

**A MINI FINAL  
EXAM REVIEW:  
SOME  
PRACTICE  
QUESTIONS**

FIRST -- The answers to the

**G-5 GROUP ACTIVITY**  
**on VOLCANISM &**  
**CLIMATE**

# G-5 VOLCANISM & CLIMATE ACTIVITY

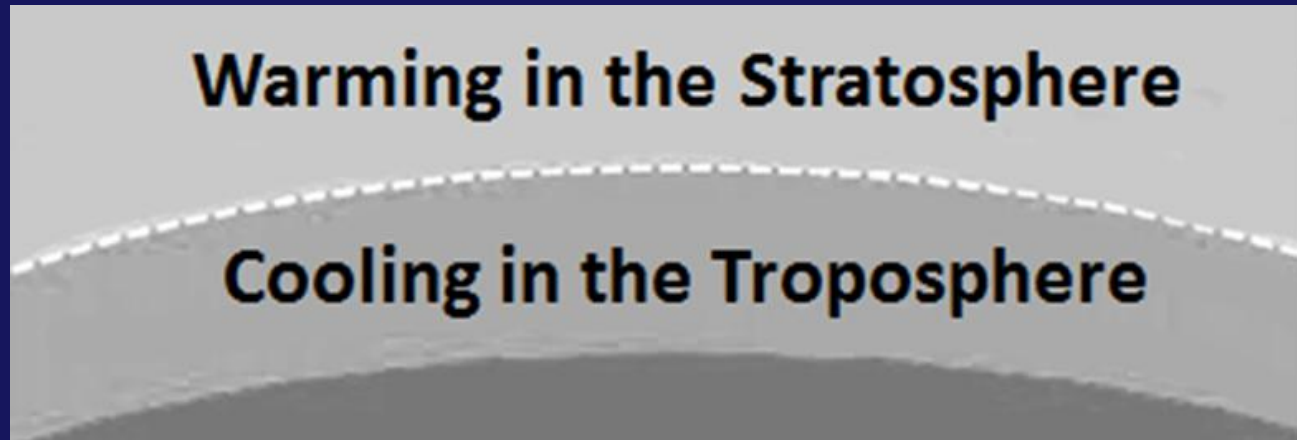
## #1. List 4 reasons why Tambora in 1815 resulted in the largest GLOBAL cooling:

- #1 Low latitude eruption → both hemispheres
- #2 Large amount of eruptive material (50 sq km!)
- #3 Aerosol cloud was HUGE and went into both hemispheres equally
- #4 Sulfuric acid ( $\text{H}_2\text{SO}_4$ ) content was very large

