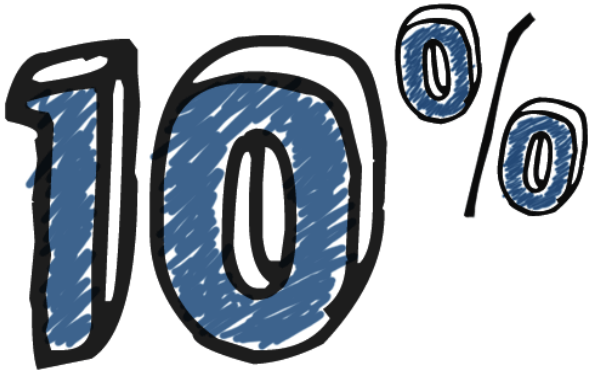


ENERGY PYRAMIDS

LT: I can use the Rule of 10% to calculate energy transfer in a food chain.

74 days until the AP exam!

Algebra review time!

- **What is the relationship between cost, revenue, and profit? You can express it below in sentence form or as an equation**

(30 seconds)

The 10 percent rule of Food Webs says:

- Only about **10** percent of the **energy** available in one trophic level is passed on to organisms in the next trophic level up.

- In other words, only 10% of the original energy will be completely transferred to the next trophic level and incorporated into the body of the animal.

Check for Understanding

- ***Which trophic level is at the BOTTOM of a food web? Which trophic levels are usually at the TOP of a food web?***

- *Bottom:*

  Top:

HOW TO CALCULATE ENERGY TRANSFER ACCORDING TO THE 10 PERCENT RULE

- **In order to calculate 10 percent** of an amount of energy (which is measured in the Joule unit), you divide the value by 10, which is the same thing as moving the **decimal point** **1** place to the **left**.

Example (not in your notes)

If the grass in the a field contain 5000 Joules (that's the unit for energy), how much energy is passed onto the rabbits (which eat the grass)?

DO I T YOURSELF (1 min)

- Knowing the 10 percent rule, how much energy would be passed on to the next trophic level? (1 minute)

- *100 Joules→*

330 Joules→

- *4530 Joules→*

- *3349 Joules →*

Calculating Energy Loss

- To calculate how much energy is ***lost***, simply subtract the energy transferred (10 percent) you calculated from the total value

