Chapter 1

1. Two spheres are cut from a certain uniform rock. One has radius 4.50 cm. The mass of the other is five times greater. Find its radius.
Ans:

2. A proton, which is the nucleus of a hydrogen atom, can be modeled as a sphere with a diameter of 2.4 fm and a mass of 1.67×10^{-27} kg. (a) Determine the density of the proton. (b) State how your answer to part (a) compares with the density of osmium, give in Table 14.1 in Chapter 14. (Hit: the density of osmium = 22.6×10^{3} kg/m^{3})
Ans:

Chapter 2.

1. A particle moves according to the equation $x = 10t^2$, where x is in meters and t is in seconds. (a) Find the average velocity for the time interval from 2.00 s to 3. 00 s. (b) Find the average velocity of the time interval from 2.00 to 2.10 s.
Ans:

2. A position-time graph for a particle moving along the x axis is shown in Figure P2.7. (a) Find the average velocity in the time interval $t = 1.50$ s to $t = 4.00$ s. (b) Determine the instantaneous velocity at $t = 2.00$ s by measuring the slope of the tangent line shown in the graph. (c) At what value of t is the velocity zero?
Ans:

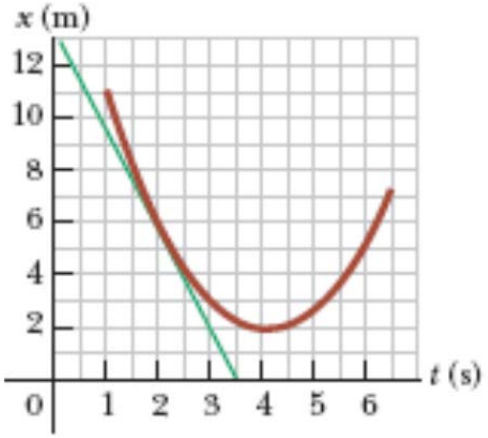

Figure P2.7

Chapter 3.

1. Two points in the xy plan have Cartesian coordinates (2.00, -4.00) m and (-3.00, 3.00) m. Determine (a) the distance between these points and (b) their polar coordinates.
Ans:

2. Given the displacement vectors $\vec{A} = (3\hat{i} - 4\hat{j} + 4\hat{k})$ m and $\vec{B} = (2\hat{i} + 3\hat{j} - 7\hat{k})$ m, find the magnitudes of the following vectors and express each in terms of its rectangular components. (a) $\vec{C} = \vec{A} + \vec{B}$ (b) $\vec{D} = 2\vec{A} - \vec{B}$
Ans:

Chapter 4.

1. Suppose the position vector for a particle is given as a function of time by $\vec{\mathbf{r}}(\mathrm{t}) = x(t)\hat{\imath} + y(t)\hat{\jmath}$, with $x(t) = at + b$ and $y(t) = c\mathrm{t}^2 + d$, where $a = 1.00$ m/s, $b = 1.00$ m, $\mathrm{c} = 0.125$ m/s^2, and $\mathrm{d} = 1.00$ m. (a) Calculate the average velocity during the time interval from $\mathrm{t} = 2.00$ s to $\mathrm{t} = 4.00$ s. (b) Determine the velocity and the speed at $\mathrm{t} = 2.00$ s.
Ans:

2. The vector position of a particle varies in time according to the expression $\vec{\mathbf{r}} = 3.00\hat{\imath} - 6.00\mathrm{t}^2\hat{\jmath}$, where $\vec{\mathbf{r}}$ is in meter and t is in seconds. (a) Find an expression for the velocity of the particle as a function of time. (b) Determine the acceleration of the particle as a function of time. (c) Calculate the particle's position and velocity at $\mathrm{t} = 1.00$ s.
Ans:

Chapter 5.

1. A 3.00 kg object undergoes an acceleration given by $\vec{\mathbf{a}} = (2.00\hat{\imath} + 5.00t^2\hat{\jmath})$ m/s^2. Find (a) the resultant force acting on the object and (b) the magnitude of the resultant force.
Ans:

2. The average speed of a nitrogen molecule in air is about 6.70×10^2 m/s, and its mass is 4.68×10^{-26} kg. (a) If it takes 3.00×10^{-13} s for a nitrogen molecule to hit a wall and rebound with the same speed but moving in the opposite direction, what is the average acceleration of the molecule during this time interval? (b) What average force does the molecule exert on the wall?
Ans:

Chapter 6.

1. In the Bohr model of the hydrogen atom, an electron moves in a circular path around a proton. The speed of the electron is approximately 2.20×10^{6} m/s. Find (a) the force acting on the electron as it revolves in a circular orbit of radius 0.529×10^{-10} m and (b) the centripetal acceleration of the electron.
Ans:

2. Whenever two *Apollo* astronauts were on the surface of the Moon, a third astronaut orbited the Moon. Assume the orbit to be circular and 100 km above the surface of Moon, where the acceleration due to gravity is 1.52 m/s^2. The radius of the Moon is 1.70×10^{6} m. Determine (a) the astronaut's orbital speed and (b) the period of the orbit.
Ans: