

OUR LAST CLASS!



A Few GRADING POINTS for the I-4 ASSIGNMENT

– from TA Adriana

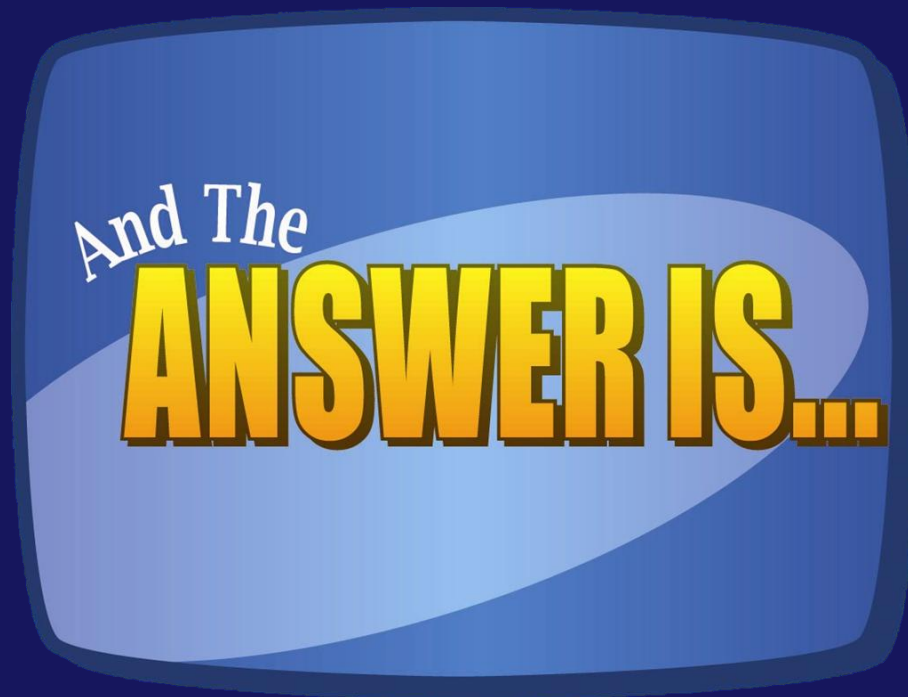
Q3: Ocean heat question. Many students attributed this to **a higher albedo** in the oceans compared to land surfaces. Other students attributed to ocean circulation and others to the large amount of water.

Q4: Guilty forcing factor. Many students mentioned human activity without really considering the graphs. Most students mentioned human-produced **aerosols** and GHG. Even though **aerosols produce cooling**, I counted it as correct because the video mentions aerosols as part of the anthropogenic forcing but fails to specify its cooling effect (solar dimming).

Q7: Precipitation projection. Many students just repeated what the video said: Higher latitudes will receive more precipitation and subtropical land regions, less precipitation. **Most students failed to recognize that Arizona is located in a subtropical region.**

FINAL EXAM STUDYING “JUMP START” REVIEW

Some review 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...

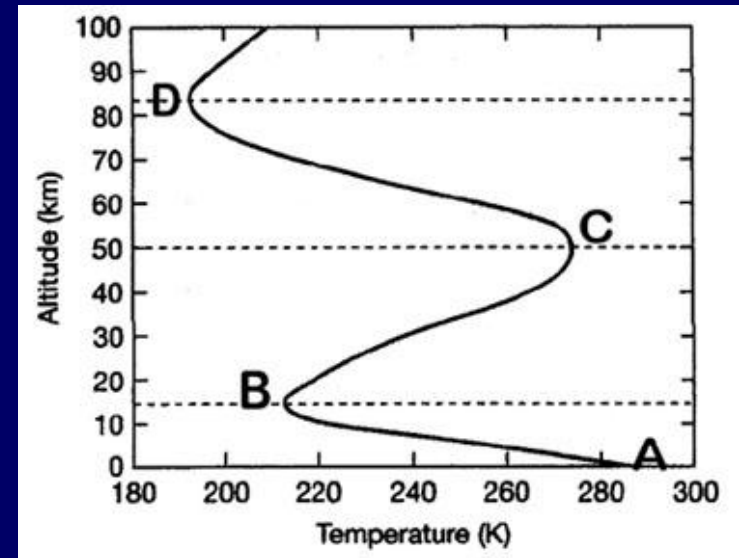
1. Layer A - B



2. Layer B - C

3. Layer C - D

4. Layer D and above



The circled symbol:

$$R_{NET} = \downarrow_{SW} + \downarrow_{SW} - \swarrow_{SW} - \updownarrow_{LW} + \downarrow_{LW} = H + LE + G$$

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 CO₂ gas molecules, once they get into the atmosphere.

What is...

1. ~10-12 years

2. ~50 years

3. ~100 years

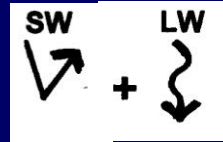


4. ~ 500 years

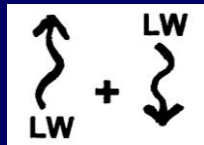
The Greenhouse effect is represented by this symbol.

What is...

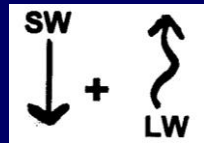
1. This one:



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

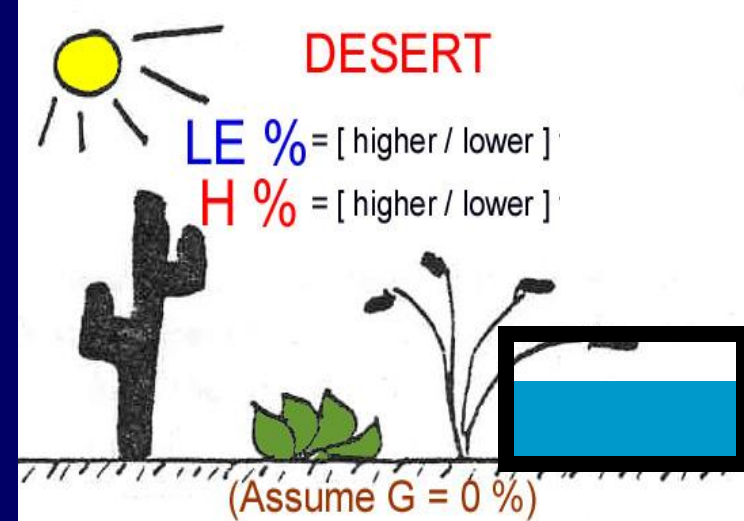


5. G

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

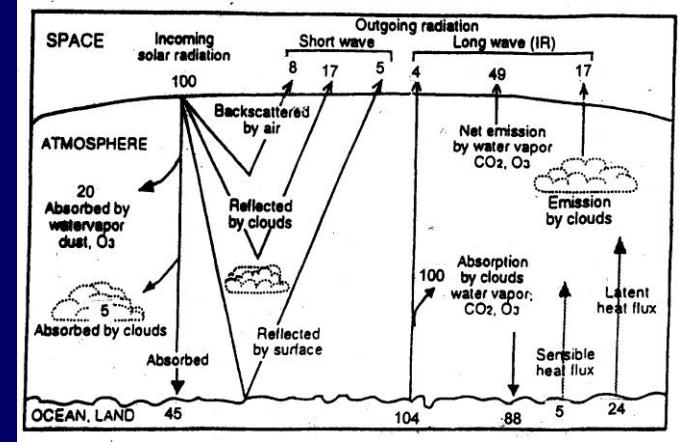
Who is...

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...




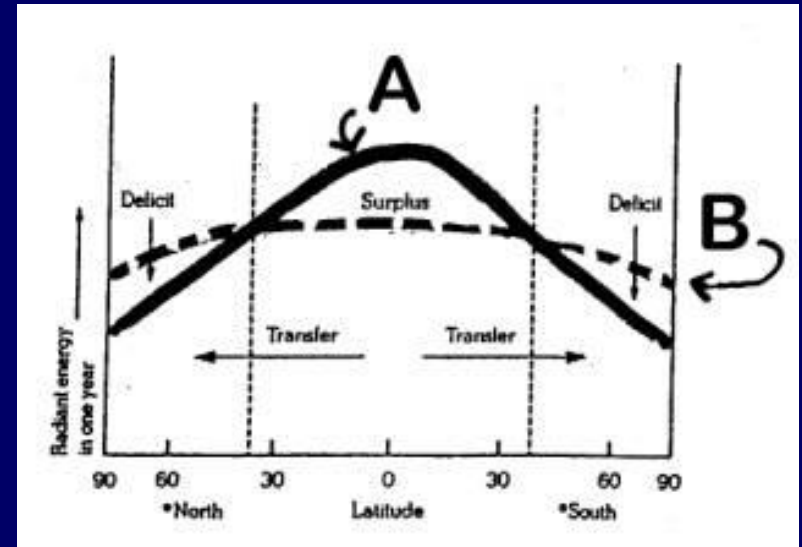
1. UV energy absorbed by ozone in stratosphere
2. Solar energy reflected back to space by clouds, atmosphere, & surface combined.
3. IR energy radiated from the Earth's surface directly out to space
4. IR energy re-radiated to the Earth's surface after being absorbed in the atmosphere.



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 20th 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...

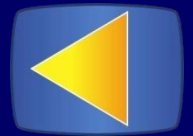
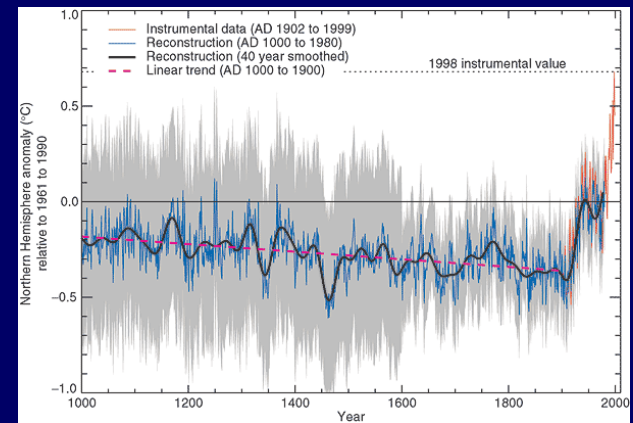
1. **Decreased solar brightness and cooling on Earth**
2. **Increased solar brightness and warming on Earth**
3. **Glacial advances**
4. **More volcanic eruptions**



The “Hockey Stick” diagram is evidence of this.

What is...

1. A period in the Medieval times that was warmer than the 20th 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 20th 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 CO₂ 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.

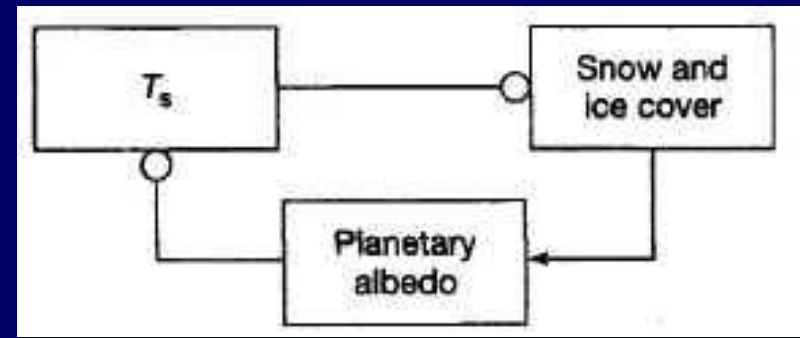
What is...

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...

