

## Astronomy 101. Assignment 1.

Due : Friday Sept 22, 2006 \* by 5PM \* in your lab slot, Hennings 312.

Late Penalty: -30% if in slot by 5 PM Sept 25; -20% per day additional until Thursday Sept 28, 5 PM.

Format: Normal lined 8.5x11" paper with pages STAPLED if >1 page. Upper right corner should contain:

Last Name:

First Name:

Student ID #:

Grading: Only 1 question of 3 will be graded, determined randomly. You MUST show your work!

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1. Devious spies have kidnapped you, knocked you out, and taken you via helicopter to somewhere on Earth's Northern hemisphere. To test your knowledge of astronomy, they have left you some items: a sextant, a clock showing universal time, today's newspaper, and coffee (they are devious, but not cruel...). Your goal is to discover your position. You awake shivering just before at sunrise and watch the heavens for about 12 hours, during which you amass the following information:

- A. The newspaper says it's December 21st (so, that explains the shivering).
- B. When the Sun crossed your southern meridian, its was altitude = 36.5 degrees, and the UT clock read 18:00 at that instant.
- C. The Moon is a first quarter but the sky was too cloudy to see stars before sunrise.
- D. The Sun rose in the east and set in the west.

Using the information above (some of which is extraneous or useless), determine the following, EXPLAINING in point form the logic you use:

- a) what is your latitude?
- b) what is your longitude?
- c) consult an atlas: what is the nearest large city? Along which compass direction do you need to walk to get there?

2. We have discussed in class that the determination of absolute distances to the Sun and Moon are difficult. The great Alexandrian astronomer Aristarchus of Samos (two thousand years ago) made an argument similar to the following: We see the shadow of the Earth on the Moon during an eclipse and estimate that the Earth's diameter is 3 times the Moon's. The Moon has an apparent angular diameter of 0.50 degrees (we say it `subtends' half a degree in the sky). Eratosthenes had determined the Earth's circumference to be  $4.2 \times 10^4$  km.

Using this information, and *paying attention to significant figures and units*:

- a) compute the diameters of the Earth and Moon, in km.
- b) compute an estimated distance to the Moon. Express this in km *and in multiples of the Earth's radius*.
- c) After watching the lunar phases, Aristarchus estimated the distance to the Sun was about 20 times further from us than the Moon; here he was incorrect. Since the Sun is nearly the same angular size as the Moon, and using the correct value that the Sun is about  $3.9 \times 10^2$  times further from the Earth than the Moon, what is the distance to and radius of the Sun? (expressed in *km and Earth radii*).

3. It was recently discovered that Pluto, not too long before its demotion to dwarf status, had two satellites besides Charon orbiting it; these were named Hydra and Nix. Pluto's current distance from Earth is 29.63 AU. The semimajor axes of the two moons are:  $4.87 \times 10^4$  km for Nix, and  $6.48 \times 10^4$  km for Hydra. Using this, as well as information from your textbook:

- a) calculate the angular diameter of Pluto as seen from Earth, in arcseconds.
- b) calculate the angular distances of (i) Nix and (ii) Hydra, from Pluto, as seen from Earth when they are as far as possible from the planet, also in arc-seconds.