Unit 7A Review

Chapters 14, 15

Chapter 14 Highlights

- **Point vs nonpoint source**
  - *Point*: single, identifiable – ***"you can point to it"***
    - **Ex:** smokestack, drainpipe – think *single, concentrated and isolated*
    - **Easy and cheap** to regulate, control, and prevent
  - *Nonpoint*: dispersed and difficult to identify
    - **Ex:** all forms of erosion, **all forms of runoff** – think *dispersed, scattered, spread out*
    - **Difficult and expensive** to regulate, control, and prevent
- **Clean Water Act** – 1972
  - protects wildlife and recreation.
- **Safe Drinking Water Act** – 1974, 1986, 1996
  - sets national standards for drinking water.

Chapter 14 Highlights

- **Types of Water Pollution**
  - *Organic waste*: fecal coliform is indicator for water contaminated by animal sewage
  - *Heavy Metals*: lead, arsenic, mercury.
  - *Acid*: lowering of pH from acid deposition or acid mine drainage.
  - *Pesticides*: DDT and others can bioaccumulate.
  - *Pharmaceuticals/Hormones*: not filtered out by treatment.
  - *Military compounds*: perchlorates from weapons testing.
  - *Industrial compounds*: PCBs, PBDEs – used in plastics, insulation, and flame retardants.
  - *Oil*: most oil comes from natural seeps, largest human impact is from city streets, urban runoff.
  - *Sediment*: soil eroded – 70% from human activities
  - *Thermal*: drastic change in temperature, lowers available DO; associated with nuclear power plants
  - *Noise*: sonar and underwater air guns disrupt whales and marine animals.

Chapter 14 Highlights

- **Cultural eutrophication**
  - Human activities greatly accelerating the input of *inorganic plant nutrients* (**nitrogen** and **phosphorus**) to a lake.
    - Sources include *agricultural runoff*, *urban runoff*, *suburban lawns*, and *mining sites* – all *nonpoint sources*.
  - **Influx of nutrients can lead to an algal bloom.**
    - Algae population explodes, consuming nutrients in lake.
    - Algae eventually dies, leading to an abundance of organic matter to be decomposed.
    - Decomposers explode in number, raising biological oxygen demand (BOD) and consuming dissolved oxygen (DO).
    - DO drops and kills off most fish species.
    - Process represented by an ***oxygen sag curve*** – effects last longer the slower the flow rate of water.

    ADVICE: Be able to explain step by step how agriculture can ultimately lead the death of many marine organisms.

Chapter 14 Highlights

- **Waste Water Treatment**
  - **Primary treatment:** *physical process*, involving filters, screens, grit tanks, settling tanks – uses *gravity* and *particle size* to separate – **"floaters and sinkers"**
  - **Secondary treatment:** *biological process*, aerobic bacteria removes organic waste.
  - **Tertiary treatment:** *chemical process*, also known as advanced treatment. Uses *specialized chemicals* and *filters* to remove *nitrates* and *phosphates*. Process can be performed **naturally by a wetland** – *ecosystem service.*
    - Water is treated with ***chlorine*** to remove coloration and to kill remaining bacteria. *Ozone* and *UV* light are alternatives.

Chapter 15 Highlights

- **Air Pollution – tragedy of the commons!**
  - **Primary** (directly) vs. **Secondary** (reaction in atmosphere)
    - ***Photochemical smog***: formed when NO2 breaks up and reacts with ozone and VOCs.
      - Atmospheric and regional characteristics can cause *inversions* trapping photochemical smog and air pollution near ground. (Los Angeles has inversion for most of year)
    - ***Acid deposition***: regional problem, sulfur dioxide (SO_2) reacts with water vapor to form ***sulfuric acid*** **(H_2SO_4)** and nitrogen oxides (NO_x) react to form ***nitric acid*** **(HNO_3)**.
      - Damages leaves, bark, reduces photosynthesis, lowers soil pH, leaches soil nutrients, releases toxic metal ions from rocks, lowers lake pH.
  - *National Ambient Air Quality Standard*s established **criteria pollutants (SPLONC)**
    - **Sulfur dioxide (SO_2)**
    - **Particulates (PM)**
    - **Lead**
    - **Ozone (O_3)**
    - **Nitrogen oxides (NO_x)**
    - **Carbon monoxide (CO)**
  - **Pollution control measures:** *Fluidized bed combustion* (SO_2)*, catalytic converters* (NO_2)*, electrostatic precipitators* (PM) and *scrubbers* (PM, SO_2).