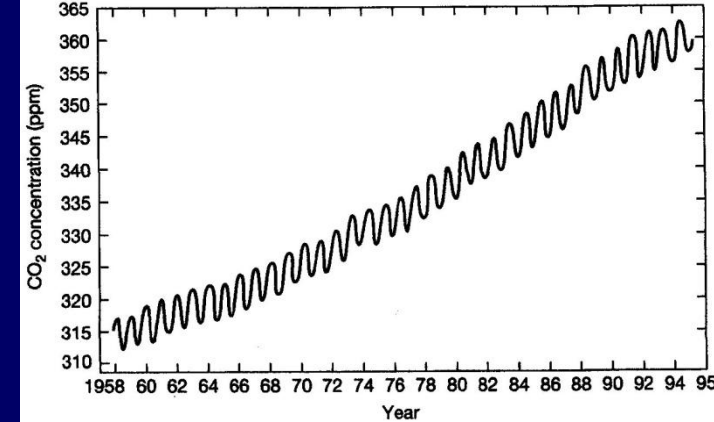



1. A self-regulated return to an equilibrium state
2. An ice age followed by a warm period.
3. A self-amplifying change in the Earth's surface temperature
4. A runaway Greenhouse Effect!

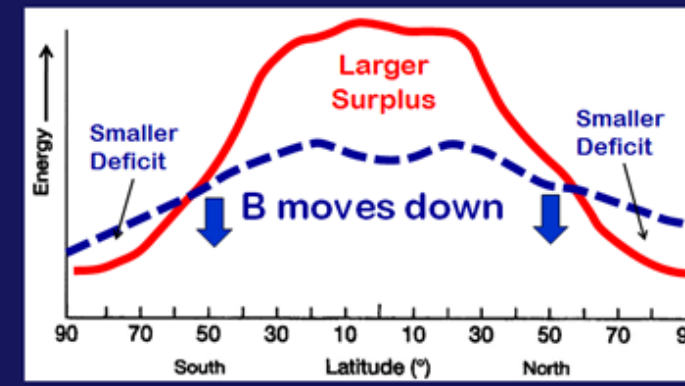
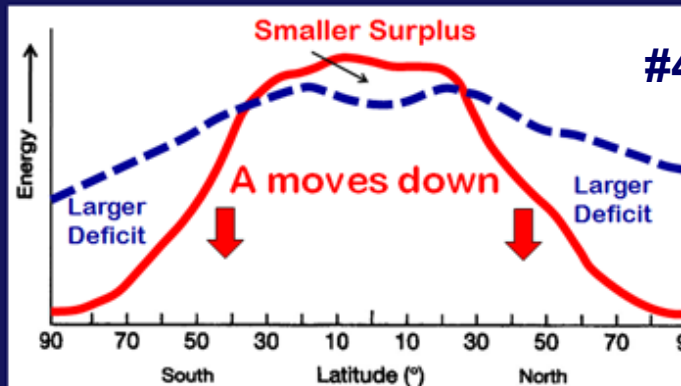
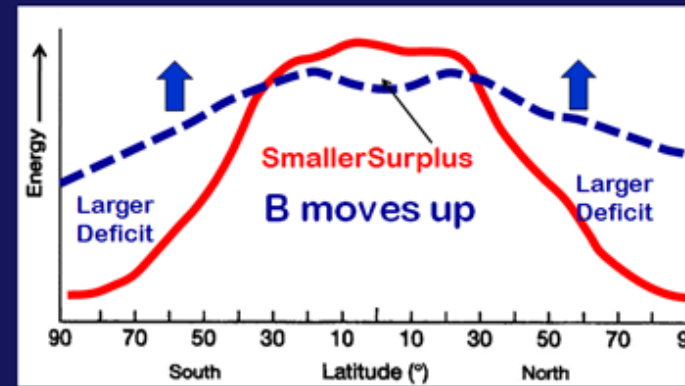
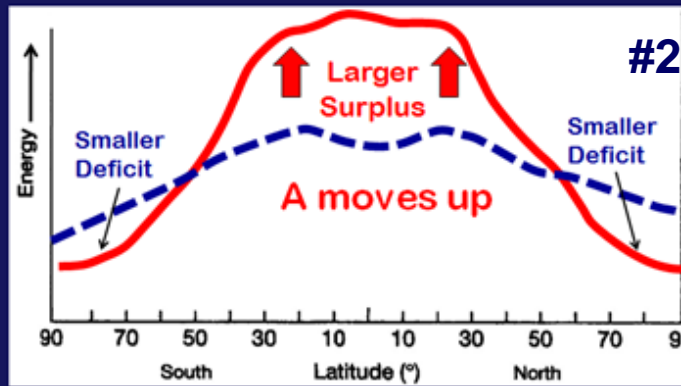


This is illustrated by the Keeling Curve.

