MAKE-UP G-1 GROUP ASSIGNMENT: UNDERSTANDING RADIATION, ABSORPTION & WAVELENGTHS OF THE ELECTROMAGNETIC SPECTRUM (worth 10 pts)

CIRCLE ONE: Sec 001 T TH @ 12: 30 pm or Sec 003 T TH @ 3:30 pm

Your *SIGNATURE:* *PRINT YOUR NAME legibly next to the signature:*

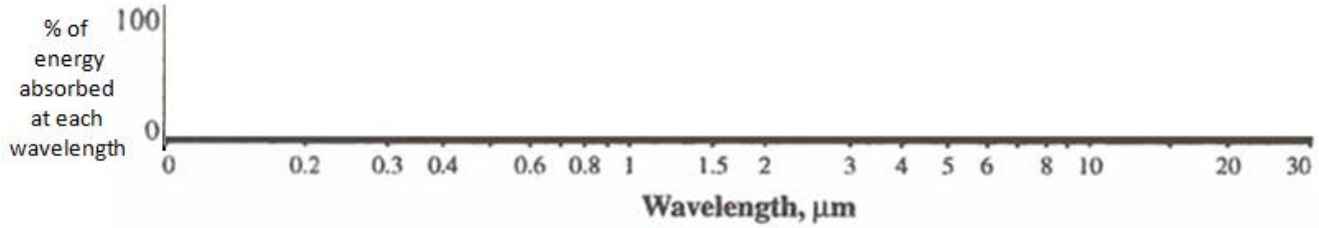
_____ _____

BACKGROUND (Radiation Law #6):

ABSORPTION CURVES (diagrams that show *which* wavelengths of energy different gases selectively absorb)

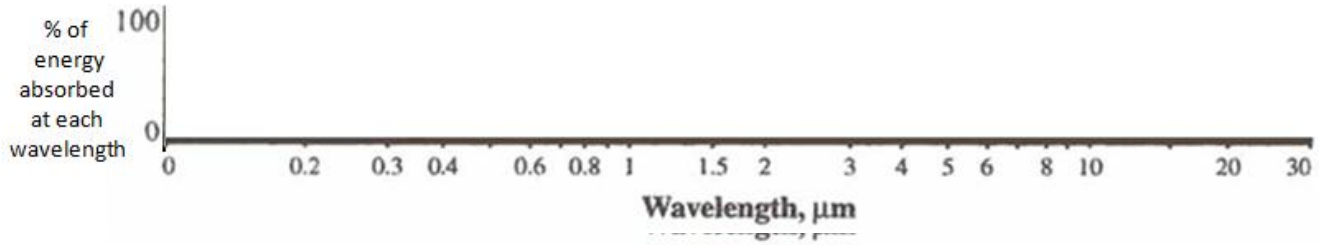
> We use an **absorption curve** (graph) to show the relationship between **wavelengths** of the electromagnetic spectrum (along the horizontal axis) and the **% of energy at each wavelength** that is absorbed by a particular gas (vertical axis)

Q1. *Draw an absorption curve for a hypothetical gas that can absorb ALL UV radiation but zero visible light and IR radiation. Then **shade in the area under your curve** in this and subsequent questions.*



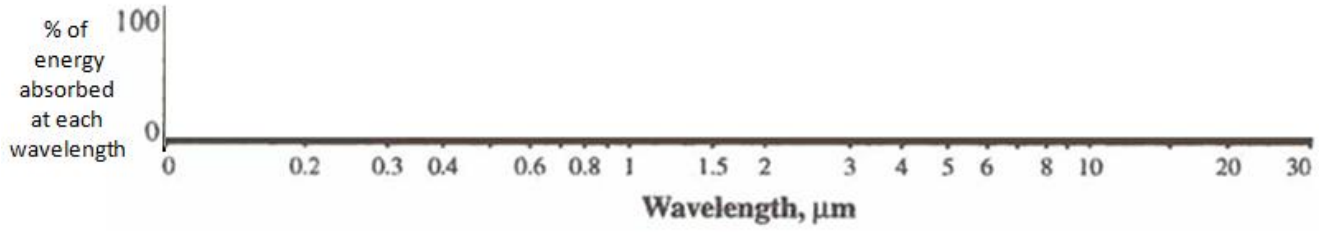
In a sentence or two, explain WHY you answered as you did:

Q2. *Draw an absorption curve for a "perfect" greenhouse gas that absorbs ALL IR radiation, but no visible or UV:*



