# SCIENCE OLYMPIAD
# GREEN GENERATION: EXAM

## PART ONE: POTPOURRI

1. What are the similarities and differences between allochoton and autochoton?

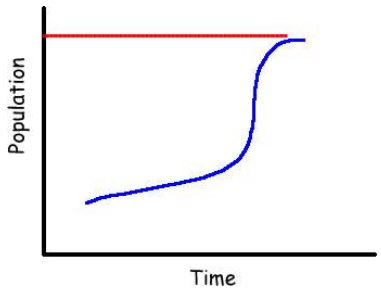
2. What is the formula for carrying capacity? *Hint: Logistic

3. Biologists stocked a lake with 200 fish and estimated the carrying capacity (the maximal population for the fish of that species in that lake) to be 14,000. The number of fish tripled in the first year.

a) Assuming that the size of the fish population satisfies the exponential model, find an expression for the size of the population after t years.

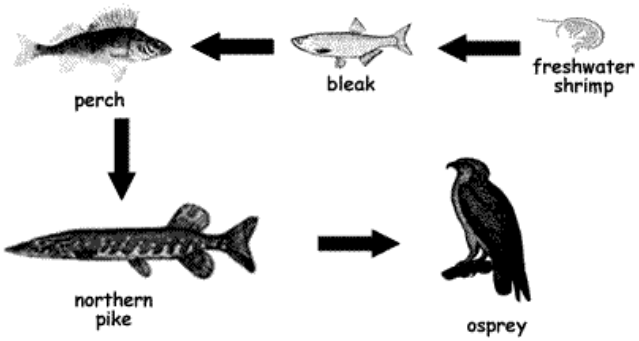
b) How long will it take for the population to increase to 5000?

4.



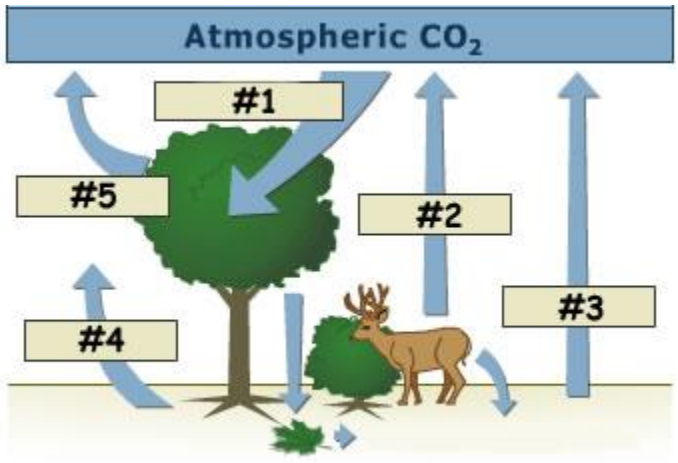

The curve shown above is an example of:
a) Exponential growth
b) Logistic growth
c) Dynamic growth
d) None of the above

5.




The perch has:
a) 100x more energy than the osprey
b) 10x more energy than the bleak
c) 1/100x more energy than the shrimp
d) 1/10x more energy than the pike
e) both a and c

6.

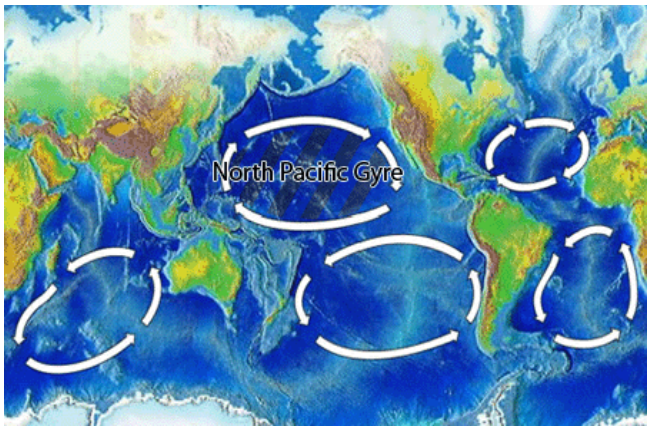



a. In addition to CO2, what chemical compound is released into the atmosphere as a result of processes #2 and #5? _____

b. Name this process _____

7. According to the Guinness World records, which country has the worst marine pollution and why?

8.




