

**SIERRA COLLEGE OBSERVATIONAL ASTRONOMY
LABORATORY EXERCISE**

NUMBER III.G. TITLE: The Moons of Jupiter

DATE- PRINT NAME/S AND INITIAL BELOW: GROUP

DAY-

LOCATION

Objective: Plot the distance of two different moons from Jupiter vs. time and determine the average orbital distance (a) and period of orbit (P) of each moon and compute the mass of Jupiter.

Procedure:

- 1) Your lecture textbook (Astro 10 and 2) discusses the satellites of Jupiter.
- 2) Instructor will demonstrate the use of the *Contemporary Labs Experiences in Astronomy* for the collection of Jovian (Jupiter) moon data.
- 3) Instructor will discuss how to use Kepler's 3rd Law modified by Newton: $M = \kappa a^3/P^2$, where $\kappa = 5.919 \times 10^{11} \text{ kg} \cdot \text{s}^2/\text{m}^3$
- 4) Use the *Contemporary Labs Experiences in Astronomy* to determine the separation distance (d) of two of the moons of Jupiter in 5 hour intervals and complete the table below
- 5) Plot d vs. time (t) onto the graph below.
- 6) From the graph determine the average distance (a) of the moons from Jupiter in Jovian Diameters. Convert to meters (1 Jovian Diameter = **142,980,000 m**).
- 7) From the graph determine the orbital period (P) the moons in hours. Convert to seconds (1 hour = 3600 seconds).
- 8) Using $M = \kappa a^3/P^2$ where $\kappa = 5.919 \times 10^{11} \text{ kg} \cdot \text{s}^2/\text{m}^3$ find the mass of Jupiter in kilograms.
- 9) Answer the 2 bluebook questions on page 3.
- 10) If time permits: On the back page use *TheSky* and sketch out the moons of Jupiter on today's and tomorrow's date at 10 PM (or the date and time specified by the instructor). Indicate which moons are which and note how many are visible (i.e. and not behind, in front, or in Jupiter's shadow).

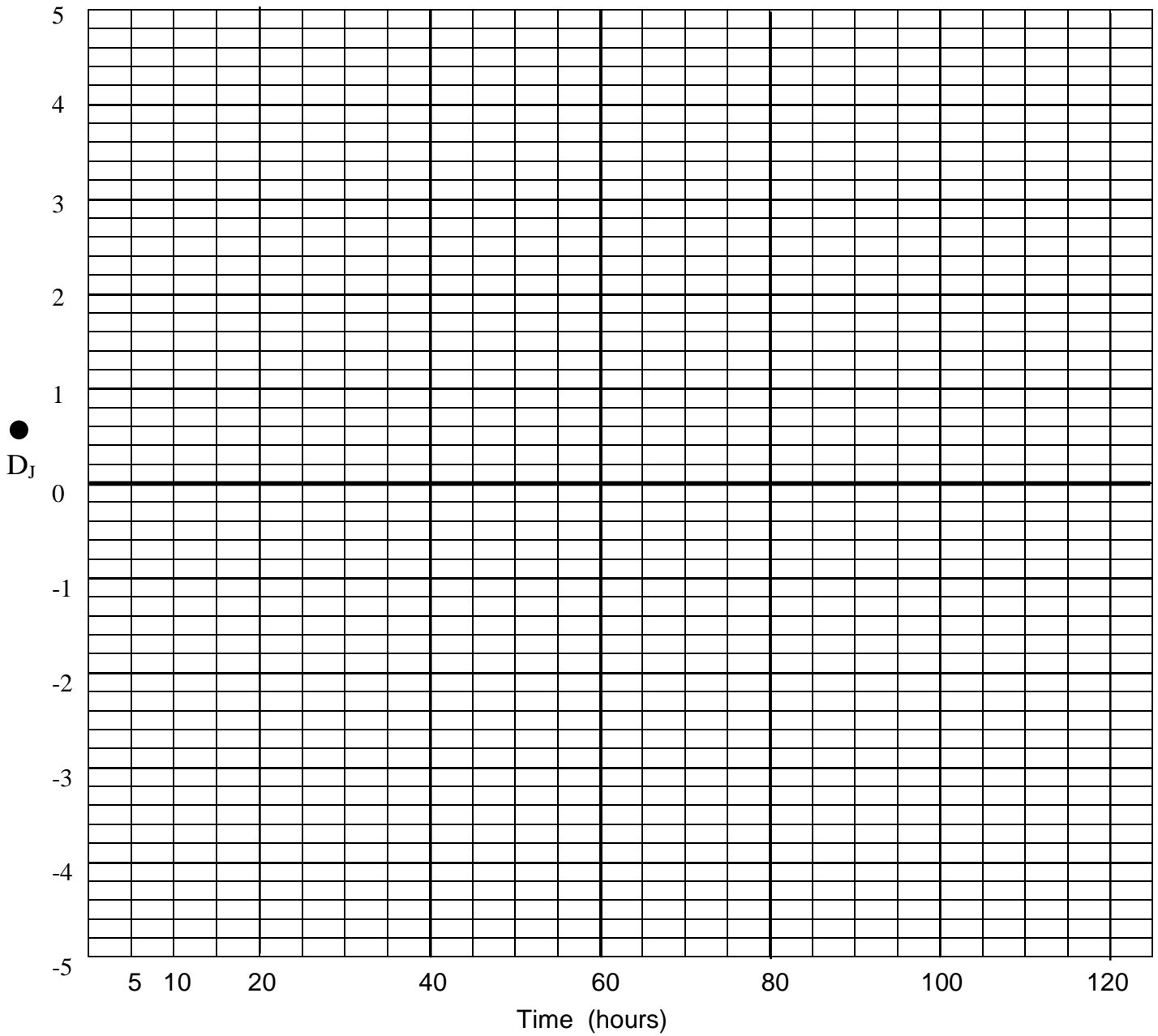
Starting date and time: _____ Note: Make East + and West –

Hours from Starting date	Moon 1	Moon 2
	Separation distance from Jupiter (D_J)	Separation distance from Jupiter (D_J)
0		
5		
10		
15		
20		
25		
30		
35		
40		
45		

50		
55		
60		
65		
70		
75		
80		
85		
90		
95		
100		
105		
110		

Note: Some measurements may be marred by "clouds"

Enter "CS" for cloudy skies and "B" for satellite (moon) behind Jupiter



Average distance from Jupiter of Moon 1 = _____ Jupiter Diameters = _____ m.

Average distance from Jupiter of Moon 2 = _____ Jupiter Diameters = _____ m.

Orbital Period of Moon 1 = _____ hours = _____ seconds.

Orbital Period of Moon 2 = _____ hours = _____ seconds.

Mass of Jupiter using Moon 1 (show work on next page):

$$a^3 = \text{_____ m}^3 \quad P^2 = \text{_____ sec}^2$$

$$M = \text{_____ kg.}$$

Mass of Jupiter using Moon 2 (show work on next page):

$$a^3 = \text{_____ m}^3 \quad P^2 = \text{_____ sec}^2$$

$$M = \text{_____ kg.}$$

Questions (answer below and put in Bluebook):

1. Explain any discrepancies of the calculation of the mass of Jupiter when using Moon 1 and using Moon 2.

2. If the mass of one of Jupiter's moon's was 0.1 the mass of Jupiter, how would this affect the determination of M ?