APES Math & Graphs Review

Conversions

Area Conversions

Several FRQ's from the past have had students calculate the number of acres and/or hectares of land needed to feed or grow a certain crop. multiply by this number to covert to the following:

2.47 acres = 1 hectares 1 square mile = 640 acres

Acres x 0.4047 = Hectares Hectares x 2.47 = Acres

Length Conversions

multiply by this number to covert to the following:

Feet x 0.3048 = Meters Meters x 3.2808 = Feet

Kilometers x 0.62 = Miles Miles x 1.609347 = Kilometers

	Prefix	Means	Abbriviations
Largest	Kilo	1000	k
	Hecta	100	h
	Deca	10	dk
Base	Meter, liter, kilogram	1	m, L, kg
	Deci	0.1	d
	Centi	0.01	c
Smallest	mili	0.001	m

Pneumonic device: King Henry Died Unfortunately Drinking Chocolate Milk

Masses

multiply	By this	To convert to
Grams	0.002205	Pounds
Pounds	0.4535925	Kilograms
Metric tons	1.1023	Tons (short 2000 lbs)
Tons (short 2000 lbs)	0.9072	Metric tons

Temperature

Multiply this	By this	To convert to
Farenheit	(F – 32) x 1.8	Celsius
Celsius	(C x 1.8) + 32	Farenheit
Celsius	Add 273.15	Kelvin
kelvin	Subtract 273.15	celsius

Trophic level math:

How much energy is available for the third trophic level lions in the Serengeti ecosystem?

Producers (plants) = (10,000 joules) x (10% ecological efficiency) = amount of energy in joules = (10,000 joules) x (0.1) = 1000 joules available for second trophic level zebras.

Once we calculate the amount of energy available for zebras, we now need to calculate the amount of energy that will be available for lions. Calculate the amount of energy available to the third trophic level (lions) with an ecological efficiency of 10%.

Primary Consumers = (1,000 joules) x (10% ecological efficiency) = amount of energy in joules = (1,000 joules) x (0.1) = 100 joules available for third trophic level (lions)

Final answer = 100 joules of energy is available for lions at the third trophic level.

Doubling Time and the Rule of 70

The doubling time or Rule of 70 is a useful tool for calculating the time it will take for a population (or money) to double. The rule of 70 explains the time periods involved in exponential growth at a constant rate. To find the approximate doubling time of a quantity growing at a given annual percentage, such as 10%, divide 70 by the percentage growth rate.

Here is an example of a similar AP multiple-choice question that asks student to calculate doubling time using the Rule of 70.

Example: If the population of rabbits in an ecosystem grows at a rate of approximately 4 percent per year, the number of years required for the rabbit population to double is closest to

a. 4 years b. 8 years c. 12 years d. 17 years e. 25 years

Solution: 70/4 = 17.5 years, the closest answer to 17.5 would be “d” 17 years.

Global Growth Rate:

It explains that the crude birth rate (CBR) is the number of births per 1,000 individuals per year. The crude death rate (CDR) is the number of deaths per 1,000 individuals per year. The rate is expressed mathematically as Global population growth rate = $\frac{[(CBR) - (CDR)]}{10} = \frac{[(20) - (8)]}{10} = 1.2\%$

Resource Usage:

The Draper family of four wanted to find ways to live more sustainably. Dad recommended analyzing their water and energy usage. He noted that each person in the family showers twice a day with an average of 6 minutes per shower. The shower has a flow rate of 5.0 gallons per minute. Their standard hot-water heater raises the water temperature to 130 F, which requires 0.2 kWh per gallon at a cost off $0.10/kWh.

Solve the following problems making sure to use the correct units and show your work.

Problem:

1. Calculate the total amount of water the Draper family uses for showering per year.

Solution:

(6 min/shower)(5.0 gallons/min)(2 showers per day per person)(4 people)(365 days/yr) = 87,600 gallons /year used for showers

Problem:

2. Calculate the annual cost of the electricity needed to heat the water the Draper family uses for showers. Assume that 2.5 gallons per minute of hot water is being used.

