

ASTR 310. 8:30 – 11:00, Dec 5/2014

FINAL EXAMINATION

UBC Student ID # : _____

Family name: _____ First name: _____

I have read and understand the information below: _____(signature)

Don't open the exam until instructed to do so, but you should read and fill out this page.

1. Closed-book. Calculators may not have any stored material in them. No 'electronic organizers' or phones may be used as calculators or watches.
2. By counting pages without opening your exam, ensure it contains a total of xx pages (this will include a final page of scrap paper); no other scrap paper will be allowed; the scrap pages will NOT be examined when your exam is graded.
3. Formulae & constants are on the 2nd last page; you may detach these after the exam starts.
4. You may not ask questions of the invigilators, except in cases of supposed errors or ambiguities in examination questions.
5. You must place your UBC student card on your desk.
6. Stay in your seat until you finish your exam. Then and only then collect your belongings and turn in your exam to the appropriate person (alphabetized by family name). Once you begin to store your belongings you are declaring you have finished your exam and you may *not* re-open your paper.
7. You may not leave the exam before 9:30 AM. If you finish your exam before 10:45 AM you may (1) collect your belongings and (2) turn your exam in to the appropriate station based on your last name. *After 10:45 you must stay in your seat until 11:00 and follow the end of exam instructions.*
8. Should a fire alarm go off you must (1) close your exam; (2) take your student ID card and valuables (eg. purse); (3) follow instructions from the professor for leaving the building; (4) do not speak with anyone else; any conversation will result in you not being allowed to finish your exam upon return to the examination room.
9. In multiple-choice and true-false sections, choices which are not clearly indicated will result in zero points awarded on that question.
10. Students suspected of any of the following, or similar, dishonest practices shall be immediately dismissed and shall be liable to disciplinary action:
 - i. Having any books, papers, computers, telephones, or any memory aids.
 - ii. Speaking or communicating with any other person except an invigilator
 - iii. Purposefully exposing their papers to the view of other students; the pleas of accident or forgetfulness shall not be received.

For Grader use : MC _____ (/xx) T/F _____ (/xx)

Short Ans 1: _____ (/xx) Problems _____ (/xx)

TOTAL: _____ (/100)

POSSIBLY USEFUL FORMULAE AND CONSTANTS.

$$P^2 = \frac{4\pi^2}{GM_{tot}} a^3 \quad M_{tot} = \frac{4\pi^2}{G} \frac{a^3}{P^2} \quad P_{yr}^2 = a_{AU}^3 \quad P_{yr} = a_{AU}^{3/2} \quad a_{AU} = P_{yr}^{2/3}$$

$$\text{angular diameter}^{(o)} = \frac{360^\circ}{2\pi} \frac{\text{diameter}}{\text{distance}} \quad \text{diffraction limit ('')} = 250,000 \frac{\lambda}{D}$$

$$\text{circumference (circle)} = 2\pi r \quad \text{Perihelion} = a(1-e) \quad \text{Aphelion} = a(1+e)$$

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

$$F = \frac{GM_1M_2}{r^2} \quad \frac{d}{D} = \sqrt{\Delta I}$$

$$\text{intensity} = \frac{S_o}{d_{AU}^2} \quad \text{density} = \frac{\text{mass}}{\text{volume}} \quad F = \sigma T^4 \quad \lambda_{max} (nm) = \frac{2,900,000}{T_K} \quad T_K = T_C - 273$$

$$T = 280 K \times \sqrt[4]{\frac{1-\text{albedo}}{d_{AU}^2}} \quad \frac{v}{c} = \frac{\Delta \lambda}{\lambda} \quad f\lambda = c$$

Constants

$$G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2 \quad c = 3 \times 10^8 \text{ m/s} \quad S_o = 1300 \text{ W/m}^2$$

$$1 \text{ m} = 100 \text{ cm} \quad 1 \text{ cm} = 10 \text{ mm} \quad 1 \text{ m} = 1,000,000 \text{ microns}$$

$$1 \text{ nm} = 10^{-9} \text{ m} \quad 1 \text{ AU} = 1.5 \times 10^8 \text{ km} \quad 1 \text{ pc} = 3.09 \times 10^{13} \text{ m}$$

$$\text{Mass (Earth)} = 6.0 \times 10^{24} \text{ kg} \quad \text{Mass (Sun)} = 2.0 \times 10^{30} \text{ kg} \quad \text{Mass (H}_2\text{)} = 3 \times 10^{-27} \text{ kg}$$

$$\text{Masses (relative to Earth)} : \text{Jupiter} = 317, \text{ Saturn} = 95, \text{ Earth's Moon} = 1/81$$

$$\text{Radii: Earth} = 6400 \text{ km} \quad \text{Mars} = 3400 \text{ km} \quad \text{Uranus} = 25,600 \text{ km} \quad \text{Sun} = 700,000 \text{ km}$$

$$\text{Radii (relative to Earth)} : \text{Venus} = 0.95, \text{ Mars} = 0.53, \text{ Jupiter} = 11, \text{ Uranus} = 4.0$$

$$\text{Semimajor axes (AU): Mercury} = 0.39, \text{ Venus} = 0.71, \text{ Earth} = 1.0, \text{ Mars} = 1.52,$$

$$\text{Jupiter} = 5.20, \text{ Saturn} = 9.5, \text{ Uranus} = 19.2, \text{ Neptune} = 30.0, \text{ Pluto} = 39.4$$

$$\text{Wavelengths (approximate): visible} = 500 \text{ nm}, \text{ IR} = 0.01 \text{ mm}, \text{ X-ray} = 1 \text{ nm}, \text{ Radio} = 10 \text{ m}$$

$$\text{Approximate densities (kg/m}^3\text{)} : \text{rock} = 3000, \text{ metal} = 5000, \text{ water} = 1000$$

$$\text{Earth: } 5500, \text{ Jupiter: } 1300, \text{ Ganymede: } 2000$$

$$\text{Orbital periods (days) of : Mimas} = 0.0942 \quad \text{Enceladus} = 1.37 \quad \text{Titan} = 15.9$$

$$\text{Obliquity of the ecliptic: } 23.5 \text{ degrees. } 1 \text{ degree} = 60 \text{ arcmin. } 1 \text{ arcmin} = 60 \text{ arcsec.}$$