What is the name for the "structure" resulting from the accumulation of debris that occurs because of the events on this map?

9.

a) What is the name of this strange occurance?

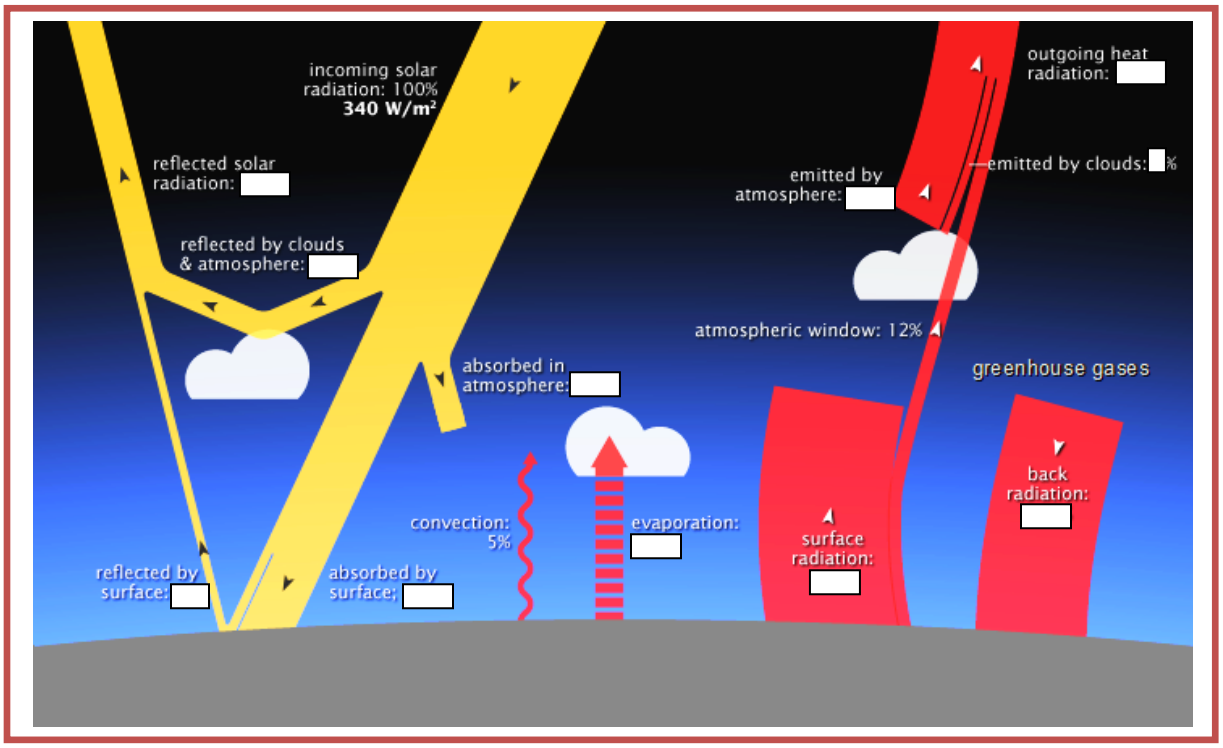
b) Why does this occur?

c) What is the organism related to this?

10. a. Why does shutdown of thermohaline circulation occur?

b. What countries would this primarily affect?

11. Insert the percentages in the green house effect diagram: (Allow a +/-5% error)




12. All of the following gases have been implicated in contributing to the increase in global temperatures via the greenhouse effect, except:

a) O2
b) CH4
c) N2O
d) CO2
e) CFCs

13.

a) What is the name of this highly endangered animal?

b) What is the cause of endangerment?

