Name:

AP BIOLOGY MATH REVIEW #1

Show your work for all problems. Give your answers to the nearest hundredths.

I. STANDARD DEVIATION

1. The table below shows the estimated population size of two types of plants in one county in Colorado. Calculate the standard deviation for the *Penstemon palmeri* population.

	1998	**1999**	**2000**	**2001**	**2002**	**2003**
Penstemon barbatus	15,000	12,000	10,000	16,000	20,000	22,000
Penstemon palmeri	8000	11,000	16,000	18,000	18,000	20,000

2. The table below shows scores students earned on AP exams. Calculate the standard deviation for the AP biology exam.

	AP Literature	**AP History**	**AP Biology**
John Wilson	3	2	1
Brianna Douglas	2	2	3
Ken Sythe	5	4	1
Marion Williams	4	3	3
Peter Cook	1	1	4
Elizabeth Sweet	1	5	2

II. MAKING SOLUTIONS

Three common ways of making solutions include percent solutions, molar solutions, and dilutions of stock solutions. Pay attention to the bold sentences because they contain key information on how to solve the problems.

PERCENT SOLUTIONS:
Concentrations of some solutes may be expressed as a percentage of 100 mL of solution. **1% solution contains 1 g of solute dissolved in 100 ml of solvent.**

3. If a culture medium requires 3% sucrose, how many grams of sucrose would you need to use to make 100 ml of this solution?

4. How much glucose would you need to use to make 1 liter of a 3% glucose solution? Show your calculations.

5. How much casein (milk protein) would you need in order to make 30 ml of a 1% casein solution? Show your calculations.

6. How much NaCl would you use to make 500 ml of 5% NaCl solution? Show your calculations.

MOLAR SOLUTIONS:
Frequently the concentrations of solutes in solutions are expressed in molarity (M). **A 1 M solution contains 1 mole of solute in 1 liter of solution.** A mole is the number of grams of the solute that equals its molecular weight.

Example:

How many grams of sucrose do you need to make 250 mL of a 0.1 M solution?
Molar mass of sucrose = 342.3 g/mol

This means that 1 L of 1 M sucrose solution contains 342 g of sucrose.
Then 1 L of 0.1 M solutions has 342 g x 0.1 M = 34.2 g of sucrose. Since we have only 250 ml and not 1 L (1000 ml), we need to multiply 34.2 g x 0.250 L = **8.55 g**
You need 8.55 g of sucrose to make 250 Ml of a 0.1 M sucrose solution.

7. How many grams of salt do you need to make 100 ml of a 0.5 M solution?
Molar mass of NaCl = 58.44 m/mol

8. How many grams of sucrose do you need to make 5L of 0.6 M solution?
   Molar mass of sucrose = 342.3 g/mol

9. How many grams of fructose do you need to make 150 ml of 1 M solution?
   Molar mass of fructose = 180.16 g/mol

DILUTION OF STOCK SOLUTION:

To make a dilution of a stock solution of known concentration, **use the formula $C_1V_1 = C_2V_2$ where C_1 is the initial concentration, C_2 is the final concentration, V_1 is the initial volume, and V_2 is the final volume**.

Example:

If you dilute 174 ml of a 1.6 M solution of LiCl to 1 L, what is the new concentration of the solution?

Here is what is given to you:
V_1 = 174 ml
V_2 = 1 L
C_1 = 1.6 M
C_2 = ? – you need to solve for C_2

Remember: 174 ml = 0.174 L

$$C_1V_1 = C_2V_2$$

$$C2 = \frac{C1V1}{V2}$$

$$C2 = \frac{1.6\ \text{M x}\ 0.174\ \text{L}}{1\text{L}}$$

C_2 = 0.28 M

10. Assume you have 200 mL of 2 M NaOH. What volume of the solution would you need to make 4 M NaOH? Show your calculations.

11. You have 3 L of 1.2 M KNO_3. What molarity will the potassium nitrate solution be if you dilute it to 10 L? Show your calculations.

12. The stock solution of NaF is 1 M. You diluted it and made 250 ml of 0.5 M NaF. What was the volume of the stock solution before your dilution? Show your calculations.

13. By diluting a stock solution, you made 2 L of 0.2 M sucrose solution. Your stock solution had a volume of 500 ml. What was the original concentration of the stock solution?

III. PROBABILITY

14. An **XxYYZZ** parent mated with an **xxYyZz** parent. Assuming independent assortment of these three genes, what is the chance for the offspring to be **xxYyZZ**?

15. An organism with the genotype **BbDDEEff** is mated to one with the genotype **BBDdEeFf**. Assuming independent assortment of these four genes, what is the chance for the offspring to be **BBDdEEff**?

16. The genotype of F_1 individuals in a tetrahybrid cross is **AaBbCcDd**. Assuming independent assortment of these four genes, what are the possibilities that F_2 offspring will have the **AaBBCCdd** genotype?