

TOPIC # 7 (wrap up) The RADIATION LAWS

...and some course logistics points

GLOBAL CHANGE IN THE NEWS!



<http://www.earthweek.com/>

<http://www.earthweek.com/>



Walruses have joined polar bears and other creatures that are acutely affected by the record decline of Arctic sea ice in recent years.

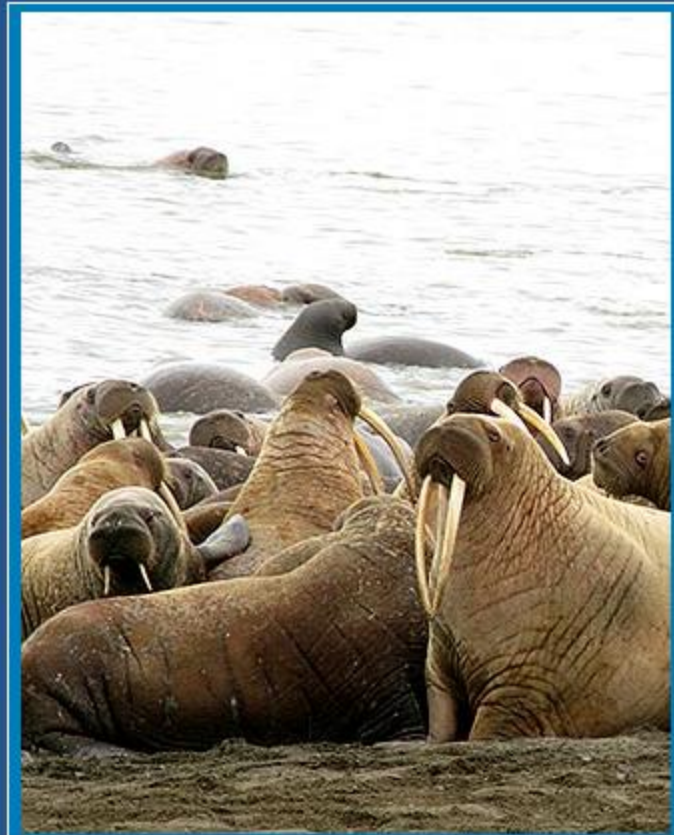
Researchers from the U.S. Geological Survey found that for the third time in four years, unprecedented numbers of the marine mammals are congregating onshore in northwest Alaska due to the lack of an icepack.

Large numbers of walrus calves have been found swimming in the Arctic alone, presumably abandoned by their mothers while they were making an arduous ice-free journey to shore.

The bulky animals normally float on ice over the summer, occasionally diving to the sea floor to forage for food. But again this year, tens of thousands have been forced to swim to land and crowd together in Alaska and Siberia due to ice-free conditions.

The Fish and Wildlife Service fears that stampedes could prove fatal for the youngest of the ice refugees, which have historically only gathered on land in the hundreds rather than thousands.

Photo: U.S. Geological Survey



Never before have tens of thousands of walruses been seen crowded together on Alaska's coast.

<http://www.hulu.com/watch/179484/nbc-nightly-news-with-brian-williams-pacific-walrus-natural-habitat-could-be-on-the-rocks>

Extreme Heat Bleaches Coral, and Threat Is Seen



What is unfolding this year is only the second known global bleaching of coral reefs. Scientists are holding out hope that this year will not be as bad, over all, as 1998, the hottest year in the historical record, when an estimated 16 percent of the world's shallow-water reefs died. But in some places, including Thailand, the situation is looking worse than in 1998.

Coral bleaching, like that seen in the Florida-Caribbean Basin on the Texas-Louisiana border, is an indicator of heat stress.

By JUSTIN GILLIS
Published: September 20, 2010

This year's extreme heat is putting the world's coral reefs under such severe stress that scientists fear widespread die-offs, endangering not only the richest ecosystems in the ocean but also fisheries that feed millions of people.

- RECOMMEND
- TWITTER
- E-MAIL
- SEND TO

<http://www.nytimes.com/2010/09/21/science/earth/21coral.html>

**TO VISIT OFTEN:
Two New York Times Blogs on
environment & science**



<http://dotearth.blogs.nytimes.com/>



<http://green.blogs.nytimes.com/>

Some POINTS on “COURSE POINTS”

1. Your final grade is based on the % of points you earned at the end of the semester out of **500 total available Course Points** .
2. **Always check your gradebook** to be sure grades have been entered correctly and contact the grader if you have any questions. **Legitimate queries are always addressed** or explained, but
3. **Point bickering** is NOT the way to help your grade! It tends to result in more scrutiny of your assignment and tests the patience of your instructors! 😞

4. Instead of bickering about the “gray area” of a disputed point with a grader, **use your energy in a positive way** that will result in learning something new Go after a **BONUS opportunity** instead! 😊

5. But do realize that **BONUS points** require a certain level of **effort and quality!** If I ask you to find out some information, e.g. it is assumed that you will provide documentation and reference the source of the information. Remember . . . **SCIENCE IS ALL ABOUT SUBSTANTIATING CLAIMS!!** 😊

6. The most important thing in this class is **HOW MUCH YOU LEARN** . . . Now how many points you rack up

Q. What's the Difference between "THE TOP TWO" and Bonus Pts??

The **TOP TWO points** of a 20 pt assignment are PART of the assignment's point total. They are a bit more challenging, but if you want to try for an "A" on the assignment (i.e., a grade of 19/20 - 20/20) you need to complete them!

BONUS POINTS for an assignment are extra – they are over and above the regular point total for an assignment.

7. The Online Syllabus spells out how points are allotted. One category is: **“CLICKER POINTS”**
(10 Individual clicker points & 5 Team clicker points)

8. Since the total number of clicking opportunities all semester is not known at this time, these points will be allotted based on:
the % of clicker responses you have recorded, out of all possible clicker opportunities,
e.g., if we have a total of 100 clicker questions and you were present with your clicker to answer 85 of them, you will get 8.5 individual clicker points.

NOTE: prior to the Midterm any answer you enter will be counted, but afterwards, only the CORRECT answers will count!

Which Brings Me To My FINAL Point:

MANY of you have **not followed the posted directions** properly on how to REGISTER YOUR CLICKER.

- Some have not registered at all
- Some have registered, but did NOT enter their **UANetID** under “Other Info:

DIRECTIONS ARE POSTED AT QUICKLINKS!

Do it SOON & do it RIGHT! ☺

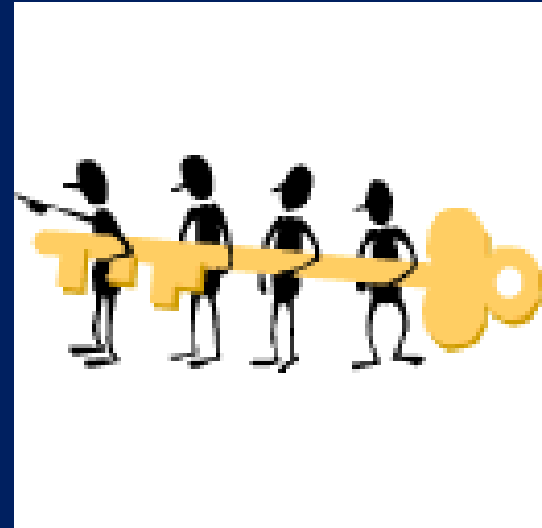
<http://fp.arizona.edu/kkh/nats101gc/clicker-reg.html>

TOPIC # 7 (wrap up)

The RADIATION LAWS

More KEYS
to unlocking the topics of:
The GREENHOUSE EFFECT,
GLOBAL WARMING &
OZONE DEPLETION!

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Wrap-Up of Law #6 . . .

LAW #6: Selective emission and absorption

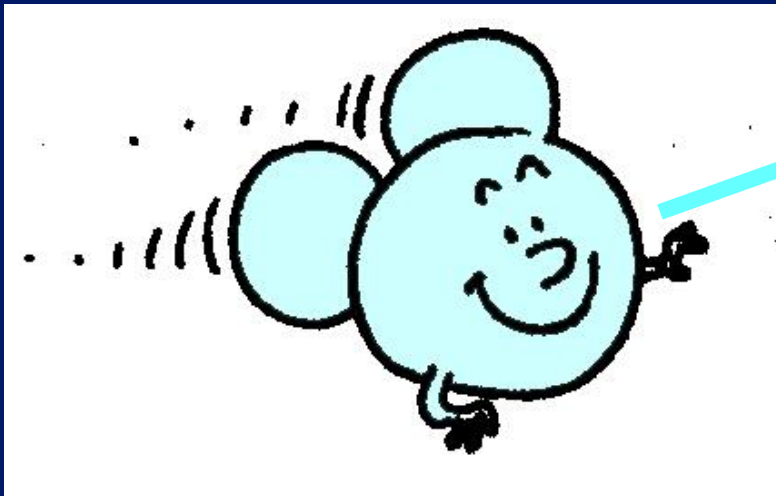
Some substances emit and absorb radiation at **certain wavelengths only.**

This is mainly true of gases.

Law # 6 says that :

Different gases absorb & emit radiation at different wavelengths

How do we know which wavelengths are absorbed/emitted by different gases?



Hi!!
I'm a water vapor molecule and I absorb and emit mostly IR wavelengths of radiation. That makes me a GREENHOUSE GAS !

