

PHYS 111 K

HOMework #1

Due : 27 August 2015

This homework assignment is due at the beginning of class on 27 Aug. 2015. No credit will be given for homework submitted late. Please follow the formatting rules described in the syllabus (write on only one side of the paper, be legible, and show all the steps you used in solving the problem).

1. What real values of u satisfy the equation :

$$u^{2/3} - 5u^{1/3} + 6 = 0$$

2. The number of radioactive nuclei in a sample at any time t is given by :

$$N(t) = N_o e^{-\lambda t}$$

where N_o is the number of radioactive nuclei at some $t = 0$, and λ is the decay constant of the isotope (which is related to but not identical to the half life). The half - life of an isotope, as you likely know, is the time it takes for half of the remaining sample to decay.

- a) The half - life of C - 14 is 5730 years. Determine the value of its decay constant (and express the answer in appropriate MKS units).

- b) Using this value of λ , how long would it take for 90 % of a sample of C - 14 to decay?

3. Use the following data to determine the angular diameters of the sun and the moon as viewed from the Earth :

Solar distance = 1.5×10^8 km; solar radius = 7×10^5 km

Lunar distance = 4×10^5 km; lunar radius = 1736 km

Express your answers either in degrees or arc seconds (60 arc seconds = 1 arc minute; 60 arc minutes = 1 degree). Use your data to determine which appears larger to an Earth bound observer. Is your conclusion consistent with your observations?

4. Consider a projectile fired from the surface of the Earth at a launch angle θ with respect to the Earth and an initial speed of v . If we neglect friction, we can show (and we will when we cover projectile motion) that the range of the projectile is

$$R = \frac{2 v^2 \sin \theta \cos \theta}{g}$$

The maximum height achieved by the projectile is :

$$h_{\max} = \frac{v^2 \sin^2 \theta}{2g}$$

At what angle should the projectile be launched such that its range is equal to its maximum height?

5. Given that :

$$x = \cos(n\pi) \quad \text{and} \quad y = \sin(k\pi/2)$$

where n and k are integers. For which values of n will $x = 0$? For which values of k will $y = 0$?