

A close-up photograph of a mole emerging from a mound of dark, moist soil. The mole's head is in the center, with its pinkish nose and whiskers visible. Its front paws are extended to the left, showing long, sharp claws. The background is a soft, out-of-focus green, suggesting a natural outdoor setting. A semi-transparent grey rectangular box is overlaid on the image, containing the title and subtitle text.

Mathy Bits – Part 2

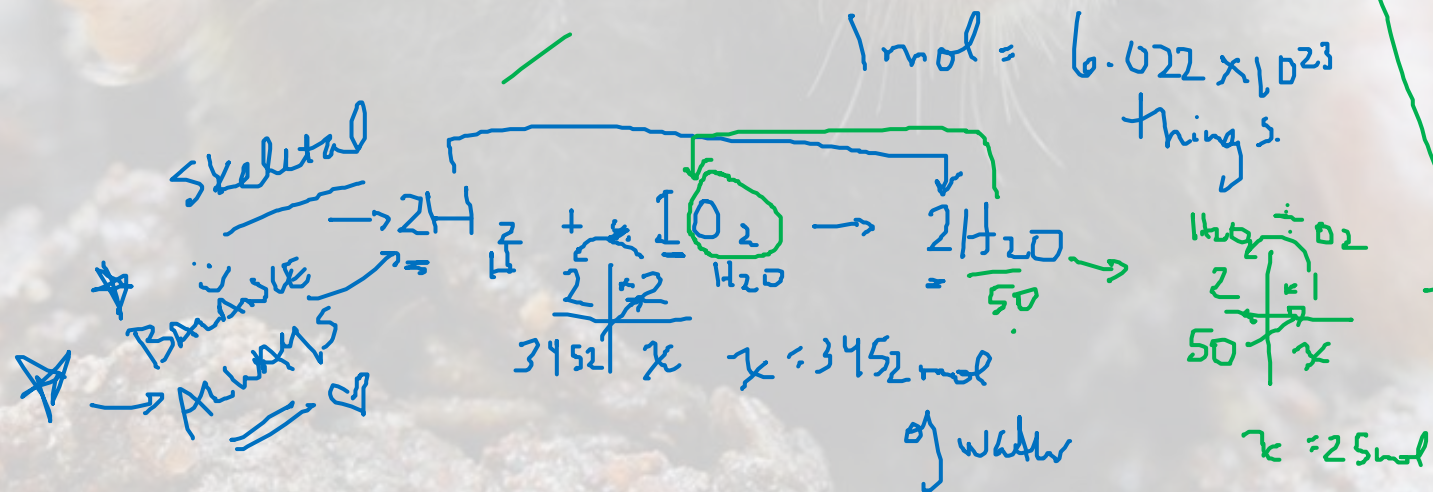
The Weight of it...

Relationships we know about...

- Moles... n
- Mass... m
- Molecular mass... mm

$$n = \frac{m}{mm}$$

mol — n = $\frac{\text{mass in g}}{\text{molecular mass g/mol}}$

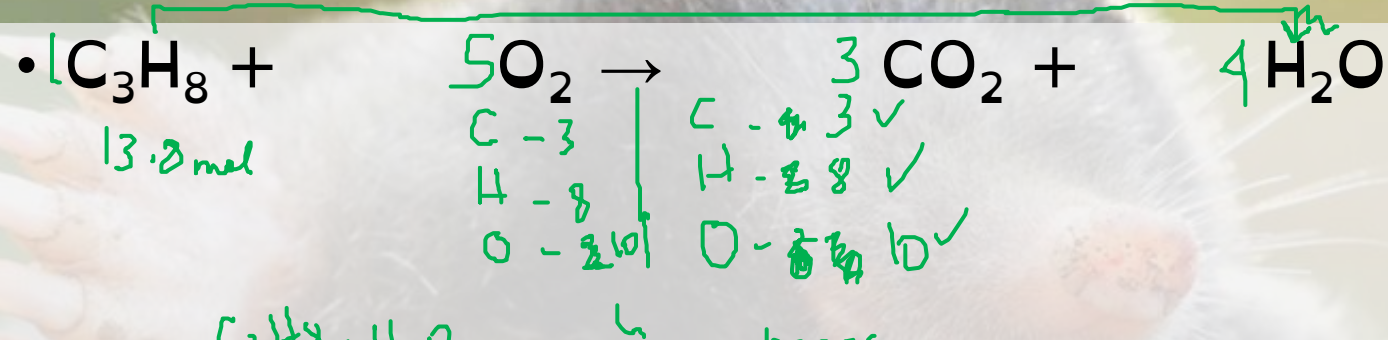


Mathy Bits – continued...

