Unit 4 – Review

Fill in the blanks in the table with the words in the list below.

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                                    ┌─────────────┐
                                    │ _____ │
                                    └──────┬──────┘
              ┌────────────────────────────┼────────────────────────────┐
              ▼                             ▼                            ▼
   ┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐
   │ _____              │   │ _____              │   │ _____              │
   │ Particles are        │   │ Particles constantly │   │ Strong attractions   │
   │ independent,         │   │ make and break       │   │ between particles    │
   │ widely separated,    │   │ temporary attractions│   │ lock them into a     │
   │ with no attractive   │   │ between each other.  │   │ fixed arrangement.   │
   │ forces between them. │   │ Particles can slip   │   │                      │
   │ They fill the volume │   │ past one another     │   │                      │
   │ of the container.    │   │ easily. They take    │   │                      │
   │                      │   │ the shape of the     │   │                      │
   │                      │   │ container.           │   │                      │
   └──────────┬───────────┘   └──────────────────────┘   └──────────┬───────────┘
              └──────────────────────┬───────────────────────────────┘
                    ▼                                    ▼
   ┌──────────────────────────────┐   ┌──────────────────────────────┐
   │ _____                      │   │ _____                      │
   │ These have fixed             │   │ These have variable          │
   │ compositions, one set of     │   │ composition. Their physical  │
   │ intrinsic physical           │   │ properties vary depending    │
   │ properties (density, mp,     │   │ on the composition. They can │
   │ bp). and can be separated    │   │ be separated by physical     │
   │ only by chemical means       │   │ means.                       │
   └──────────┬───────────────────┘   └──────────────────────────────┘
          ▼              ▼
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_____
Particles are independent, widely separated, with no attractive forces between them. They fill the volume of the container.

_____
Particles constantly make and break temporary attractions between each other. Particles can slip past one another easily. They take the shape of the container.

_____
Strong attractions between particles lock them into a fixed arrangement.

_____
These have fixed compositions, one set of intrinsic physical properties (density, mp, bp). and can be separated only by chemical means

_____
These have variable composition. Their physical properties vary depending on the composition. They can be separated by physical means.

_____
These cannot be broken down into simpler substances by physical or chemical means. The smallest particle of this is called an atom.

_____
These are made of elements in fixed mass ratios. They can be broken down into simper substances by chemical means.

_____
Exists in one phase only and has uniform properties throughout the sample.

_____
May exist in more than one phase and have variable properties in different parts of the sample

Heterogeneous	Liquid
Matter	Solid
Pure Substance	Mixtures
Elements	Compounds
Homogeneous	Gases