**#2. Give at least two reasons why the eruption of Mt St. Helens was NOT a very climatically effective eruption:**

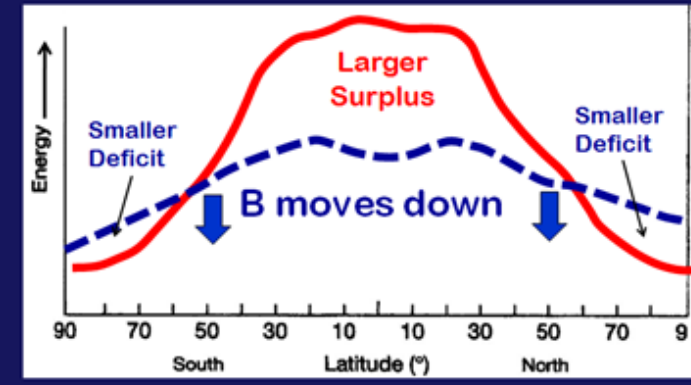
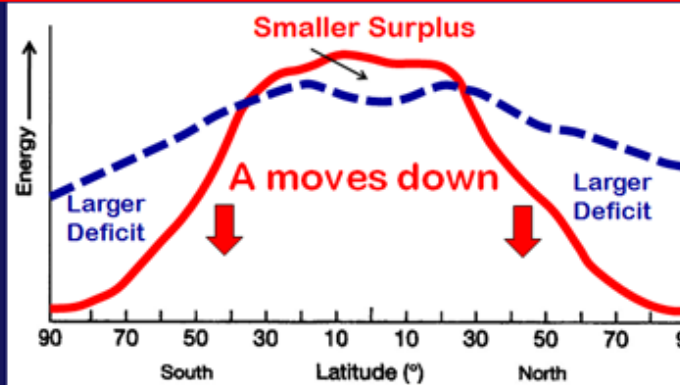
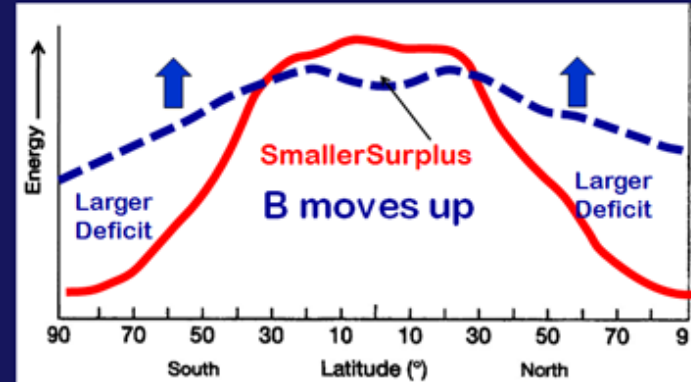
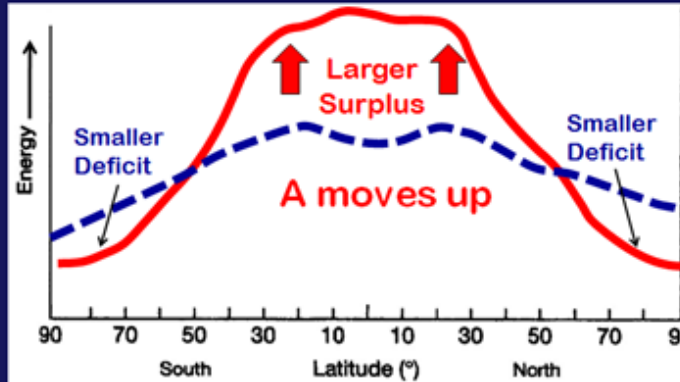
**#1 High latitude – could only affect part of Northern Hemisphere**

**#2 Low sulfur content  
(also, low volume, didn't get to S. Hemisphere, etc.)**



- Major eruptions with a long-lived sulfate aerosol veil REFLECT incoming solar radiation back to space BEFORE it enters the mid- & lower troposphere or gets to the Earth's surface, hence the **TROPOSPHERE & SURFACE** get **COOLER** after an eruption.
- The aerosols in the stratosphere can also ABSORB some wavelengths of incoming SW and outgoing LW, so that the **STRATOSPHERE WARMS** slightly after an eruption.

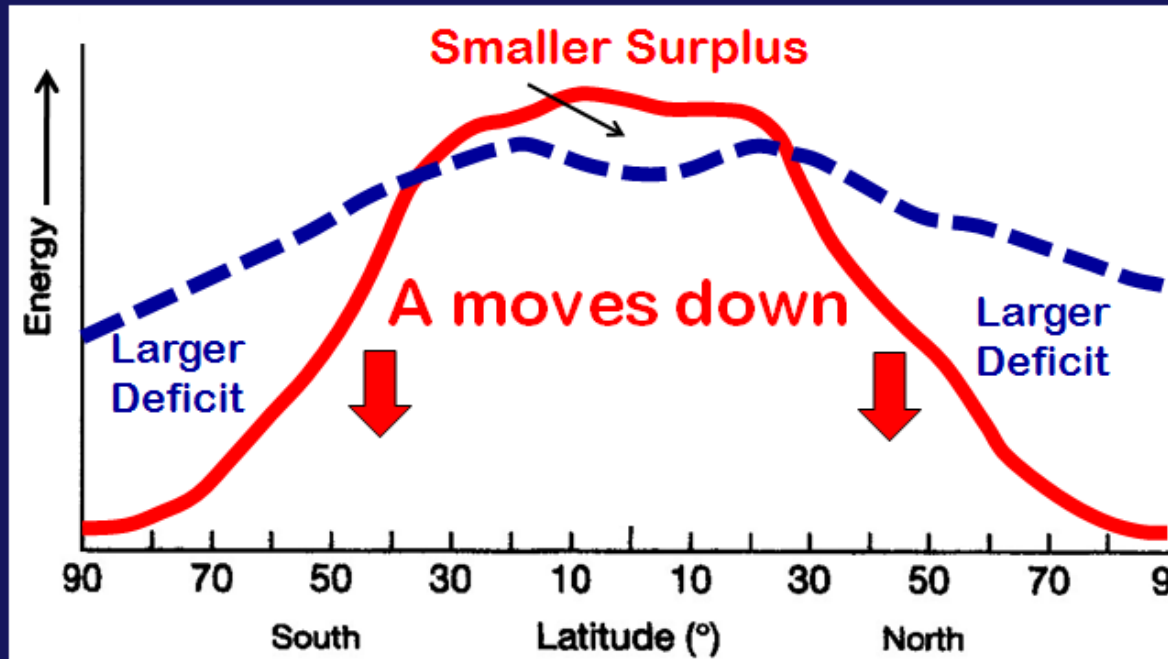
# Show how the energy balance would change if a major volcanic eruption occurred:



**WHICH ONE IS RIGHT ?**

**Does the change affect CURVE A or CURVE B?**

**A moves down, and B stays the same . . . .**



# FINAL EXAM STUDYING “JUMP START” REVIEW

Some questions from earlier in the semester  
and some Q's on more recent topics . . . .



# The wavelength range of infrared radiation.

## What is...

1.  $< 0.4$  micrometers

2.  $> 0.7$  micrometers



3. 400 – 700 nanometers

4. Longer wavelengths than microwaves

# The key factor that makes certain gases act as greenhouse gases!

What is...

1. They are diatomic
2. They absorb shortwave radiation and emit longwave radiation
3. They easily reflect IR radiation back to the Earth's surface
4. They absorb and emit infrared radiation



The observation that “the atmosphere is heated from below” is most evident in this layer.

What is...

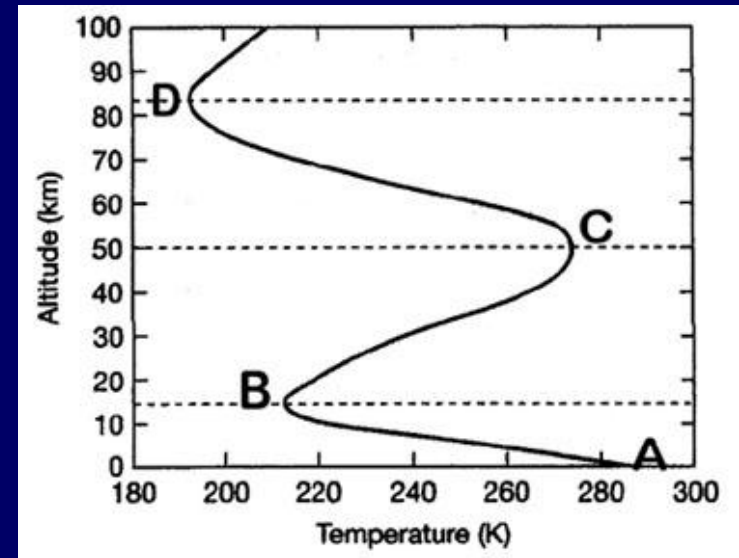
1. Layer A - B



2. Layer B - C

3. Layer C - D

4. Layer D and above



# The circled symbol:

$$R_{NET} = \begin{matrix} \text{SW} \\ \downarrow \end{matrix} + \begin{matrix} \text{SW} \\ \downarrow \end{matrix} - \begin{matrix} \text{SW} \\ \nearrow \end{matrix} - \begin{matrix} \uparrow \\ \text{LW} \end{matrix} + \begin{matrix} \downarrow \\ \text{LW} \end{matrix} = H + LE + G$$

What is...

1. Outgoing longwave radiation
2. Reflected infrared radiation
3. One of the symbols that's part of the Greenhouse Effect

4. Albedo



# The residence time of CO<sub>2</sub> gas molecules, once they get into the atmosphere.

What is...

1. ~10-12 years

2. ~50 years

3. ~100 years

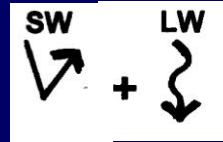


4. ~ 500 years

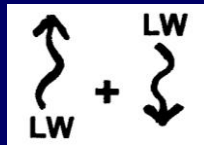
# The Greenhouse effect is represented by this symbol.

What is...