- A **balanced equation** is essential for all calculations involving amounts of reactants and products.
- Problems involving moles and masses can be solved in basically the same way as mole-mole problems.
- In a **mole-mass** problem you are asked to calculate the **mass of a substance that will react with, or be produced from, a given number of moles of a second substance.**

moles A $\longrightarrow$ **moles B** $\longrightarrow$ **mass B**

Propane is a gas that is commonly used in BBQs. Its formula is C_3H_8 . Calculate the mass of water that is produced by the combustion of 13.8 mol of propane.



$$\begin{array}{r}
 C_3H_8 = 44 \\
 13.8 \times 44 \\
 \hline
 607.2
 \end{array}$$

$$x = 55.2 \text{ mol}$$

$$m = n \times mm$$

$$m = n \times mm$$

↑
H₂O

$$\begin{array}{r}
 2 \times 1 = 2 \times 1.0079 \\
 1 \times 16 = 1 \times 15.9994 \\
 \hline
 18.0158 \text{ g/mol}
 \end{array}$$

$$m = n \times mm$$

$$\begin{array}{r}
 = 55.2 \times 18.0152 \\
 = 994.439 \text{ g}
 \end{array}$$

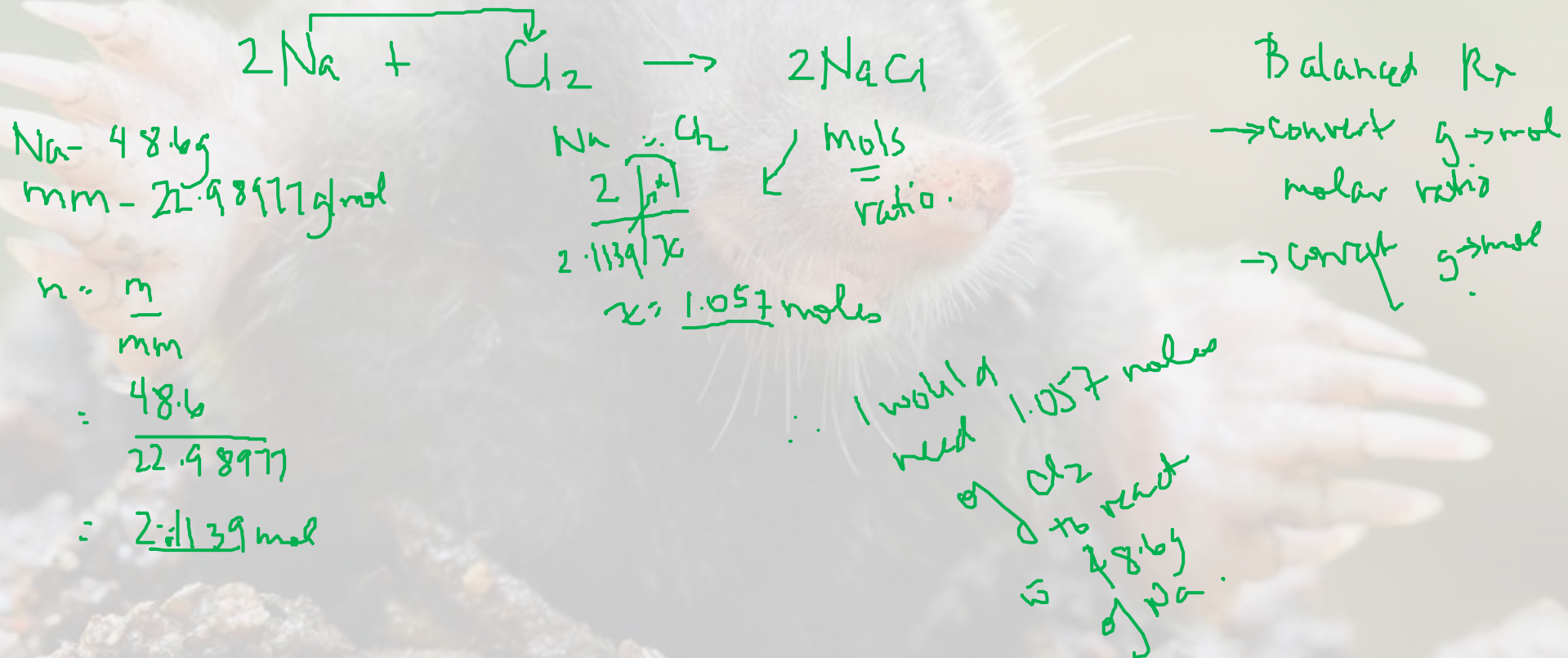
R_x

∴ The amount of water produced is 994.439g

- 1) Balance
- 2) Use ratio
- 3) find mm
- 4) use eqⁿ.



