

ΕΠΩΝΥΜΟ:		ΟΝΟΜΑ:
ΤΜΗΜΑ: ΜΗΥ&Π		Α.Μ.:
ΕΤΟΣ ΣΠΟΥΔΩΝ:		
ΜΑΘΗΜΑ: ΕΡΓΑΣΤΗΡΙΟ ΦΥΣΙΚΗΣ Ι		ΕΞΑΜΗΝΟ:
ΗΜΕΡΟΜΗΝΙΑ: 28/9/2013		ΥΠΟΓΡΑΦΗ:
Lab Instructor: Καθ. Μ. Βελγάκης		
Written exam:	Lab reports:	Final grade:

1. A simple pendulum (εκκρεμές) is known to have a period of oscillation  $T = 1.55$  s. Student A uses a digital stopwatch (ψηφιακό χρονόμετρο) to measure the total time for 5 oscillations and calculates an average period  $T = 1.25$  s. Student B uses an analog wristwatch (αναλογικό ρολόι χεριού) and the same procedure to calculate an average period for the 5 oscillations and finds  $T = 1.6$  s.

- Which student made the more accurate measurement? Explain.
- Which measurement is more precise? Explain.
- What is the most likely source of error that could account for the difference in the results? (Ποιά είναι η πιο πιθανή πηγή σφάλματος που ευθύνεται πιθανώς για τη διαφορά των αποτελεσμάτων)

2. The number of significant figures (σημαντικών ψηφίων) reported for a measured value suggests a certain degree of precision (βαθμό ακρίβειας). What is the relative uncertainty (σχετική αβεβαιότητα) implied (που ενέχεται) by the following numbers?

- 0.30 implies an uncertainty of  $\pm$  \_\_\_\_\_ %
- 9.8 implies an uncertainty of  $\pm$  \_\_\_\_\_ %
- 52 implies an uncertainty of  $\pm$  \_\_\_\_\_ %
- 0.503 implies an uncertainty of  $\pm$  \_\_\_\_\_ %

3. A student uses a protractor (μοιρογνώμονιο) to measure an angle to be  $\theta = 85^\circ \pm 1^\circ$ . What should she report for  $\sin \theta$ ?

$$\sin \theta = \underline{\hspace{2cm}}$$

4. Use any available equipment to find the radius of a steel ball (χαλύβδινη σφαίρα) as accurately as possible. Explain the procedure you used.

$$R = \underline{\hspace{2cm}}$$

5. Use a ruler (υποδεκάμετρο) to measure the diameter of a quarter (κέρμα του ευρώ).

$$D = \underline{\hspace{2cm}}$$

6. Use a Vernier caliper (παχύμετρο) to measure the diameter of a quarter (κέρμα του ευρώ).

$$D = \underline{\hspace{2cm}}$$

7. Use any available equipment to measure the acceleration of a glider (αμαξίδιο) on an inclined air track (κεκλιμένο επίπεδο) as accurately as possible. Clearly identify the measurements you make and the procedure you use.

8. A group of students are told to use a meter stick (μετροταινία) to find the length of a hallway (διαδρόμου). They take 6 independent measurements as follows: 3.314 m, 3.225 m, 3.332 m, 3.875 m, 3.374 m, 3.285 m. Show how they should report their findings and explain your answer.

9. In an investigation to empirically determine the value of  $\pi$ , a student measures the circumference (C) and diameter (D) of several circles of varying size and uses Excel to make a linear plot of circumference versus diameter (both in units of meters). A linear regression fit (γραμμική προσαρμογή) yields (δίδει) the result of:  $y = 3.1527x - 0.0502$ , with  $R^2=0.9967$  for the 5 data points plotted. How should this student report the final result? Does the empirical ratio of C/D agree with the accepted value of  $\pi$ ?

10. A student performs a simple experiment to find the average acceleration of a falling object. He drops a baseball from a building and uses a string and meter stick to measure the height the ball was dropped. He uses a stopwatch to find an average time of fall for 3 trials from the same height and reports the following data:  $h = 5.25 \pm 0.15$  (m),  $t = 1.14 \pm 0.06$  (s).

a) Use the equation  $a = 2h/t^2$  to determine the average acceleration and its uncertainty.

b) Comment on the accuracy of the acceleration result. Do you think the student made any mistakes?

11. Describe a procedure you could use to determine the coefficient of friction between various materials.