

# APES Unit 8 Study Guide

## Ultimate Review Packet (8.1 - 8.3)

### 8.1 - Point and Nonpoint Source Pollutants

- a. **Describe** the difference between point and nonpoint source pollutants, using an example of each  
**Point source pollutants** are singular, easily identifiable sources of a specific pollutant such as an oil spill or a power plant emitting  $SO_x$  or  $NO_x$ . **Nonpoint sources** of pollution are diffuse or spread out sources that are difficult to associate with a specific instance of pollution, such as urban runoff carrying sediment into bodies of water
- b. **Identify** each of the following sources of pollution as point or nonpoint:
- |  |              |                         |   |
|--|--------------|-------------------------|---|
| A golf course                                    | An oil spill | Urban stormwater runoff | CAFO waste  |
| <b>Nonpoint</b>                                  | <b>Point</b> | <b>Nonpoint</b>         | <b>Nonpoint</b>   |
| (many other nearby homes farms, land uses, etc.) |              |                         | (often located near other CAFOs or in agricultural regions) |

### 8.2 - Human Impacts on Ecosystems

- a. **Identify** TWO sublethal effects an organism can suffer if a pollutant or environmental condition in its ecosystem exceeds its range of tolerance **limited growth, infertility, increased heartrate**
- b. **Describe** the process of coral bleaching **as ocean temperature rises and exceeds the range of tolerance for algae living in the reef, they leave, draining reef of color and stressing coral**
- c. **Identify** a specific pollutant that disrupts coral reef ecosystems and **describe** how that pollutant disrupts the coral reef ecosystem **sediment - increases turbidity/decreased sunlight & photosynth. Oxybenzone (sunscreen)/pesticides - interfere with coral reproduction/increase likelihood of bleaching, Fertilizers - lead to eutrophication, algal blooms/less sunlight/less dissolved oxygen**
- d. **Describe** TWO effects that an oil spill can have on marine organisms **direct toxicity/lethality of hydrocarbons, decreased photosynthesis due to blocked sunlight, clogged gills in fish, feathers/fur coated in oil (decreased flight, buoyancy, insulation)**
- e. **Describe** an economic consequence that an oil spill can have on coastal communities **destabilized shoreline due to salt marsh grass/plant death, habitat/breeding ground loss for commercial fish species, decreased tourism revenue**

### 8.3 - Endocrine Disruptors

- a. **Define** the term endocrine disruptor **chemicals that mimic hormones or block their receptors, interfering with endocrine function in animals**
- b. **Identify** TWO specific, non lethal effect that endocrine disruptors can have on aquatic species **infertility, intersex, birth defects, development of eggs in testes, gender imbalances**
- c. **Identify** TWO specific endocrine disruptors and **describe** how each of these chemicals could be released from their source into the environment **human medications - pass through our bodies and enter sewage systems with waste and are then discharged into local surface waters | antibiotics fed to livestock - CAFO manure lagoon leaks can carry endocrine disruptors into nearby surface waters or into groundwater | pesticides (atrazine/DDT) - agricultural runoff carries them from fields into nearby surface waters or into groundwater | phthalates - chemical waste from plastic or cosmetic manufacturing improperly disposed of or leachate from landfills entering groundwater**
- d. **Identify** a human health consequence of exposure to endocrine disruptors **preterm births, low sperm count in men**

# APES Unit 8 Ultimate Review Packet (8.3 - 8.5)

## 8.3 - Endocrine Disruptors (cont.)

- d. **Identify** a human health consequence of exposure to methylmercury **central nervous system damage, menstrual cycle disruption, learning disabilities in children, damage to fetal brain**
- e. **Identify** the main anthropogenic source of heavy metal pollution and **explain** how these heavy metals may impact ecosystems far away from their release **coal combustion - particulates containing mercury are released from combustion, carried by the wind and then either fall as dry particles or dissolve into rain water and fall as precip. downwind from emission source, coal ash ponds can overflow, releasing heavy metals into surface waters that can carry them downstream**

## 8.4 - Human Impacts on Wetlands

- a. **Describe** how an area can be distinguished as a wetland ecosystem **soil that is submerged or saturated with water for all or part of the year, emergent vegetation, plants with adaptations to survive waterlogged soil or complete submergence of roots in standing water**
- b. **Identify** TWO examples of ecosystem services provided by wetlands **plants or animals harvested for food sources, regulation of local temperature, absorption of flood waters, recharge groundwater, pollinator habitat, pest control, water filtration**
- c. **Identify** TWO human activities that disrupt wetland ecosystems **agricultural runoff carrying pesticides or fertilizers, motor oil/plastic/trash carried in urban stormwater runoff, commercial development that drains wetlands/removes them, upstream dams that limit water and nutrient flow into wetlands, diversion of water for drinking/agriculture that decreases water flow into wetlands, overfishing**
- d. **Identify** a non energy related purpose for damming a river and **describe** one ecological consequence for wetlands located downstream from a dam **flood control/recreation/water supply - deprives downstream wetlands of nutrients in sediments needed for plant growth, decreases water flow to downstream ecosystems, lowering water level and decreasing wetland habitat**