How many moles of chlorine are required to react completely with 48.6 g of sodium to produce sodium chloride?



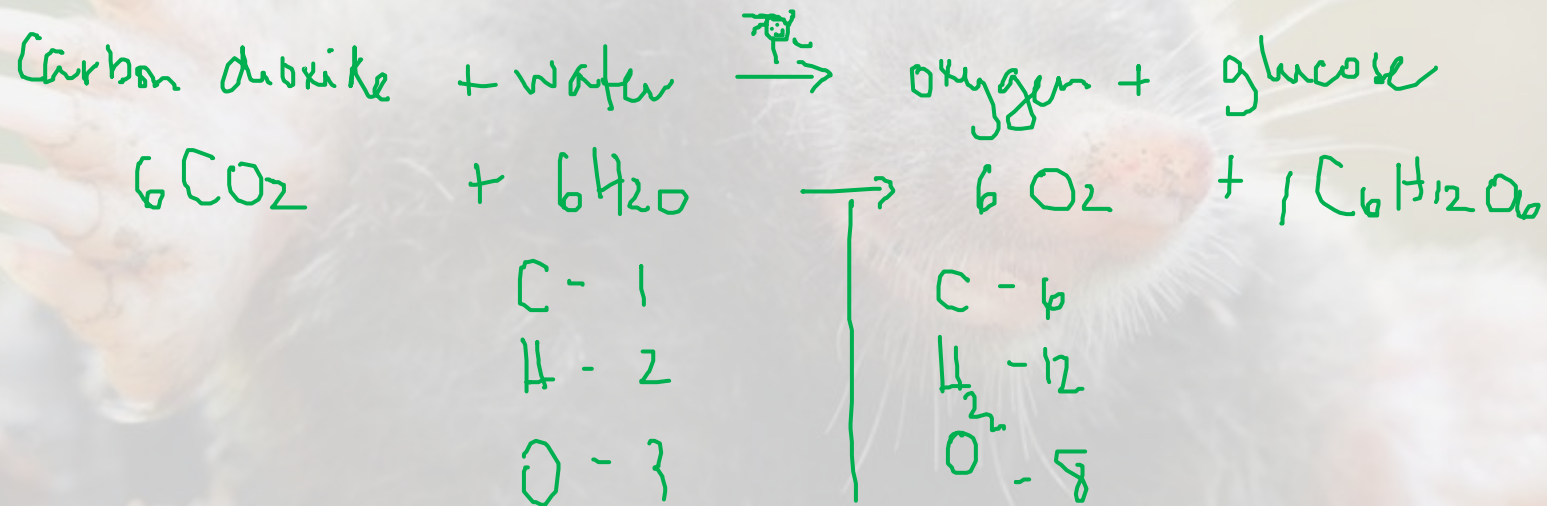
How Big is Your Mouth??

Plants and animals live in a reciprocal relationship where they give each other the essentials of life. The two reactions that allow us to live are cellular respiration and photosynthesis. Cellular respiration is the reaction of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) with oxygen to produce water, carbon dioxide and energy. Photosynthesis is the opposite reaction.

- Q1. Write a word equation for photosynthesis.
- Q2. Write a skeletal equation and balance it.
- Q3. If you were a root tip “slurping” up water (use the value your mouth can hold), how much oxygen could you produce? Show all calculations.
- Q4. If you only produced 4.4g of oxygen what is the percentage yield (Think about a test and your mark... calculate percentage)? Show all calculations.
- Q5. What may have created such a small yield?

How Big is Your Mouth??

- Q1. Write a word equation for photosynthesis.
- Q2. Write a skeletal equation and balance it.



How Big is Your Mouth??

