

Homework: Ch. 6

1. Convert each of the following:
 - a. $65 \text{ rad} = \underline{\hspace{2cm}} \text{ rev}$
 - b. $222^\circ = \underline{\hspace{2cm}} \text{ rad}$
 - c. $2.3 \text{ rev} = \underline{\hspace{2cm}}^\circ$
 - d. $10 \text{ rev/min} = \underline{\hspace{2cm}} \text{ rad/s}$
 - e. $100 \text{ rev/min}^2 = \underline{\hspace{2cm}} \text{ rad/s}^2$

2. At what altitude above the Earth surface would the gravitational acceleration equal 4.9 m/s^2 ?

3. What is the linear speed for an object is rotating around a circular path of radius 4.50 m at a rate of 225 rev/min ?

4. If the wheel of a car with a radius of 0.30 m is being rotated at 900.0 rev/min , find the linear speed of the outer edge of the wheel.

5. An ultracentrifuge accelerates from rest to $1.00 \times 10^5 \text{ rev/min}$ in 2.00 min .
 - a. What is its angular acceleration in rad/s^2 ?
 - b. What is the centripetal acceleration of a point 9.50 cm from the axis of rotation?

6. A toy plane with a mass of 4.00 kg attached to a string is moving at a constant speed on a circular path of radius 25.0 cm . Find the centripetal acceleration and the centripetal force on the toy plane for linear speeds of 20.0 m/s and 35.0 m/s .

7. In a rainy day if you are driving in the interstate at a speed of 32.0 m/s assume that the road becomes frictionless. To drive safely through a curved path of radius 500.0 m , what angle should the road be banked?

8. For a frictionless racing track, calculate the safest maximum speed at which a racing car can drive through a curved path of radius 200.0 m if the track is banked at an angle of 50.0° .

9. One model for a certain planet has a core of radius $R = 6.00 \times 10^6 \text{ m}$ and mass $M = 4.10 \times 10^{24} \text{ kg}$ surrounded by an outer shell of inner radius R and outer radius $2R$ and mass $4M$. What is the gravitational acceleration of a particle located a distance of $3R$ from the center of the planet?

10. Two identical E.coli bacteria are floating in a petri dish. Under the microscope, you observe that the two are separated by a distance of $25 \mu\text{m}$. If a typical E.coli bacteria has a mass of about 1.0 pg , what is the magnitude of the gravitational force between the two bacteria?

11. Galileo discovered the four largest moons of Jupiter: Io, Ganymede, Calisto, and Europa. Io, which he measured to be 4.2 Galilean units from the center of Jupiter, has a period of 1.8 Earth days. He measured Ganymede's orbit to be 10.7 Galilean units and Calisto's period to be 16.7 Earth days.
- What is the period of Ganymede in Earth days?
 - What is Calisto's distance from the center of Jupiter in Galilean units?
12. Left over from the big bang at the beginning of the universe, tiny black holes may still be wandering the universe. If one with a mass of 1.0×10^{11} kg and radius of only 1.0×10^{-16} m reached Earth, at what distance from your head would its gravitational pull on you match that of the Earth's?
13. The figure below shows three particles of equal mass, $m = 2.50$ kg. The distances are $d_1 = 0.250$ m and $d_2 = 0.500$ m. What is the magnitude and direction of the force produced by the other two particles on sphere A?

