

ASTR 101. October 2005 MIDTERM EXAMINATION

UBC Student ID # : _____

Family name : _____

First name : _____

1. Closed-book. Non-programmable calculators allowed.
2. Formulae and constants are on next page.
3. Insure your exam contains a total of 10 pages (this will include 2 final pages of scrap paper); no other scrap paper will be allowed; the scrap pages will NOT be examined when your exam is graded. No other paper may be inserted or used.
4. You MUST write the exam in pen.
5. All caps or hats must be removed.
6. In multiple-choice and true-false sections, choices which are not clearly indicated will result in zero points awarded on that question. Indicate your final response clearly if you erase.
7. Hint: Do NOT get stalled on any one question. If you get stuck, move on and come back to the question if time remains at the end.

For Grader use : MC _____ T/F _____

Short Ans.: _____ Prob _____

TOTAL: _____

POSSIBLY USEFUL FORMULAE AND CONSTANTS.

$$P^2 = \frac{4\pi^2 a^3}{G(M_1 + M_2)} \quad F = \frac{GM_1 M_2}{r^2} \quad K = mv^2/2 \quad v_{\text{esc}} = \sqrt{\frac{2GM}{r}}$$

$$E = \frac{3}{2} kT \quad E = mgh$$

$$\theta_{\text{rad}} = d/D \quad \theta^\circ = \frac{360}{2\pi} \frac{d}{D} \quad \theta_{\text{arcsec}} = 206265 \frac{d}{D} \quad \theta_{\text{arcsec}} = 2.5 \times 10^5 \lambda/D$$

$$\theta_{\text{radians}} = 1.22 \lambda/D$$

$$\text{Vol}(\text{sphere}) = \frac{4}{3} \pi r^3 \quad \text{Area}(\text{sphere}) = 4\pi r^2 \quad \text{Area}(\text{circle}) = \pi r^2$$

$$\text{Circumference}(\text{circle}) = 2\pi r \quad \text{Pericenter } q = a(1 - e) \quad \text{Apocenter } Q = a(1 + e)$$

$$T^4 = \frac{S_o(1 - A)}{4\sigma d_{\text{AU}}^2} \quad \rho = M/V \quad c = \lambda \nu \quad E = h\nu = \frac{hc}{\lambda}$$

$$\frac{1}{S} = \frac{1}{P_{\text{inner}}} - \frac{1}{P_{\text{outer}}} \quad \lambda_{\text{max},m} = \frac{0.0029}{T_K} \quad F = \sigma T^4$$

Constants

$$\begin{array}{lll} G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2 & c = 3 \times 10^8 \text{ m/s} & h = 6.63 \times 10^{-34} \text{ J s} \\ \sigma = 5.67 \times 10^{-8} \text{ W}/(\text{m}^2\text{K}^4) & k = 1.38 \times 10^{-23} \text{ J/k} & S_o = 1370 \text{ W/m}^2 \\ 1 \text{ nm} = 10^{-9} \text{ m} & 1 \text{ AU} = 1.5 \times 10^8 \text{ km} & \text{Mass}(\text{Earth}) = 6.0 \times 10^{24} \text{ kg} \end{array}$$

Diameters: Earth=12800 km Mars=6800 km Saturn=120 000 km

Semimajor axes (AU): Venus=0.71, Earth=1.0, Mars=1.52,
Jupiter=5.2, Saturn=9.5, Uranus=19.2, Neptune=30.0 Pluto=39

Masses (relative to Earth) : Jupiter = 317, Saturn=95, Earth's Moon = 1/81

Wavelengths (approximate) : Visible = 500 nm, IR = 10 μ m, X-ray = 1 nm, Radio = 10 m

Approximate densities (g/cm^3) : rock = 3, metal = 7, water = 1