Solution

(Hint the other 2.5 gallons of water used in the 5 gallons/min is cold water)

First, find the total amount of hot water used in gallons.

87,600 gallons/year / 2 = 43,800 gallons of hot water per year

Then, find the cost per year to heat 43,800 gallons.

(43,800 gallons/yr)(0.20 kWh/gallon)($0.10/kWh) = $876 per year

Half Lives

# of half lives	% left	Fraction left
0	100	1
1	50	½
2	25	¼
3	12.5	1/8
4	6.25	1/16
5	3.12	1/32
6	1.50	1/64
7	0.78	1/128
8	0.39	1/256
9	0.20	1/512
10	0.10	1/1024

Units of Energy

Watt A kilowatt-hour (kWh) is the amount of energy expended by a 1 kilowatt (1000 watts) device over the course of one hour. Often measured in the context of power plants and home energy bills.

Kilo (means 1,000 or 103) 1 kW = 103 watts

Mega (M) (means 1,000,000 or 106) 1 MW = 106 watts

Btu (British Thermal Unit) Btu is a unit of energy used in the United States. In most other countries it has been replaced with the joule. A Btu is the amount of heat required to raise the temperature of 1 pound of water by 1 degree F. 1 watt is approximately 3.4 Btu/hr

LD 50

LD-50 is the measure used to indicate the "lethal dose" of a material that, when given at once, kills 50% of a group of test animals, such as laboratory rats.

Problem:

Assume that for a certain pesticide, the LD-50 dosage level for laboratory rats is determined to be 200 mg/kg of body mass.

a) Calculate the amount of the pesticide that would be considered safe for animals to ingest?

b) Calculate what amount of pesticide would be considered safe for humans to ingest?

Solution:

See page 475 of textbook, "For most animals, a safe concentration is obtained by taking the LD-50 value and dividing it by 10. The logic is that if the LD-50 value causes 50 % of the animals to die, then 10% of the LD-50 value should cause few or no animals to die."

a) $\frac{200\text{mg/kg}}{10}$ = 20 mg/kg of mass is considered safe for mammals

See page 475 of textbook, " the LD-50 and ED-50 values obtained from rats and mice are divided by 1,000 to set the safe values for humans."

b) $\frac{200\text{mg/kg}}{10}$ = 0.2 mg/kg of mass is considered safe for humans

Elements in Living Things: (not in order)

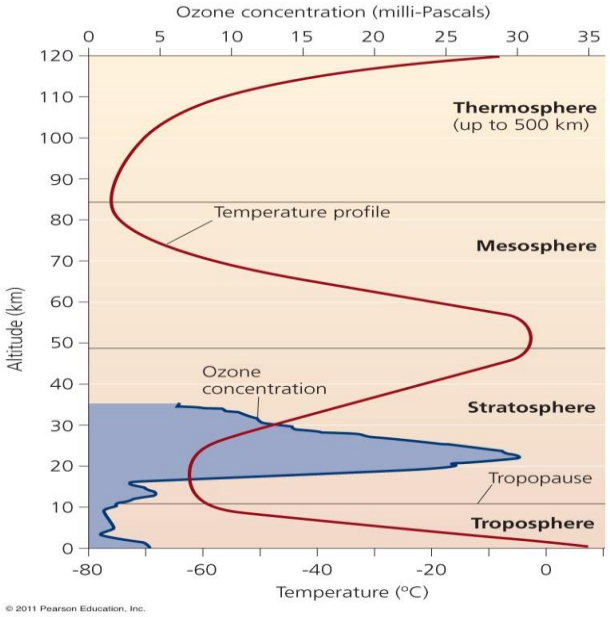
NCHOPS nitrogen, carbon, hydrogen, oxygen, phosphorus, sulphur

Elements in Earth's crust in order:

