

# Potential APES FRQ Topics for May 2018

## 1. Tar sands

1. Also called oil sands
2. Surface oil deposits mixed with soil and rock, Must be cooked with natural gas to extract it, raising the C footprint of this. The resulting product is "bitumen" which must be diluted with natural gas because it is so thick
3. Putting in through pipes is challenging because it requires hit temps and pressure, possibly leading to pipe failures.
4. One solution has been to put it on train cars. Significant accidents have occurred from this as it is highly flammable. Lac Megantic, Quebec is a town that had its town center incinerated by a runaway "oil train".
5. "Dilbit" is the name for "diluted bitumen", the tar sands product. Another key feature here is that its actually denser than water, unlike traditional petroleum. this means it sinks which makes cleanup really challenging when spills occur over water like rivers and lakes.
6. The Keystone XL pipeline that has received a lot of attention over the years is a good example of the controversy here. Putting it over environmentally sensitive habitats or protected habitats could be a bad idea because the pipes are possibly more prone to bursting.
7. The Keystone XL pipeline would transport unrefined oil from oil sands in Canada (largest producer) to refineries in SE United States, it replaces older pipeline and allows for higher capacity of oil transport
8. Possible water contamination – as part of the pipeline goes over the Ogallala Aquifer
9. Habitat degradation issues – goes through sensitive sandhill ecosystem in Nebraska
10. Less incentive to develop sustainable energy

## 2. Mercury Deposition

1. Most of the mercury emitted into the environment comes from the combustion of coal, most of which is burned for electrical power generation
2. the majority of this mercury ends up depositing in the oceans where it has been proven to both bioaccumulate and biomagnify
3. Mercury is a known neurotoxin
4. Little has been known, however, about the impact of its deposition on land
5. Recent studies have suggested that Hg deposition on land also bioaccumulates and biomagnifies through terrestrial food chains.
  - In particular, some species of birds have been shown to have reduced reproductive success and toxicity due to ingestion of mercury. Breeding songs may be incorrect in some way or behavior may be altered in some way. regardless, the mercury is having an impact.
  - The million dollar question at this point is what other impacts is it having upon other organisms. Mice, raptors, fox, coyote, humans, etc.

## 3. Algae blooms

1. eutrophication / also known as "cultural eutrophication" and "nutrient loading"
2. Primary sources are human sewage and animal waste (manure)
3. Nitrogen Cycle - natural and Human Impact
4. Oxygen Sag Curve - hypoxia

## 4. Declining ice shields

1. As the arctic, antarctic and greenland ice sheets have begun thawing less solar radiation is being reflected back into space.
2. In essence, the polar regions are becoming less white.
3. As this occurs a larger amount of incoming solar radiation could be absorbed.
4. That solar radiation warms the surface and the air above it. Further, as the energy is released back into the atmosphere greenhouse gases can absorb it and re emit it back into the atmosphere as heat yet again. This is the greenhouse effect. The darker the polar regions the greater the amount of energy the atmosphere will absorb and heat.
5. Receding polar ice may also cause an increase in sea level rise (although due primarily to thermal expansion)

## 5. Plastic Pollution in oceans

1. Plastic is frequently washed into the ocean or blown into the ocean. Sometimes dumped.
2. In the ocean it accumulates fat soluble pollutants like DDT, dioxin, PCBs, and PBDEs.
3. It breaks down into smaller fragments over time and can be ingested by ocean organisms.
4. That ingestion can then lead to bioaccumulation and biomagnification of the pollutants.

## 6. Plastic Bag Ban or Water Bottle Ban

1. Problems: persistence of plastic in landfill, energy cost and oil dependence in producing bags, 2 liters of oil for every one liter bottle, nonrecyclable plastic bags (bottles are recyclable)
2. Solution: reusable alternatives are pretty simple, ban or charge? (pricing structure). How much of a deposit would change your behavior? fake fields, diapers, other products can be made from recycled bottles

## 7. Prescription drugs in our surface water

1. Gets in there from what humans pee out
2. Occurs because sewage treatment plants are not designed to handle them
3. Water treatment plants are not designed to remove them
4. Impact on wildlife? Hormones?

## 8. Human Population

1. World population was hitting 7 billion in 2011
2. One of the issues with this is that yes, the population growth rate is coming down. Meaning the annual growth rate. But remember, 1.2% growth rate at 5 billion is very different from 1.2% growth rate at 7 billion. Its millions of extra people.
3. Also at this time is the other big concern of the rise in affluence. For many people there is more economic opportunity and more and more people are able to demand more economic goods. More meat, a car, a house, air conditioning, a cell phone, TVs, computers. this rise in affluence is very challenging, even if the world population stabilizes if more and more people become increasingly affluent its almost like putting more people on the planet. This connects to Ehrlich's I=PAT formula.
4. Another relevant connection here is agriculture and the environmental implications therein like salinization, eutrophication, soil degradation,

desertification. And potential solutions like conservation tillage, IPM, biocontrol, hydroponics, GM crops and drip irrigation.