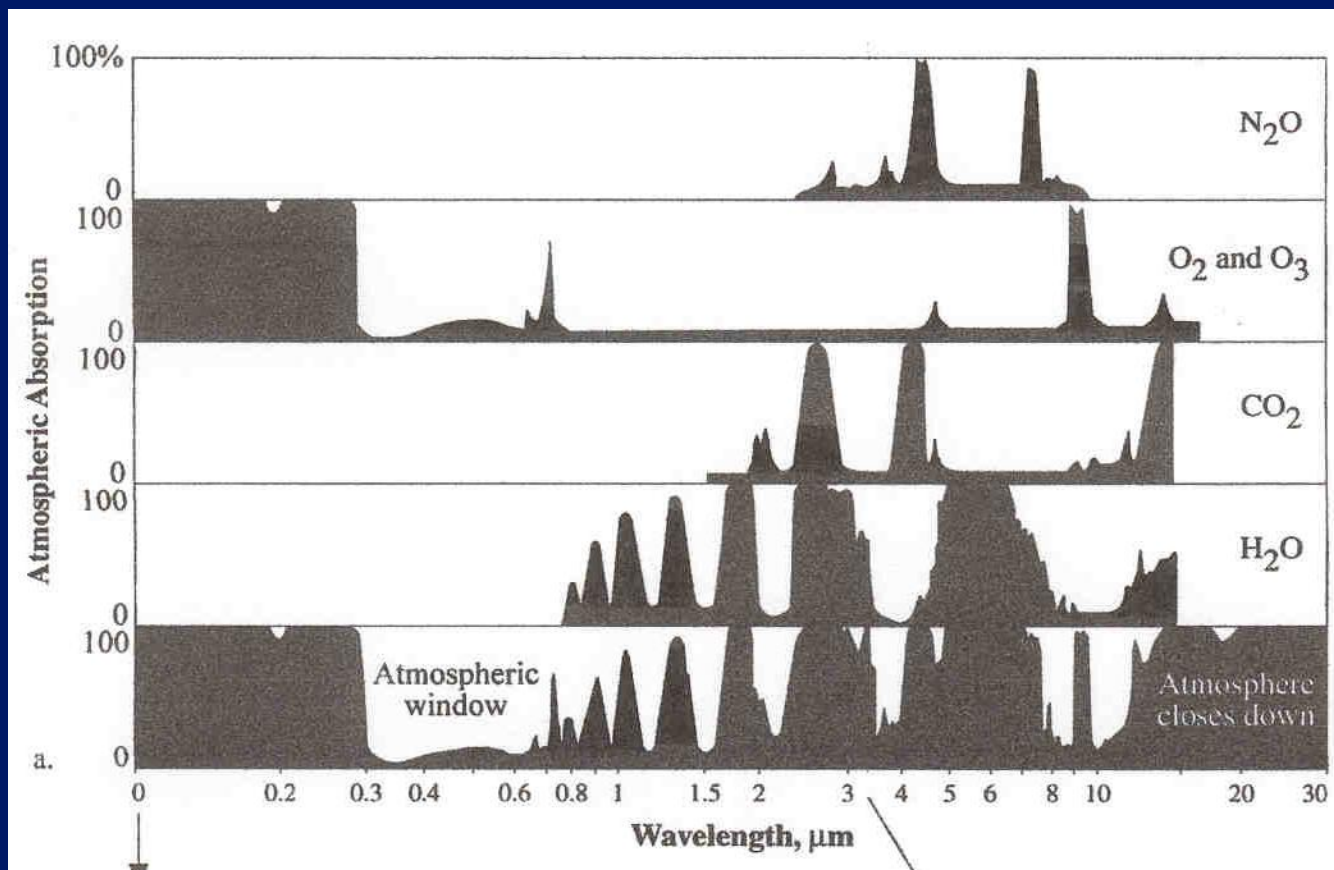


DEFINITION OF GREENHOUSE GASES

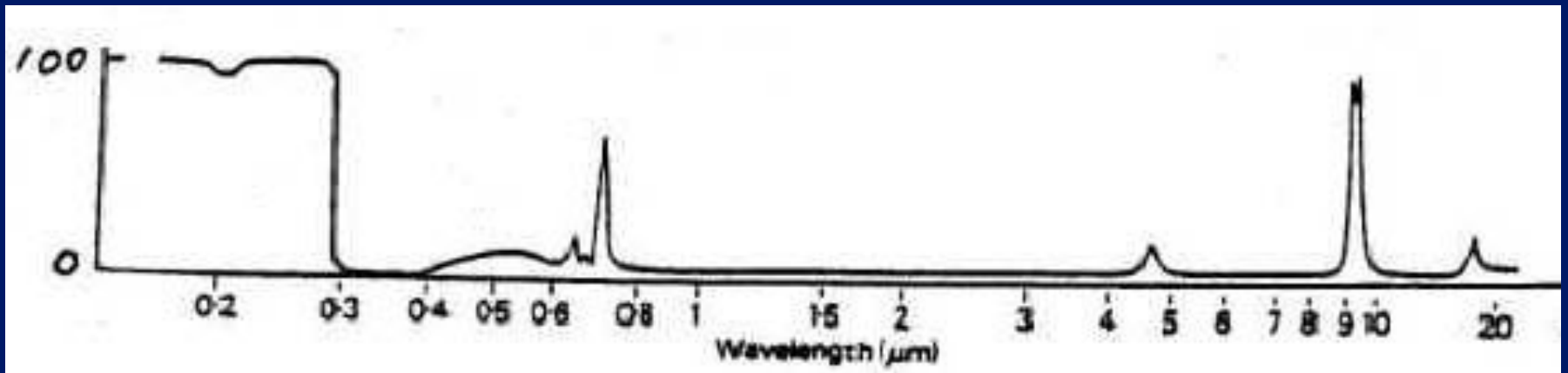
(def): Greenhouse gases are gases which both absorb and emit electromagnetic radiation in the infrared (IR) part of the spectrum.

The pattern of electromagnetic wavelengths that are **absorbed** & **emitted** by a particular atom (or combination of atoms)

is called its **ABSORPTION SPECTRUM** or its **ABSORPTION CURVE**



An absorption curve: another view



ABSORPTION CURVES

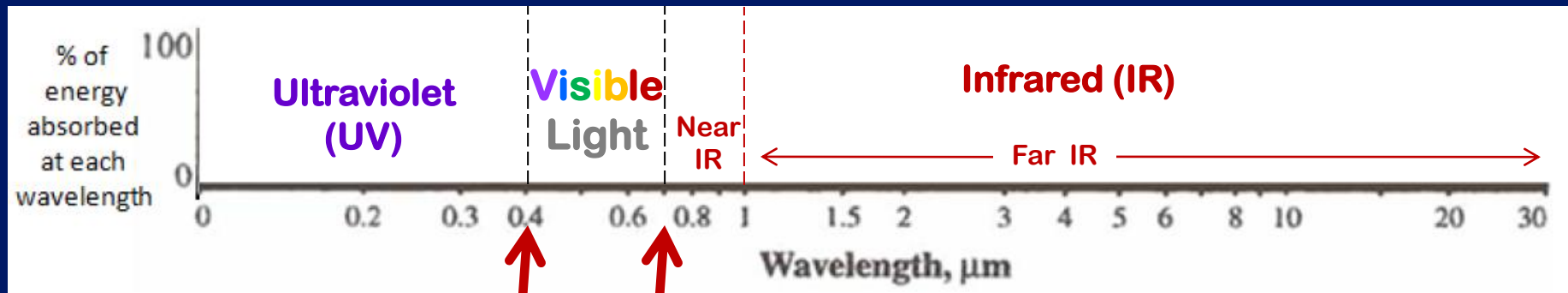
We use an absorption curve to show :

how much **electromagnetic energy**
at each wavelength

is being **absorbed** by a substance (e.g., a gas)

horizontal axis = **wavelength**

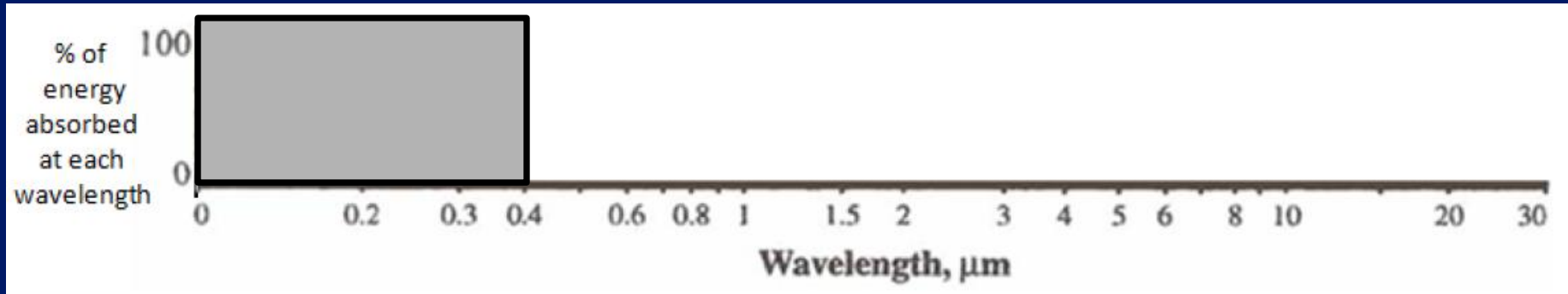
vertical axis = **the % of electromagnetic energy absorbed** (at each wavelength)