Example: 330 Joules

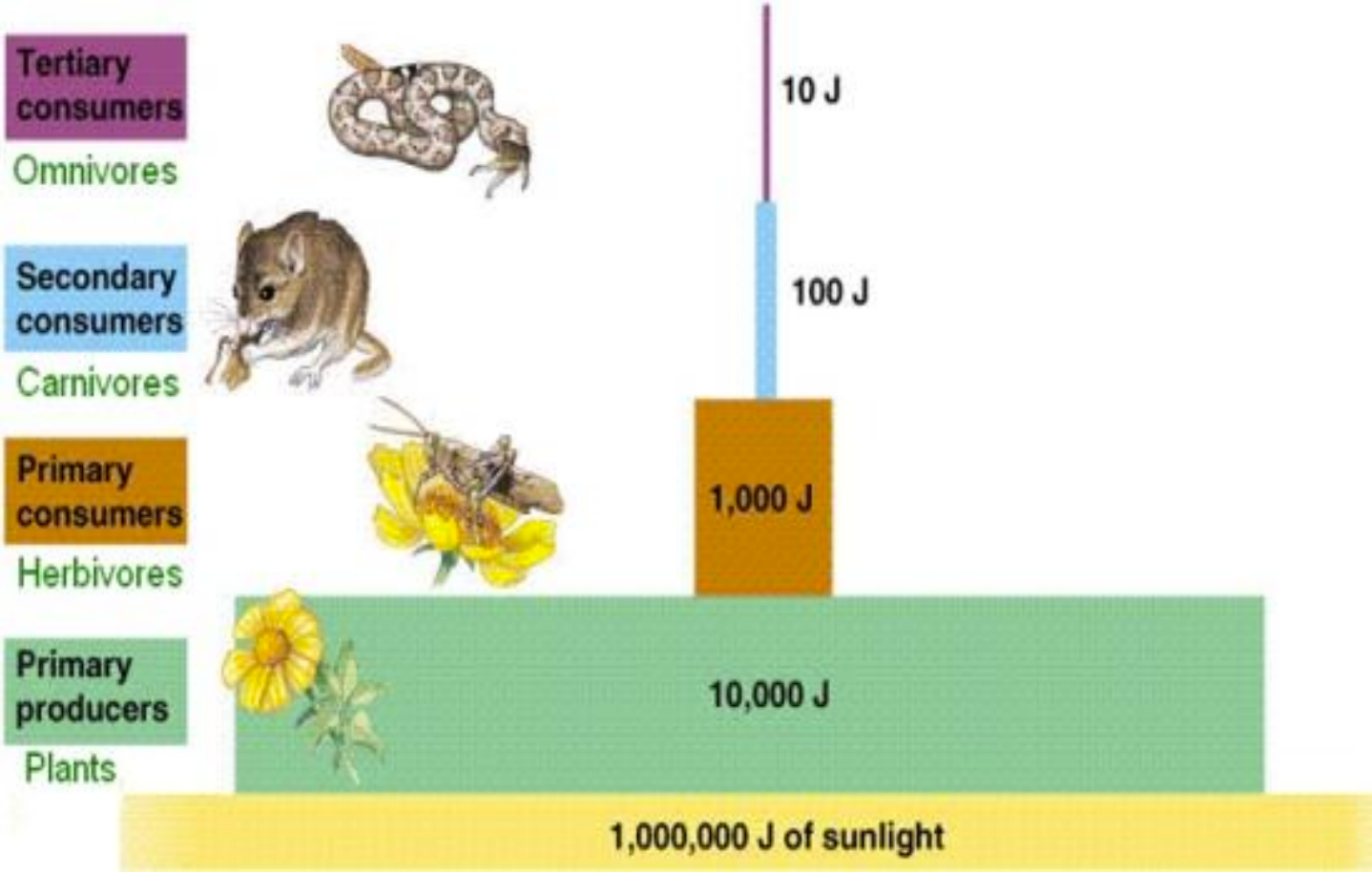
Sales analogy

- Energy passed to next trophic level = *original amount of energy* – **energy lost**
- Profit = *Revenue* – **cost**

In a nutshell-

- **Basically…**
- Anywhere along the food chain, **10%** of energy is passed on to the animal that eats the organism, and **90%** is “lost” to the environment.

This is called an Energy Pyramid

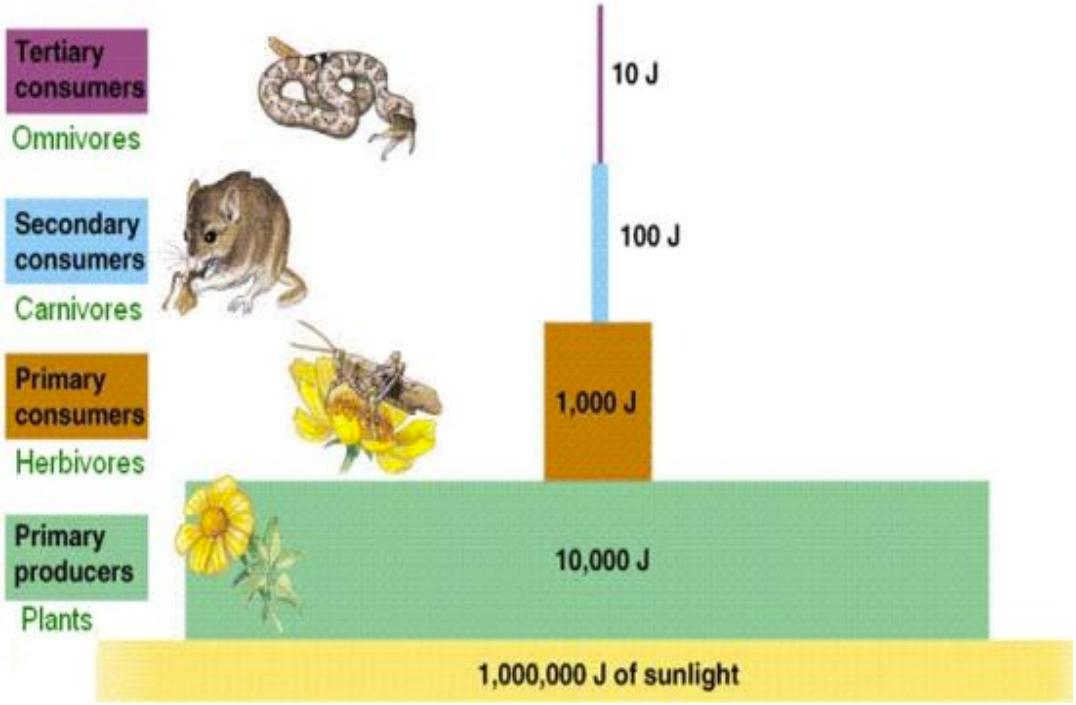


DISCUSS WITH TABLESMATES- WHY is energy lost at each trophic level? Where does the energy go? (1 min)

DISCUSS WITH TABLESMATES- WHY is energy lost at each trophic level? Where does the energy go? (1 min)

- **Use of energy to move and survive**
- **Excretion of waste**
- **Metabolism (keep bodies breathing, running functioning)**
- Farming changed this- we had much more useable energy because we just kept food all in one place.

