

Here are the final numerical results for each section of the exam. You can use them to check your work if you do the exam for practice. If you have trouble with the problems, or don't get the answers shown here, stop by during office hours or make an appointment and we can go over them.

### Question 1

(1) The Q's and TCA's are shown below:

Firm	Qa	TCA
1	450	\$202,500
2	300	\$135,000
3	150	\$67,500
Total	900	\$405,000

(2) Efficient tax rate = \$900. The efficient levels of pollution and the taxes and total compliance costs will be as follows:

Firm	Qp	Taxes	Total
1	550	\$495,000	\$697,500
2	700	\$630,000	\$765,000
3	850	\$765,000	\$832,500
Total	2100	\$1,890,000	\$2,295,000

(3) Equilibrium permit price will be \$900. The initial allocation of permits and final compliance costs will be follows:

Firm	Permits Issued	Compliance Cost
1	775	\$0
2	625	\$202,500
3	700	\$202,500
Total	2100	\$405,000

(4) With firm 1 exempted and firms 2 and 3 together achieving 900 units of abatement, the MCA and the price of a permit will be \$1800. Efficient quantities of abatement: Q2=600, Q3=300. Abatement costs: TCA2 = \$540,000, TCA3 = \$270,000. Total abatement cost = \$810,000. Distribution of permits: 400 to firm 2 and 700 to firm 3.

(5) The first policy is much better. The second costs \$405,000 more but achieves exactly the same abatement. Alternatively, if only firms 2 and 3 are to be regulated, the efficient Qa is 600 and setting Qa=900 produces \$135,000 DWL.

### Question 2

(1) Efficient Qa = 2000; efficient Qp = 2000; MCA = \$300; MBA = \$300.

(2) Permit price = \$300; extra permits purchased = 500.

(3) Permit price = \$250; extra permits purchased = 0.

**Question 3**

(1) The equilibrium without banking and borrowing:

Period	Qa	Permit Price	TCA	PV of TCA
0	100	\$300	\$15,000	\$15,000
1	600	\$1200	\$360,000	\$180,000
2	1100	\$1100	\$605,000	\$151,250
Total	1800			\$346,250

(2) With full banking and borrowing:

Period	Permit Price	Permits Used	Permits Banked	TCA	PV of TCA
0	\$337.5	887.5	12.5	\$18,984	\$18,984
1	\$675.0	1162.5	-262.5	\$113,906	\$56,953
2	\$1350.0	650.0	250.0	\$911,250	\$227,812
Total		2700.0	0.0		\$303,749

There is net borrowing in period 1 but that's OK because the policy in the question allows full banking and borrowing.

**Question 4**

(1) The results are summarized below:

Period	R	MEC	P	Q
0	\$120	\$400	\$520	120
1	\$240	\$400	\$640	280
2	\$480	\$400	\$880	520
Total				920

(2) Since the price rises above \$800, the backstop will be used. The new equilibrium looks as follows:

Period	R	MEC	P	Q
0	\$100	\$400	\$500	125
1	\$200	\$400	\$600	300
2	\$400	\$400	\$800	600
Total				1025

105 units are produced from the backstop.