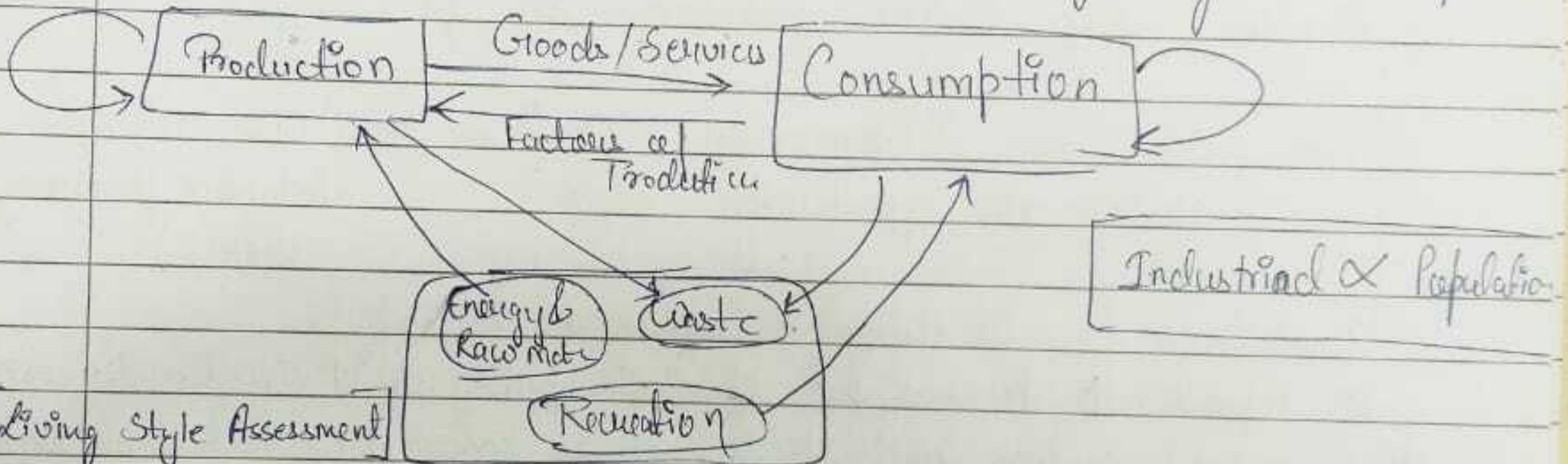


Resource & scarce

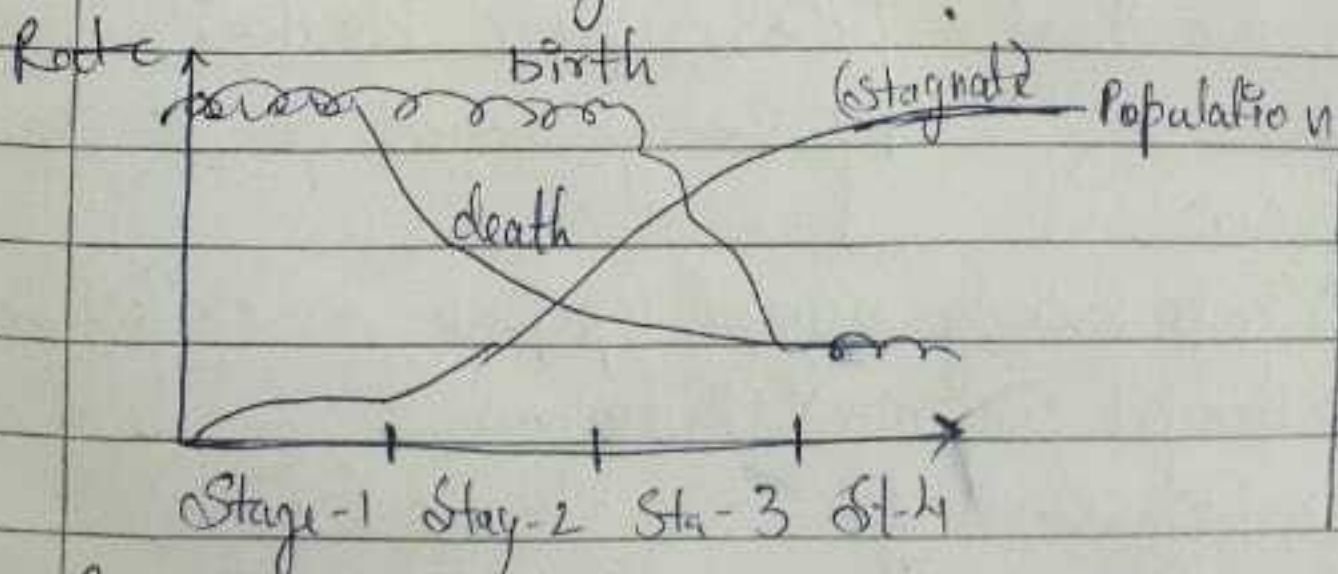
- ① How people buy ② work & save  
③ How much produce & hire ④ division of resources

