

## Final Examination

**At the end of the examination hand in all pages of the booklet.  
Materials permitted: Calculator and two 8½" x 11" sheets of paper**

### Table of Values:

Gravitational constant, G	6.67	$\times 10^{-11}$	$\text{m}^3 \text{kg}^{-1} \text{s}^{-2}$
Planck's constant, h	6.6	$\times 10^{-34}$	J s
Mass of the Sun, $M_{\text{U}}$	2	$\times 10^{30}$	kg
Astronomical Unit, A.U.	1.5	$\times 10^{11}$	m
Parsec, pc	206 000		A.U.
Stefan-Boltzmann constant, F	5.67	$\times 10^{-8}$	$\text{W m}^{-2} \text{K}^{-4}$
Speed of light, c	3	$\times 10^8$	$\text{m s}^{-1}$

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### Section A: Multiple choice (25%)

10 questions worth 2 points each

**Circle the letter corresponding to the most appropriate answer to each**

- A1) Full Moon occurs next Friday. What will be its Right Ascension?  
a) 0 h                      b) 6 h                      c) 12 h                      d) 18h                      /2
- A2) A superior planet is closest to Earth at:  
a) Quadrature              b) Conjunction              c) Opposition              d) Greatest Elongation              /2
- A3) The Sun orbits our Galaxy at  $250 \text{ km s}^{-1}$ ; the corresponding escape speed in  $\text{km s}^{-1}$ , is:  
a) 29.5                      b) 250                      c) 350                      d) 300 000                      /2
- A4) How many times does Mercury rotate on its axis in one orbit around the Sun?  
a) 0.667                      b) 1.0                      c) 1.5                      d) 2.0                      /2
- A5) How many continents are there on Venus?  
a) 0                      b) 1                      c) 2                      d) 7                      /2
- A6) What is the major component of the atmosphere of Mars?  
a)  $\text{H}_2\text{O}$                       b)  $\text{CO}_2$                       c)  $\text{N}_2$                       d)  $\text{CH}_4$                       /2
- A7) What is the major component of the atmosphere of Titan?  
a)  $\text{H}_2\text{O}$                       b)  $\text{CO}_2$                       c)  $\text{N}_2$                       d)  $\text{CH}_4$                       /2
- A8) What is the major component of the material being deposited on the surface of Io?  
a) Ice                      b) Sulphur                      c) Dry ice                      d) Silicates                      /2
- A9) The spacecraft which flew by Neptune was:  
a) Galileo                      b) Pioneer                      c) Voyager                      d) Viking                      /2
- A10) The period of a comet in the Oort Cloud, in years, is:  
a)  $10^3$                       b)  $10^4$                       c)  $10^5$                       d)  $10^7$                       /2

**Section B (25%)**  
10 questions worth 2 points each  
**Answer each question in the space provided**

What *name* describes each of the following?

- B1) The discoverer of the four large satellites of Jupiter \_\_\_\_\_ /2
- B2) The largest satellite in the Solar System \_\_\_\_\_ /2
- B3) A “shooting star” that hits the ground \_\_\_\_\_ /2
- B4) 1-to-1 spin-orbit coupling. \_\_\_\_\_ /2
- B5) Spacecraft which mapped Venus using  
synthetic aperture radar \_\_\_\_\_ /2
- B6) Largest volcano in the Solar System \_\_\_\_\_ /2
- B7) The most prominent of the gaps in Saturn’s rings. \_\_\_\_\_ /2
- B8) Spacecraft which orbited Jupiter \_\_\_\_\_ /2
- B9) Satellite with volcanoes and a sulphur-covered surface \_\_\_\_\_ /2
- B10) Gaps in the spacing of asteroid orbits,  
caused by Jupiter’s gravity \_\_\_\_\_ /2

**Section C (25%)**

Points for each part are shown beside its answer space

**Answer each question in the space provided**

C1) Given that argon is *just* retained in the atmosphere of a planet with mass  $M$ , radius  $R$ , and surface temperature  $T$ :

a) Would argon be retained by a planet of mass  $2M$ , radius  $R$ , temperature  $T$ ? \_\_\_\_\_ /1

b) Would argon be retained by a planet of mass  $M$ , radius  $R$ , temperature  $2T$ ? \_\_\_\_\_ /1

Explain.

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C2) Mars Global Surveyor (MGS) is in a circular orbit with a period of 1h 57 m around Mars, which has a mass of  $6.4 \times 10^{23}$  kg and a diameter of 6 794 km.

a) Calculate the radius of the orbit (km)

\_\_\_\_\_ km /5

b) Calculate the altitude of MGS above the surface of Mars.

\_\_\_\_\_ km /4

c) The orbit of MGS passes over the North pole of Mars. Explain how this makes it possible for MGS to observe the entire surface of the planet.

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**Section D (25%)**

10 questions worth 2 points each

**Answer each question in the space provided**

In a *few sentences*, with a *diagram* if useful, explain what is meant by **each** of the following terms:

D1) Saros \_\_\_\_\_

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D2) Doppler effect \_\_\_\_\_

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D3) Oort Cloud \_\_\_\_\_

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D4) Aurorae \_\_\_\_\_

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D5) Greatest Eastern Elongation \_\_\_\_\_

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D6) Greenhouse Effect \_\_\_\_\_

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D7) Saturn's Rings \_\_\_\_\_

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