CALCULATION SHEET FOR MAKING DRUG PREPARATIONS

For most applications the following formula is applicable:

$(C_1)(V_1) = (C_2)(V_2)$ where

C_1 is the concentration of solution 1; V_1 is the volume of solution 1

C_2 is the concentration of solution 2; V_2 is the concentration of solution 2

EXAMPLE: You have 20 ml of a 10 mg/ml solution and you want to make 15 ml of a 2.5 mg/ml solution. You know the concentration of the starting solution (C_1), the concentration of the desired solution (C_2) and the volume of the desired solution (V_2). Set up the math as follows:

C_1 = 10 mg/ml *C_2 = 2.5 mg/ml*
V_1 = unknown *V_2 = 15 ml*

(10 mg/ml) (V_1) = (2.5 mg/ml) (15 ml)

$$\text{Therefore } V_1 = \frac{(2.5\ mg/ml)\ (15\ ml)}{(10\ mg/ml)}$$

mg/ml on the top and bottom cancel each other and you are left with:

(2.5) (15 ml)/10 = 37.5 ml/10 = 3.75 ml = V_1

So you dilute 3.75 ml of C_1 to a final volume of 15 ml therefore you need to add 15 - 3.75 = 11.25 ml of diluent

HOW DO YOU CALCULATE THE PROPER DRUG CONCENTRATIONS FOR DELIVERING A COMPOUND TO AN ANIMAL?

First you need to know what volume you want to inject into the animal with each treatment being administered, then you need to know how much drug should be in that given volume.

Let's say you want to inject compound at the rate of 0.1 ml of solution for each 10 grams of body weight and you want to administer a drug dose of 50 mg/kg of body weight:

50 mg/kg of body wt = 50 mg/1000 gm of body wt or 0.05 mg/1 gm = .5 mg/10 gm of body wt therefore you need to have .5 mg of drug in each 0.1 ml of solution since you want to administer 0.1 ml/ 10 gm of body wt and you need to give 0.5 mg of drug for each 10 gm of body wt.

0.5 mg/0.1 ml = 5 mg/ml. Therefore a 5 mg/ml solution administered at the rate of 0.1 ml/10gm of body wt will result in a treatment dose of 50 mg/kg.

HOW DO YOU CALCULATE THE DRUG PREP REQUIREMENTS FOR AN EXPERIMENT?

You need to know the following information:

- *Dose to be administered in mg compound/kg of body wt*
- *How many animals are to be treated*
- *How many treatments are to be given*
- *Body weight of the animals being treated*
- *Desired injection volumes*

Let's say you want to treat 15 hamsters with 75 mg/kg of a compound at the rate of 0.1 ml/20 gm of body weight and you want to prepare enough drug to dose 4 days. The amount of drug to be prepped is calculated as follows:

15 hamsters X 75 mg/kg/treatment X 4 treatments X 100 gm/hamster
15 H X 75 mg/1000gm/TRT X 4 TRT X 100 gm/H
H cancels, TRT cancels and gm cancels leaving you with
15 X 75mg/1000 X 4 X 100 = 450000mg/1000 = 450mg

Therefore, you need a total of 450 mg to do the injections and you know you want to dose at the rate of 0.1 ml/20 gm of body wt. Now you can calculate what volume the 450 mg needs to be in.

75mg/kg = 75mg/1000 gm = .075 mg/gm = 1.5mg/20gm so to inject at 0.1 ml/20 gm you need 1.5 mg in 0.1 ml which is equal to 15 mg/ml so 450 mg/ 15 mg/ml = 30 ml of solution. Thus 450 mg should be diluted to a final volume of 30 ml of solution so that you can dose 75 mg/kg at the rate of 0.1 ml of solution/20 gm body wt.

There is another way this can be calculated and that is to know that you need the solution to be at 15 mg/ml and then calculate the number of ml you need to make.

15H x 0.1 ml/20 gm/treatment x 4 treatments x 100 gm/H
H, gm and treatment cancels leaving you with

15 x 0.1 ml/20 x 4 x 100 = 600 ml/20 = 30 ml of solution set at 15 mg/ml.

Then you calculate the amount of drug to be weighed out as follows:

15mg/ml x 30 ml = 450 mg where the ml cancel each other

HOW DO YOU CALCULATE CELL PREPARATIONS?

To calculate cell preps you need to know the following information:

- *Challenge dose*
- *Volume in which challenge is to be administered*
- *Starting density of the cells*
- *How much prep you need to dose all of the animals*

EXAMPLE: Let's say you want to challenge 100 mice with 500 cells and each mouse is to receive its challenge in a volume of 0.5 ml. The stock cells are at 5×10^7 cells/ml.

You immediately know the concentration that the challenge cells should be prepared at because 500 cells/0.5 ml = 1000 cells/ml and you know the volume of cells you need since there are 100 mice X 0.5 ml each = 50 ml minimum therefore you need to make at least 60 ml of solution containing 1000cells/ml.

You can use the $(C_1)(V_1) = (C_2)(V_2)$ formula for this calculation which will result in the following formula:

$$(5 \times 10^7 \text{ cells/ml})\,(V_1) = (1000 \text{ cells/ml})(60 \text{ ml})$$

$$V_1 = \frac{(1000 \text{ cells/ml})(60 \text{ ml})}{5 \times 10^7 \text{ cells/ml}} = \frac{(1000)(60)}{5 \times 10^7} = \frac{60000}{5 \times 10^7} = \frac{6000}{5 \times 10^7} = \frac{60000}{50000000} = \frac{6}{5000} = 0.0012 \text{ ml}$$

You can see however that this is an unreasonable result since you would need to dilute 0.0012 ml into a volume of 60 ml. Therefore you need to do serial dilutions of the stock cells so that you have reasonable dilution steps.

$$(5 \times 10^7 \text{ cells/ml})\,(V_1) = (5 \times 10^5 \text{ cells/ml})(10 \text{ ml})$$

$$V_1 = \frac{(5 \times 10^5 \text{ cells/ml})(10 \text{ ml})}{5 \times 10^7 \text{ cells/ml}} = \frac{(5 \times 10^5)\,(10\text{ml})}{5 \times 10^7} = \frac{5 \times 10^6}{5 \times 10^7} \text{ ml} = 0.1 \text{ ml}$$

Therefore 0.1 ml (100 ul) of the cell stock diluted to a volume of 10 ml provides you with 10 ml of 5×10^5 cells/ml. Now you can calculate the dilution necessary to prep the challenge cells as follows:

$$(5 \times 10^5 \text{ cells/ml})\,(V_1) = (1000 \text{ cells/ml})\,(60 \text{ ml})$$

$$V_1 = \frac{(1000 \text{ cells/ml})\,(60 \text{ ml})}{5 \times 10^5 \text{ cells/ml}} = \frac{60000}{500000} \text{ ml} = \frac{6}{50} \text{ ml} = 0.12 \text{ ml}$$

Therefore 0.12 ml (120 ul) of the cells would be diluted to a final volume 60 ml.