Looking back at the pyramid (but also using common sense), where does a majority of life on earth originally get its energy from?



What do you call the process through which plants convert the sun's energy into sugars?

- Don't look at your notes!

The Source of All Energy

- Looking back at the pyramid (but also using common sense), where does a majority of life on earth originally get its energy from?

- What do you call the <u>process</u> through which plants convert the sun's energy into sugars?

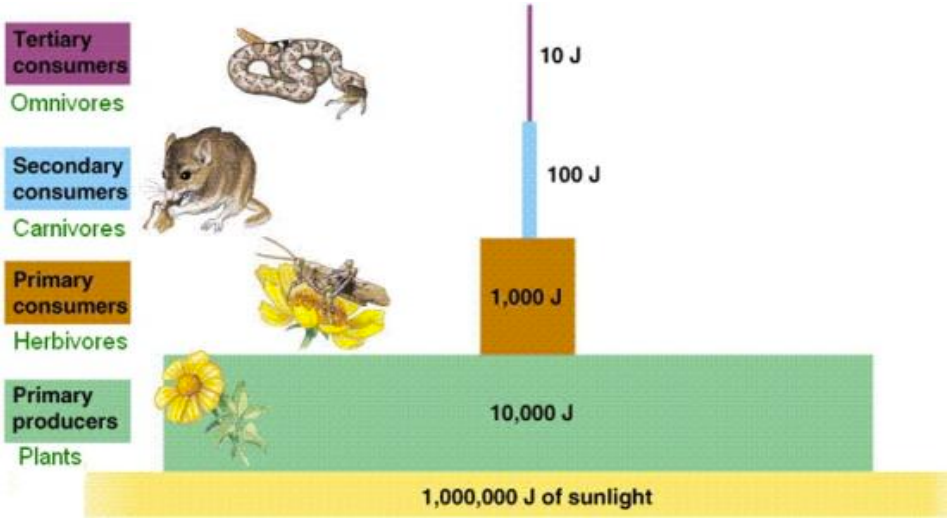
Important Note!

- The only exception to the 10 percent rule is that there's actually a "**1 percent** rule" between the energy from the sun to the producers (the first transfer of energy in a food web).
- **What this means:** If you are asked to calculate how much energy is passed on from the sun to the producers through photosynthesis, you divide by **100** instead (but ONLY for this step).

Check for Understanding

- If the sun gives off 100 Joules of energy (unrealistic), how much of it is kept by the plant?
- Remember the Rule of 1 exception here

DISCUSS WITH TABLESMATES- How is the shape of an ENERGY PYRAMID similar to the shape of an Egyptian pyramid? How are they different? (30 seconds)

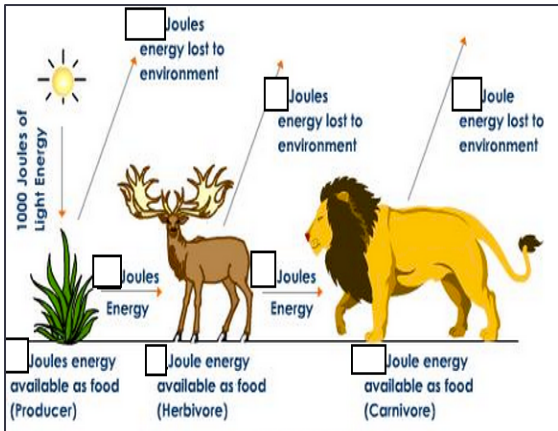


Group/Table Work (3 min)