- Q3. If you were a root tip “slurping” up water (use the value your mouth can hold), how much oxygen could you produce? Show all calculations.



mass - g

mm - 18.01 g/mol

$$n = \frac{m}{\text{mm}}$$

+

convert in grams

* Balanced Rx

Known

① Convert mass to mole
 $n = \frac{m}{M_m}$

②

mole ratio

$\frac{\quad}{\quad} \times \quad x = \quad$

Comparison

Unknown

③ Convert moles to grams
 $m = n \times M_m$

liquids

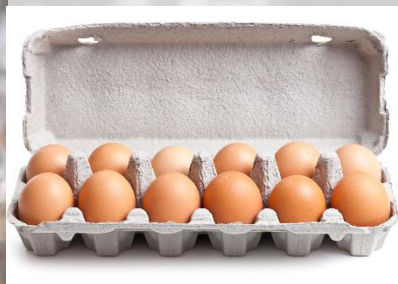
gases

Percentage Yield

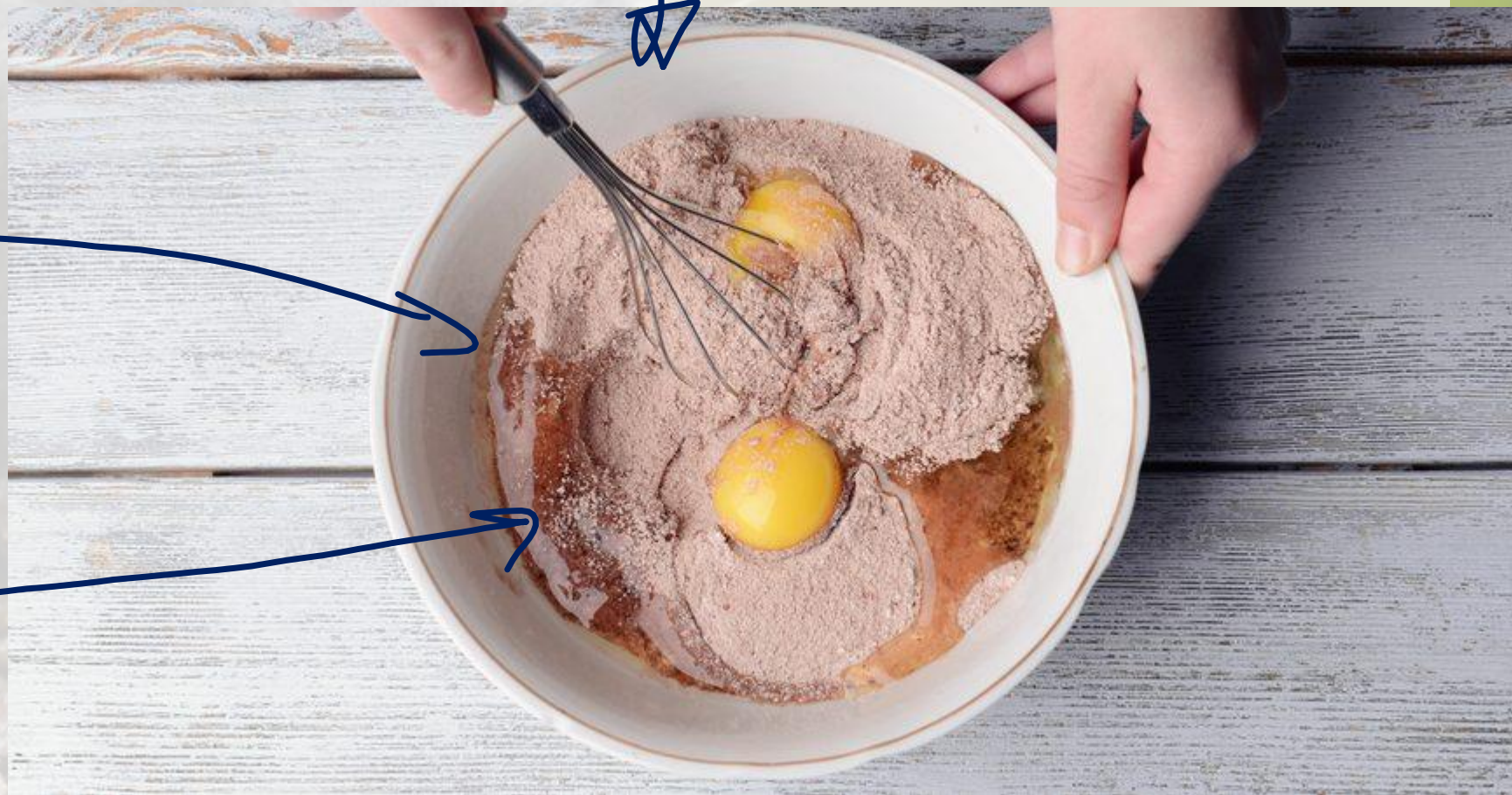




$\frac{1}{3}c$



2



24 cupcakes ← expected yield
↓
20 actual

percentage yield
Yield = $\frac{\text{actual}}{\text{expected}} \times 100\%$

$$\frac{20}{24} \times 100\% = 83\%$$



Percentage Yield

- The **theoretical yield** is the **maximum** amount of product that could be formed from given amounts of reactants.
- In contrast, the amount of product that actually forms when the reaction is carried out in the laboratory is called the **actual yield**.
- The actual yield is often less than the theoretical yield.
