**PHYS 500 (Research Methodology)- Fall 2019**

**HOMEWORK I (30 marks)**

**Dr. Vasileios Lempesis**

Hand in: Thursday 5$^{th}$ October 2017 at 23:59

1.  The mass of a small glass beaker was measured with a balance and found to be 45.64g. When a liquid was added to the beaker the balance indicated 92.5g. Give the mass of the liquid in the beaker to the appropriate number of significant figures.

    (5 marks)

    **Solution:**

    $$92.5 - 45.64 = 46.86$$

    But we must keep one decimal so

    $$46.86 \rightarrow 46.9 \text{ g}$$

2.  In a heat transfer experiment, an amount of heat, $Q$, is transferred to silver at its melting point, causing mass, $m$, of the silver to melt. The relationship between $m$ and $Q$ is $Q = mL$, where $L$ represents the heat of fusion of the silver. Given that $L = 88 \times 10^3$ J/kg and $Q = 4550$ J, calculate the mass of silver melted in kg. Express your answer in scientific notation to the appropriate number of significant figures.

    (5 marks)

    **Solution:**

    $$m = \frac{Q}{L} = \frac{4550}{881000} = 5.164 \times 10^{-3} \ kg$$

    But we must keep two s.f. so

    $$5.164 \times 10^{-3} \ kg \rightarrow 5.2 \times 10^{-3} \ kg$$

3.  Round the following recordings at the digit which is underlined:

    | Recorded Value | 3.1<u>0</u>8 | 59<u>2</u>3 | 6.<u>9</u>73 | 0.04<u>5</u>6 | <u>9</u>.5 |
    |---|---|---|---|---|---|
    | Rounded Value | 3.11 | 5920 | 7.0 | 0.05 | 10 or 9 |

    (5 marks)

**4.** Fill in the following table by keeping significant figures and rounding properly the recorded values taken in an experiment for a physical quantity:

| | Before the selection of significant figures | | After the selection of significant figures | | Final Result |
|---|---|---|---|---|---|
| Recorded value | $x$ | $\delta x$ | $\delta x$ | $x$ | $x \pm \delta x$ |
| 1 | 4.2838 | 0.01762 | 0.018 | 4.284 | $4.284 \pm 0.018$ |
| 2 | 91.2 | 0.0219 | 0.022 | 91.200 | $91.200 \pm 0.022$ |
| 3 | 27.2679 | 0.7538 | 0.8 | 27.3 | $27.3 \pm 0.8$ |
| 4 | 3982 | 213 | 210 | 3980 | $3980 \pm 210$ |
| 5 | 11348 | 84 | 80 | 11350 | $11350 \pm 80$ |

(5 Marks)

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**Comment [3]:** First s.f. of error is 1 so we must keep 2 s.f. in the error after rounding

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**Comment [4]:** First s.f. of error is 2 so we must keep 2 s.f. in the error after rounding