

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

**Mutual Gravitation Practice (Level 2)**  
Astronomy

Write out the mutual gravitation formula and identify all of the variables.

1. An 850 kg spacecraft was measuring a gravitational force of 69.578 N when it was a distance of  $6.6992 \times 10^8$  m away from a planet. What is the mass of that planet?
2. How far from the core would a 500 kg spacecraft have to be to experience 100 N of force here on Earth?
3. What is the mass of an object on Earth's surface if the force of gravity is 974 N?
4. Would a 466 kg space probe experience more gravitational force on Venus or Earth if it was the same distance from the core as it would be on Earth's surface? (Venus:  $m = 4.867 \times 10^{24}$  kg ) What if it was able to sit on Venus's surface? ( $r = 6.052 \times 10^6$  m) Explain.
5. What is the mass of a planet if an object is only 114 kg and at a distance of  $7.031 \times 10^6$  m from its core and exerting a gravitational force of 2100 N?
6. What would the distance be for two objects (60 kg and 135 kg) to exert a gravitational force of only  $7.442 \times 10^{-9}$  N?

7. What is the mass of an object on Earth's surface if the force of gravity is 1600 N?
  
8. What is the mass of a moon if an object is only 400 kg and at a distance of  $2.450 \times 10^6$  m from its core and exerting a gravitational force of 1800 N?
  
9. Two spherical objects have masses of 200 kg and 500 kg. Their centers are separated by a distance of 25 m. Find the gravitational attraction between them.
  
10. Two spherical objects have masses of  $1.5 \times 10^5$  kg and  $8.5 \times 10^2$  kg. Their centers are separated by a distance of 2500 m. Find the gravitational attraction between them.
  
11. Two spherical objects have masses of  $3.1 \times 10^5$  kg and  $6.5 \times 10^3$  kg. The gravitational attraction between them is 65 N. How far apart are their centers?
  
12. Two spherical objects have equal masses and experience a gravitational force of 25 N towards one another. Their centers are 36 cm apart. Determine each of their masses.
  
13. A 1 kg object is located at a distance of  $6.4 \times 10^6$  m from the center of a larger object whose mass is  $6.0 \times 10^{24}$  kg.
  - a. What is the size of the force acting on the smaller object?
  
  
  
  
  
  
  
  
  
  
  - b. What is the size of the force acting on the larger object
  
  
  
  
  
  
  
  
  
  
  - c. What is the acceleration of the smaller object when it is released?
  
  
  
  
  
  
  
  
  
  
  - d. What is the acceleration of the larger object when it is released?

14. Two spherical objects have masses of 8000 kg and 1500 kg. Their centers are separated by a distance of 1.5 m. Find the gravitational attraction between them.
15. Two spherical objects have masses of  $7.5 \times 10^5$  kg and  $9.2 \times 10^7$  kg. Their centers are separated by a distance of  $2.5 \times 10^3$  m. Find the gravitational attraction between them.
16. Two spherical objects have masses of  $8.1 \times 10^2$  kg and  $4.5 \times 10^8$  kg. The gravitational attraction between them is  $1.9 \times 10^{-3}$  N. How far apart are their centers?
17. Two spherical objects have equal masses and experience a gravitational force of 85 N towards one another. Their centers are 36 mm apart. Determine each of their masses.
18. A 1 kg object is located at a distance of  $7.0 \times 10^8$  m from the center of a larger object whose mass is  $2.0 \times 10^{30}$  kg.
- What is the size of the force acting on the smaller object?
  - What is the size of the force acting on the larger object?
  - What is the acceleration of the smaller object when it is released?
  - What is the acceleration of the larger object when it is released?

19. Two spherical objects have masses of 8000 kg and 5.0 kg. Their centers are separated by a distance of 1.5 m. Find the gravitational attraction between them.
20. Two spherical objects have masses of  $9.5 \times 10^8$  kg and 2.5 kg. Their centers are separated by a distance of  $2.5 \times 10^8$  m. Find the gravitational attraction between them.
21. Two spherical objects have masses of  $6.3 \times 10^3$  kg and  $3.5 \times 10^4$  kg. The gravitational attraction between them is  $6.5 \times 10^{-3}$  N. How far apart are their centers?
22. Two spherical objects have equal masses and experience a gravitational force of 25 N towards one another. Their centers are 36 cm apart. Determine each of their masses.
23. A 1 kg object is located at a distance of  $1.7 \times 10^6$  m from the center of a larger object whose mass is  $7.4 \times 10^{22}$  kg.
- What is the size of the force acting on the smaller object?
  - What is the size of the force acting on the larger object?
  - What is the acceleration of the smaller object when it is released?
  - What is the acceleration of the larger object when it is released?