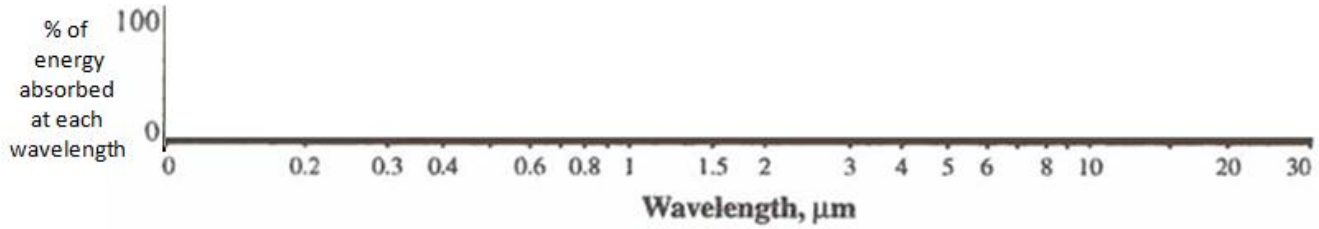
In a sentence or two, explain WHY you answered as you did:

Q3. *Draw an absorption curve for a hypothetical gas that absorbs ALL UV radiation and ALL IR radiation, but leaves a "WINDOW" open for visible light, allowing the visible light wavelengths to pass through the gas unimpeded <u>without</u> being absorbed:*



In a sentence or two, explain WHY you answered as you did:

Q4. *Draw an absorption curve for a hypothetical gas that can absorb 100% of the IR radiation in these three wavelength bands*: **band from 2 to 2.5 µm** **band from 3 to 4 µm** **band from 13 to 20 µm**



In a sentence or two, explain WHY you answered as you did:

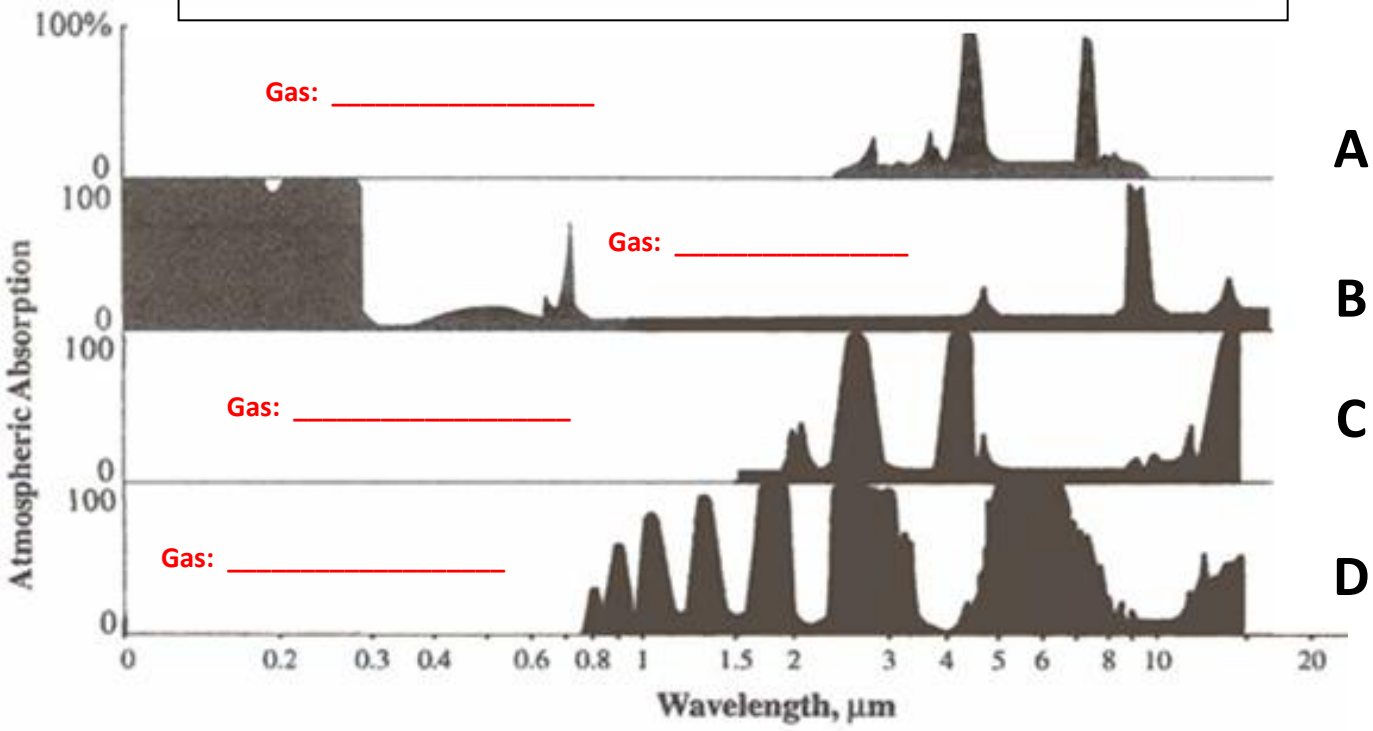
Q5. Is the hypothetical gas in Q4 likely to be a GREENHOUSE GAS? YES No ***(circle one)***

