Can you clean up Coralia?

One day on the town council, four files, four **stamps: a price, a cap, a rule, an owner** · for each file: its lesson's numbers → the stamp that reaches the goal → the **one number** the stamp needs ($35 · $400 · $80 · $100) · Micro 10 had one tool (a $20 tax: 50 → 40 tons); this course has four. **This lesson shows what each tool does; it does not tell you which policy is right.**

1 Four stamps

question 10

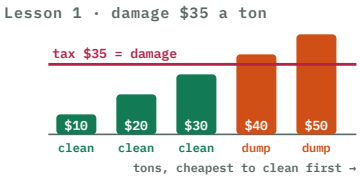
- **Price** = tax / permit price per ton (permit = right to 1 ton) → fixes the cost of the last ton, the tons find themselves → fits: harm per unit known, costs not (Lessons 1, 3, 4) · **Pigouvian tax** = tax equal to the harm per unit (Arthur Pigou, English economist, 1920)
- **Cap** = fixed total of tons, boats, permits → the price finds itself → fits: the quantity must not be missed (Lessons 2, 4) · **cap and trade** = a cap cut into permits that sell
- **Rule** = standard (a limit for all) or ban, same for all → fits: right amount = **zero**, or a price costs more to run than it saves (Lesson 5) · **Owner** = licence, deed (ownership paper), village in common → somebody gains from keeping it (Lesson 2) · the sky: nobody can own it (Lesson 9)

STAMP	FIXES	FAILS WHEN
Price	the price	the tons must not be missed
Cap	the tons	the price turns out wild
Rule	everyone alike	cheap fixes go unused
Owner	who gains from keeping it	nobody can hold it: the sky

2 Files 1-2

sludge · reef

- **Sludge** (Lesson 1): clean $10, $20, $30, $40, $50 · damage `$35` /ton · council knows the $35, not the staircase ⇒ **price** · cleans 3 ($60), dumps 2 → tax `2 × $35 = $70` · island's bill = cleaning + damage `$60 + $70 = $130` (lowest) · ban $150 · tax = a transfer, not a cost
- **Reef** (Lesson 2): n boats, each catches $(12 – n) hundred, costs $400 · **open access** (anyone may come) → 8 boats, $0 · best **4 boats, $1,600** a day ⇒ cap of 4 licences = fee of $400 = owner who runs four · licence worth `$800 – $400 = $400` · tradable → cheapest crews fish (New Zealand 1986, Iceland 1990) · ban × loses $1,600 · who gets the licences: open
- Practice · dye works $15…$55, damage $40 → cleans 3 ($75), tax `2 × $40 = $80`, bill **$155**, ban **$175** · clam beds $(14 – n) hundred – $400 → open access 10, best **5 rakers, $2,500** (4 or 6: $2,400), licence **$500**



3 Files 3-4

ten tons · 6 pm

- **Ten tons of CO_2** (Lessons 3-4): A's tons $10, $20, $30… `$10 × k`, B's `$40 × k` · goal: **exactly ten**, costs unsure ⇒ **cap**: 10 permits that trade → cheapest ten A 8 + B 2 = **$480** (5 + 5 = $750) · permit between 10th ($80) and 11th ($90) ≈ **$80** · a tax of $85 cuts ten only if costs are as expected; twice as dear → 5 tons
- **6 pm peak** (Lesson 6): wants 200 MW (megawatts) at $20, steady plants 150, **peaker** (plant run only at the peak) +50 at $100 fuel ⇒ **price** $100 at 6 pm → wants 160 → peaker `160 – 150 = 10` MW, 40 MW move to the night · cap 150 = blackout · flat price kinder to who cannot move dinner (open)
- Practice · A `$10 × k`, B `$20 × k` → ten cheapest 10, 20, 20, 30, 40, 40, 50, 60, 60, 70 → price **$75** (10th $70, 11th $80) → A 7 + B 3 = `$280 + $120 = $400` vs 5 + 5 `$150 + $300 = $450` · chain: fewer permits → permit price ↑ → dearer fixes pay → more tons cut

4 Real world

eight settled cases

- **Price**: Sweden's carbon tax (1991, ≈ $120/ton 2023) · British Columbia (Canadian dollars: C$10 2008 → C$80 2024; zero for households 2025)
- **Cap**: US Acid Rain Program (SO_2 = sulfur dioxide; allowances, 1995) · EU emissions trading (2005) · **Rule**: lead out of US road fuel (1996; last country 2021) · Montreal Protocol (ozone-thinning chemicals → zero)
- **Owner**: Maine's lobster crews · a Japanese village forest (in common; Elinor Ostrom, American, Nobel 2009)
- Practice · price: ferry smoke ($50/ton harm), beach bags (10¢ a bag) · cap: lagoon nitrogen (≤ 100 tons/yr), beach sand (≤ 2,000 m^3/yr) · rule: lead paint · owner: hill pasture (the village)

5 So what

the whole checklist

- Science in one line: human influence has warmed the planet, "unequivocal" (IPCC, the UN's climate science panel, 2021) · the rest (which tool, how fast, at what cost, which discount rate = weight of far-off harm, who pays) = economics · university: **integrated assessment model** (economy + climate in one model; William Nordhaus, Nobel 2018) → its key number, the discount rate, still debated
- **Ten questions to ask about any green policy**: **1** · What does the smoke really cost, and who pays it now? · **2** · Who owns the resource? · **3** · Does it cut where cutting is cheapest? · **4** · Price or quantity, and which mistake is worse here? · **5** · The cheap fix, the visible one, or the next invention? · **6** · Does it work at the peak, or only on the average day? · **7** · What is a dollar of damage in 2100 worth today, at which discount rate? · **8** · Did the smoke really fall, or just move abroad? · **9** · Who can free-ride, and what brings them in? · **10** · **Which tool fits this problem: a price, a cap, a rule or an owner?**

Watch out: one favorite tool for every problem × · the $35 tax fit the sludge; a tax on ten tons misses them if cleaning is twice as dear · a ban is the **cleanest**, not the **cheapest** (dye works $175 vs $155; clam beds –$2,500 a day) → fits where the right amount is zero · which tool to choose = the council's call, the numbers say what each costs