
   1. CH4 \_\_\_**dispersion**\_\_\_\_
   2. HCl \_\_**dipole-dipole**\_\_\_\_
   3. CH3OH \_\_ **H bonds**\_\_\_
   4. CO2 \_\_\_ **dispersion** \_\_\_
   5. Xe \_\_\_ **dispersion** \_\_\_\_
   6. NH3 \_\_\_**H bonds**\_\_
   7. He \_\_\_ **dispersion** \_\_\_\_
   8. N2 \_\_\_\_ **dispersion** \_\_\_
   9. HF \_\_\_**H bonds**\_\_\_



**Energy Changes:** Identify the Q equation needed to solve each of the following energy word problems below, then solve each problem.

1. How much energy is required to heat a 35.0 g sample of water from 35ºC to 75ºC?

Equation:\_\_\_\_**Q = mcΔT**\_\_\_\_\_\_\_

**Q = (35.0g)(4.18J/gºC)(40 ºC) = 5,852 J**

1. An ice cube at 0˚C with a mass of 175.0g melts. How much energy does the ice absorb to melt?

Equation: \_\_\_\_**Q = mHf**\_\_\_\_\_\_\_\_\_\_\_\_\_

**Q = (175.0g)(334J/g) = 58,450 J**

1. An 85.0g sample of water at 100.0˚C boils. How much energy is required to convert the water to steam at 100.0˚C?

Equation: \_\_\_\_ **Q = mHv** \_\_\_\_\_\_\_\_\_\_\_

**Q = (85.0g)(2260J/g) = 192,100 J**

1. A sample of water with a mass of 160.0g is heated from 15.0˚C to 70.0˚C. How much energy is required to heat the water?

Equation: \_\_\_\_\_ **Q = mcΔT** \_\_\_\_\_\_\_\_

**Q = (160.0g)( 4.18J/gºC)(55ºC) = 36,784 J**

1. 450.0g of water at 0.0˚C is frozen to ice at 0.0˚C. How much energy is released to the environment?

Equation: \_\_\_\_\_\_ **Q = mHf**\_\_\_\_\_\_\_\_

**Q = (450.0g)(334J/g) = 150,300 J**

1. 200.0g of steam at 100.0˚C condenses to water at 100.0˚C. How much energy is released to the environment?

Equation: \_\_\_\_ **Q = mHv** \_\_\_\_\_\_

**Q = (200.0g)(2260J/g) = 452,000 J**

1. A 225g sample of water is cooled from 95.0˚C to 40.0˚C. How much energy is released to the environment?

Equation: \_\_\_\_\_ **Q = mcΔT** \_\_\_\_

**Q = (225g)(4.18J/gºC)(-55ºC) = (-) 51,727.5 J**

1. A block of ice at 0.0˚C with a mass of 1.0kg melts. How much energy is absorbed from the environment to convert it to water at 0.0˚C?

Equation: \_\_\_\_ **Q = mHf**\_\_\_\_\_\_\_\_\_

**Q = (1000g)(334J/g) = 334,000 J**

1. A 200.0g sample of water at 100.0˚C is boiled and converted to steam at 100.0˚C. How much energy is required?

Equation: \_\_\_\_\_ **Q = mHv**\_\_\_\_\_\_\_

**Q = (200.0g)(2260J/g) = 452,000 J**

1. If you carry out a reaction in a Styrofoam cup calorimeter and
   1. the temperature of the water increases, is the reaction endothermic or **exothermic**?
   2. the temperature of the water decreases, is the reaction **endothermic** or exothermic?
   3. How would you calculate the energy change? **Q = mcΔT**

**Phase Changes**

|  |
| --- |
| boiling endothermic heat of fusion phase change condensation  evaporation heat of vaporization solid constant exothermic  increasing sublimation decreasing fusion liquid  temperature deposition gas melting vaporization |

1. \_**temperature**\_ is a measure of the average kinetic energy of the particles of a substance.
2. \_**vaporization**\_ is another word for boiling.
3. \_**heat of fusion**\_ is the amount of energy required to melt one gram of a solid at its melting point.
4. \_**fusion**\_\_ is another word for melting.
5. One type of physical change is a \_**phase change**\_\_\_.
6. Solid to liquid or gas is an example of an \_**endothermic**\_\_ process.
7. \_**\_evaporation**\_\_ is the spontaneous change from liquid to gas at any temperature.
8. \_\_**sublimation**\_\_ is the change from solid phase to gas phase.
9. The average kinetic energy of the particles of a substance is increasing when the temperature is \_\_**\_increasing**\_\_\_\_\_\_.
10. \_\_**gas**\_\_ takes the shape and volume of its container.
11. \_\_**boiling**\_\_ is the change from liquid phase to gas phase at a constant temperature.
12. \_\_**condensation**\_ is a change from gas to liquid phase which is noticeable on glass.
13. \_\_**melting**\_\_\_ is the change from solid to liquid phase at a constant temperature.
14. \_\_**heat of vaporization**\_\_ is the amount of energy required to convert one gram of a liquid to the gas phase at its boiling point.
15. \_\_**deposition**\_ is the change from gas phase to the solid phase.
16. \_\_**solid**\_\_ has a definite shape and a definite volume.
17. Gas to liquid or solid is an example of an \_**exothermic**\_\_ process.
18. When the temperature is constant, the average kinetic energy of the particles in a substance is \_\_\_**constant**\_\_\_\_.
19. \_\_**liquid**\_\_ has definite volume and indefinite shape.
20. When temperature decreases, the average kinetic energy of the particles of a substance is \_\_**decreasing**\_\_\_.