Physics 218 – Exam I

Short Answer:  
1) $\theta = 11.3^\circ$  
[LO 2.1, 3.1]  
2) At the maximum height, $H$  
[LO 11.1, 12.1, 13.1]  
3) $v_y$  
[LO 12.2, 13.2]  
4) $R = 1.66 \times 10^{-3}$ m$^3$/s  
[LO 10.1]  
5) $|\mathbf{a}| = 1.68 \times 10^3$ m/s$^2$  
[LO 18.1, 19.1, 20.1]

Problem 1:  
(a) $h = 602$ m  
[LO 3.2, 12.3, 14.1]  
(b) $t_{tot} = 38.1$ s  
[5.1, 14.2]  
(c) $t_y$  
[LO 12.4, 13.3, 13.4]

Problem 2:  
(a) $d = 28$ m  
[LO1.1, 3.3, 5.2, 14.3, 15.1]  
(b) $\alpha = 8.6^\circ$ below the horizontal  
[LO 13.5]  
(c) $\langle \mathbf{v} \rangle = (64.7\hat{i} - 7.75\hat{j})$ m/s or 65.2 m/s at 6.8$^\circ$ below the horizontal  
[LO11.2]

Problem 3:  
(a) $\mathbf{v}_{ball/cyclist} = (0.5\hat{i} + 1.0\hat{j})$ m/s or 1.12 m/s at 26.6$^\circ$ clockwise from $\hat{j}$  
[LO 1.2, 2.2, 21.1]  
(b) $\mathbf{d}_{train} = 5.0\hat{j}$ m and $\mathbf{d}_{cyclist} = (2.5\hat{i} + 5.0\hat{j})$ m = 5.59 m/s at 26.6$^\circ$ clockwise from $\hat{j}$  
[LO 12.5]  
(c) $\theta = 30^\circ$ counterclockwise from $\hat{j}$  
[LO 7.1, 21.2]  
(for these answers, we take $\hat{i}$ to be along $\mathbf{v}_{rail}$ and $\hat{j}$ to be along $\mathbf{v}_y$ as shown on the exam)

Problem 4:  
(a) $v(t) = a_0t + \frac{2}{3}bt^{3/2}$  
[LO 8.1, 14.4, 15.2]  
(b) $d = \frac{1}{2}a_0t^2 + \frac{4}{15}bt^{5/2}$  
[LO 8.2, 14.5]  
(c) $\theta = \tan^{-1} \left[ \frac{(a_0t + \frac{2}{3}bt^{3/2})^2}{R(a_0 + bt^{3/2})} \right]$  
[LO 1.3, 18.2]