## 8.5 - Eutrophication

- a. **Define** the two root terms that make up the word "eutrophication" **eu - good/true, -troph - nourishment/food**
- b. **Identify** TWO possible sources of excess nitrogen and phosphorous that can lead to cultural eutrophication **agricultural runoff, urban runoff, improperly treated sewage, CAFO manure/livestock runoff**
- c. **Explain** how excess nitrogen and phosphorous in a water source lead to hypoxic waters **N/P influx leads to algae bloom. When algae die, bacteria break them down via aerobic decomposition, using up dissolved oxygen in water which leads to hypoxic or low oxygen waters**
- d. **Explain** how hypoxic waters can become dead zones **hypoxic waters lead to death of aquatic organisms, which leads to more aerobic decomposition, decreasing dissolved oxygen even further until levels of oxygen are too low to support most forms of aquatic life**
- e. Define oligotrophic **clear waters with stable algae populations and high dissolved oxygen levels**
- f. **Describe** the process of oligotrophic waters becoming eutrophic naturally over time **sediments and organic matter accumulate at the bottom of waters over time, releasing more nutrients into the water, leading to naturally eutrophic waters**

# APES Unit 8 Ultimate Review Packet (8.6 - 8.8)

## 8.6 - Thermal Pollution

- Describe** the relationship between water temperature and dissolved oxygen **they have an inverse relationship (as temperature increases, dissolved oxygen decreases)**
- Describe** a specific impact that thermal pollution can have on aquatic species **increased respiration rate, suffocation due to decrease oxygen levels, thermal shock and death if temperature of water rapidly increases above zone of intolerance**
- Identify** TWO human activities that can lead to thermal pollution **urban runoff, discharge of waste water used to cool industrial processes, discharge of waste water used in power plants**
- Propose a solution** to the problem of thermal pollution **expanded use of cooling towers that enable cooling of water before discharge into surface waters**

## 8.7 - Persistent Organic Pollutants (POPs)

- Define** the term persistent organic pollutant **synthetic, carbon-based, fat-soluble pollutants that aren't easily metabolised by organisms bodies**
- Define** the term bioaccumulation **the buildup/concentration of POPs/fat soluble pollutants in the bodies of organisms over time**
- Explain** why POPs bioaccumulate in organisms over time **because they are not water-soluble, they're not easily filtered/removed from blood and excreted as waste/urine or broken down/metabolized. Instead they accumulate in fat-tissues of organisms**
- Identify** one impact that that accumulation of POPs can have on an organism **central nervous system damage, reproductive system damage/disruption**
- Identify** TWO examples of persistent organic pollutants **phthalates, BPA, dioxins, perchlorates, DDT, PCBs, mercury**
- Explain** why DDT and PCBs still remain in many ecosystems today, despite being banned in the US in the 1970s **because they're not easily metabolized by organisms or broken down by microbes/bacteria/biological or chemical processes they persist in soils/sediments**
- Describe** one way that POPs may be released into ecosystems **medical waste incinerators/fertilizer factories/coal fired power plants can release particulates with POPs attached to them that are carried by wind and deposited in ecosystems as precipitation or dry particles, leachate from landfills can carry POPs into groundwater, improper disposal of plastic/rubber/cosmetic/pesticide manufacturing waste can release POPs into surface waters**

