

# Potential APES FRQ Topics for May 2017

These represent the best guesses the "National APES Teachers" have for possible FRQs. Crossed out items have been on recent exams, but that doesn't mean they won't show up again. There are links at the bottom for more details.

## 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 high 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 it's 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 and Missouri River watershed
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 it is 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, animal waste (manure), nitrogen-based fertilizers

## ~~4. Fracking~~

- ~~1. Fracking is done for natural gas and shale oil~~
- ~~2. Key issues to keep in mind: groundwater contamination, surface water contamination from production fluids that come out of well, yet another fossil fuel to add more CO<sub>2</sub> to the atmosphere, air pollution issues as gases are "scrubbed" clean emitting VOCs into the air, and fracking requires a lot of water (typically a million gallons of fresh water or so per well). This was on the 2012 exam.~~

## 5. 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 (lower albedo).
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)
6. See Permafrost below.

## ~~6. Bees / Colony Collapse Disorder (CCD) / neonicotinoid pesticides / endocrine disruptors~~

- ~~1. Bees pollinate 1/3 of all produce, a service worth billions of dollars annually~~
- ~~2. Several years ago bee colonies began dying off without warning for no apparent reason~~
- ~~3. The syndrome became called CCD for colony collapse disorder~~
- ~~4. Although there may be multiple causes, one of the leading causes seems to be widespread use of a new type of pesticide called neonicotinoids. They are a variant of nicotine.~~
- ~~5. These pesticides appear to have a degree of persistence in the wild and may operate as endocrine disruptors in bees. Essentially interfering with their overall health and their ability to navigate successfully. In essence, they lose track of home.~~

6. ~~No absolute definitive link has been established yet, but the suggested link is strong. This was on the 2011.~~

## 7. 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.

## 8. 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 from chemical birth control (pills, patch, ring) causing feminization of amphibians?

## 9. ~~White Nose Syndrome~~

1. ~~White nose syndrome (WNS) is an emergent disease of hibernating bats that has spread from the northeastern to the central United States at an alarming rate. Since the winter of 2007-2008, millions of insect-eating bats in 25 states and five Canadian provinces have died from this devastating disease. The disease is named for the white fungus, Pseudogymnoascus destructans, that infects skin of the muzzle, ears, and wings of hibernating bats.~~
2. ~~An introduced fungal infection in bats that causes them to develop a white powdery nose as a symptom~~
3. ~~This infection, among other things, reduces their ability to hibernate successfully. They emerge out of hibernation hungry and early at a time when no insects may be present for them to eat.~~
4. ~~Overall the mortality from this invasive infection have been massive and extinction of some species could occur. Some mortality rate in some species have approached 90%. Imagine the human population being hit by 90% in a few years, our population would be reduced to 710 million, roughly half the population size of China. This was 2016.~~

## 10. 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.

## 11. 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)

## 12. Dams/Rivers

1. Three Gorges Dam – Yangzi River in China, World's largest hydropower project
2. Displaced 1.2 million people, Reservoir is polluted from submerged factories, mines, dumps
3. Erosion on banks of reservoir causing landslides
4. Worsens drought downstream
5. BUT... provides "clean" energy, reliable water source

## 13. 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

## 14. 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

## 15. 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

## 16. 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.

## 17. 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

## 18. Items that were “current events” three years ago and may show up on the exam:

1. [China and US pledge action on Global Warming](#)
2. [Deforestation drops in Brazil](#) (but now it appears to be going back up again)
3. [California, Brazil and Central America face crippling droughts](#)
4. [Africa has lost 1/5 of elephants and rhinos hit grim record](#)
5. [Obama pledges to cut power plant emissions](#) and then [Trump rolled that back](#) (They won't ask about Trump's policies because that's too recent, but you can write about them if it's relevant.)
6. [California bans plastic bags](#)
7. [West Antarctic Ice Sheet in irreversible loss pattern](#) There's a great short video on this page that will help you
8. [NC Dan River Coal Ash Spill](#)

## 2015 FRQ Topics:

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

1. Everglades, climate change
2. E-waste
3. BP oil spill
4. Urban sprawl

## 2016 FRQ Topics:

1. Bat disease – White-nose syndrome
2. Coal and iron ore production math
3. Municipal Solid Waste, tires
4. Soil formation, horizons