Name:
APES Math Practice

1. After 100 million years, only 1/32 of the original amount of a particular radioactive waste will remain. The half-life of this radioactive waste is how many million years?
   a. 50 b. 25 c. 12 d. 6 e. 3

2. In a particular forest ecosystem the vegetation is producing 55,000 kcal/m2/yr of energy in the form of glucose. About 30,000 kcal/m2/yr is left over after the plants perform cellular respiration. What is the net primary productivity (NPP) of the system?
   a. 85,000 kcal/m^2/yr
   b. 25,000 kcal/m^2/yr
   c. 30,000 kcal/m^2/yr
   d. 55,000 kcal/m^2/yr
   e. none of above

3. If the population of a country grows at a rate of approximately 4 percent a year, the number of years required for the population to double is
   a. 5 years b. 10 years c. 15 years d. 25 years e. 35 years

4. A nation currently has a population of 200 million and an annual growth rate of 3.5%. If the growth rate remains constant, what will be the population of this nation in 40 years?
   a. 200 million
   b. 350 million
   c. 400 million
   d. 600 million
   e. 800 million

5. If the annual consumption of petroleum in the United States is about 23 barrels per capita, the total annual consumption of petroleum in the United States is closest to
   a. 12 million barrels
   b. 240 million barrels
   c. 2 billion barrels
   d. 6 billion barrels
   e. 10 billion barrels

6. Uranium-235 has a half life of 710 million years. If it is determined that a certain amount of stored U-235 will be considered safe only when its radioactivity has dropped to 0.10 percent of the original level, approximately how much time must the U-235 be stored securely to be safe?
   a. 7.1×10^6 years
   b. 7.1×10^7 years
   c. 7.1×10^8 years
   d. 7.1×10^9 years
   e. 7.1×10^{10} years

7. A sample of radioactive waste has a half-life of 30 years and an activity level of 2 curies. After how many years will the activity level of this sample be 0.25 curie?
   a. 30 years b. 60 years c. 90 years d. 120 years e. 150 years

8. Compared to a solution that has a pH = 8, a solution that has a pH = 5 is
    a. is 10 times more acidic and [H+] < [OH-]
    b. is 100 times more acidic and [H+] < [OH-]
    c. is 1000 times more acidic and [H+] > [OH-]
    d. is 10000 times more acidic and [H+] > [OH-]
    e. is 10000 times more acidic and [H+] < [OH-]

9. If a city population of 10,000 experiences 100 births, 40 deaths, 10 immigrants and 30 emigrants in the course of a year, what is its net annual percentage growth rate?
    a. 0.4% b. 0.8% c. 1.0% d. 8% e. 10%

10. The atmospheric concentration of carbon dioxide increased from 250 ppm in 1790 to 400 ppm in 2007. What is the approximate percent increase in carbon dioxide concentration from 1790 to 2007?
    a. 40% b) 55% c) 60% d) 63% e) 150%

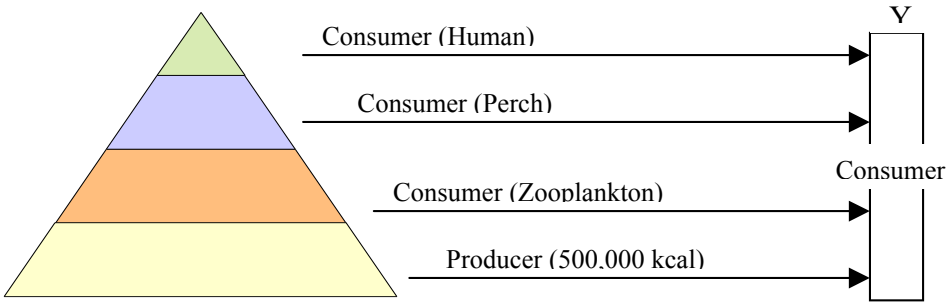
11. The combustion of one gallon of automobile fuel produces about 5 pounds of carbon (in CO_2). Two autos are making a trip of 600 miles. The first auto gets 20 miles per gallon, and the second gets 30 miles per gallon. Approximately how much less carbon (in CO2) will be produced by the second auto on this trip?
    a. 300 lbs
    b. 150 lbs
    c. 100 lbs
    d. 75 lbs
    e. 50 lbs