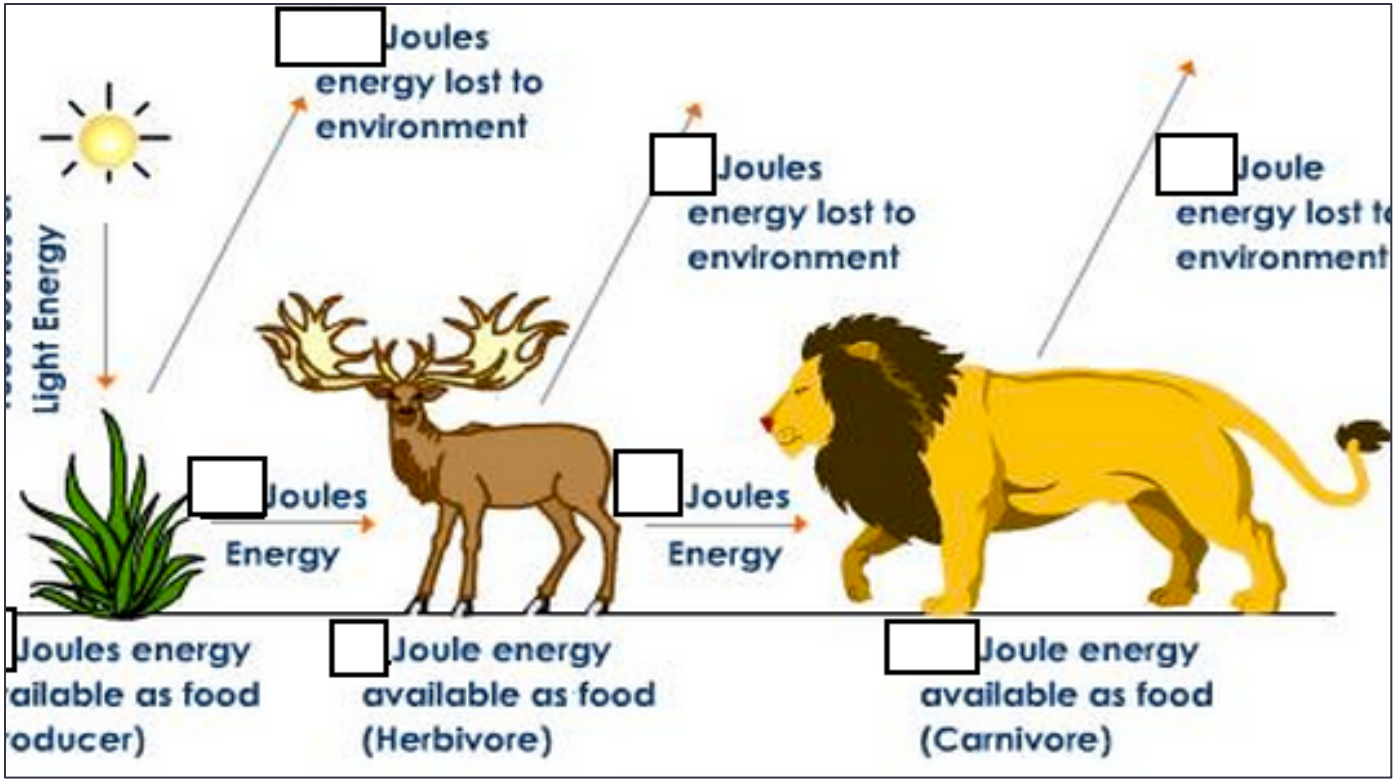
- ***Given the starting energy values, how much energy is "LOST" once it's passed onto the next trophic level? Assume you're not starting at the level of the sun's energy (3 minutes)***
- Example:
- 100 Joules
  10% of 100 → 10 Joules passed on
- Total energy – Energy passed on = **Energy lost after energy transfer**
  100 Joules – 10 Joules = **90 Joules lost after energy transfer**

Individual Check for Understanding (5 min, checked towards the end)

- Use the Rule of 10 to calculate the amount of energy passed on AND lost at each step of this food chain.
- Don't forget the "1% rule" that applies to energy transfer between the sun and producers (divide energy from sun by 100 instead of 10)!



Review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(Herbivore)
Joule energy
available as food
(Carnivore)

DISCUSS WITH TABLEMATES (1 min)

- If producers (plants) contain most of the energy in an ecosystem, what happens to consumers (animals) in a biome if you remove producers (for example, to build a parking lot?)

If you learned nothing else

- As trophic level goes up, energy available as food goes **down.**

If you learned nothing else

- The transfer of energy amount organisms in an ecosystem is very inefficient. A whopping **90** percent of energy is used up by an organism for basic function and survival and only **10** percent is available for the next organism in the trophic level to take in.

If you learned nothing else

- Because of the limited amount of energy available, there are limits to the length of a food chain (that’s why there are only 4 or 5 at most).

Group work (10 min)

- **When you’ve finished AS A GROUP, raise your hand to receive a stamp.**