ECO136, Answer to the problem on P.542. (Ch.24, Appendix).

Y (salary) = $ 1500
Use $ 50 per day,
One month = 30 days
$ 4 switching cost

Given r = 10%, fill in the table below:
Hint1: Average Money Holding = [Y/(# switches + 1)] / 2
Hint 2: Average Bond Holding = [Y – Y/(# switches +1)] / 2

# Switches	Average Money Holding	Average Bond Holding	Interest earned r = 0.1 (10%)	Cost of switching	Net Profit
0	= [1500/(0 + 1)]/2 = 750	= (1500 – 1500)/2 = 0	0	0	0
1	= [1500/(1+1)]/2 = 375	= [1500 – (1500/2)]/2 = 375	= 375 * 0.1 = 37.5	4	= 37.5 – 4 = 33.5
2	= [1500/(2+1)]/2 = 250	= [1500 – (1500/3)]/2 = 500	= 500*0.1 =50	4* 2 = 8	= 50-8 = 42
3	= [1500/(3+1)]/2 =187.5	= [1500 – (1500/4)]/2 =562.5	=-562.5*0.1 = 56.25	4*3 = 12	= 56.25 – 12 = 44.25
4	= [1500/(4+1)]/2 =150	= [1500 – (1500/5)]/2 =600	=600*0.1 = 60	4*4 = 16	= 60-16 = 44
5	=[1500/(5+1)]/2 =125	= [1500 – (1500/6)]/2 =625	=625*0.1 =62.5	4*5 = 20	=62.5 – 20 =42.5

The story goes like this…
For 0 switch, he does not have to go to bank at all. Start $1500 in his pocket, use $50 each day, finish $1500 after 30 days (1500/50 = 30).

For 1 switch, he goes to the bank once to switch bond to money. Each month, he starts with $ 750 in his pocket, use $50 each day, finish $750 after 15 days (750/50 = 15), then go to bank on the 15th day, switch bond to money, and get $750 in cash.

For 2 switches, he goes to the bank twice. Each month, he starts with $500 in his pocket, use $50 each day, finish $500 after 10 days (500/50 = 10), then go to bank on the 10th day to get another $ 500 in cash by selling $500 equivalent of bond.

If you are still confused, draw the zigzag figure you can find on page 527 for each case. The average money holding can be computed as the half of the money he start each month with.

a. Describe briefly how Mr. Peabody should decide how much money to hold.

A: He should allocate Money-Bond in the way to maximize the net profit computed as the interest earning minus the cost of switching.

b. Calculate the Peabody's optimal money holdings.

A: Done in the table. We found that the net profit is maximized when he switches three times and the average money holding is $187.5.

c. Suppose the interest rate rises to 15%. Find Peabody's optimal money holdings at this new interest rate.

A: Re-compute the table by changing the "Interest earned" column and "Net Profit" column. See the table below.

# Switches	Average Money Holding	Average Bond Holding	Interest earned r = 0.15 (15%)	Cost of switching	Net Profit
0	= [1500/(0 + 1)]/2 = 750	= (1500 – 1500)/2 = 0	0	0	0
1	= [1500/(1+1)]/2 = 375	= [1500 – (1500/2)]/2 = 375	= 375 * 0.15 = 56.25	4	= 56.25 – 4 = 52.25
2	= [1500/(2+1)]/2 = 250	= [1500 – (1500/3)]/2 = 500	= 500*0.15 =75	4* 2 = 8	= 75-8 = 67
3	= [1500/(3+1)]/2 =187.5	= [1500 – (1500/4)]/2 =562.5	=-562.5*0.15 = 84.375	4*3 = 12	= 84.375 – 12 = 72.375
4	= [1500/(4+1)]/2 =150	= [1500 – (1500/5)]/2 =600	=600*0.15 = 90	4*4 = 16	= 90-16 = 74
5	=[1500/(5+1)]/2 =125	= [1500 – (1500/6)]/2 =625	=625*0.15 =93.75	4*5 = 20	=93.75 – 20 =73.75

For r = 15% case, we confirmed that the optimal money holding is $150, and the optimal number of switches is 4.

For r = 20%, just repeat the same procedure.

# Switches	Average Money Holding	Average Bond Holding	Interest earned r = 0.20 (20%)	Cost of switching	Net Profit
0	= [1500/(0 + 1)]/2 = 750	= (1500 – 1500)/2 = 0	0	0	0
1	= [1500/(1+1)]/2 = 375	= [1500 – (1500/2)]/2 = 375	= 375 * 0.20 = 75	4	= 75 – 4 = 71
2	= [1500/(2+1)]/2 = 250	= [1500 – (1500/3)]/2 = 500	= 500*0.20 =100	4* 2 = 8	= 100-8 = 92
3	= [1500/(3+1)]/2 =187.5	= [1500 – (1500/4)]/2 =562.5	=-562.5*0.20 = 112.5	4*3 = 12	= 112.5 – 12 = 100.5
4	= [1500/(4+1)]/2 =150	= [1500 – (1500/5)]/2 =600	=600*0.20 = 120	4*4 = 16	= 120-16 = 104
5	=[1500/(5+1)]/2 =125	= [1500 – (1500/6)]/2 =625	=625*0.20 =125	4*5 = 20	=125 – 20 =105
6	= [1500/(6+1)]/2 =107.14	=[1500-1500/7]/2 =642.86	=642.86*0.20 =128.57	4*6 = 24	=128.57-24 = 104.57

For r = 20%, we found that the optimal money holding is $125, and the optimal number of switches is 5.

d. Graph your answer from b and c with the interest rate on the vertical axis and the amount of money demanded on the horizontal axis.