Biology 4605/7220 Name____Key____________
2 October 2002 Exam #1b

1. For the following quantity, construct a frequency distribution (8).

Pulse = P = [69 75 68 71 69 67 70 68 68 67 68] $\cdot$ beats$\cdot$min^{-1}

___67-68__	____6_____
___69-70__	____3_____
___71-72__	____1_____
___73-74__	____0_____
___75-76___	____1_____

2. The range is defined as the difference between the largest and smallest value of a quantity.

What is the range for the Pulse data ? ___75 − 67 = 8___ (1)

What units will the range (of the Pulse rate) have ? __beats $\cdot$ min^{-1}__ (1)

3a. The median is defined as the observation that has an equal number of observations above and below it. For the pulse data, what is the median ?_____68___(1)

3b. Rescale the Pulse data from a ratio scale to a nominal scale by scoring a value positive if it is <u>above</u> the median (place + or − sign beneath each value)

Pulse = P = [69 75 68 71 69 67 70 68 68 67 68] $\cdot$ beats$\cdot$min^{-1} (2)
Pnominal = [+ + − + + − + − − − −]

4. The mean is defined as the sum of the observations, divided by the number of observations. The median is defined as the observation that has an equal number of observations above and below it. The mode is defined as the most frequently occurring observation. Calculate these three measures of central tendency, for the pulse data.

Mean(Pulse) = __________69____ (1) $\Sigma P = 760$

Median(Pulse) = __________68____ (from above)

Mode (Pulse) = __________68____ (1)

Which of these three measures of central tendency is largest ____________mean_______(1)

Is the distribution symmetrical ? (Circle one) Yes $\boxed{\text{No}}$ (1)

Discuss how symmetry or its lack affects the 3 measures of central tendency (2)

A few large values will skew the distribution to the right
Skew to the right pulls the mean above the median and the mode.

5. Calculate the following quantities. Be sure you report units.

4 megameters = ____4000____ km (1)

$(30\ mm)^{1.1}$ = ______$42.15\ mm^{1.1}$___ (Report units here as well as a value) (2)

500 m * 2 km = _________1___ km^2 (1)

2 cm * $(4\ cm)^{0.5}$ = _________$4\ cm^{1.5}$___ (Report units here as well as a value) (2)

10 calories = ____2.39___ Joules (1 kilocalorie = 4.186 kiloJoule) (1)

$30^{1.1} = 42.15$

$$10cal \cdot \frac{1J}{4.186cal} = 2.39J$$

8. Oxygen intake scales with body size (mass) as Mass$^{0.72}$
Hence a doubling in body mass
will increase oxygen intake by a factor of $2^{.72}$ = __1.65_ (1)

If body mass increases tenfold,
by what factor will respiration increase ? __5.25__ (1)

9. The Poisson distribution describes the frequency of events that are random and rare (*i.e.*, average success rate under 5 per sampling unit). Using the cumulative distribution given to you for a Poisson distribution with mean of 0.5, fill in the 2 blank values of the probability density function (pdf). K = no events per unit, 1 event per unit, 2 events per unit, *etc.* (2)

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MTB > cdf;
SUBC> poisson .5.

    POISSON WITH MEAN =    0.500
   K       P( X LESS OR = K)  P(X = K)
                 cdf             pdf
   0             0.6065         _0.6065__
   1             0.9098
   2             0.9856
   3             0.9982
   4             0.9998         0.9998 − 0.9982=0.0016
   5             1.0000
```

10. What is the probability of 1 or fewer balsam fir trees per unit, if the mean number is 0.5 balsam fir trees per sampling unit ?

__0.9098__ (1)

11. Survival percentage is defined as $e^{-\mu * t}$ where μ is the mortality rate (% / month) and t is measured in months. When the mortality is 2% / month, what is the survival percentage after a year ? __78.7% ___ (1)

$e^{-(0.02)(12)} = 0.787$

12. An ecological geneticist, P.F. Brussard, calculated heterozygosity (H_Dps = %) of the fruitfly *Drosophila persimilis*, in relation to altitude (Elev = ft), from data reported in 1948 by Theodosius Dobzhansky at mountainous locations in Yosemite Park in California.

Calculate the expected heterozygosity at an elevation of 10000 ft, assuming

H_Dps = 0.58 ! 0.000039 * Elev

Heterozygosity at 10000 ft = H_Dps(10000 ft) = _______0.19__ (1)

Write a data equation, for an observed value of H_Dps = 0.68 (68%) at 10000 ft

___0.68_____ = ______0.19____ + ____0.49_____ (3)

$$_{Elev}$ = !0.000039 is a parameter with units of ________% ft$^{!1}$___ (1)

$$_{Elev}$ = !0.000039 is a parameter with dimensions of _______L$^{!1}$_____ (1)

In words, what does $$_{Elev}$ measure ? (vertical) rate of change in heterozygosity___ (1)

13. Set up a pair of statistical hypotheses (H_A and H_o) concerning whether heterozygosity changes with altitude. Use $$_{Elev}$ in forming both hypotheses. (1)

H_A : $$_{Elev}$ … 0

H_o : $$_{Elev}$ = 0

14. For the following situations would you accept or reject the null hypothesis (H_o), that the observed outcome is JUST LUCK ? p is the probability of the observed outcome, calculated from a frequency distribution that applies when the H_o is true.

Circle one.

" = 5 %	1 ! p = 98%	Accept H_o	$\boxed{\text{Reject } H_o}$	(1)
" = 5 %	p = 4.7%	Accept H_o	$\boxed{\text{Reject } H_o}$	(1)
" = 10%	p = 13 %	$\boxed{\text{Accept } H_o}$	Reject H_o	(1)