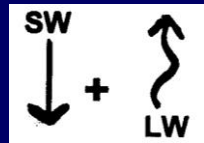
1. This one:



2. This one:



3. This one:



4. H + G

5. None of the above

# Evaporation and transpiration are represented by this symbol.

What is...

1. LW

2. SW

3. H

4. LE

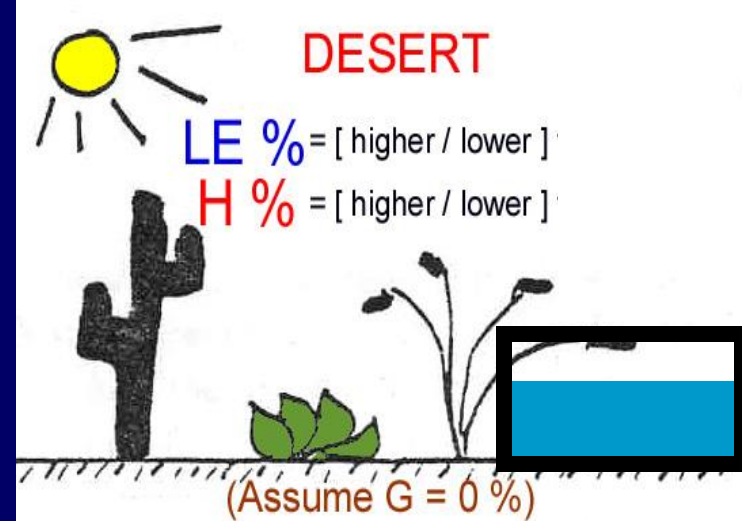


5. G

**This will happen after a canal or reservoir is built in a desert.**

Who is...

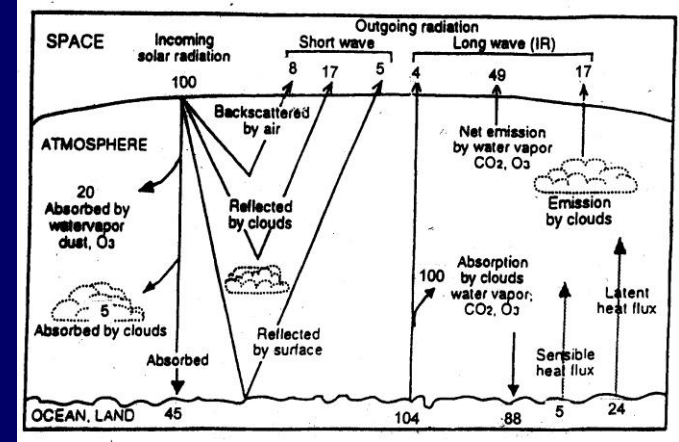
1. No change in H or LE
2. More energy goes into H, making it hotter.
3. More energy goes into LE, making it hotter.
4. More energy goes into LE, making it cooler.





Of these 4 choices, **THIS** part of the energy balance and its pathways involves the **MOST** units of energy.

What is...




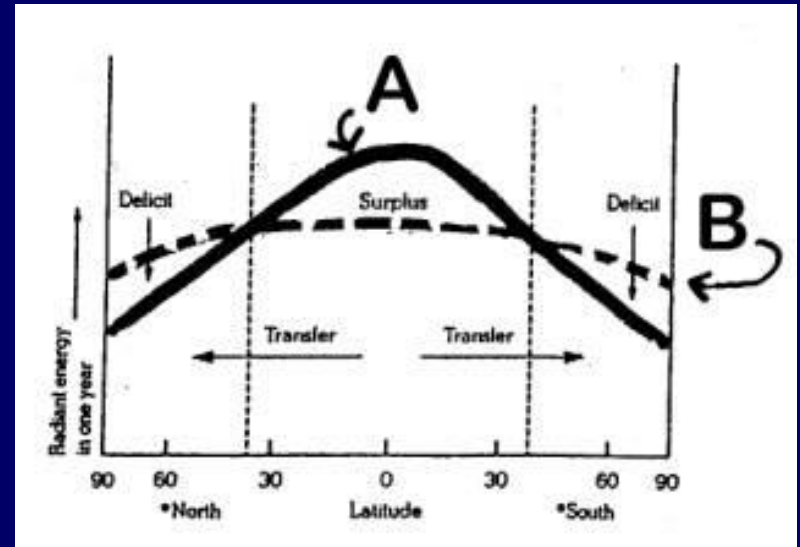
1. UV energy absorbed by ozone in stratosphere
2. Solar energy reflected back to space by clouds, atmosphere, & surface combined.
3. IR energy radiated from the Earth's surface directly out to space
4. IR energy re-radiated to the Earth's surface after being absorbed in the atmosphere.



