

### The Bean Lab

- 1: a) Score = 20  
b) gross = 144  
c) Decade = 10  
d) ream = 500
- 2: a)  $7 \times 12 = 84$   
b)  $0.25 \times 500 = 125$
- 3: (total mass of spheres/100):(total mass of marbles/100)

Notes: 1) Because I only had two different types of beans I substituted pecans (Pe), popcorn (Po) and pistachios (Pi) for the 3rd thru 5<sup>th</sup> bean types.  
2) The smallest unit on the scale used is 1 g  
3) The weight of the cup is 2 g

Part 1 Table

Type of bean	Symbol	Mass of cup and 50 beans	Mass of 50 beans alone	Relative mass	Rank
Popcorn	Po	10g	8g	1.00	1
Black	B	11g	9g	1.13	2
Kidney	K	28g	26g	3.25	3
Pistachio	Pi	30g	28g	3.50	4
Pecans	Pe	103	101g	12.63	5

Part 2 Table

Type of bean	Symbol	Relative mass	Number in pot
Popcorn	Po	1.00	4
Black	B	1.13	4
Kidney	K	3.25	5
Pistachio	Pi	3.50	5
Pecan	Pe	12.63	4

### Analysis and Conclusions

- 1) Yes, the results were consistent from type to type. I noticed there was greater variability among the pistachio nuts and kidney beans than there were among the other types, so this may account for the difference in the "pot" number for pistachios and kidney beans. Also, the smallest unit on my scale was 1 gram, which made my measurements less precise than they would have been if I were able to measure in smaller units.
- 2)  $4 \pm 1$

- 3) Sample calculations (Popcorn)
- a)  $250 \text{ grams} / 1 \text{ g per pot} = 250 \text{ pots}$
  - b)  $250 \text{ grams} * 4 \text{ kernels per gram} = 1,000 \text{ kernels}$
  - c)  $250 \text{ beans} / 4 \text{ kernels per pot} = 62.5 \text{ pots}$
  - d)  $3.17 \text{ pots} * 4 \text{ kernels per pot} = 12.68 \text{ kernels say } 13$
  - e)  $3.17 \text{ pots} * 1 \text{ g per pot} = 3.17 \text{ grams}$

	a. # pots in 250g	b. # beans in 250g	c. # of pots in 250 beans	d. # beans in 3.17 pots	e. # grams in 3.17 pots
Popcorn	250	1,000	62.5	13	3.17
Black	221.23	885	62.5	13	3.58
Kidney	76.92	385	50	16	10.30
Pistachio	71.43	357	50	16	11.10
Pecan	19.79	79	62.5	13	40.04

- 4) The bean types which had the same number of beans per pot had the same results for calculations c and d. The bean types which differed in number of beans per pot had different results for calculations c and d. The reason for this is that the c & d is concerned with pots and number of beans based on relative mass, while a, b, and e rely on grams. Since each bean type had a different weight in grams, you would expect to see that calculations based on weight in grams would differ.
- 5) This restriction of reporting the beans in whole numbers parallels our understanding of atoms because you can't have half an atom.
- 6) This experiment simulates the calculation of the relative atomic masses found on the periodic table because it cancels out the units (grams) to come up with a unitless measure. The "pot" provides an analogy to the mole because *"a mole is a numerical quantity, the precise number being defined as the number of entities (in this case atoms) in exactly 12 grams of stationary carbon-12 (the most abundant isotope of the carbon element) in its ground state."* (wiki) In this experiment, the "pot" is analogous to a mole and the beans are the number of entities contained therein.