

Homework No. 01 (Fall 2022)

PHYS 205A-002: UNIVERSITY PHYSICS

School of Physics and Applied Physics, Southern Illinois University–Carbondale

Due date: Friday, 2022 Aug 26, 2:00 PM, on D2L

Instructions

- You are encouraged to use any of the resources to complete this homework. However, the extent to which you depend on resources while doing this homework is a measure of how much extra work you need to put in to master the associated concepts. Solutions should be the last resource and are available at

<http://sphics.com/tc/202101-SIU-P205A/>.

- Describe your thought process in detail and organize it clearly. Make sure your answer has units and the right number of significant digits.
- After completion, scan the pages as a single PDF file, and submit the file on D2L (under Assessments → Assignments).

Problems

1. (10 points.) The corners of a square lie on a circle of radius R . Find the area of the square as a function of R .
2. (10 points.) What can you deduce about the physical quantity c in the famous equation

$$E = mc^2, \quad (1)$$

if the energy E has the dimensions ML^2T^{-2} and mass m has the dimension M . In particular, what is the dimension of c ? That is, given

$$[c] = M^\alpha L^\beta T^\gamma, \quad (2)$$

determine α , β , and γ .

3. (10 points.) Consider the mathematical expression

$$x = vt + \frac{1}{2!}at^2 + \frac{1}{3!}bt^3 + \frac{1}{4!}ct^4, \quad (3)$$

where x is measured in units of distance and t is measured in units of time. Determine the dimension of the physical quantity represented by the symbol b . That is, given

$$[b] = M^\alpha L^\beta T^\gamma, \quad (4)$$

determine α , β , and γ .

4. (10 points.) Consider the mathematical expression

$$x = Ae^{-\omega t}, \quad (5)$$

where x is measured in units of distance and t is measured in units of time. Evaluate $\frac{dx}{dt}$. Then, determine the dimension of ωA . That is, given

$$[\omega A] = M^\alpha L^\beta T^\gamma, \quad (6)$$

determine α , β , and γ .

5. (10 points.) Complete the operations and express your answer in scientific notation with correct number of significant digits.

(a) 345×72

(b) $55 \div 11$

(c) $34.3456 + 42.1$

(d) $46.32 - 56.92345$

(e) $15600 - 12$