DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
ECE-441
LAB 1

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Date Performed:	TBD
Partners:	TBD
Instructor:	Professor Saniie

1 Introduction

The main purpose of this lab is for the student to familiarize the equipment, which is the SANPER Educational Lab Unit and the TUTOR software (Courtesy of MOTOROLA®. This lab will help the student to understand the fundamentals about MC68000 instruction set, especially the functionality of the TRAP #14 instruction.

```
MOVE.B #<Function Number>, D7
TRAP #14
```

1.1 Background

The SANPER ELU: The SANPER ELU (Educational Lab Unit) is based on an MC68000 microprocessor made by MOTOROLA®. The SANPER ELU is developed by Dr. Saniie and Mr. Perich and the unit include multiple peripherals.

MC 68000: The MC 68000 is a 16/32-bit CISC microprocessor, which implements a 32-bit instruction set, with 32-bit registers and 32-bit internal data bus, but with a 16-bit main ALU and a 16-bit external data bus, designed and marketed by MOTOROLA®.

2 Lab Equipment and Procedure

2.1 Equipment

- SANPER ELU
- TUTOR software

2.2 Procedure

2.2.1 Part A

(a) Connect SANPER unit

(b) Command testing

  - `HE <CR>`
    Help Command
  - `DF <CR>`
    Display Formatted Registers Command
  - `.SR 0000 <CR>`
    Modify the value of the Register (e.g: set to zero)
  - `.A1 1234 <CR>`
    Changeing the contents of A1 register to 1234 ($00001234) or type in the command without the number to examine A1 register
  - `.A <CR>`
    Display all address registers
  - `.D <CR>`
    Display all data registers

2.2.2 Part B

(a) Assemble program provided (Table 1.1)

(b) Start the program from $1000

(c) Set the $900 to output

(d) Run the program

(e) Notice problem

(f) Use trace mode to check register changes

(g) Repeat for programs in Table 1.2 - 1.4

(h) Set SANPER-1 ELU to hardware single-step mode and reset it

(i) Depress the SINGLE STEP PULSE and observe

3 Sample Calculation

Mass of magnesium metal	$= 8.59\,\mathrm{g} - 7.28\,\mathrm{g}$
	$= 1.31\,\mathrm{g}$
Mass of magnesium oxide	$= 9.46\,\mathrm{g} - 7.28\,\mathrm{g}$
	$= 2.18\,\mathrm{g}$
Mass of oxygen	$= 2.18\,\mathrm{g} - 1.31\,\mathrm{g}$
	$= 0.87\,\mathrm{g}$

Because of this reaction, the required ratio is the atomic weight of magnesium: 16.00 g of oxygen as experimental mass of Mg: experimental mass of oxygen or $\frac{x}{1.31} = \frac{16}{0.87}$ from which, $M_{\mathrm{Mg}} = 16.00 \times \frac{1.31}{0.87} = 24.1 = 24\,\mathrm{g\,mol^{-1}}$ (to two significant figures).

4 Results and Conclusions

The atomic weight of magnesium is concluded to be $24\,\mathrm{g\,mol^{-1}}$, as determined by the stoichiometry of its chemical combination with oxygen. This result is in agreement with the accepted value.

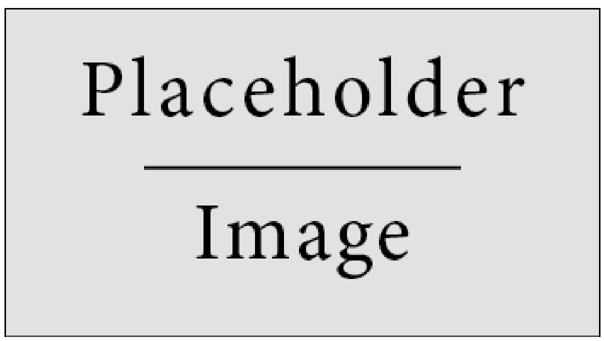

Figure 1: Figure caption.

5 Discussion of Experimental Uncertainty

The accepted value (periodic table) is $24.3\,\mathrm{g\,mol^{-1}}$ **?**. The percentage discrepancy between the accepted value and the result obtained here is 1.3%. Because only a single measurement was made, it is not possible to calculate an estimated standard deviation.

The most obvious source of experimental uncertainty is the limited precision of the balance. Other potential sources of experimental uncertainty are: the reaction might not be complete; if not enough time was allowed for total oxidation, less than complete oxidation of the magnesium might have, in part, reacted with nitrogen in the air (incorrect reaction); the magnesium oxide might have absorbed water from the air, and thus weigh "too much." Because the result obtained is close to the accepted value it is possible that some of these experimental uncertainties have fortuitously cancelled one another.

6 Answers to Definitions

a. The *atomic weight of an element* is the relative weight of one of its atoms compared to C-12 with a weight of 12.0000000..., hydrogen with a weight of 1.008, to oxygen with a weight of 16.00. Atomic weight is also the average weight of all the atoms of that element as they occur in nature.

b. The *units of atomic weight* are two-fold, with an identical numerical value. They are g/mole of atoms (or just g/mol) or amu/atom.

c. *Percentage discrepancy* between an accepted (literature) value and an experimental value is

$$\frac{\text{experimental result} - \text{accepted result}}{\text{accepted result}}$$