What is...

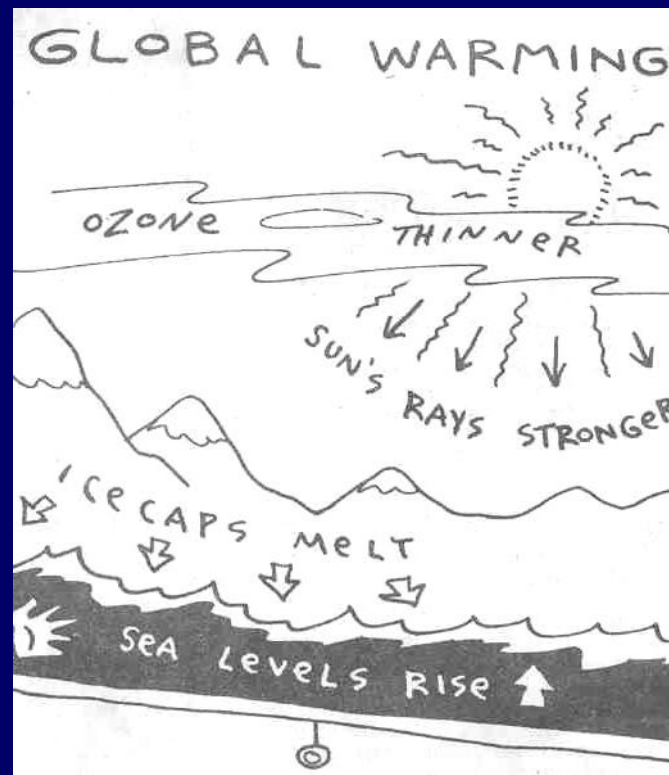


1. Quasiperiodic variations with an upward trend 
2. Increasing variance with a constant mean
3. A step change with an abrupt jump
4. The “breathing” of the Southern Hemisphere forests.



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?

And now

**THE FALL 2013
CLASS
GLOBAL WARMING
DEBATE**

Epilogue!



WHAT CAN I DO??

- VOTE for those who will promote good POLICY (economic and environmental) to produce major change
- Be a GLOBAL CHANGE SAVVY CONSUMER
- Make INDIVIDUAL CHANGES in your own life
- Inspire others to WAKE UP to the “ALARM BELL”
- Think about the LONG TERM – not just NOW
- Foster COMPASSION that leads to action for those most vulnerable to Global Climate Change

MORE LINKS TO GET YOU GOING!