Chapter 15 Highlights

- **Ozone depletion – tragedy of the commons!**
  - Ozone most concentrated in stratosphere (**ozone layer**) – Ozone is ***good in stratosphere*** (absorbs harmful UV light), but ***bad in the troposphere*** (acts as GHG, secondary pollutant, photochemical smog)
    - Increased UV exposure will increase *skin cancer, eye cataracts, sunburns, reduce crop yields, disrupt aquatic food chains.*
  - ***Cholorofluorocarbons (CFCs)*** disrupt natural ozone (O_3) formation in the stratosphere when chlorine/bromine steal away a free oxygen molecule. This breaks apart current ozone and prevents new ozone forming.
  - CFCs were used as *coolants* (A/C, refrigerators), *aerosols* (spray cans), *cleaning products, insulation*.
    - Highly stable, CFCs can exist in stratosphere **up to 385 years**, each chlorine molecule destroying thousands of O_3.
    - **Sherwood Rowland** and **Mario Molina** at UCI were first to point this out and called for CFC ban.
    - ***Montreal Protocol, 1987***: international agreement to ban CFCs, ozone layer is rebounding, but will still feel affects of CFCs for next 50+ years due to lag time.
- Keep in mind **climate change** and **ozone depletion** have similarities, but generally **have little affect on each other!** (Ozone depletion doesn't necessarily lead to warming, GHG don't increase ozone depletion.)
  - Ozone and CFCs are what they share in common, but don't confuse – CFCs deplete ozone in stratosphere, act as GHG in troposphere, ozone is a pollutant in troposphere, beneficial in stratosphere.

Chapter 15 Highlights

- **Indoor Air Pollution**
  - Significant hazard in developing and developed countries.
    - ***Developing***: 3 billion people burn wood, manure, or coal indoors for heating and cooking – dangerous levels of PM and CO.
    - ***Developed***:
      - *Carbon monoxide* (malfunctioning heaters, can cause death)
      - *Asbestos* (insulation, construction materials, can cause lung cancer)
      - *Radon-222* (natural decay of uranium, 2nd leading cause of lung cancer)
      - *VOCs* (furniture, glues, paints, "new car smell", can cause asthma and lung cancer)
      - **Sick Building Syndrome:** buildup of indoor air pollutants in new airtight buildings.
        - » *Headaches, nausea, eye or throat irritation, fatigue*

Unit 7B Review

Chapters 16, 17

Chapter 16 Highlights

- **Solid Waste – tragedy of the commons!**
  - **5 R's:** Refuse, Reduce, Reuse, Repurpose, Recycle
    - order of most to least desirable, most to least energy efficient
  - ***Sustainable*** societies focus on ***waste prevention*** rather than cleanup – attacking *affluenza, planned obsolescence*
  - *Sanitary landfills*: over half of U.S. *municipal solid waste* (**MSW**), biggest component is packaging (paper, cardboard)
    - Biggest problem is *leachate, water contamination*.
  - *Incinerating waste*: reduces *solid waste*, but now have *air pollution, water pollution,* and possibly *hazardous waste* to deal with.
    - Still, **Japan** and some **European nations** incinerate most of their waste.
- **Hazardous Waste – tragedy of the commons!**
  - **Treatment**
    - *Physical*, *chemical* and *biological* ways to convert to less hazardous substance.
      - *Charcoal filters, chemical reactions with specific catalysts, bioremediation, phytoremediation*
  - **Storage**: Yucca Mountain was proposed, plan scrapped. Stored on site.
  - **CERCLA:** Superfund, cleanup of toxic sites (brownfields), result of ***Love Canal***.
    - *Environmental Justice* – all are entitled to protection from environmental hazards.
  - **RCRA:** "cradle to grave" – tracking hazardous waste from start to end.

Chapter 16 Highlights

- **Reducing Waste**
  - **Composting**
    - Decomposing organic matter under controlled conditions.
      - *Takes time, space, and must be turned consistently to speed up aerobic respiration.*
      - *Helps reduce demand for landfill space.*
  - **Life-cycle analysis**
    - Looks at materials used and released throughout lifetime of product
      - Gather raw materials, manufacture, use, and disposal.
  - **Integrated Waste Management**
    - Similar to IPM, employs *various strategies to reduce environmental impact* of MSW.
      - Source reduction, recycling, composting, landfill, incineration, etc.
      - **"cradle to cradle"** – designing products to minimize waste before during, and after manufacture and designing products that are easily broken down and recycled and the end of their lifespan.