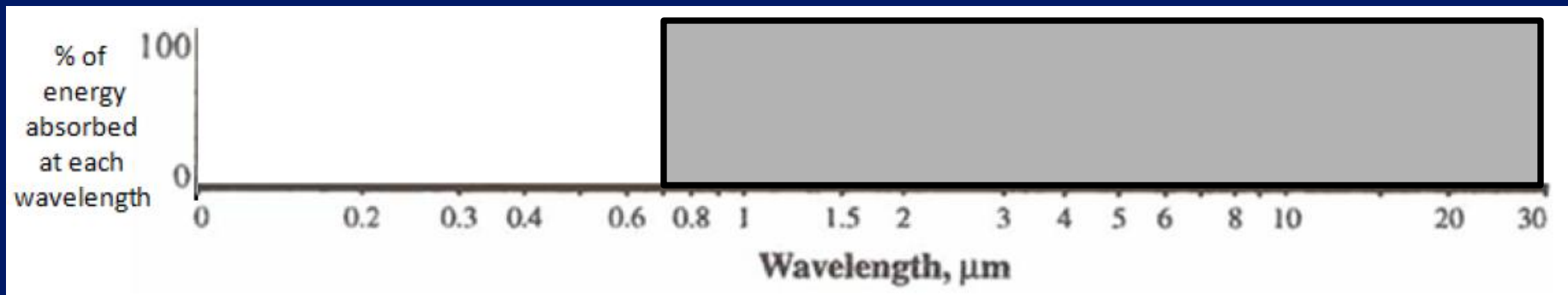
0.4 0.7

Make-a-sketch question:

Draw an absorption curve for a hypothetical gas that can **absorb ALL UV** radiation but **zero Visible light and IR**:

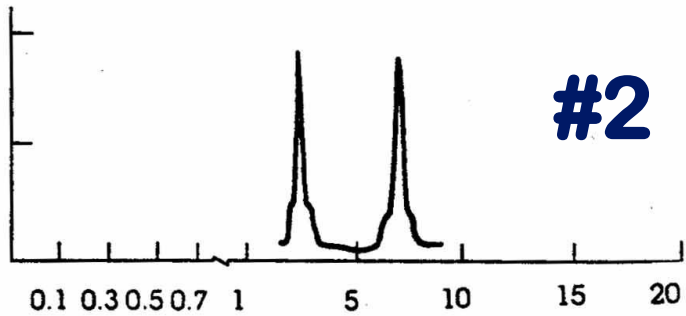
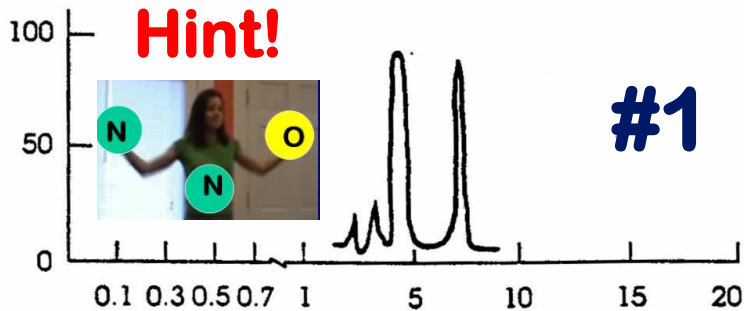


Draw an absorption curve for a “perfect” greenhouse gas that **absorbs ALL IR** radiation, but **NO visible or UV**:

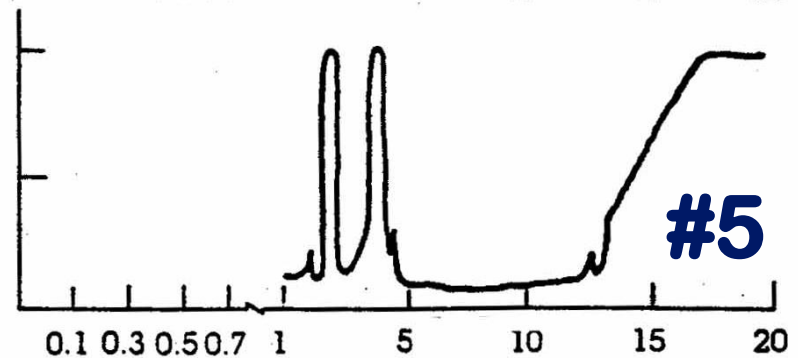
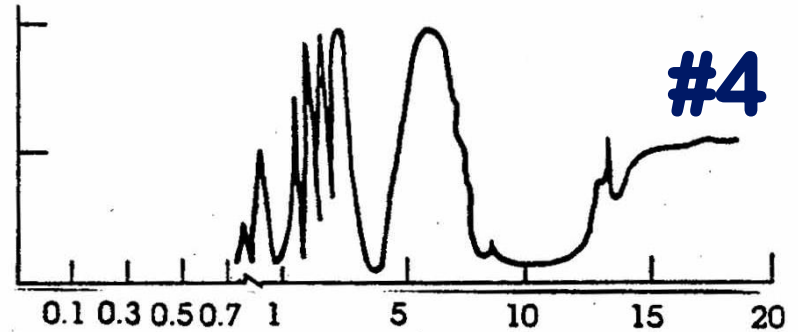
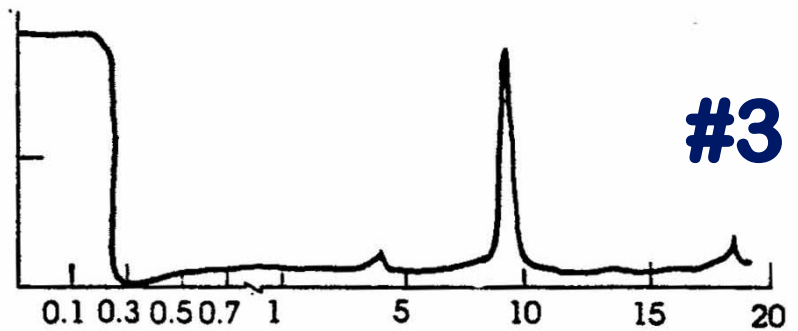


Q1 - Match the right absorption curve with the right gas:

Hint!