UA's ENVIRONMENTAL PORTAL

<http://portal.arizona.edu/>

<http://portal.arizona.edu/campus-sustainability/clubs-and-groups>

<http://portal.arizona.edu/campus-sustainability/climate-action>

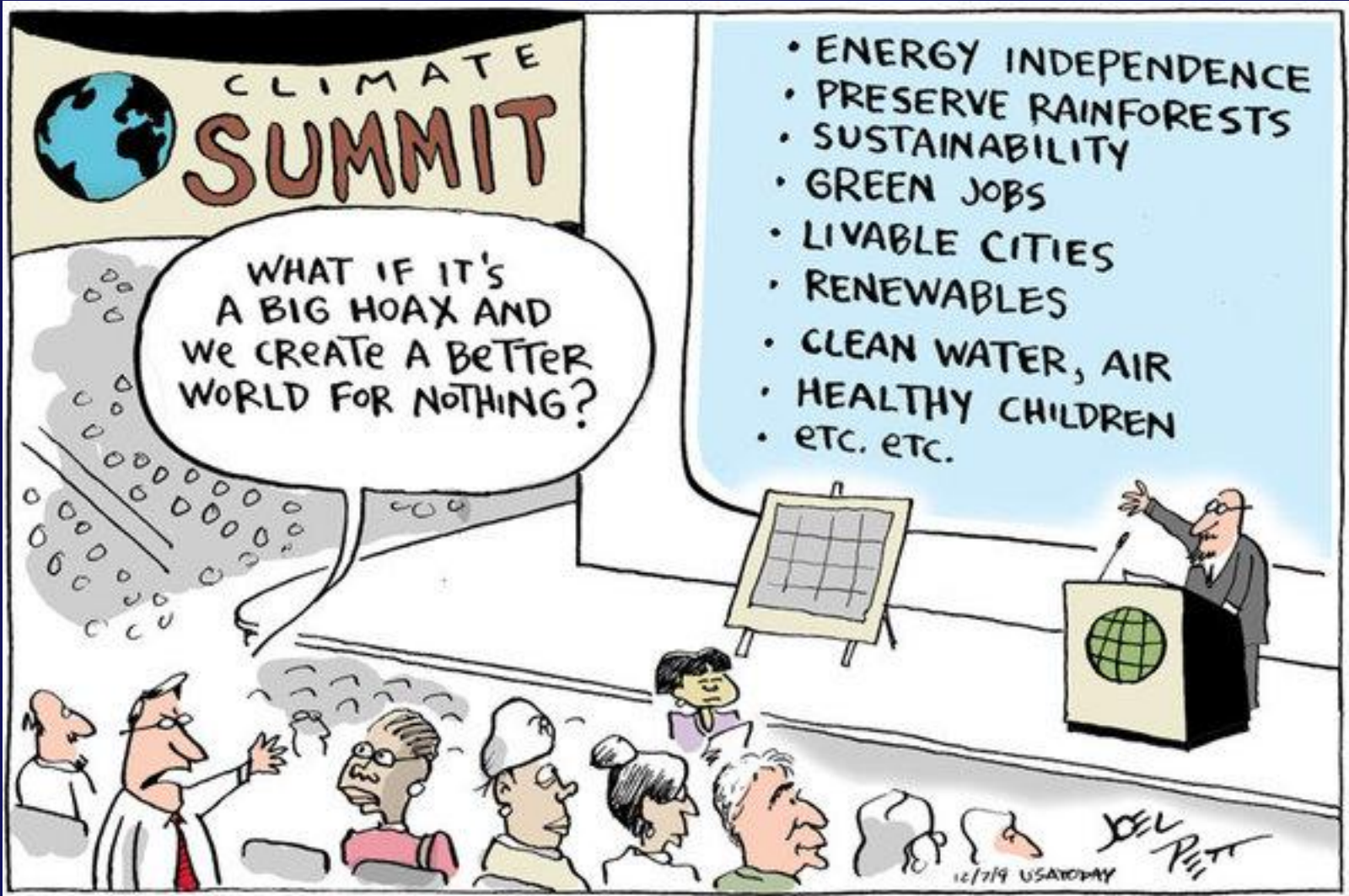
SUSTAINABLE TUCSON

<http://www.sustainabletucson.org/what-you-can-do/sustainability-actions-everyone-can-do/>

<http://www.sustainabletucson.org/what-you-can-do/top-10/>

CONTINUE LINKING TO YOUR LIFE

<http://www.sustainableminds.com/industry-blog/creating-knowledge-workers-greener-product-marketplace-part-1>



CLIMATE
SUMMIT

WHAT IF IT'S
A BIG HOAX AND
WE CREATE A BETTER
WORLD FOR NOTHING?

- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- etc. etc.

JOEL PITT
12/19 USA TODAY

THANKS TO YOUR TA's



Adriana Zuniga



Scott Jones



Saeahm ("Sam") Kim



Dr. Kit O'Connor !

PERSONAL REMARKS

FROM Dr H

&

An 8 minute MESSAGE
from the film "HOME"