If the Earth had NO atmosphere, this change in curve A or B would occur.

What is...

1. A moves up
2. A moves down
3. B moves up 
4. B moves down



**A = incoming solar shortwave radiation**

**B = outgoing terrestrial longwave radiation**

**Tree-ring & other past records have shown that this was concentrated mostly in Europe and was not a completely global event.**

What is...

1. **The Little Ice Age**

2. **The Medieval Warm Period**




3. **The Maunder Minimum**

4. **The recent 20<sup>th</sup> century warming**

# The LEAST likely to be a climatically effective volcanic eruption with a global influence.

## What is a ...

1. High latitude eruption, like Mt St. Helens 
2. Low latitude eruption, like Pinatubo.
3. Sulfur-rich eruption, like Tambora.
4. Highly explosive eruption ejecting material into the stratosphere, like Krakatau.

# **This is likely to occur during a sunspot cycle with a **MAXIMUM** of sunspots**

## What are...

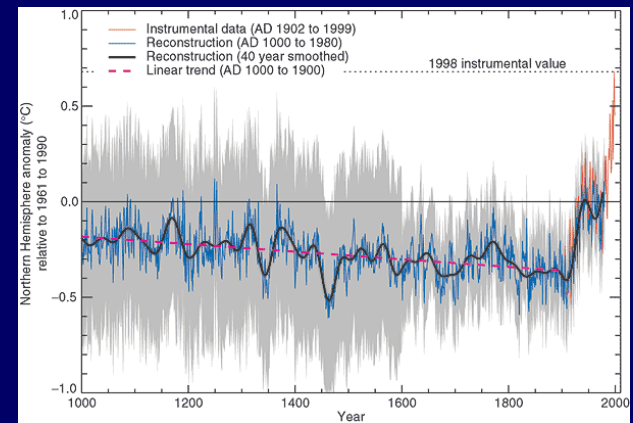
1. **Decreased solar brightness and cooling on Earth**
2. **Increased solar brightness and warming on Earth**
3. **Glacial advances**
4. **More volcanic eruptions**



# The “Hockey Stick” diagram is evidence of this.

## What is...

1. A period in the Medieval times that was warmer than the 20<sup>th</sup> century
2. The start of a global ice age – hence more hockey games!
3. The fact that proxy records (like tree rings) can estimate temperatures as accurately as thermometers
4. An unprecedented global warming trend in the 20<sup>th</sup> century pointing to an anthropogenic cause



# The LIKLEY after-effect of an explosive, sulfur-rich volcanic eruption.

## What is...

1. Lots of reflection of solar SW by ash many weeks after the eruption
2. Stratospheric COOLING and tropospheric WARMING
3. Stratospheric WARMING and tropospheric COOLING
4. A decreased Greenhouse Effect



# What scientists now agree is the cause of the Antarctic ozone hole.

## What are...

1. Anthropogenically produced CFCs that destroy ozone chemically
2. Sunspot variations that destroy ozone naturally
3. Increased burning of fossil fuels and resulting CO<sub>2</sub> emissions
4. Dramatic decreases in the number of volcanic eruptions





# What the **SCIENTIFIC** debate on global warming is all about.

## Whether or not...

1. Global warming is occurring
2. The Greenhouse Effect is real
3. Recently observed global warming is due to anthropogenic causes
4. The Kyoto Protocol should be signed



# What the POLICY debate on global warming is all about.

## Whether or not...

1. Developing countries should be required to reduce emissions in addition to developed countries.
2. The Kyoto Protocol should be signed.
3. Laws and policies should be enacted in the U.S to reduce GHG emissions.
4. All of the above.



# The link between biodiversity and deforestation.

## What is...

1. Biodiversity causes deforestation.
2. Deforestation greatly reduces biodiversity.
3. All biodiversity “Hotspots” occur in forested areas.
4. The presence of humans increases both biodiversity and deforestation.



