Chemistry 11 – Taking a closer look at TYPES OF DECOMPOSITION REACTIONS **ANSWERS**

1) Metal carbonates decompose to produce metal oxides and carbon dioxide.

Sodium carbonate \rightarrow Na₂CO₃(s) \rightarrow Na₂O(s) + CO₂(g)

Calcium carbonate \rightarrow calcium oxide + carbon dioxide CaCO₃(s) \rightarrow CaO(s) + CO₂(g)

Potassium carbonate \rightarrow potassium oxide + carbon dioxide K₂CO₃ (s) \rightarrow K₂O (s) + CO₂(g)

2) Metal hydroxides decompose to produce metal oxides and water.

Calcium Hydroxide \rightarrow Ca(OH)₂ (s) \rightarrow CaO (s) + H₂O(l)

Zinc hydroxide \rightarrow zinc oxide + water Zn(OH)₂(s) \rightarrow ZnO (s) + H₂O(l)

Iron (III) hydroxide \rightarrow iron (III) oxide + water 2Fe(OH)₃ (s) \rightarrow Fe₂O₃ (s) + 3H₂O(l)

3) Metal chlorates decompose to produce metal chlorides and oxygen gas.

Potassium chlorate \rightarrow 2KClO₃(s) \rightarrow 2KCl(s) + 3O₂(g)

Magnesium chlorate \rightarrow magnesium chloride + oxygen

 $Mg(ClO_3)_2(s) \rightarrow MgCl_2(s) + 3O_2(g)$

Remember that diatomic elements like oxygen would be O_2 even if they were liquid. A diatomic element is NOT dependent on it being in the gaseous state.

Nickel (II) chlorate \rightarrow nickel (II) chloride + oxygen Ni(ClO₃)₂(s) \rightarrow NiCl₂ (s) + **3**O₂(g)

4) Oxyacids decompose to produce water and a nonmetal oxide gas.

Carbonic acid \rightarrow H₂CO₃ (aq) \rightarrow H₂O (l) + CO₂ (g)

Sulphuric acid \rightarrow water and Sulphur trioxide H₂SO₄ (aq) \rightarrow H₂O (l) + SO₃ (g)

Boric acid \rightarrow water and diboron trioxide 2H₃BO₃ (aq) \rightarrow 3H₂O (l) + B₂O₃ (g)

5) Metal oxides decompose to produce metals and oxygen gas.

Mercury (II) oxide → 2HgO (s) → 2Hg (l) +O₂ (g) *Mercury is a liquid at room temperature*

Copper (II) oxide \rightarrow copper (solid at room temp) and oxygen (gas at room temp) 2CuO (s) \rightarrow 2Cu (s) + O₂ (g)

Silver oxide \rightarrow silver and oxygen Ag₂O (s) \rightarrow **2**Ag (s) + $\frac{1}{2}$ O₂(g)

7) Hydrates are compounds that readily absorb water into their crystal structure. When a hydrate decomposes, water is removed.

Barium iodide dihyrate \rightarrow BaI₂ • 2H₂O(s) \rightarrow BaI₂(s) + 2H₂O(l)

Copper (II) sulphate pentahydrate \rightarrow copper (II) sulphate plus water CuSO₄ • **5**H₂O(s) \rightarrow CuSO₄ (s) + **5**H₂O(l)

Magnesium chloride hexahydrate \rightarrow magnesium chloride plus water MgCl₂ • **6**H₂O(s) \rightarrow MgCl₂(s) + **6**H₂O(l)

7) Some compounds can be decomposed by electricity into their elements. NOTE THAT This is very different than dissociation of solutions into ions!

Sodium chloride \rightarrow sodium solid and chlorine gas

 $2 \text{NaCl}(s) \rightarrow 2 \text{Na}(s) + Cl_2(g)$

SOLID Silver bromide \rightarrow (decomposition can occur with only the addition of sunlight) **2**AgBr (s) \rightarrow **2**Ag(s) + Br₂(l)

Bromine is a diatomic element. It is also a liquid at room temperature

SOLID Aluminum oxide \rightarrow 2Al₂O₃ (s) \rightarrow 4Al (s) + 3O₂ (g)

8) AS PART OF THE ABOVE CATEGORY, Water can decompose to produce oxygen gas and hydrogen gas. Often by the process of electrolysis (decomposition by applying electricity).

WATER \rightarrow hydrogen (gas) and oxygen (gas) 2H₂O (l) \rightarrow 2H₂(g) + O₂(g)