PHYS 500
1st Midterm Exam – FALL 2019
Sunday 6th November 2016

Instructor: Prof. V. Lempesis

Please answer all questions

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

Recorded Value	7.3̲7	30̲19	3.9̲67	3̲.501
Rounded Value	**7.4**	**3000**	**4.0**	**4**

(2 marks)

2. 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	δx	δx	x	$x \pm \delta x$
1	1092	11	**11**	**1092**	**1092±11**
2	136.4	0.129	**0.13**	**136.40**	**136.40±0.13**
3	528.35767	0.261	**0.26**	**528.36**	**528.36±0.26**
4	7.121	0.542	**0.5**	**7.1**	**7.1±0.5**
5	163	4.62	**5**	**163**	**163±5**

(5 marks)

3. You are given the following recordings for the acceleration of gravity (with a real value $= 9.8$ m/s^2)

g_i (m/s^2)	$\left(g_i - \bar{g}\right)^2$ (m/s^2)
8.33	
8.12	
8.31	
8.30	
8.42	
$\sum_{i=1}^{5} g_i =$ **41.48**	$\sum_{i=1}^{5}\left(g_i - \bar{g}\right)^2 =$ **0.0472**

a) Fill in the table

(2 marks)

b) Find the average value of the acceleration of gravity:

(1 mark)

c) Find the absolute error of the average value and round it to correct number of significant digits

(2 marks)

d) Quote the experimental result:

(1 marks)

e) Find the relevant error:

(2 marks)

h) Is the above experiment precise or accurate? **Explain**

(2 marks)

Solution

b) $\bar{g} = 8.296\ (\text{m/s}^2)$

c) $\delta g = 0.04884\ (\text{m/s}^2)$, thus the error, to 1 s.d is $\delta g = 0.05\ (\text{m/s}^2)$. The average value is then $\bar{g} = 8.30\ (\text{m/s}^2)$

d) The experimental result is given as $\bar{g} = \left(8.30 \pm 0.05\right)\ (\text{m/s}^2)$.

e) $\dfrac{\delta \bar{g}}{\bar{g}} = \dfrac{0.05}{8.30} = 0.006$ or 0.6%

h) This is a precise measurement since the relevant error is very small. The results are clustered around the average value. Since the real value is 9.81 m/s^2 this is an not accurate experiment.

4. How many significant figures there are in the following recordings:

Recording	Number of significant digits
64000	**2**
1.20	**3**
0.10000738	**8**

(3 marks)

MATHEMATICAL FORMULAS

- $\delta x = \sqrt{\frac{\sum_{i=1}^{N}\left(x_i - \bar{x}\right)^2}{N(N-1)}}$