Chapter **02** (Bueche & Jerde) ***Uniformly Accelerated Motion***

P**11**. (a) $v_{av} = 0$; (b) $v_A = (200–0)/12 = 16.7$ (m/min), $v_B = 0$, and $v_C = (–150–200)/(28–18) = –35.0$ (m/min) .

P**22**. The bullet traveling initially with $v_0 = 220$ m/s stops ($v_f = 0$) within $\Delta x = 4.33\times10^{-2}$ m. Therefore, from the relation $v_f^2 = v_0^2 + 2a\Delta x$ the acceleration $a = –5.59\times10^5$ m/s^2. The time taken t is found from $t = x/\underline{v} = (4.33\times10^{-2})/[(½)(0+220)] = 3.94\times10^{-4}$ (s) .

P**30**. In a time t, the car has traveled $x = (½)a\,t^2 = 1.22t^2$. The bus has also moved the same distance given by $x = v\,t = 19.6\,t$. Equating the distance we can solve for t to obtain $t = 1.61$ s. The velocity of the car $v_{car} = a\,t = (2.44)(16.1) = 39.2$ (m/s). The distance moved $x = 19.6\,t = 316$ m .

P**34**. $v_0 = 23.9$ m/s: $H = v_0^2/(2g) = 29.1$ m and $t = v_0/g = 2.44$ s .

P**36**. $t = 9.3$ s gives $v_0 = (½)g\,t = 45.6$ m/s. $H = v_0^2/(2g) = 106$ m .

P**39**. $t_1 = 6.25$ s, $H_1 = (½)g\,t_1^2 = 191$ m; $t_2 = 6.25–0.85 = 5.40$ (s), $H_2 = (½)g\,t^2 = 143$ m .

P**40**. For elevator floor $y = (3.35)t$; for coin $y = 1.25 + 3.35t – (½)g\,t^2$. Eliminating y from the two eqs., $t = [(2)(1.25)/g]^{1/2} = 0.505$ (s) .

P**44**. $v_{0x} = 24.4\cos50.0° = 15.7$ m/s & $v_{0y} = 24.4\sin50.0° = 18.7$ m/s. (b) $t = 2v_{0y}/g = 3.82$ s; (a) $R = v_{0x}\,t = 60.0$ m .

P**46**. Using $y = x\tan\theta_0 – g\,x^2/(2v_0^2\cos^2\theta_0) = 2.0$, where $x = 15$ m and $\theta_0 = 35°$, we find $v_0 = 13.9$ m/s .

P**53**. $y = h + v_0\,t – (½)g\,t^2$. Set $y = 0$ to find $g\,t^2 – 2\,v_0\,t – 2h = 0$. Solving for t gives $t = (v_0/g)(1 \pm [1+(2gh/v_0^2)]^{1/2}$) (Taking the positive sign) .

P**56**. $v_0 = 50.0$m/s. $y_1 = 100 – (½)g\,t^2$ & $y_2 = v_0\,t – (½)g\,t^2$. Set $y_1 = y_2 = H$ to find $t = 100/v_0 = 2.00$ (s) (b) $H = 80.4$ m (a). $v_2 = v_0 – g\,t = 30.4$ m/s; so the rock will be rising (c) .

P**57**. Let the distance during the period t_1 of the acceleration a_1 be S_1 and the distance during the period t_2 of the acceleration a_2 be S_2. The maximum speed of car is $v_{max} = (2a_1S_1)^{1/2} = (2|a_2|S_2)^{1/2}$. From $S = S_1+ S_2$, we have $S_1 = |a_2|S/(a_1+|a_2|) = (½)a_1t_1^2$ and $S_2 = a_1S/(a_1+|a_2|)= (½)|a_2|t_2^2$. Solve them to find $t_1 = \{\ 2|a_2|S/[a_1(a_1+|a_2|)]\ \}^{1/2}$ and $t_2 = \{\ 2a_1S/[|a_2|(a_1+|a_2|)]\ \}^{1/2}$. Using $S = 0.25$ mi = 1320 ft, $a_1 = 24$ ft/s^2, and $a_2 = –32$ ft/s^2 leads to t (= t_1+t_2 = $\{2(a_1+|a_2|)S/(a_1|a_2|)\}^{1/2}$) = 13.9 s .