1. Describe the contents of each cell using the terms atoms, molecules, element, compound, mixture, solid, liquid and gas.
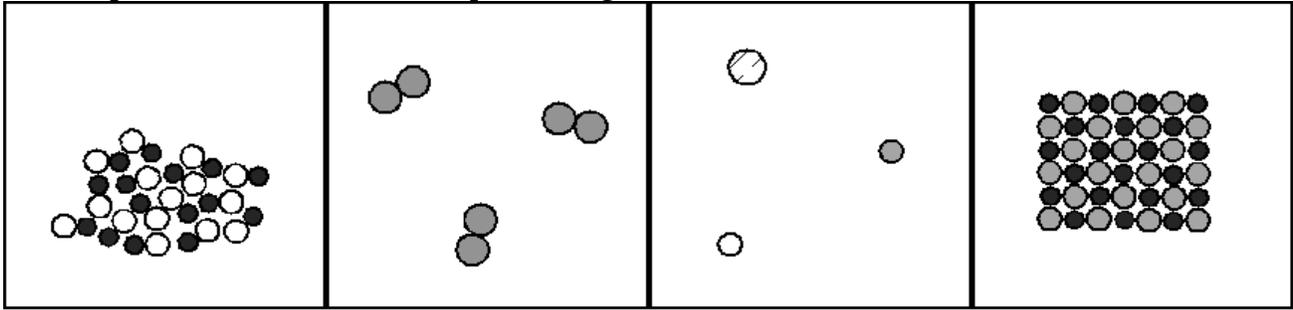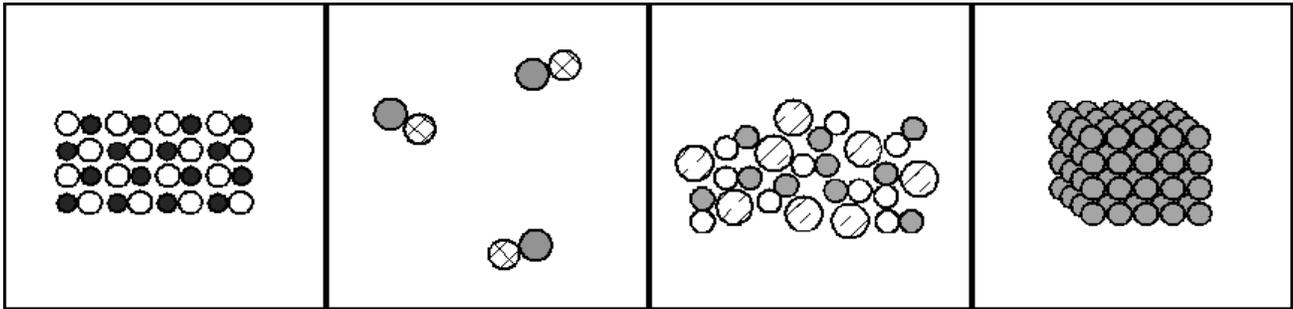