Absorption (%)



Wavelength (micrometers)

Fill in the blanks by entering a graph #' for each gas:

H₂O

O₂/O₃

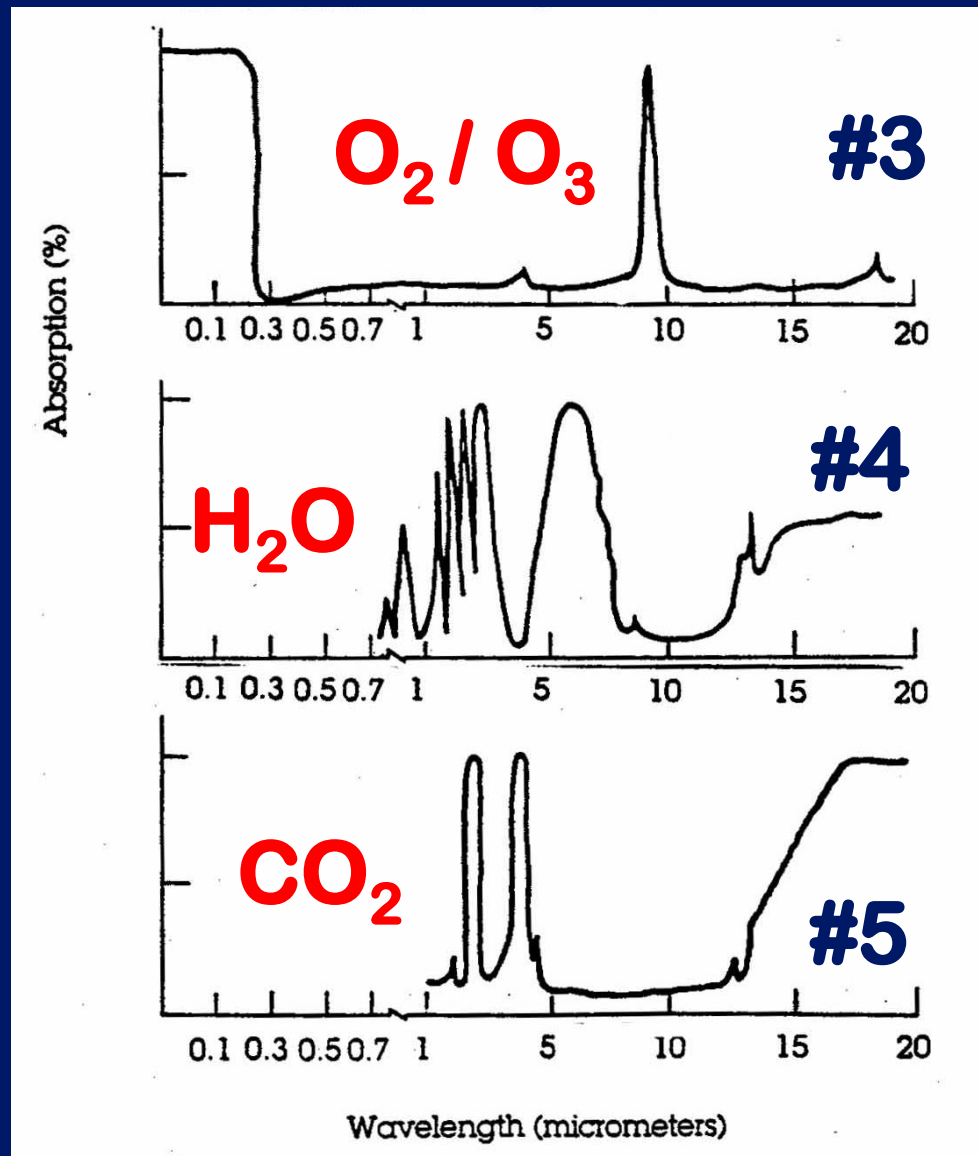
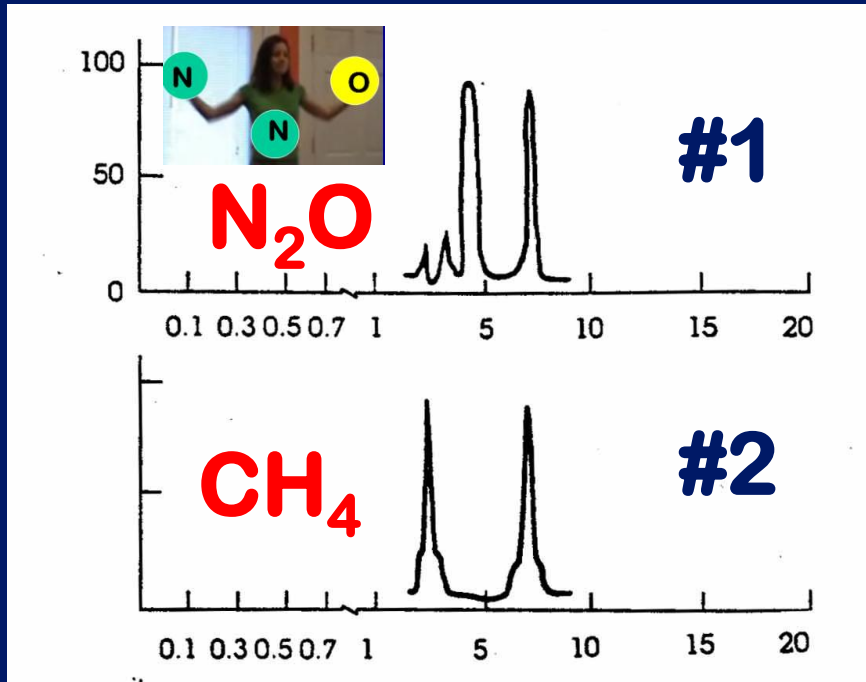
N₂O

CH₄

CO₂

1

ANSWER!



H₂O

4

O₂ / O₃

3

N₂O

1

CH₄

2

CO₂

5

Q2-Match the GAS with the Absorption Curve #:

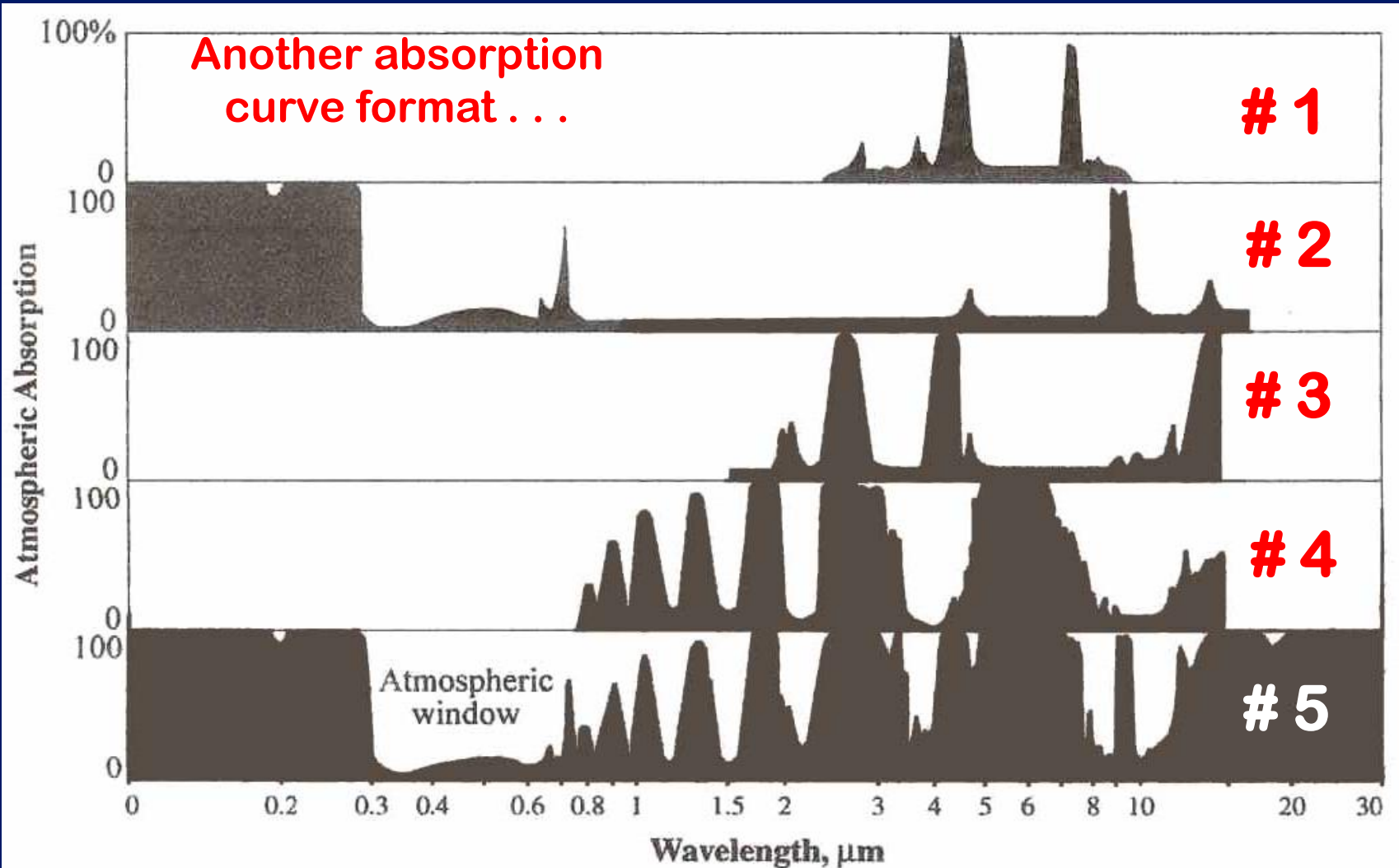
CO_2

H_2O

O_2/O_3

N_2O

& ?



Match the GAS with the Absorption Curve #:

CO₂

3

H₂O

4

O₂/O₃

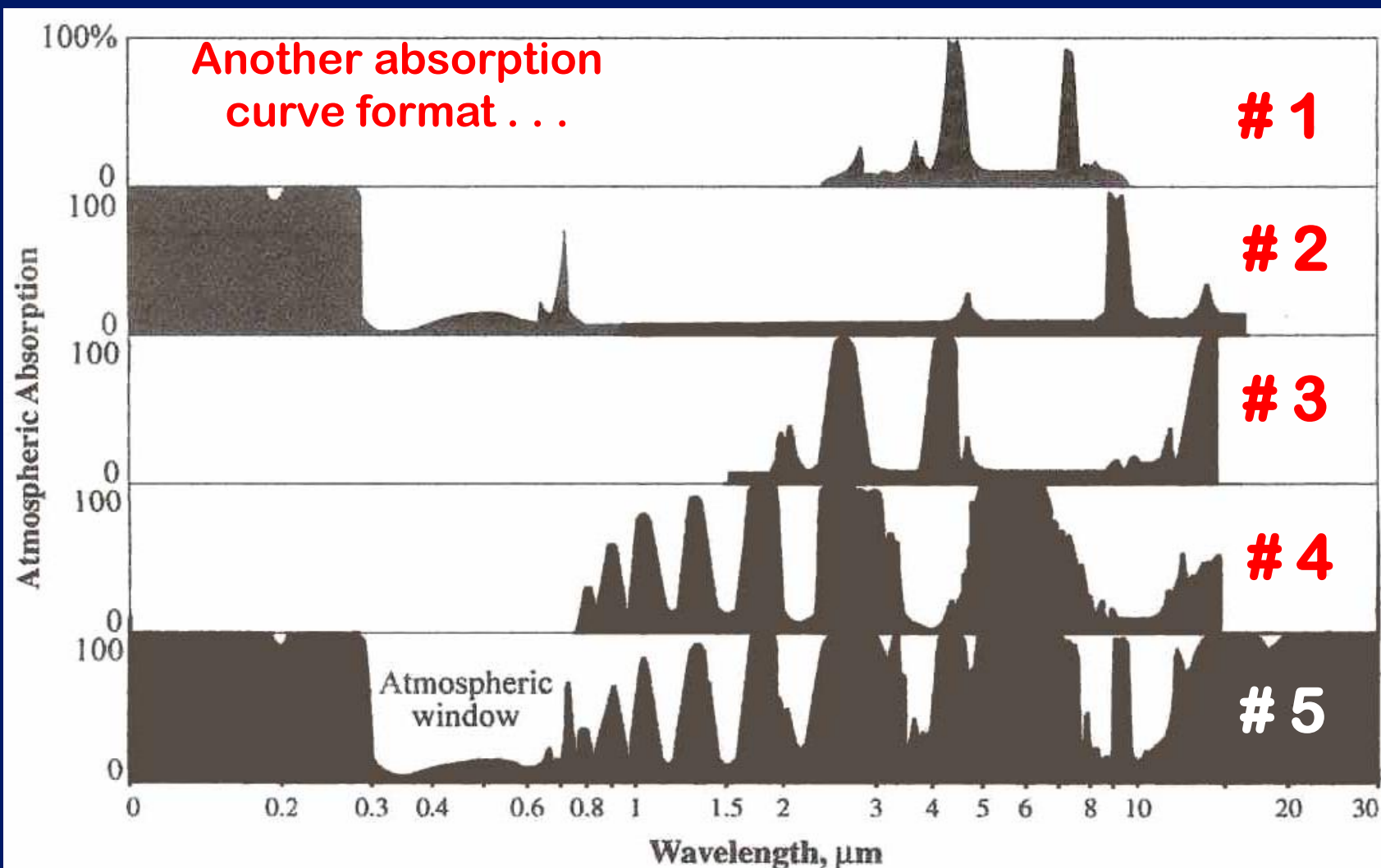
2

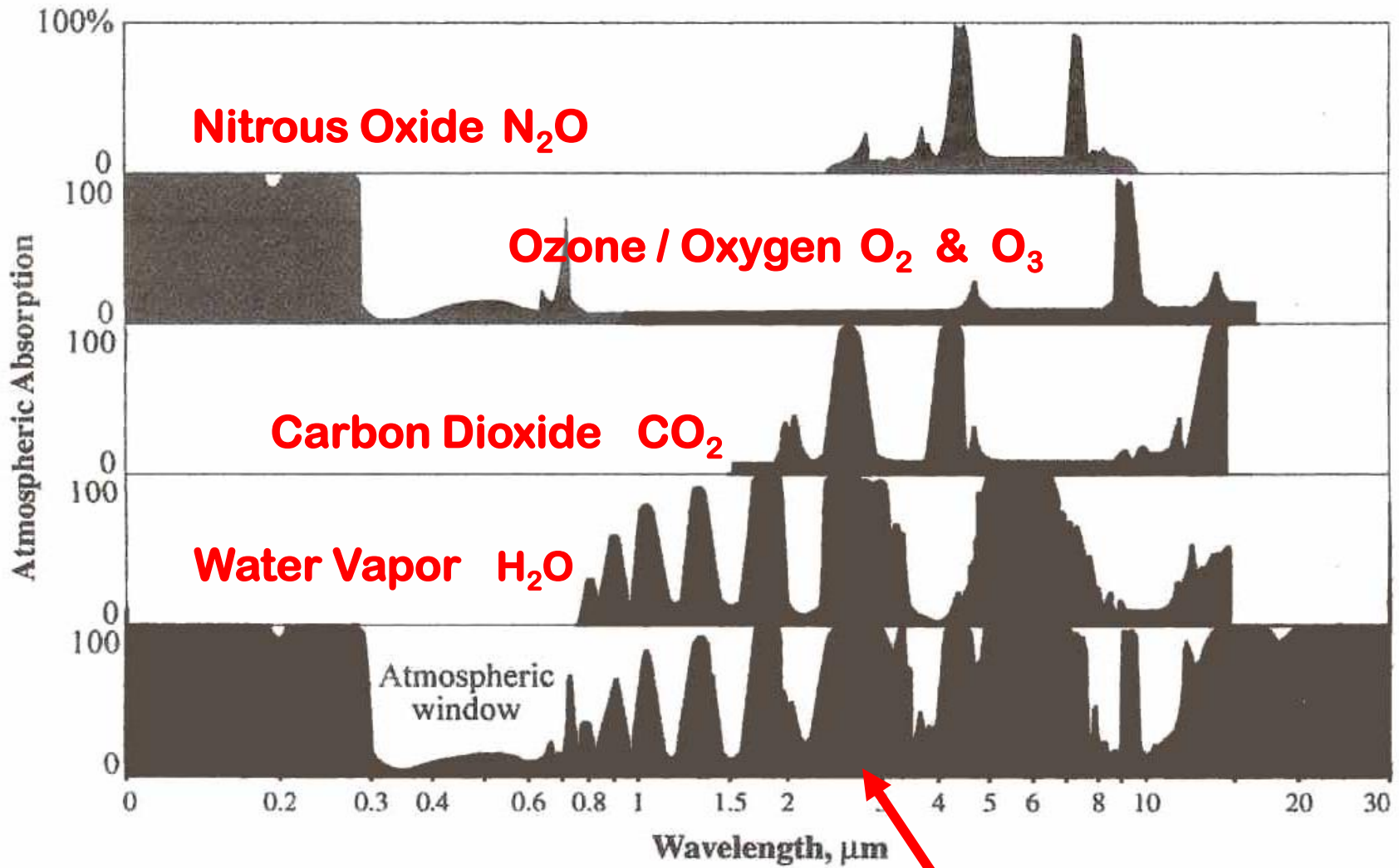
N₂O

1

& ?