Chapter 17 Highlights

- **Health Risks**
  - *Risk factors* differ between nations and lifestyles.
    - *High-income*: lifestyle choices, lack of exercise, overnutrition
    - *Low-income*: poor sanitation, low nutrition, unsafe water
    - *Acute* (rapidly impairs, short-lived) vs *chronic* (slowly impairs, often life-long)
    - *Epidemic* (rapid increase) often leads to *pandemic* (spread over large region)
  - **Infectious diseases:** caused by pathogens
    - Historic: plague, malaria, tuberculosis
    - Emergent: HIV/AIDS, Ebola, Mad Cow, Swine/Bird Flu, SARS, West Nile, Zika
  - **Chemical risks**: *neurotoxin, carcinogen, teratogen, mutagen, allergen, endocrine disruptor*
    - **LD50**: lethal dose that kills 50% of individuals in study

Chapter 17 Highlights

- **Solubility and persistence**
  - *Water soluble*: tend to easily wash off surfaces, percolate into groundwater, and runoff into surface waters.
  - *Fat-soluble*: found in high concentrations in soils and stored in organisms.
    - **Bioaccumulation**: fat-soluble, does not pass through organism, stored in cells (pg. 609)
      - Leads to **biomagnification**: trace concentrations at low trophic levels increase to significant levels at high trophic levels.
      - ***Mercury in Minamata Bay, Japan*** – important example/case study
      - Cause for endangerment of bald eagles, thinned egg shells. Banning DDT (**1972**) led to recovering, success story for ESA.
  - *Persistence*: how long chemical remains in environment.
    - Higher the persistence, the higher the risk for harm. *(DDT is 30+ years)*

ADVICE: Be able to explain step by step how chemicals can enter water bodies and ultimately cause human health concerns.

Unit 8 Review

Chapters 18, 19

Chapter 18 Highlights

- **Conservation of Biodiversity**
  - Extinction
    - *Background extinction*: continuous, low level extinction due to natural selection.
    - *Mass extinction*: extinction of 75% to 95% species in a relatively short period of time. Requires millions of years to recovery lost biodiversity.
    - *Endangered species*: so few individuals that species could soon become extinct over natural range. (**Red Light**)
    - *Threatened species*: vulnerable, likely to become endangered. (**Yellow Light**)
  - Ecosystem services
    - Provisions, regulating services, support systems, resilience, and cultural services

Chapter 18 Highlights

- **HIPPO**: describes greatest threats to species.
  - ***H****abitat loss/fragmentation* – area reduced to smaller, scattered patches, creating habitat islands – island biogeography
  - ***I****nvasive species* – deliberate or accidental, outcompete and takeover
  - ***P****opulation growth* – expanding human ecological footprint
  - ***P****ollution* – persistent pesticides, biomagnification
  - ***O****verexploitation* – overfishing, overhunting, poaching
  - **Legislation** (pg. 647, 651, Study Book, pg 20, 23)
    - ***Endangered Species Act*** (ESA), 1973: designed to protect endangered species. Makes it illegal to harm species or destroy/ modify habitat.
    - ***Convention on International Trade in Endangered Species*** (CITES), 1975: bans hunting, capturing, selling of threatened or endangered species. Limited enforcement, small fines, not every country on board.

Chapter 19 Highlights

- **Climate change – tragedy of the commons!**
  - *Greenhouse effect*: atmospheric gases absorb outgoing IR radiation, keeping heat closer to Earth's surface for a longer period of time
    - ***Natural and necessary process***, but human activities (burning fossil fuels specifically) is increasing greenhouse gas concentrations and causing climate change (warming). – CO_2 is now over 400ppm and rising.
    - *Greenhouse gases*: water vapor (biggest, but nonanthropogenic), CO_2, CH_4, N_2O, and CFCs.
  - Lots of **evidence of global warming** (pg 674) – be able to interpret it!
  - **Consequences**: Widespread threats to biodiversity, crop production, unpredictable and extreme weather, sea-level rise, more severe droughts.
    - Two significant *positive feedback loops*:

    1. Melting of sea ice, lowers albedo, absorbing more solar energy, increasing melting.

    2. Increasing temperatures leads to more evaporation, more water vapor increases warming as water vapor is GHG, which causes more evaporation.

    ADVICE: Climate change is a wildcard, it can be brought up in any topic. Be ready to answer an FRQ on how climate change will impact _____.