# What ozone does in the troposphere vs. stratosphere.

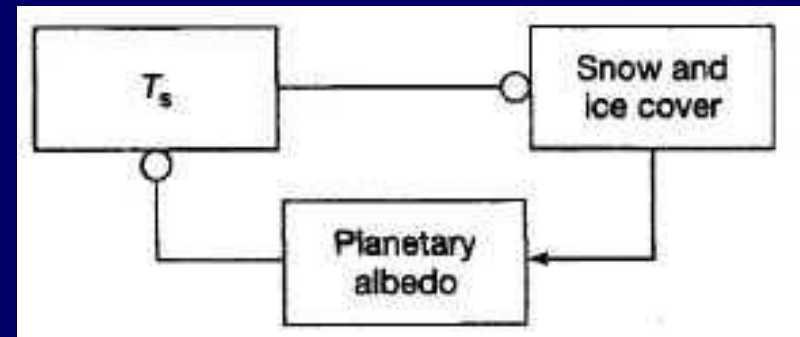
## What is...

1. Ozone absorbs IR in the troposphere (acting as a GHG) and absorbs harmful UV in the stratosphere (NOT acting as a GHG).
2. Ozone is “good” ozone in the TROPOSPHERE and “bad” ozone in the STRATOSPHERE
3. The Ozone Hole in the stratosphere allows more SW radiation to reach the Earth’s surface and this is a DIRECT cause of global warming in the troposphere.
4. None of the above



# What this feedback loop will lead to.

What is...

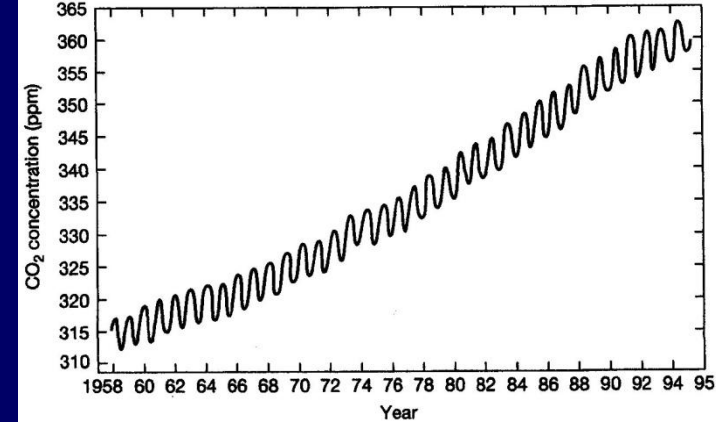



1. A self-regulated return to an equilibrium state
2. An ice age followed by a warm period.
3. A self-amplifying change in the Earth's surface temperature
4. A runaway Greenhouse Effect!