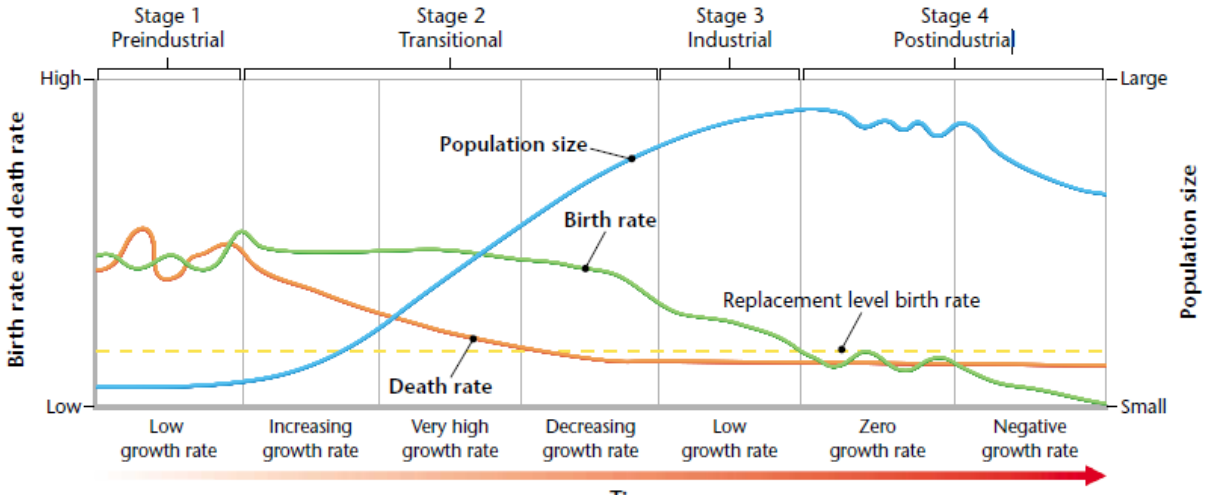
O, Si, Al, Fe (iron), Ca, Na (sodium), P, Mg: Only silly apes in college study past midnight

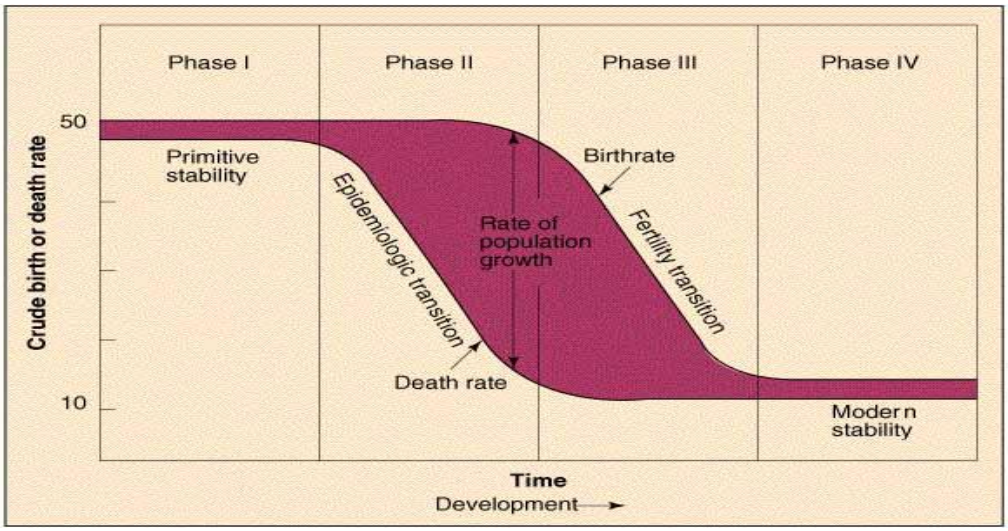
Graphs:

altituide vs. temp

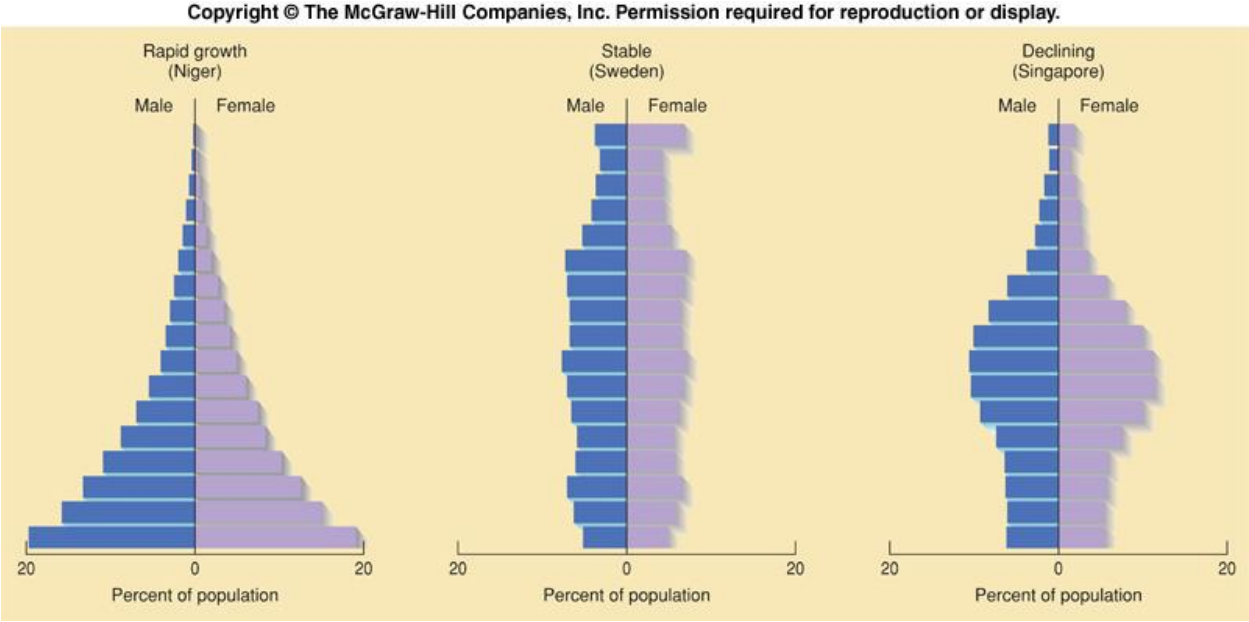


Demographic Transition Model (4 stages)





Age Structure Diagrams:



Ecological Footprint: It's about affluence, not always size

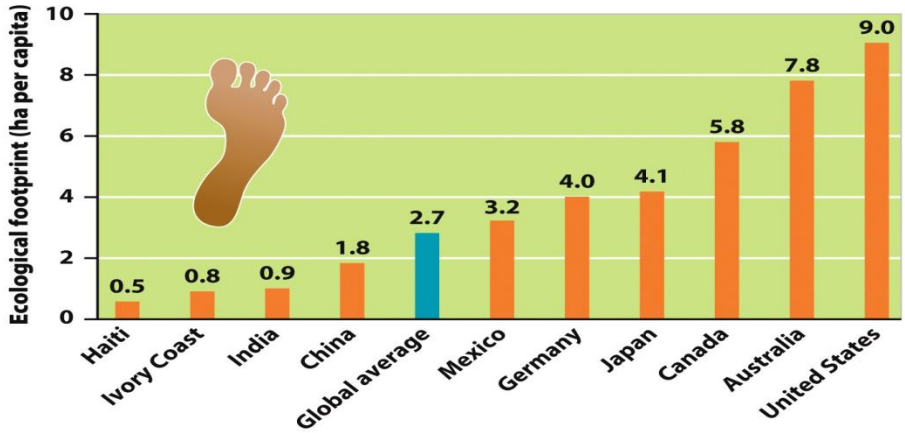


Figure 7.15
Environmental Science
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Survivership Curves: 3 classes