12. In 1999, Australia had a crude birth rate of 16 and a crude death rate of 7. Based on these figures, the annual rate of increase or decrease, expressed as a percent, equals:
    a. 0.009%
    b. 0.09%
    c. 0.9%
    d. 9.0%
    e. 90.0%

13. The current global human population is growing at an annual rate of 1.35. If world population were to grow at this rate for the next year, approximately how many people would be added?
    a. 8×10^5
    b. 8×10^6
    c. 8×10^7
    d. 8×10^8
    e. 8×10^9

14. A country currently has a population of 400 million and an annual growth rate of 5.0%. If the growth rate remains constant, after 70 years, the population will be approximately
    a. 400 million
    b. 800 million
    c. 1.6 billion
    d. 3.2 billion
    e. 6.4 billion

15. If there are 300,000 kilocalories (kcal) in the producer level, how many kcal will become incorporated in the tissues of the secondary consumers?



a. 3 b. 30 c. 3,000 d. 30,000 e. 300,000

16. The town of Apeston has a power plant that serves two other towns in addition to Apeston, East Apeston and West Apeston. The maximum capacity of the existing power plant is 4,000 MW.

POPULATION AND ELECTRIC POWER DEMAND IN APESTON, EAST APESTON & WEST APESTON

Town	Population growth rate	Population size	Per capita power demand
Apeston	2.0 % per year	100,000	10 kW
East Apeston	Zero	75,000	5 kW
West Apeston	5.0 % per year	50,000	7 kW

a. Calculate the number of years that the power plant will be capable of supplying all of the demand for energy in the three towns.
b. Assuming per capita demand remains constant, what will be the approximate power demand in Apeson in 20 years?
c. Calculate the percent of the total available power currently used by West Apeston.

17. Between 1950 and 2000, global meat production increased from 52 billion kilograms to 240 billion kilograms. During this period, the global human population increased from 2.6 billion to 6.0 billion.
    a. Calculate the per capita meat production in 1950 and in 2000.
    b. Use the values from part (a) to calculate the change in global per capita meat production during this 50-year period as a percentage of the 1950 value.

18. The Smith family is looking at ways to decrease their home water and energy usage. Their current hot-water heater raises the water temperature to 150 degrees F, which requires 0.30 kWh/gallon at a cost of $0.10/kWh. Each person in the family of three showers once a day for an average of 10 minutes per shower. The shower has a flow rate of 5.0 galllons per minute.
    a. Calculate the following. Be sure to show all your work and include units with your answers.
        i. The total amount of water that the family uses per year for taking showers.
        ii. The annual cost of the electricity for the showers, assuming that 2.5 gallons per minute of the water used is from the hot-water heater
    b. The family is considering replacing their current hot-water heater with a more energy efficient model that costs $1,500 and uses half the energy that their current hot-water heater uses. How many days would it take for the new hot-water heater to recover the $1,500 initial cost?

19. A coal-fired electric power plant produces 15 million kilowatt-hours of electricity each day. Assume that an input of 10,000 BTUs of heat is required to produce an output of 1 kilowatt-hour of electricity.
    a. Showing all steps in your calculations, determine the number of
        i. BTUs of heat needed to generate electricity produced by the power plant each day
        ii. Pounds of coal consumed by the power plant each day, assuming that one pound of coal yields 5,000 BTUs of heat
        iii. Pounds of sulfur released by the power plant each day, assuming that the coal contains one percent sulfur by weight
        iv. Based on the EPA standard for power plants (no more than 1.2 pounds of sulfur emitted per million BTUs of heat generated), does this power plant meet EPA standards?