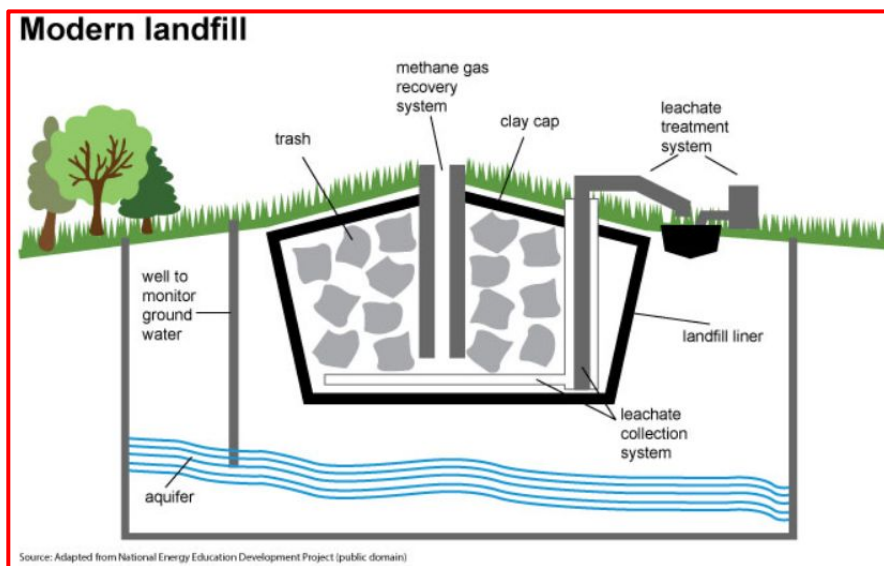
## 8.8 - Biomagnification

- Explain** how biomagnification differs from bioaccumulation **bioaccumulation is the accumulation of POPs in the body of an organism over its lifetime, while biomagnification is the increasing concentration per unit of body tissue of POPs in organisms at higher trophic levels**
- Describe** a specific health impact that biomagnification of POPs can cause in top predators **thinning of eggshells in large predatory birds, damage to central nervous system in large marine predators, reproductive system disruption/birth defects**
- Describe** one way that mercury can enter aquatic ecosystems **combustion of coal releases particulates with mercury attached that can be deposited in downwind aquatic ecosystems by particulates or precipitation, coal ash ponds can overflow which releases mercury into nearby surface water**
- Propose** a solution to limit human exposure to methylmercury **limit consumption of large, predatory seafood**

# APES Unit 8 Ultimate Review Packet (8.9 - 8.10)

## 8.9 - Solid Waste Disposal

- Identify** TWO sources that contribute to Municipal Solid Waste **school waste, business waste, home waste, yard waste**
- Define** e-waste and **explain** why it should not be disposed of in landfills **old electronic devices such as phones or computers that contain hazardous chemicals like cadmium, lead, mercury, PBDEs which can be released into groundwater if leachate leaks through landfill liners**
- Identify** TWO other examples of products that should not be disposed of in landfills **old paint, cleaners, antifreeze, motor oil, car batteries, rubber tires**
- Explain** why rubber tires should not be disposed of in large piles **they can collect standing water that creates a breeding ground for mosquitoes that act as disease vectors**
- Draw a picture of a sanitary landfill and label and **describe** THREE specific features that are designed to prevent contaminants from being released into the surrounding environment



Plastic/clay liner - prevents leachate from carrying contaminants into groundwater

Leachate collection system - series of pipes for collecting leachate to reduce risk of it leaking through liner

Clay cap - prevents runoff/wind from carrying waste out of landfill into ecosystem/release of  $\text{CO}_2$  &  $\text{CH}_4$

Methane collection system - reduces buildup of methane and release into atmosphere

- Describe** ONE environmental drawback of landfills **Risk of groundwater contamination, methane/ $\text{CO}_2$  release contributing to global warming, habitat loss**
- Identify** TWO benefits of burning waste **reduction of total waste volume, generation of electricity in waste to energy power plants**
- Describe** an environmental consequence of disposing of waste by dumping it in the ocean **ingestion of plastic by marine organisms leading to suffocation/starvation/death, decreased light penetration and photosynthesis, entanglement of marine organisms in plastic/solid waste**

## 8.10 - Waste Reduction Methods

- Describe** a benefit and a drawback of recycling **benefits: reduced demand for new raw materials which reduces mining/deforestation/harvesting of raw material, reduced need for landfills and the hab. loss/water contamination/GHG release, | disadvantages: requires time and energy to sort/ship/process recycled materials, cost of shipping/sorting/processing recycled materials**
- Explain** why reducing or reusing waste is more sustainable than recycling **reducing/reusing waste lessens demand for new raw materials and also reduces energy/cost of sorting/shipping/processing recycled materials or energy/cost of converting them into products**

# APES Unit 8 Ultimate Review Packet (8.10 - 8.13)

## 8.10 - Waste Reduction Methods (cont.)

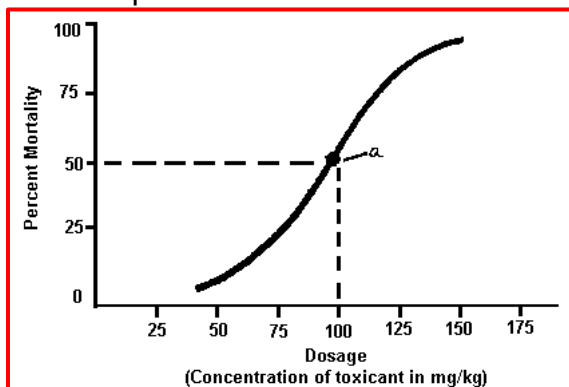
- c. **Identify** TWO examples of waste that can be composted and **describe** the process of composting **plant-based food scraps, yard waste, paper, cardboard**. Composting involves **bacteria/microbes breaking down/decomposing organic matter in the presence of oxygen & H<sub>2</sub>O**
- d. **Identify** ONE potential drawback of composting **release of foul odors, attraction of animal pests**
- e. **Describe** the proper disposal of e-waste **removal of valuable metals like gold, silver, platinum for reuse in new electronics with protective equipment to limit worker exposure to toxicants/toxic metals**