10-principles of economics

- ① People face tradeoffs ⑤ Trade can be mutually beneficial  
② Cost of action is foregone opportunity ⑥ Market is good for trade coord.  
③ Rationality in marginal cost & benefits ⑦ Gov. can improve market  
④ People respond to incentives ⑧ Country living & GIS & produce



- \* GDP current → India (6<sup>th</sup>) (PPP) Adjusted → India (3<sup>rd</sup>)
- \* Predicted Growth Rate for growing economy higher.
- \* Gini coefficient for inequality. (Higher → greater inequality)
- \* Literacy Rate (India ~ 50-60%, developed ~ 80-90%)
- \* Life Expectancy (US/Australia ~ 80, India ~ 70)



Environmental Impact

(Population) (Consumption) (Technology)

$$P \times A \times T$$

(Affluent)

$$= I \text{ (Environmental Impact)}$$

- \* Road pavement can reduce PM by 17%
- E-waste → ① white (refrigeration, washing machine, air cond)  
② grey (computer, laptop, printer) ③ brown (tv set, camera)



\* Air Pollution has cost of GDP (Delhi ~ 13%)

- ① Environmental Burden of disease (% disease due to pollution)  
② Expected years of disease (Total diseased) 12y (9m)

(CAGR) [GDP ~ Production, Consumption, Net Exports, Govt. Expenditure]  
(12%) \* Crop Protection Industry ↑ (Pesticides) Good/Bad  
(6.4%) \* Fertilizers market also inc. (Profitability decline)  
(16.5%) \* Pharmaceutical sector (Increase diseases or better well being?)  
40% \* Water bottle industry (Quality in pipe ↓) (Industry grows)  
\* Chemical, Textile, Leather growing (Very polluting)

- ① Fluorine in water ② Open water defecation ③ COPD (chronic obstructive pulmonary disease)  
Health IS opportunity cost

Conclusions ① Economy x Environment Tradeoff  
② Population ↑ Resources ↓ ③ Earth capacity limit ④ Air, Water, soil  
⑤ Economic indicators bad (X) ⑥ Consider tradeoff ⑦ Technology needed

WHY ENVIRONMENT PROBLEM OCCUR? (Market Failure)

For Market Success

- ① Property rights defined, freely traded  
② competitive, max benefit, min cost  
③ prices transparent  
④ Transaction cost zero

For Market Failure

⑤ Incomplete Market  
⑥ Enough market for all txn.

II Property Right :   
→ Comprehensively assigned (private or collective)  
→ Benefit only mine (Exclusive)  
→ Transferable → Secure (law)  
[Pure = Non excludable]  
Market fail! (Environment in public)   
→ Pure public (no competition)  
→ No exclusivity  
→ No rival good



- II Depletable Extremality : Manure of cow (I take, other cannot)  
 III Non-Depletable Extremality : Vehicular pollution - not depletable

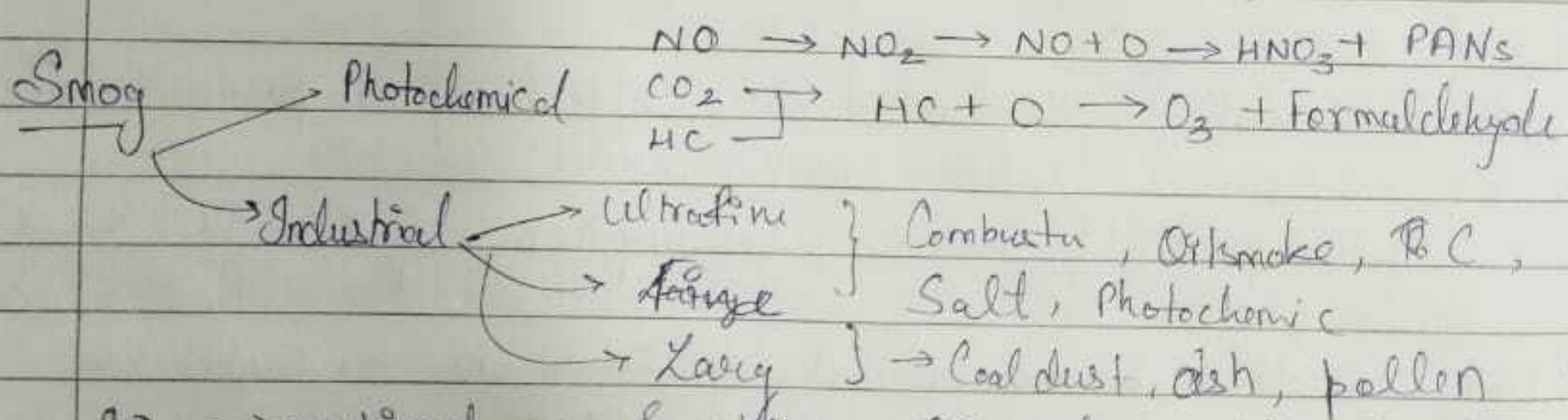
III How to solve environment problem? (Air, Water, Solid, Toxic)