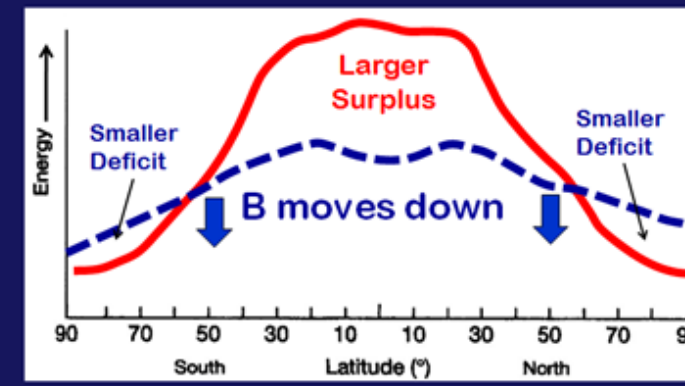
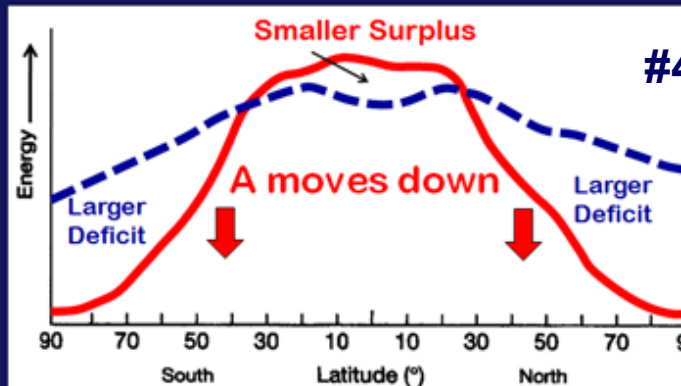
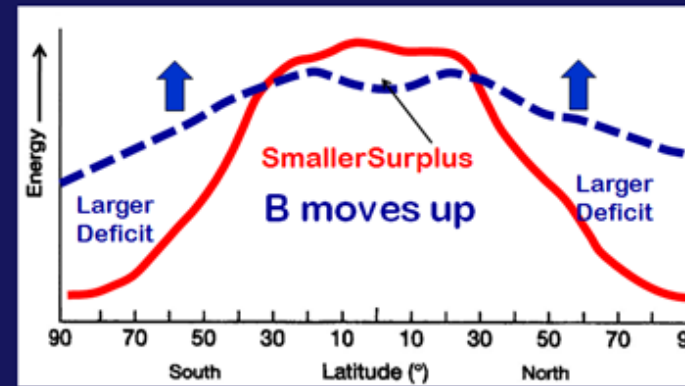
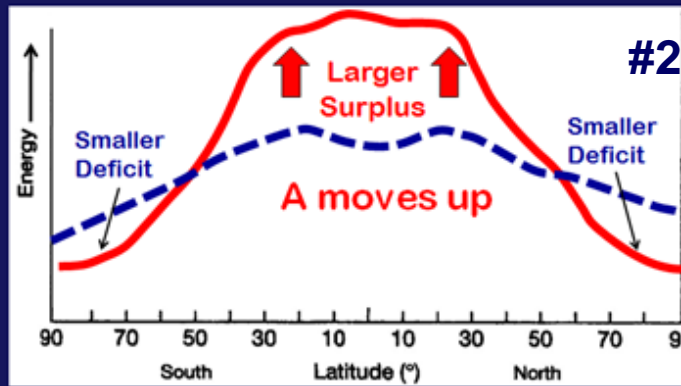


# This is illustrated by the Keeling Curve.

## What is...

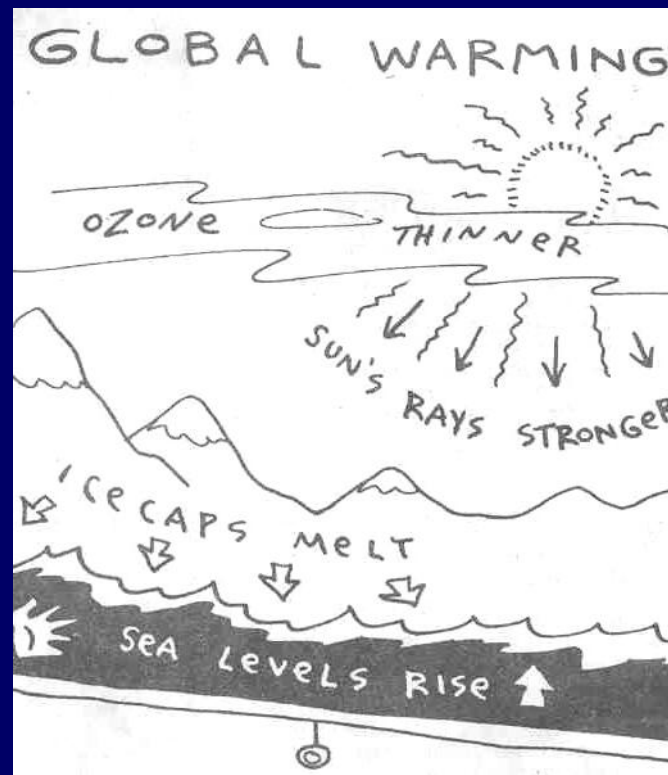


1. Quasiperiodic variations with an upward trend 
2. Increasing variance with a constant mean
3. A step change with an abrupt jump
4. The “breathing” of the Southern Hemisphere forests.



Which of these four graphs best depicts how the energy balance would initially change with a **WEAKER greenhouse effect** than today's:

**POSSIBLE  
ESSAY  
QUESTION:**



- WHY is the cartoon's depiction of thinner ozone as the principle cause for global warming incorrect?
- WHAT IS the principle cause for anthropogenically produced global warming according to the IPCC scientists?
- HOW -- if at all -- IS ozone linked to global warming?



STUDY HARD!

See you at the Final Exam in  
THIS CLASSROOM