14. What is the name of the endangered animal, whose nickname is "The Asian Unicorn"?

15. Which of the following is most likely to occur in a forested region that has been recently clear-cut?
a) the concentration of nitrates in streams running through the regions will increase
b) the average depth of topsoil will increase
c) the water temperature in streams running through the region will decrease
d) volume of runoff after rains will decrease
e) the frequency of landslides will decrease

16. Which of the following is the best long-term method of preventing extinctions?

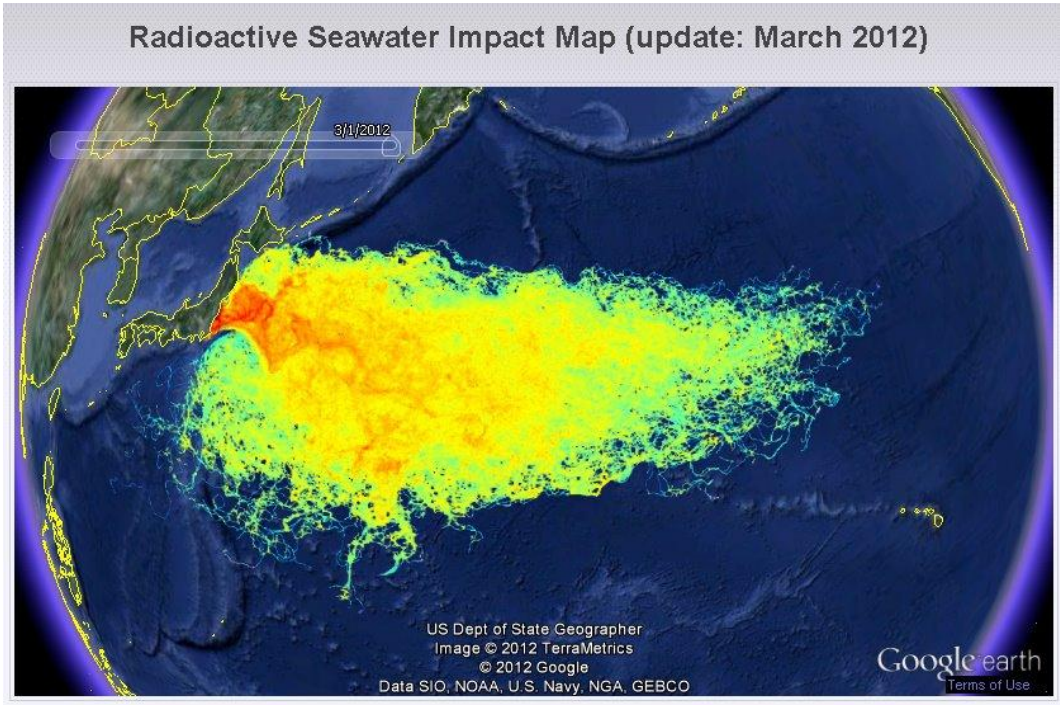
a) breeding endangered species in captivity
b) habitat protection
c) stopping hunting
d) removing invasive species
e) there is no way to prevent extinctions because it is an evitable part of the cycle of life

17.

a) What infamous event does this image depict?

b) How did this happen?