Air Pollution → Presence of harm chemical in air ① Cause harm ② After direct  
 ① Primary → directly enter atmosphere  
 ② Secondary → Under rxn & emerge

Major Classes ① CO, ~~CO<sub>2</sub>~~ ② SO<sub>2</sub>, SO<sub>3</sub> ③ NO, N<sub>2</sub>O, NO<sub>2</sub>  
 ④ SPM (dust, soot, sulphate, nitrate, PCB, dioxine, pesticid) ⑤ VOC (organic CH<sub>4</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>8</sub>)  
 ⑥ Photochemical (Ozone, PAN (peroxyacetylene nitrate), H<sub>2</sub>O<sub>2</sub>)  
 ⑦ Radioactive (Radon-222, Iodine-131, Sr-90, P-239) ⑧ Hazardous (toxic)

TRIC : Toxic : 39 cancer, mutagenic, teratogenic, Reactive, Ignitable  
 Corrosive

Criteria : (CO, NO<sub>2</sub>, SO<sub>2</sub>, SPM, O<sub>3</sub>, Pb, CFCs)



SO<sub>2</sub> → respiratory & vision CO → haemo globin / headache  
 NO<sub>2</sub> → airway restriction O<sub>3</sub> → eyes, chest, cough  
 Acid → HNO<sub>2</sub>, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> → damage structure

Pollutants	Source	Effect
Hot water	CI water	Cancer
Para-dichloro benz	Air freshener	Cancer
1,1,1, trichloro ethane	Aerol	Irregular breathing
NO <sub>2</sub>	gas stove, fuels	lung, child cold
Asbestos	vinyl ceiling, insula	lung cancer



CO — furnace, kerosene, woodstoves — headache, haemolysis  
 CH<sub>3</sub>Cl — Paint, thinner — Nerve disorder, diabetes  
 Styrene — Carpet, Plastic — Kidney, liver  
 Tetra chloro ethylene — fluid foam — Nerve, liver kidney

\* O<sub>3</sub> Depletors by CFCs → Greenhouse Effect

Water Pollution → ① Point Source (Easy control)

→ ② Non-point source (no source single out)

Bacteria (Cholera, Dysentery, Typhoid), Virus (Hepatitis), Parasite (Amoeba)  
 Protozoa (Giardiasis), Parasitic worm (Schistosomiasis)

Ground Pollution → Run off arsenic, FI, etc.

