Math for APES

Sample APES Quantitative Multiple Choice Questions

1. (1998) If an incandescent light bulb 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 joules of light energy
    b) 1.05 joules of heat energy
    c) 0.95 joule of light energy
    d) 0.05 joule of light energy
    e) 0.05 joule of heat energy

2. (1998) A sample of radioactive waste has a half-life of 10 years and an activity level of 2 curies. After how many years will the activity level of this ample be 0.25 curie?
    a) 10 years   b) 20 years   c) 30 years   d) 40 years   e) 80 years

3. (2003) If a city of population 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) 4.0%   e) 8.0%

4. (2003) The current global human population is about 6.1 billion and is growing at an annual rate of 1.35 percent. If world population were to grow at the 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

5. (2003) If the population of a country grows at a rte of approximately 5 percent per year, the number of years required for the population to double is closest to
    a) 5 years   b) 10 years   c) 15 years   d) 25 years   e) 35 years

6) (2003) For a certain insecticide, the LD-50 dosage level for rats is determined to be 250 milligrams per kilogram of body mass. On the basis of this information, which of the following is the best prediction regarding the consequences of receiving this dosage of the insecticide?
    a) Fifty percent of any rat population would be sickened
    b) Fifty percent of the population of any warm-blooded animal would die
    c) Fifty percent of any population of mosquitoes would die
    d) Five hundred out of every one thousand people would experience acute effects
    e) Five hundred out of every one thousand rats would die

7. (2003) 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 CO_2) 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

8. (2003) 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

9. (2003) 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

10. The world's population in 2000 was approximately 6 billion. Assuming a constant growth rate of 2%, in what year would the world's population 12 billion?
    a) 2035   b) 2050   c) 2070   d) 2100   e) 4000

11. Plutonium-239 has a half life of 24,000 years. How much of the sample will remain after 96,000 years?
    a) 1 gram   b) 0.5 grams   c) 0.25 grams   d) 0.125grams   e) 0.062 grams.

Energy flow in Lake Freemont (kcal/m²/year)

Trophic Level	Energy Consumed	Waste Energy	GPP	NPP
Producer	-	1,500,000	10,000	8,000
Primary Consumer	2,000	1,600	200	180
Secondary Consumer	160	100	40	10

12. In the community described in the table above, which of the following represents the respiratory energy (kcal/m^2/year) used by autotrophic organisms?
   a) 10 b) 200 c) 1,600 d) 2,000 e) 10,000

Energy flow for Green Springs (kcal/m^2/yr).

Trophic level	Energy Available (kcal/m^2/yr)
Producers	9000
Primary Consumers (herbivores)	1500
Secondary Consumers (carnivores)	120
Tertiary Consumers (top carnivores)	12

13. Based on the table above, calculate the efficiency of energy transfer (in percent) from:
   a) Producers to primary consumers
   b) Primary consumers to secondary consumers
   c) Secondary consumers to tertiary consumers

14. A population with a crude birth rate of 46 and a crude death rate of 12 is growing at what annual percentage rate?
   a) 5.8 b) 3.4 c) 58 d) 34 e) 25

15. A population that has a crude birth rate of 46 and a crude death rate of 11. How many years will it take for this population to double?
   (a) 17 (B) 20 (C) 35 (D) 57 (E) 200

16. I-131 has a half-life of about 8 days. If an original sample weighs 240 kg, how many kg will remain after 32 days ?
   (a) 15 (b) 30 (c) 45 (d) 60 (e) 120

17. In the earth's crust the temperature increases about 2^{O}C for each 100 m depth below the surface. If the surface temperature is 30°C, a temperature of 100°C can be reached at a depth of :
   a) 7 km b) 500 m c) 35 km d) 100 km e) 3.5 km

Answers:
1. d
2. c
3. a
4. c
5. c
6. e
7. e
8. d
9. d.
10. a
11. e
12. d
13. a) 16.7%
    b) 8.0%
    c) 10.0%
14. b
15. b

16. a
17. e