## 8.11 - Sewage Treatment

- a. **Describe** the process of primary sewage treatment and **identify** one component of sewage that is removed by primary treatment **physical removal of large solid waste such as plastic, toilet paper, sticks, leaves with screens/grates/filters OR removal of sediments/sand/pebbles with a grit chamber that allows them to settle at the bottom**
- b. **Describe** the process of secondary sewage treatment and **identify** one component of sewage that is removed by secondary treatment **aerobic decomposition of solid organic waste/feces by bacteria OR removal of nitrogen/phosphorous waste by bacteria**
- c. **Identify** a component of sewage that is NOT removed by either primary or secondary treatment **bacterial/viral pathogens, medications, persistent organic pollutants**
- d. Identify a component of sewage that is reduced by tertiary treatment **phosphorus/nitrogen waste**
- e. **Identify** a method for reducing bacterial or viral pathogens in treated sewage before it is released **chlorination, UV light, ozone**
- f. **Identify** why waste water treatment plants don't always use tertiary treatment and **describe** a consequence for the body of water that effluent is released into if a plant does not use tertiary sewage treatment **tertiary treatment is costly. Lack of tertiary treatment may lead to effluent with elevated nitrogen/phosphorus levels which contribute to eutrophication/algal blooms/ less DO**

## 8.12 & 8.13 - Lethal Dose 50% (LD<sub>50</sub>) & Dose Response Curve

- a. **Describe** the process of a dose response study **groups of test organisms are exposed to increasing concentrations or doses of a toxic substance and a specific response such as death or infertility is measured**
- b. **Define** the term LD<sub>50</sub> **the concentration of a toxic substance that results in 50% mortality in a test organism**
- c. Draw a dose response curve below for a toxicant with an LD<sub>50</sub> concentration of 100 mg/KG



- d. **Describe** the relationship between a LD<sub>50</sub> concentration and lethality of a toxicant **the lower the LD<sub>50</sub> concentration, the more lethal or toxic the toxicant is, since it requires a smaller concentration/dosage to kill 50% of test organisms**

# APES Unit 8 Ultimate Review Packet (8.14 - 8.15)

## 8.14 - Pollution and Human Health

- a. **Define** the term route of exposure, and **identify** a route of exposure for methylmercury **the pathway through which a human comes into contact with pollutant, consumption of large predatory marine species is a route of exposure for humans to methylmercury**
- b. **Explain** how the concept of synergism makes it difficult to precisely measure the impact of a given pollutant on human health outcomes **numerous pollutants/toxicants can combine to have a greater combined outcome than either one would have had in the individual on their own**
- c. **Identify** the main route of exposure for cholera and dysentery **drinking water contaminated with human or animal waste**
- d. **Propose a solution** to limit exposure to cholera and dysentery in developing nations **increased sanitation such as expanded/closed sewage systems, wastewater treatment plants, increased access to improved/filtered water access**
- e. **Identify** one of the main causes of mesothelioma **exposure to asbestos**
- f. **Identify** a human health consequence of exposure to tropospheric ozone **reduced lung function/lung damage, eye irritation, respiratory muscle damage, worsened bronchitis/asthma**

## 8.15 - Pathogens and Infectious Diseases

- a. **Define** the terms pathogen and vector and provide an example of each **pathogens are disease causing organisms such as bacteria, viruses, protists or fungi | vectors are organisms that carry and transmit pathogens to other organisms**
- b. **Explain** why the range of diseases like Malaria and Yellow Fever are expected to increase in the later half of the 21st century **average increase in global temperature increases the range of the mosquitoes that carry and transmit these diseases**
- c. **Identify** the type of pathogen and vector for Malaria **protist that travels inside mosquitoes**
- d. **Describe** one way that the transmission of West Nile virus differs from Malaria **viral, rather than protist pathogen, birds serve as main host/reservoir with transmission primarily from infected bird to human via mosquito (different species than Malaria)**
- e. **Describe** one way that the transmission of Zika virus virus differs from Malaria **viral pathogen, with sexual transmission between humans possible**
- f. **Identify** the two vectors involved in the transmission of Plague **fleas living on rats**
- g. **Identify** the type of pathogen and main route of transmission for Tuberculosis **bacterial pathogen transmitted by contact with respiratory droplets from an infected person**
- h. **Identify** the type of pathogen, route of transmission, and one human health impact of SARS and MERS **viral pathogen in the Coronavirus family, transmitted by contact with respiratory droplets from infected individuals, causes respiratory damage/failure, cough, fever**