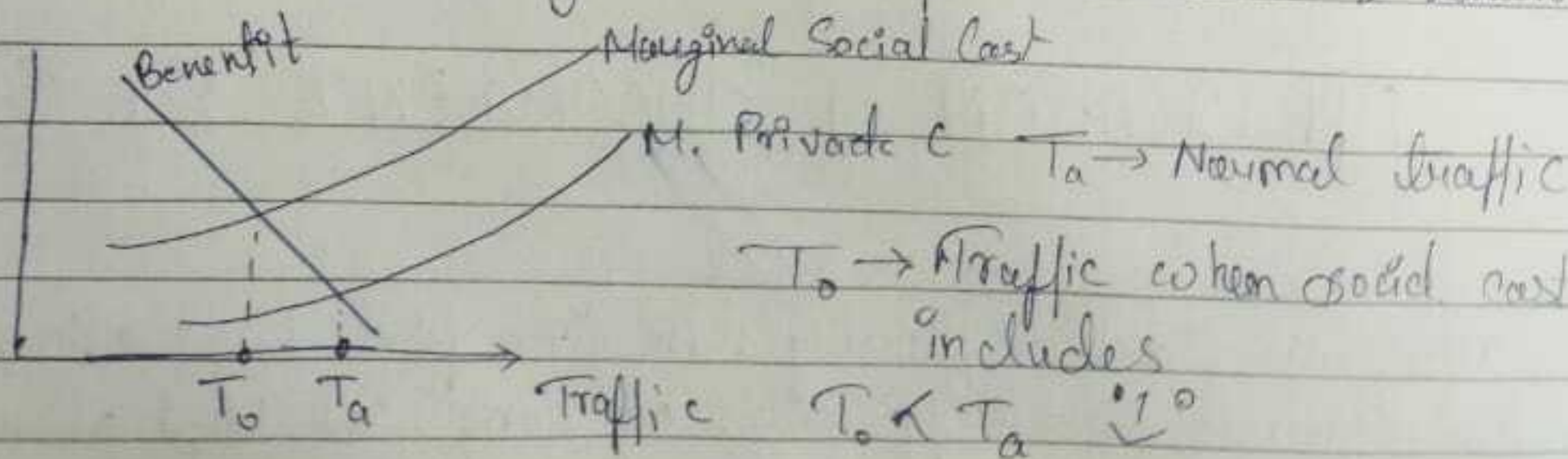
Oceanic → Industry, Cities, Urban Sprawl, Red tides (N↑), BOD↓  
 Algae ext

HOW TO SOLVE!? (Internalize Externality, Incentive, Policy)

Sol-1: Create Property Rights → Buy right to pollute air

Sol-2: Policy Instrument → Pay for pollution, Standard externalities, organ

Types of Policy: (1) Price Rationing (inc. cost of smoking) Market  
 (2) Quality R. → Acceptable level of pollut  
 (3) Liability Rule → acceptable benchmark & behaviour





## Economic Instruments to Control Pollution

(CAC)

I Regulations (1) Standards, MINAS, Product & Process Standard, (2) Bane (3) Permit / Licence Quota

II Using Markets : (1) Charge Systems - effluent charges, user charges, product charges, administrative, impact

(2) Fiscal / Environment Tax : \* Pollution tax, Input tax, Support RnD, Adopt Tech

(3) Financial Instruments : \* financial subsidy & easy loan/grant

(4) Deposit-refund System : \* Environment bond, give back bottle

III Creating Market (1) decentralise / Property right (2) Tradable permit (3) International offset (4) Liability Insurance legislation

IV Involving Participation (1) Voluntary (2) Public Trans. (3) Informed (4) Two-tier monitor

PROPER (Program for environmental eval & training)

\* GOLD: state of art \* GREEN > standard \* BLUE = standard  
\* RED < standard \* Black = No control

## APPLICATION OF INSTRUMENTS FOR GLOBAL

Criteria for measurement

- (1) Static Cost Efficiency : At given point target achieved at min cost
- (2) dynamic Cost Efficiency : At long run target achieved at min cost
- (3) Goal fulfillment : At least my target get met



- ④ Administrative Cost : Is it too high or low
- ⑤ Polluter Pays → To Hagar cooki pay
- ⑥ Politics of implementation → All agreed or not

Criteria	CAC	Tax	Permits
Static CE	No	Yes	Yes (market available)
Dynamic CE	No	Yes	Yes (depends)
Goal	No (agree)	No (optimal idk)	YES (law) -
Administrative	Best (no cost)	Depends	Difficult (survey)
Barrier to entry	(High CAC so yes)	Neutral	No/Yes (rich may buy)
Polluter Pay	Yes	Yes	Yes
Politics	<del>Yes</del> (Rent seeker)	(Nobody likes)	Neutral

Quantity based Emission Permits (limit look on total)

- Allocate out of this total to firm on ~~different~~ basis
- Go buy if you need to pollute more. (US SO<sub>2</sub>)

Allowances → utility to emit 1-ton SO<sub>2</sub> that year / next year

↳ Marketable ↳ Only used after calendar year they are allocated

Step-1 : Establish max cap (Q)

Steps-2 unit @ 0.5 pounds SO<sub>2</sub> / mm BTU heat input X units baseline  
(avg fossil fuel 1985-1987) → Revised 1.2 SO<sub>2</sub> / mm BTU

Step-3 Strict non-compliance punishment 3000 \$ per ton

Why success? → Huge difference in cost emission measure (cheap for us to emit)

(easy policy) → flexible ~~and~~ policy  
Government enforced nicely

Other Instruments → Lots of taxes & charges