Coupled reaction assignment

Coupled Reactions Louella Rose E. Tan, Frances May L. Coralde Institute of Chemistry, University of the Philippines, Diliman, Quezon City 1101 Philippines Results and Discussion A combustion reaction is a reaction that liberates heat and light. Magnesium is a stable element and reacts violently with evolution of much heat and light. The reason the magnesium burned in carbon dioxide was because it combined with the oxygen in the CO_2 leaving elemental carbon behind. $CO_2(g)$ $C(S) + O_2(g)$ $2Mg(S) + O_2(g)$ $2MgO(S)$ $2Mg(S) + CO_2(g)$ $2MgO(S) + C(S)$

The Mg ribbon burned in air resulted to a white product while the Mg ribbon burned in dry ice had a black product. The white product formed was MgO(S) while the black product formed was C(S). The magnesium had been oxidized and the carbon in carbon dioxide has been reduced to elemental carbon. The Mg ribbon burned in dry ice also had some white products. It was due to the reaction with oxygen in air when it was being lighted up. Before the slab of dry ice was put on top, some oxygen already reacted with magnesium resulting to a white product.

References Silberberg, M. S. , Principles of General Chemistry, 2nd edition. McGraw-Hill Companies, Inc. , 2010; page 692-693 Answers to Question 1. Why does it take a long time to light the Mg ribbon? Starting a fire requires oxygen, fuel and a source of heat. Since the Mg ribbon is placed on dry ice which is made up of CO_2, the needed oxygen is replaced by the CO_2 which is denser and thus the burning of Mg ribbon takes a long time. 2. Why is it important to immediately cover the Mg ribbon with the other slab of dry ice once it starts burning?

If it is not covered immediately by dry ice the Mg ribbon will react with oxygen instead of CO_2 leaving more white product than black. 3. Using theoretical ? G? values for the reactants and products in the system, calculate the ? G? rxn. Explain experimental observations based on the calculated ? G? rxn. 2Mg (S) + CO_2(g) 2MgO(S) + C(S) ? G? rxn= ? Gproducts-? Greactants = (2*? GMgO+? GC(s))-(? GCO_2+2*? GMg (S)) = (2*-569. 4+0)-(-394. 4+2*0) kJ/mol ? G? rxn= -744. 4 kJ/mol 4. Give two other reactions that can be coupled with Mg.

Show pertinent equations and ? G rxn. HgO(s) Hg(l) + $12O_2$(g)? G? = 58. 5 kJ/mol Mg(S) +$12O_2$(g) MgO(S) ? G? = -569. 4 kJ/mol Mg(S) +2HgO(s)Hg(l) +MgO(S) ? G? = -510. 9 kJ/mol FeO(s) Fe(s) + $12O_2$(g) ? G? = 251. 4 kJ/mol Mg(S) +$12O_2$(g) MgO(S) ? G? = -569. 4 kJ/mol Mg(S) +FeO(s) Fe(s)+ MgO(S) ? G? = -318 kJ/mol 5. Some of the enzyme-catalyzed reactions in the body can be interpreted as a coupled reaction. An example of which is the hexokinase-catalyzed eaction in glycolysis wherein ATP is spent in order to convert glucose (sugar) molecules to glucose-6-P, a form that can readily enter the cell: ATP + H_2O ADP + Pi ? G? = -31 kJ/mol Pi + glucose glucose-6-P + H_2O ? G? = +14 kJ/mol where ATP is adenosine triphosphate, ADP is adenosine diphosphate and Pi is inorganic phosphate. From the two equations given, derive the net reaction happening in the cell and label which reactions are endergonic and exergonic. Calculate ? G? of the net reaction. ATP + H_2O ADP + Pi ? G? -31 kJ/mol is and exergonic reaction since it is spontaneous while Pi + glucose glucose-6-P + H_2O ? G? = +14 kJ/mol is an endergonic reaction since it is a non-spontaneous process. ATP + H_2O ADP + Pi ? G? = -31 kJ/mol Pi + glucose glucose-6-P + H_2O ? G? = +14 kJ/mol ATP + glucose glucose-6-P + ADP ? G? = -17 kJ/mol It is an exergonic reaction Appendix Table A. ? Gf of Substance Substance| ? Gf (kJ/mol)| O2(g)| 0| C(s)| 0| Mg(s)| 0| Fe(S)| 0| Hg(l)| 0| MgO(s)| -569. 4| CO2(g)| -394. 4| HgO(S)| -58. 50| FeO(S)| -251. 4|