Briefly explain WHY you answered YES or NO:

Q6. IDENTIFYING THE ABSORPTION CURVES OF INDIVIDUAL GASES

Gas	Primary absorption wavelengths *(in micrometers)*	
Water vapor (H_2O)	0.8 1 1.5 2 to 3.5	4 to 7 9 to 10 11 to 20
Molecular oxygen (O_2) and Ozone (O_3)	0.0001 to 0.280 8.5 to 10	
Nitrous oxide (N_2O)	4 to 5 7 to 7.5	
Carbon dioxide (CO_2)	2 to 2.5 3 to 4 13 to 20	

Based on the primary absorption wavelengths of each of gas shown in the table above, match the gases with their corresponding absorption curves below:



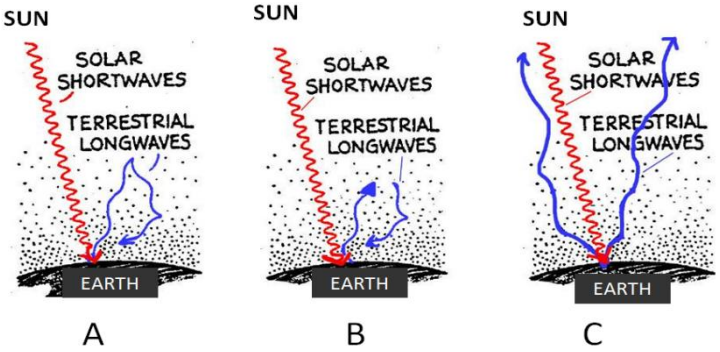
In a sentence or two, explain WHY you answered as you did:

SOLAR vs TERRESTRIAL RADIATION CLASS CONCEPTS SELF TEST

KEY: = **represents Solar shortwave (SW) radiation**

= **represents Terrestrial longwave (LW) (infrared IR radiation)**

= **represents the atmosphere and its gases** (which can absorb & emit certain kinds of radiation)



Q7. Which diagram above shows SW radiation being reflected back to space?

Diagram A *Diagram B* *Diagram C* *None of them*

Q8. **Diagram A** shows LW radiation "bouncing off" the gases in the atmosphere (i.e. being reflected back to the surface by the gases without being absorbed by them.) Is this an accurate depiction of how the **Greenhouse Effect** works? *Yes* *No* *Partly*

Why or Why not? _____

_____

Q9. **Diagram B** shows LW radiation being absorbed and them emitted by the gases in the atmosphere. Is this an accurate depiction of how the **Greenhouse Effect** works? *Yes* *No* *Partly*

Why or Why not? _____

_____

Q10. **Diagram C** shows LW radiation going right through the atmosphere out to space. Is this an accurate depiction of how **the Greenhouse Effect** works? Yes No Partly

Why or Why not? _____

_____

Q11. On the diagram <u>above</u> that you think **<u>best</u> depicts the processes involved in the GREENHOUSE EFFECT (A, B or C)** , **<u>circle</u>** the specific part of the diagram that represents **the Greenhouse Effect.**

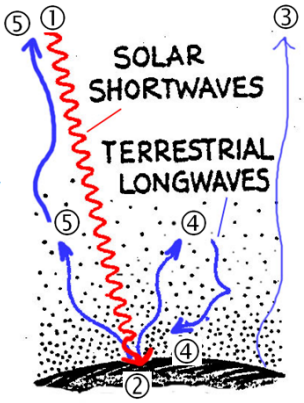
This is a modified and more accurate version of the diagram at the top of the page. It should help you understand the processes involved in more detail.

Modified Cartoon of Solar (SW) & Terrestrial (LW / IR) wavelengths of radiation:

① Some Incoming SW radiation from the SUN goes right <u>through</u> the atmosphere to Earth (w/o being absorbed)

② The Earth absorbs SW that reaches the surface

③ Some IR radiation is emitted from the Earth's surface right <u>out</u> to space through "IR window"



④ Some IR radiation is absorbed by GH gases in the atmosphere and emitted <u>back</u> to Earth

⑤ Some IR radiation is absorbed by GH gases in the atmosphere, but is emitted <u>out</u> to space (not back to Earth)