Whole atmosphere

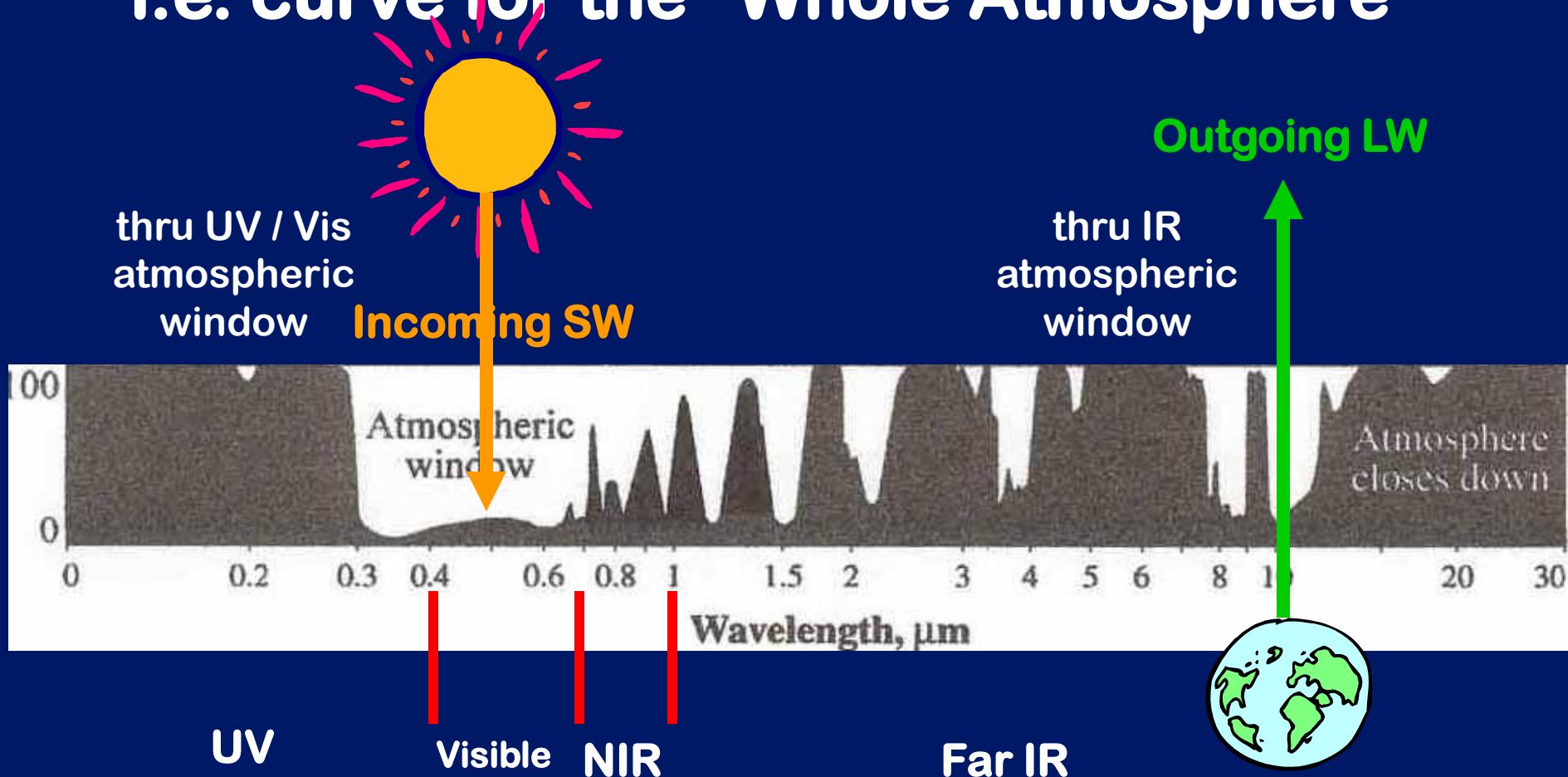




All gases in the atmosphere together!

Absorption by ALL the gases in the atmosphere put together –

i.e. curve for the “Whole Atmosphere”



KEY CONCEPTS TO GET OUT OF ALL OF THIS:

1. Solar radiation is mostly in **shortwave (SW) form (visible and UV)**.

Most visible & UV wavelengths are **TRANSMITTED** through the atmosphere but **some (esp. harmful UV) are absorbed** on their way to Earth's surface by O_2 and O_3 .



2. Most of the incoming solar energy absorbed by the Earth and the atmosphere is absorbed *at the EARTH'S SURFACE* which then radiates IR outward to heat up the atmosphere.

Hence, the ATMOSPHERE is HEATED primarily from BELOW (i.e. from terrestrial radiation)



3. Terrestrial radiation is mostly in **longwave (LW) form (IR)**.

Much of the outgoing terrestrial radiation is **ABSORBED** by **H₂O** and **CO₂** (and other GH gases) before it escapes to space, and it is **re-radiated back to the Earth's surface**

This is the
"Greenhouse Effect".

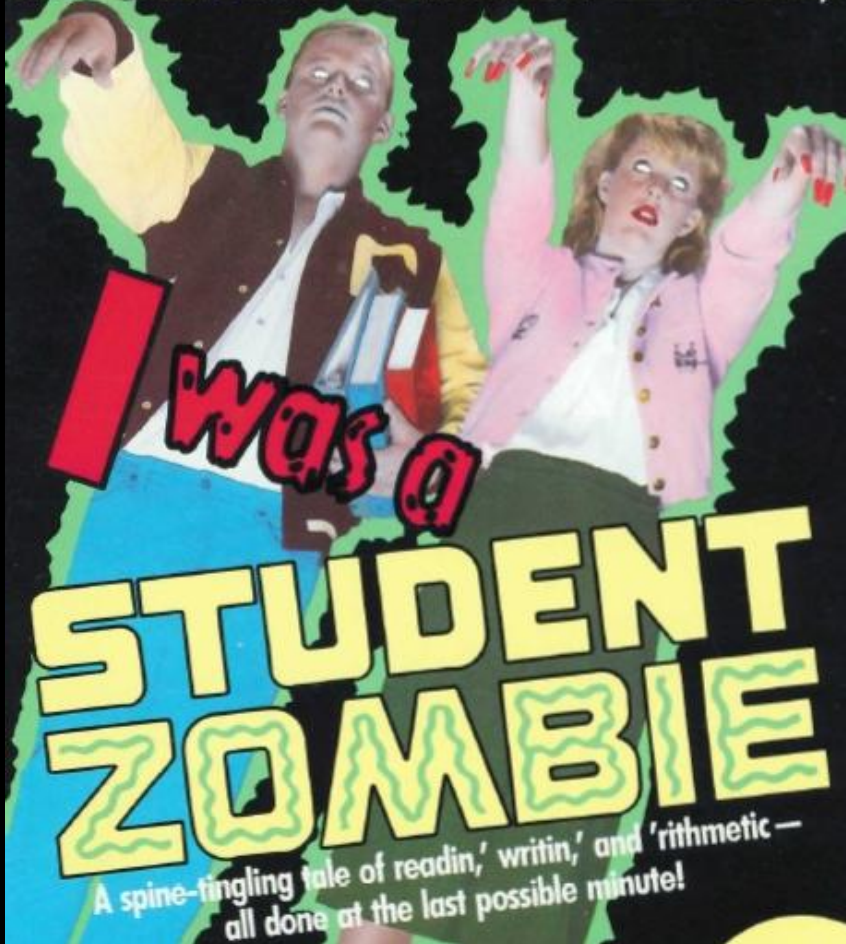


4. The re-radiation of LW (IR) energy to the Earth's surface by GH gases is what keeps the Earth in the **"just right" temperature range** for water to be present in all 3 phases and just right for US too!

Without the "Greenhouse Effect," the Earth would be too COLD for life as we know it!



It's happening right now...in YOUR town...
in YOUR school...in YOUR class...in YOUR BRAIN!



**ZOMBIE
BREAK !**

SUSTAINABILITY SEGMENT

more of:



<http://www.pbs.org/wgbh/nova/solar/>

Go CATS!!!

OPA!

(Greek Festival weekend too!)