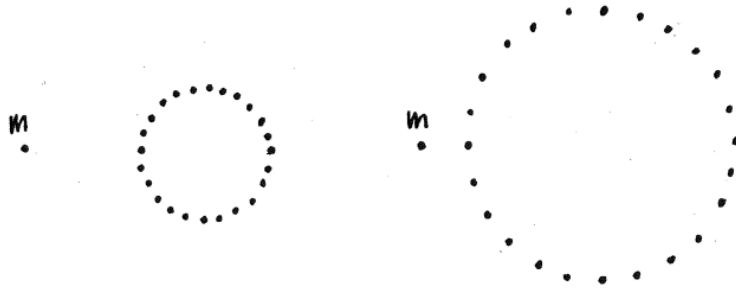


## Conceptual Questions

1. Two satellites **A** and **B** of the same mass are going around Earth in concentric orbits. The distance of satellite **B** from Earth's center is twice that of satellite **A**. What is the ratio of the tangential speed of **B** to that of **A**?<sup>1</sup>
- a)  $\frac{1}{2}$                       b)  $\frac{1}{\sqrt{2}}$                       c) 1                      d)  $\sqrt{2}$                       e) 2
2. A little mass **m** is a certain distance from the centre of a globular cluster of masses and there is a certain force of gravity, due to the cluster of masses, on **m** that pulls it toward the centre of the cluster. If neither **m** or the centre of the cluster moves, but uniformly expands, the force of gravity on **m** from the cluster will<sup>2</sup>

- a) increase  
b) decrease  
c) remain unchanged



3. Choose **each** of the following locations that could be considered as a non-inertial frame of reference:<sup>3</sup>
- a) on a merry-go-round                      d) on the sun  
b) on the equator                      e) at the centre of the milky way  
c) on the north or south pole
4. The Sun's gravitational pull on the Earth is much larger than the Moon's, yet the moon is mainly responsible for the tides. Explain [*Hint: Consider the difference in gravitational pull from one side of the Earth to the other.*]<sup>4</sup>
5. Will an object weight more at the equator or at the poles? [*Hint: Consider the difference in motion of the object and the parts of the Earth at the equator compared to the poles.*]<sup>5</sup>

<sup>1</sup> Peer Instruction – A User's Guide, Mazur, Gravitation CT 3

<sup>2</sup> Peer Instruction – A User's Guide, Mazur

<sup>3</sup> Almeida, F., Physics Department, Victoria Park C.I.

<sup>4</sup> Physics 6<sup>th</sup> Edition, Giancoli, Chapter 5 Questions, #14

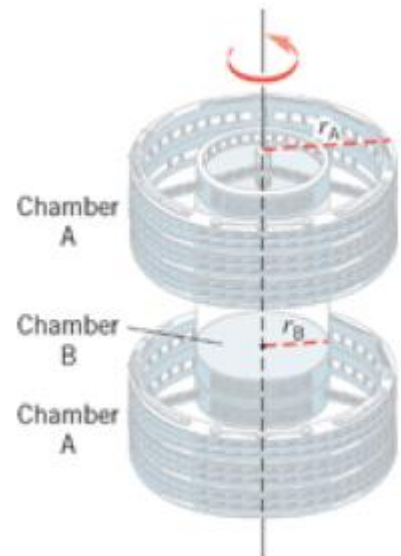
<sup>5</sup> Physics 6<sup>th</sup> Edition, Giancoli, Chapter 5 Questions, #15

6. The mass of Pluto was not known until it was discovered to have a moon. Explain how this discovery enabled an estimation of Pluto's mass.<sup>6</sup>

### Problems

7. Earth is a satellite of the Sun with an orbit radius of  $1.5 \times 10^{11}$  m. What is the Sun's mass?<sup>7</sup>
8. A satellite is in a circular orbit around an unknown planet. The satellite has a speed of  $1.70 \times 10^4$  m/s, and the radius of the orbit is  $5.25 \times 10^6$  m. A second satellite also has a circular orbit around this same planet. The orbit of this second satellite has a radius of  $8.60 \times 10^6$  m. What is the orbital speed of the second satellite?<sup>8</sup>
9. A satellite has a mass of 5850 kg and is in a circular orbit  $4.1 \times 10^5$  m above the surface of a planet. The period of the orbit is two hours. The radius of the planet is  $4.15 \times 10^6$  m. What is the true weight of the satellite when it is at rest on the planet's surface?<sup>9</sup>
10. Four 9.5-kg spheres are located at the corners of a square of side 0.60 m. Calculate the magnitude and direction of the total gravitational force exerted on one of the spheres by the other three.<sup>10</sup>
11. At what period must a cylindrical spaceship with a diameter of 32 m rotate with if occupants are to experience simulated gravity of  $0.60g$ ?<sup>11</sup>

12. To create artificial gravity, the space station shown is rotating at a rate of 1.00 rpm. The radii of the cylindrically shaped chambers have the ratio  $\frac{r_A}{r_B} = 4.00$ . Each chamber **A** simulates an acceleration due to gravity of  $10.0 \text{ m/s}^2$ . Find the values for  $r_A$ ,  $r_B$  and the acceleration due to gravity simulated in chamber **B**.<sup>12</sup>



<sup>6</sup> Physics 6<sup>th</sup> Edition, Giancoli, Chapter 5 Questions, #24

<sup>7</sup> Physics Book Two, Irwin Publishing, Chapter 2 Problems, #62a

<sup>8</sup> Physics, 7<sup>th</sup> Edition, Cutnell & Johnson, Chapter 5 Problems, #27

<sup>9</sup> Physics, 7<sup>th</sup> Edition, Cutnell & Johnson, Chapter 5 Problems, #33

<sup>10</sup> Physics 6<sup>th</sup> Edition, Giancoli, Chapter 5 Problems, #39

<sup>11</sup> Physics 6<sup>th</sup> Edition, Giancoli, Chapter 5 Problems, #45

<sup>12</sup> Physics, 7<sup>th</sup> Edition, Cutnell & Johnson, Chapter 5 Problems, #35