A   B   C   D

2.
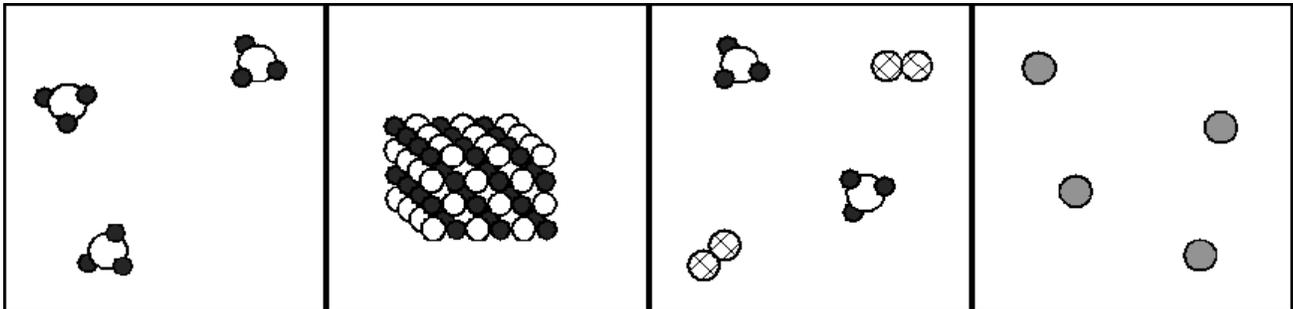

A   B   C   D

3.
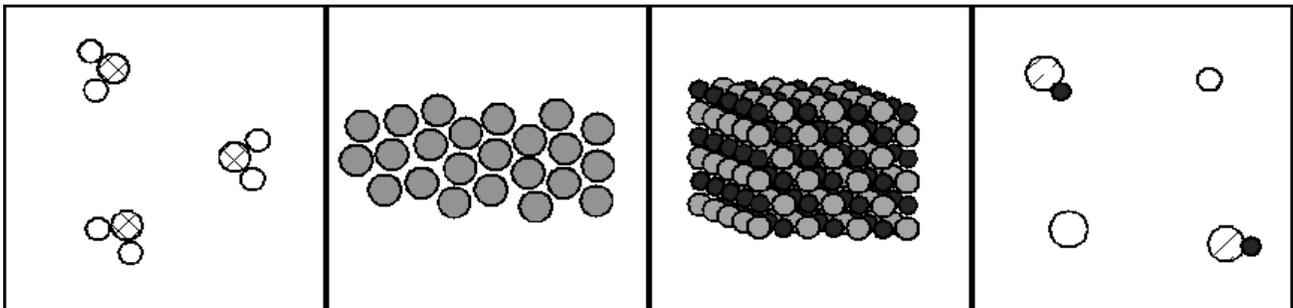

A   B   C   D

4.
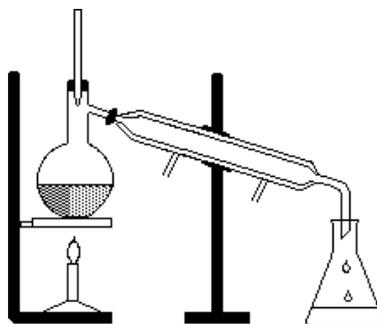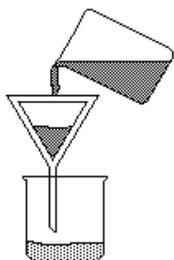

A   B   C   D

5. Identify the separation techniques pictured below. Which technique would be useful to separate a mixture of sand and salt? Of salt and water?

6. Definitions

   a. mole

   b. molar mass

   c. Avogadro's number

   d. empirical formula

   e. molecular formula

7. Find the molar mass of the following:

   a. KNO_3 _____   d. oxygen gas _____

   b. $(NH_4)_2CO_3$ _____   e. $Ca(NO_3)_2$ _____

   c. Ag_2CrO_4 _____   f. $PbSO_4$ _____

8. Consider the masses of various hardware below.

Type	Mass (g)	Relative mass
Washer	1.74	
Hex nut	3.16	
Anchor		3.00
Bolt	7.64	

   a. Do the calculations necessary to complete the table.

b. Explain the connection between these calculations and the atomic masses in the Periodic Table.

9. Convert from g → moles or from moles → g. Show units.

a. 12.0 g Fe x _____ = _____ moles

b. 25.0 g of Cl_2 gas x _____ = _____ moles

c. 0.476 g of $(NH_4)_2SO_4$ x _____ = _____ moles

d. 0.15 moles $NaNO_3$ x _____ = _____ g

e. 0.0280 moles NO_2 x _____ = _____ g

f. 0.64 moles $AlCl_3$ x _____ = _____ g

10. Use Avogadro's number to do the following. Show work, use labels.

a. How many atoms are there in 0.00150 moles Zn?

b. If you had 2.50 moles of oxygen gas, what mass of the gas would be in the sample?

c. A 4.07 g sample of NaI contains how many atoms of Na?

d. How many atoms of chlorine are there in 16.5 g of iron (III) chloride, $FeCl_3$?

*e. What is the mass of 100 million atoms of gold? Could you mass this on a balance?

11. Calculate the empirical formula of a compound that contains 4.20 g of nitrogen and 12.0 g of oxygen.

12. When 20.16 g of magnesium oxide reacts with carbon, carbon monoxide forms and 12.16 g of Mg metal remains. What is the empirical formula of magnesium oxide?

13. What is the molecular formula of each compound?

Empirical Formula	Actual Molar Mass of Compound	Molecular Formula
CH	78 g/mole	_____
NO_2	92 g/mole	_____

14. A compound is composed of 7.20 g of carbon, 1.20 g of hydrogen and 9.60 g of oxygen. The molar mass of the compound is 180 g/mole. Determine the empirical and molecular formulas of this compound.

15. What is the % by mass of oxygen in water?

16. A compound of iron and oxygen is found to contain 28 g of Fe and 8.0 g of O. What is the % by mass of each element in the compound?