

Suggested problems Chapter 13

The quiz questions will be same or very similar to the following text-book problems.

Refer to the course website for the latest version of this document.

You are encouraged to seek the help of your instructor during his office hours.

6. In Fig. 13-31, a square of edge length 20.0 cm is formed by four spheres of masses $m_1 = 5.00$ g, $m_2 = 3.00$ g, $m_3 = 1.00$ g, and $m_4 = 5.00$ g. In unit-vector notation, what is the net gravitational force from them on a central sphere with mass $m_5 = 2.0$ g?

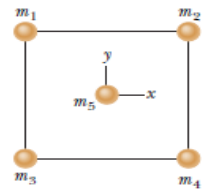


Fig. 13-31
Problem 6.

Answer: $(9.43 \times 10^{-15} \text{ N}) \hat{i} + (9.43 \times 10^{-15} \text{ N}) \hat{j}$

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

Answer: $2.6 \times 10^6 \text{ m}$

24. Two concentric spherical shells with uniformly distributed masses M_1 and M_2 are situated as shown in Fig. 13-40. Find the magnitude of the net gravitational force on a particle of mass m , due to the shells, when the particle is located at radial distance (a) a , (b) b , and (c) c ?

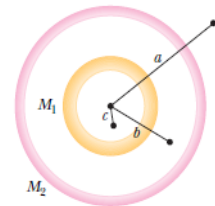


Fig. 13-40 Problem 24.

Answer: (a) $\frac{G(M_1+M_2)m}{a^2}$ (b) $\frac{GM_1m}{b^2}$ (c) gravitational force is zero

37. The three spheres in Fig. 13-44, with masses $m_A = 80$ g, $m_B = 10$ g, and $m_C = 20$ g, have their centers on a common line, with $L = 12$ cm and $d = 4.0$ cm. You move sphere B along the line until its center-to-center separation from C is $d = 4.0$ cm. How much work is done on sphere B (a) by you and (b) by the net gravitational force on B due to spheres A and C?

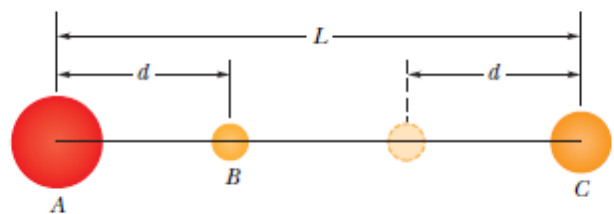


Fig. 13-44 Problem 37.

Answer: (a) 0.50 pJ (b) -0.50 pJ

47. The Sun, which is 2.2×10^{20} m from the center of the Milky Way galaxy, revolves around that center once every 2.5×10^8 years. Assuming each star in the Galaxy has a mass equal to the Sun's mass of 2.0×10^{30} kg, the stars are distributed uniformly in a sphere about the galactic center, and the Sun is at the edge of that sphere, estimate the number of stars in the Galaxy.

Answer: 5×10^{10} stars

65. A satellite is in a circular Earth orbit of radius r . The area A enclosed by the orbit depends on r^2 because $A = \pi r^2$. Determine how the following properties of the satellite depend on r : (a) period, (b) kinetic energy, (c) angular momentum, and (d) speed.

Answer: (a) $r^{1.5}$ (b) r^{-1} (c) $r^{0.5}$ (d) $r^{-0.5}$