- This can be caused by experimental errors such as lost product, **incomplete reaction**, contamination, and inadequate reaction conditions.

Percentage Yield

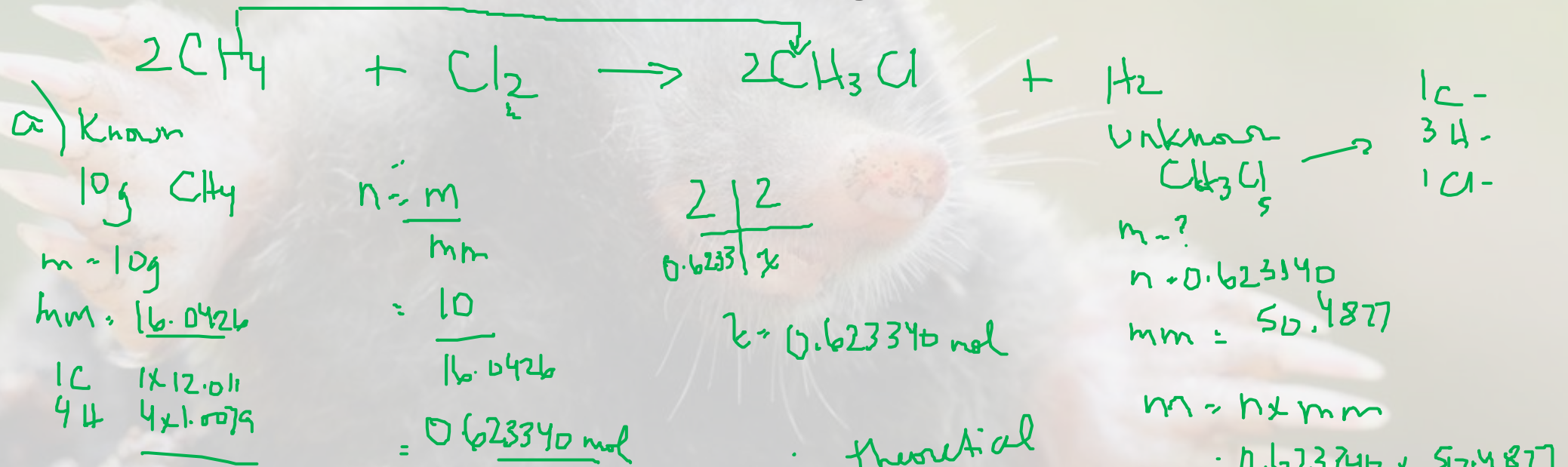
- The percentage yield is the ratio of the actual yield to the theoretical yield expressed as a percentage. The percentage yield measures the efficiency of the reaction.

$$\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100\%$$

- An organic chemist reacts 10 g of CH_4 with excess Cl_2 . She obtained 10 g of CH_3Cl and some H_2 .

✓ a) What is the theoretical yield?

b) What is her percentage yield?



b) % yield

actual - 10g

theoretical - 31.47100

$$\% \text{ yield} = \frac{\text{act}}{\text{theo}} \times 100\%$$

$$= \frac{10}{31.47100} \times 100\%$$

$$\% \text{ yield} = 31.77\% \downarrow \text{low}$$

How Big is Your Mouth??

- Q4. If you only produced 4.4g of oxygen what is the percentage yield (Think about a test and your mark... calculate percentage)? Show all calculations.
- Q5. What may have created such a small yield?