5. Rule of 70= 70/growth rate = number of years for population to double.
6. Strategies to reduce population growth- educate and empower women, decrease poverty, access to family planning.
7. China DROPS 1 Child Policy

### 9. Industrial Smog

1. China as a model for industrial smog
2. Rising "affluence" leading to more and more pollution
3. Possibly links to demographic transition model (going through industrialization)

### 10. Biofuels

1. Most often ethanol from corn or sugarcane
2. Cellulosic -- from forest and crop residues in which "cellulose" is converted into ethanol.
3. Palm oil -- from palm nuts in tropical region. Large areas of forest have been cleared for palm plantations.
4. Uses lots of water, fertilizers, pesticides.
5. Fertilizers associated with eutrophication and "dead zone" in Gulf of Mexico
6. Fertilizer runoff with phosphates and nitrates. Causes algal blooms – shades water plants below. Algae eventually dies. Bacteria decompose dead algae – uses dissolved oxygen. Fish and other animals die
7. Better alternative: Switchgrass and Algae

### 11. Overfishing

1. Aquaculture to meet rising demands for protein
2. Bycatch issues, net designs
3. Relevant laws (thinking Magnuson fisheries act) and CITES failed attempt to regulate bluefin tuna catch

### 12. Thawing permafrost

1. As the earth's temps rise the permafrost is beginning to thaw.
2. As the permafrost thaws the frozen organic material in it is beginning to decompose for the first time in tens of thousands of years.
3. As that organic material decomposes both CO<sub>2</sub> and methane (CH<sub>4</sub>) are released.
4. Those gases migrate to the surface and drift into the air, adding yet more climate change gases to the atmosphere.
5. The thawing of the permafrost, therefore, can lead to yet even more thawing and warmer temperatures in a positive feedback loop.
6. This process is already beginning and may in fact be accelerating.
7. Methane seeps through the iced areas of the arctic are a worrying symptom of this.
8. Thawing permafrost may also interfere with transportation routes as roads become impassable.
9. Paris Accord - take effect in 2020; decrease emissions

### 13. Wind Power

1. Wind spins turbine - Generator produces electricity - Electricity moves through transmission lines
2. Fastest growing renewable (though solar is close)
3. Risk to birds – collide with blades (significant, but more deaths attributed to collisions with buildings, predation by house cats, etc.)

4. Risk to bats – decreased pressure around blades causes capillaries in lungs to rupture

### 16. Hurricanes

1. Major hurricanes have been increasing in severity due to climate change
2. Sandy: New York; Katrina: Off coast of Mississippi and Louisiana
3. Katrina: Levees failed and major portions of region flooded, poorest hit regions caused massive environmental refugees
4. Ecological impacts included flooded terrestrial habitats, habitat destruction, barrier islands are made to protect coastal regions - we are doing major damage to these areas due to construction which also leads to erosion.

### 17. Endocrine Disruptors

1. PBDEs and flame retardants: used in furniture, etc.
2. PCBs: Polychlorinated biphenol: used in coolants and copy paper - now part of the banned POP
3. BPA: Bisphenol A: used in plastics, linings of bottles, chemicals leach out into the liquids in high heats, can cause many human health impacts such as learning disorders, ADHD, reduced fertility, obesity, feminization.
4. Pesticides like DDT, Atrazine. Already seeing an impact on frogs and other populations.

### 18. Climate Change

1. Caused by increasing greenhouse gas concentrations in the troposphere. Major gases: CO<sub>2</sub>, Methane, Water vapor, Tropospheric Ozone
2. Increased by fossil fuel use, industrialized agriculture, and deforestation.
3. Rise in Disease - West Nile, Zika
4. Managed by reforestation, changing behaviors, Carbon Capture System, Cap and Trade
5. Managed by Paris Climate Talks and Kyoto, none of which were ratified by USA.
6. Related to following topics
  - a. Sea level rise /thermal expansion/ice caps
  - b. Ocean Acidification
  - c. melting of permafrost

### 19. Palm Oil

1. Massive deforestation in Indonesia for monocrop plantation farms of palm oil
2. Used in everyday food and beauty products.
3. Often used with slash and burn agriculture that has led to massive wild fires in the area (good fires = surface fires that restore nutrients, bad fires = crown fires that burn everything\_
4. Soil in the region is poor, so it is a constant cycle of finding new space and excessive fertilizer use.

### 20. Drought

1. Increasing due to climate change.
2. Texas and California heavily hit
3. Cape Town Water Crisis/Mexico - no water
4. Requires behavior modifications - no water lawns, car washes, etc. Charges residents for over consumption.
5. Due to excessive use for bottled water, and gardening

Related to Wildfires and ENSO

## 21. Mass Extinction

1. 6th mass
2. HIPPO-C
3. Need predators and insects - Cecil the Lion

## 22. Hydrogen Fuel Cells

1. silent, no recharging or emissions
2. expensive, needs H<sub>2</sub>, very flammable

## 23. Haiti Earthquake 2010

1. Poor country
2. Cholera Outbreak

## 24. Flint Water Crisis

1. lead and fecal coliform
2. 40% below poverty line
3. Lead - neurotoxin

## 25. Agriculture

1. impacts of factory farming - abuse, fertilizer, energy and water intensive, antibiotic resistance, BEES

### 2017 FRQ Topics:

*Topics do not typically appear again the following year.*

1. Microbeads - Plastic and Wastewater
2. Elephant Population - K-strategists/Conservation
3. Haiti - deforestation and fertility rates
4. Dams - keystone species