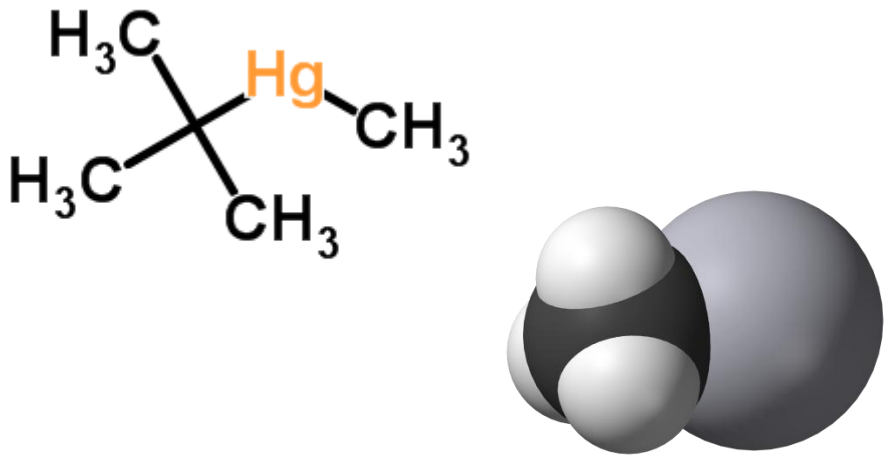
18.



a) What terrible event from 2011 does this picture depict?

b) What caused this event to occur?

19.




a) What compound do these images represent?

b) How is it related to fish and humans?

20.

a) What infamous event does this picture depict?

b) When and where did this occur?

21.

a) What is the nickname for this "hole"?

b) How was this hole created?

22. What is the difference between active and passive solar housing?

23. If an incandescent lightbulb used for lighting has an efficiency rating of 5 percent, then for every 1.00 joule of electrical energy consumed by the bulb, which of the following is produced?

a) 1.05 J of light energy
b) 1.05 J of heat energy
c) 0.95 J of light energy
d) 0.05 J of light energy
e) 0.05 J of heat energy

24. Why are fossil fuels called what they are called?

25. All of the following substances are derived from petroleum, except:

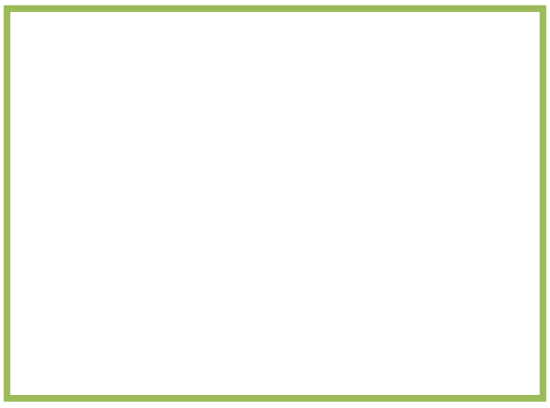
a) asphalt
b) DDT
c) cellulose
d) polystyrene
e) nylon

26. Which of the following metals is considered an energy resource?

a) uranium
b) cobalt
c) mercury
d) copper
e) palladium

27.

a) Draw the universal symbol for recycling below:



b) What do each of the arrows represent?

28. What is vermicomposting?

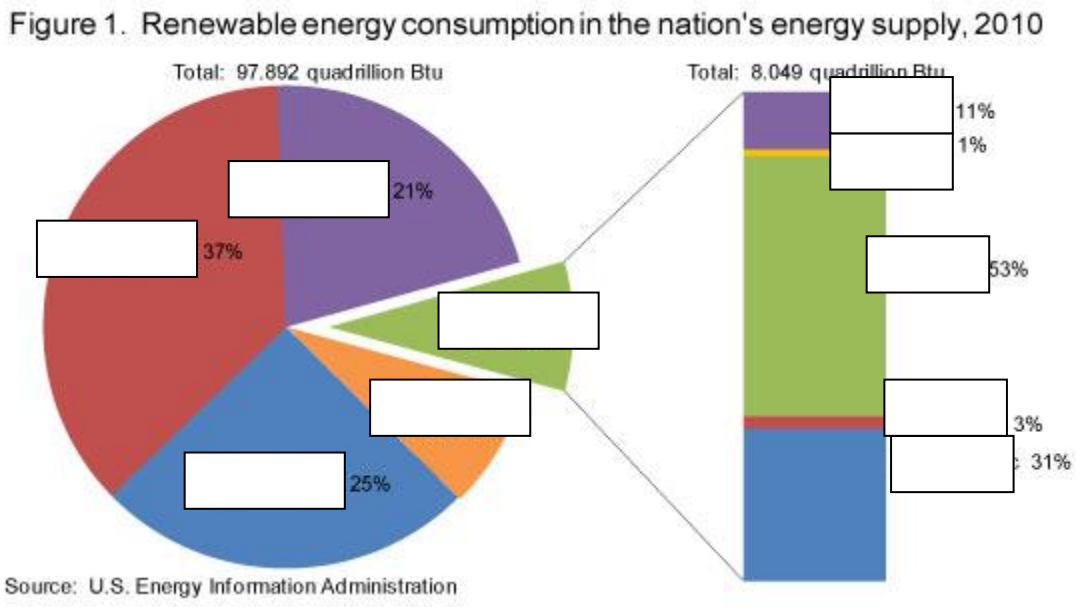
29. What is the *net capacity factor* of a power plant?

