

Avogadro's Chocolate Company

Avogadro's Chocolates has been in business for ages, and is owned by an old Italian man named Amadeo Avogadro. All of their chocolates are round and have a variety of different flavors inside.



There is something strange about the way he markets his candy: he sells them in large sets he calls “**moles**”. (“MOH-lay” is an Italian word for “pile” or “heap”.) All the chocolates are the same size, so a “one mole” box will always have the same number of chocolates, no matter what type they are.

Avogadro has just hired you to be a quality-assurance (Q.A.) manager. That means you'll need to make sure the chocolates are coming out of the factory with the right weight, the right packaging, and in the right numbers. Unfortunately, there are a LOT of chocolates in each “mole” set. You won't be able to check them one by one.

After a few days on the job, you've measured enough packages to put together this information:

Variety / filling	Factory code	Mass of one “mole”
solid chocolate	S	760 g
solid dark chocolate	Sd	785 g
chocolate-covered blueberry	Bl	444 g
malted milk ball	Mm	312 g
caramel	Ca	601 g
nougat	No	520 g

These masses have an uncertainty of about 1 g. So be picky with your Q.A. job, but not too picky!! You can't expect absolute perfection from the factory. There will always be some small differences from box to box.

- 1) Do you need to know how many chocolates are in a 1 “mole” box to compare the masses of the individual chocolates? Why or why not?
- 2) Which variety has the smallest mass? Which has the biggest mass?
- 3) Can you tell what the mass of a single chocolate-covered blueberry (Bl) is? Why or why not?

- 4) A 3 mole box of caramels (Ca) is on its way down a conveyor belt to you. What should the mass of this box be? Show your work.
- 5) You find a 2.5 mole package of solid dark chocolates (Sd) with a mass of 1963 g. Show your work to figure out whether this package is OK.

- 6) You're inspecting some 2 mole packages of nougat chocolates (No), but they all have different masses: 520 g, 1020 g, and 1040 g. Which one, if any, has the right number of chocolates inside? How do you know? Show your work!



- 7) You find a 12 mole case that has lost its label, so you aren't sure which variety of chocolate is inside. You put it on your scale and find a mass of 3745 g. Show your work to determine which label the box needs.
- 8) You put a 4.5 mole box on your scale and get a reading of 3422 g. The box says "Dark Chocolates (Sd)". Is the label right? If not, what should it say? Show your work.
- 9) After packaging up most of a batch of caramel-filled chocolates (Ca), you find there are 2500 g of them leftover. How many moles of caramels is this?
- 10) You notice a box of chocolate-covered blueberries (Bl) that isn't full yet. It's a box meant for 6 moles, but the mass is only 1688 g. How many moles of Bl are in it so far? Show work.

After working at the factory for a while, you eventually come to learn that **each “mole” contains 123 chocolates**. (That's why Amadeo calls them heaps!)

- 11) How many malted milk balls (Mm) are there in a 1 mole box? How many in a 3 mole box? Show your work!
- 12) How many nougat chocolates (No) are there in a 1 mole box? How many in a 3 mole box? Show your work!
- 13) 2100 solid chocolates (S) have just been finished and are ready to be boxed up. Show your work to figure out how many moles of packaging you'll need.
- 14) You talk to the chocolatiers and they tell you that they're working on a batch of 5000 nougat chocolates (No). How many moles is this? Show your work.
- 15) For that batch of 5000 No chocolates, what mass should you expect when you check them later? Show your work. You'll probably want to start from the answer to the previous question.
- 16) What will the mass be of 300 chocolate-covered blueberries (Bl)? Show your work. This will require TWO STEPS to answer!
- 17) Amadeo has dropped by the factory floor to see how things are going. You've just put a case of caramels (Ca) on the scale and it reads 4810 g. He asks you if you know how many caramels are in the box. Figure it out, quick!!