30. What is the largest hydroelectric dam in the world and where is it located?

31. Fill in the renewable energy source pie chart using the following word bank:

BIOMASS, COAL, GEOTHERMAL, HYDROELECTRIC, NATURAL GAS, NUCLEAR ELECTRIC POWER, PETROLEUM, SOLAR, WIND

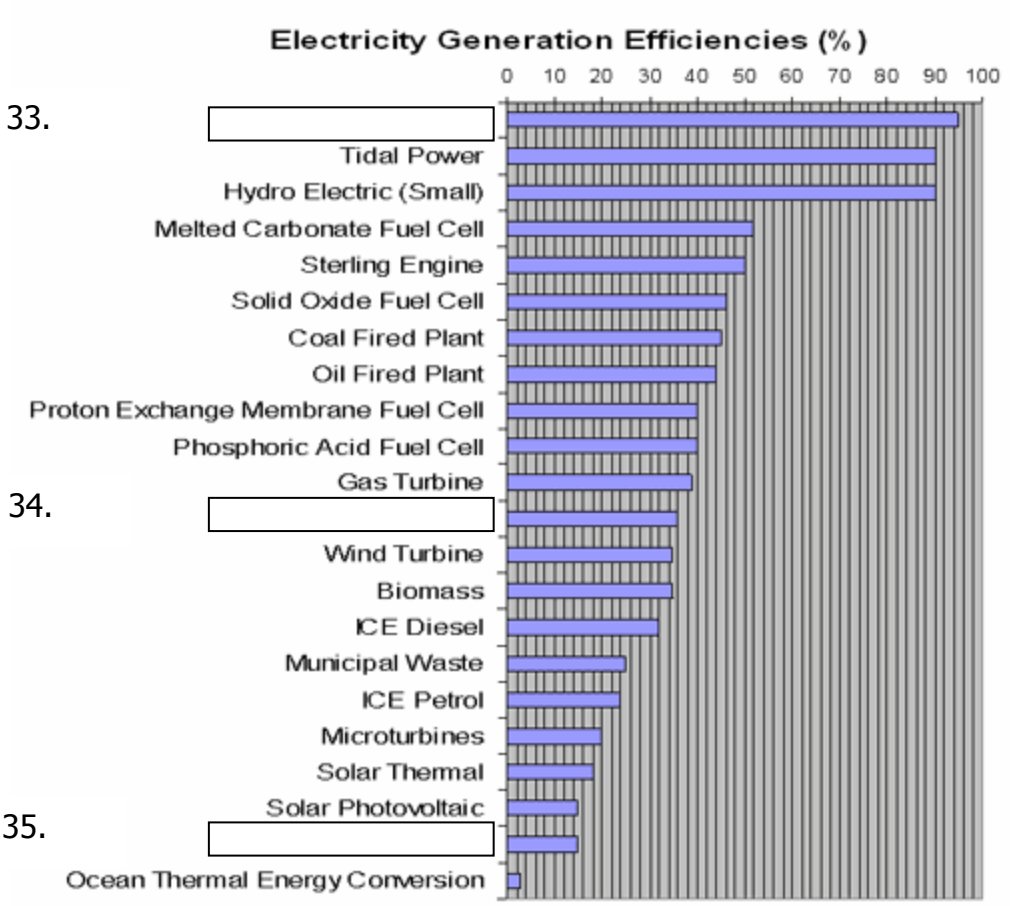
*Some percentages are covered, but not necessary for the completion of this problem.




32. Biomass used for electricity generation varies depending on where you are. For the following locations, please list the most common biomass used.

a. United States _____
b. Southeast Asia _____
c. United Kingdom _____

33-35 For the following chart comparing electricity generation efficiencies, all fill-in-the-blank answers are commonly known, renewable sources of energy.




36. What is the freshwater habitat where you would find organisms that break down organic matter?

37-41 Biomes are often characterized by the amount of rain they receive. Identify the following Biomes:

37. <25 cm of rain per year (warm) _____

38. 25 - 75 cm of rain per year _____

39. <25 cm of rain per year (cold) _____

40. 70 - 150 cm of rain per year _____

41. >500 cm of rain per year _____

42. Your Science Olympiad team is attending the national competition in Lincoln, Nebraska for the 2015 term! Congratulations! What is the main biome you are now in?

43. What is characteristic of an ecotone region?

44. What is the permanent frozen subsoil on arctic tundra called?

45.

a. Identify this biome.
b. Where is it found?
c. Describe the winters and summers here in terms of water presence. (Dry/Wet Winters, Dry/Wet Summers... Elaborate if possible.)

46. List three classification schemes for biomes. (No need to explain in detail.)

## PART TWO: FREE RESPONSE

**Read the following scenarios:**

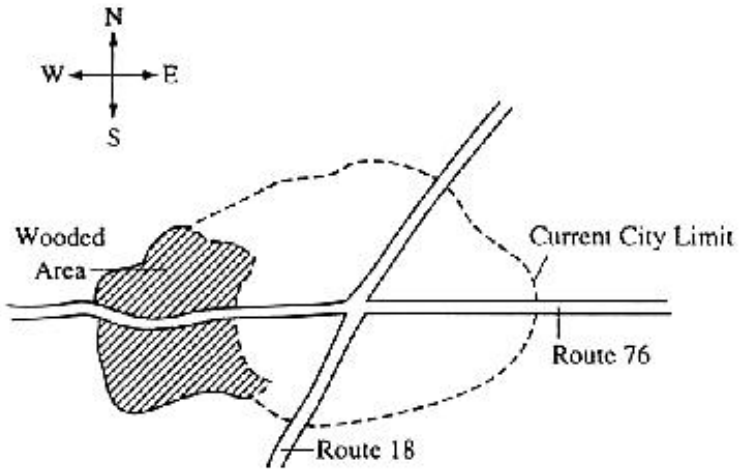
47. *Harvard Scientists are working on a new renewable energy system that can harvest the power from the earth's infrared energy. Our planet is constantly releasing hundreds of millions of gigawatts of infrared radiation into space, and now physicists at the Harvard School of Engineering and Applied Sciences (SEAS) envision two devices that could capture it. The research team proposed a pair of devices similar to photovoltaic power systems – but instead of capturing incoming visible light, the devices would generate direct current electrical power by emitting infrared light.*

Which step(s) of the 12 principles of green chemistry were followed in this scenario?

48. *Demolition is a messy business—not only does the process require heavy machinery and produce clouds of dust, but it also results in giant piles of rubble that often head straight for the landfill. Omer Haciomeroglu, a student at Sweden's Umeå Institute of Design has designed Ero – a robot that recycles concrete in an energy-efficient manner and separates it from rebar and other debris on the spot.*

Which step(s) of the 12 principles of green chemistry were followed in this scenario?

49.




Fremont

The map above shows the town of Fremont, where biologists have noted that the population of a certain species of bird has been declining over the past several years. This bird species is now found only in the wooded area on the western edge of the city. Developers view this wooded area as prime real estate and have recommended to the Fremont City Council that the area be zoned for single-family housing. A group of citizens concerned about the bird species and its habitat recommended to the council that future urban expansion be directed toward the eastern portion of the city and that the wooded area be preserved.

(a) Identify and briefly describe two federal laws or regulations that might apply to this situation.

(b) Assume that the Fremont City Council votes to preserve the wooded area. Explain the positive and negative consequences of this action. Include long- and short- term effects on the environmental, economic, and recreational needs of the citizens of Fremont.

(c) Assume that the Fremont City Council votes against preserving the wooded area. Propose and defend an alternative plan that both protects the bird species and provides for urban expansion.

50. Refer to the article and diagram below when answering the questions that follow.

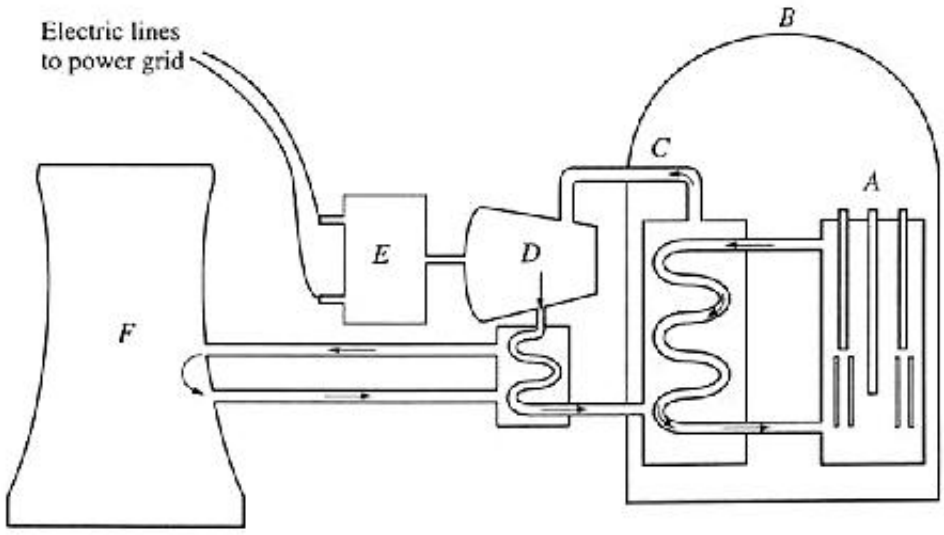
FUTURE OF NUCLEAR POWER IN DOUBT

A long decline for nuclear power in the United States began in the late 1970's when predictions that the price of oil would rise to $100 per barrel did not materialize. In 1979, the near-meltdown at the Three Mile Island nuclear plant in Pennsylvania alarmed the public over the potential hazards of nuclear power. These concerns were further exacerbated by the events at Chernobyl in 1986.

Societal concerns about nuclear power and increased costs associated with the construction and operation of nuclear generating plants have led to a virtual moratorium on new plant construction. In the United States, no new orders for nuclear power plants have been placed since 1979. Even Energy Department officials are now reluctant to predict that another nuclear reactor will ever be built in this country.

Nuclear power plants currently generate 21 percent of United States electricity and the 110 nuclear power plants across the nation are operating more efficiently and safely now than ever before. Some officials believe that if we do not continue research on nuclear energy, then we will not have a viable economy in 30 years.

DIAGRAM OF NUCLEAR POWER PLANT




(a) Identify and describe the function of any three parts labeled on the diagram of a water-cooled nuclear power plant shown above.

(b) Describe and discuss two environmental problems associated with the use of nuclear power for generating electricity.

(c) On the basis of the article and other information, what options do you foresee for the future production and use of electricity in the United States?

(d) Describe briefly the environmental implications of your answer in part (c).