How Learning Works Part I

Workshop goals for participants:

- To develop awareness of the cognitive psychology concepts of *prior knowledge* and *knowledge organization* and how they impact student learning
- To experience firsthand a few teaching techniques that address prior knowledge and knowledge organization
- To brainstorm and share additional teaching techniques applicable to one's own courses

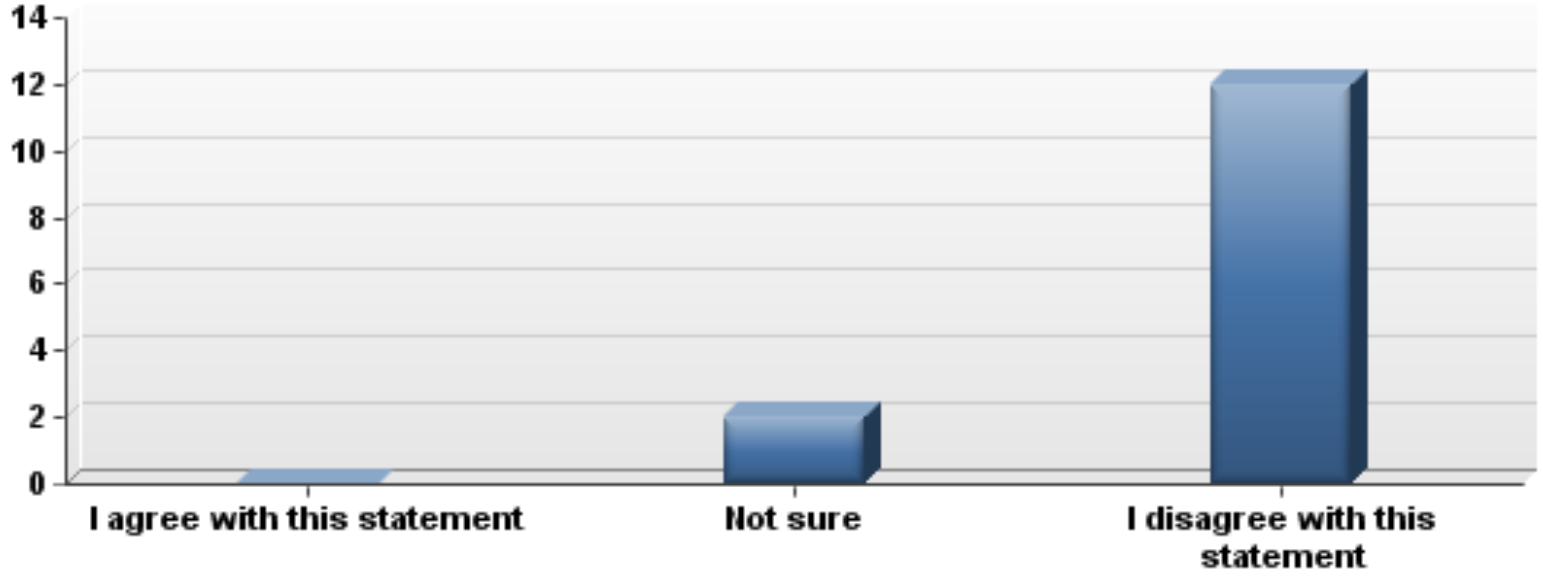
Prior Knowledge

Please indicate your familiarity with the concept of "prior knowledge." (Check all that apply)

#	Answer		%
1	I've heard of it		43%
2	I can define it		43%
3	I can explain it to someone else		36%
4	I can identify at least three ways it can help or hinder learning		43%
5	I can apply the concept to improve student learning		14%

“Felix gained strength overnight with wind speeds of 100 miles per hour. Forecasters predict the eye will hit the already battered coast of Belize tomorrow.”

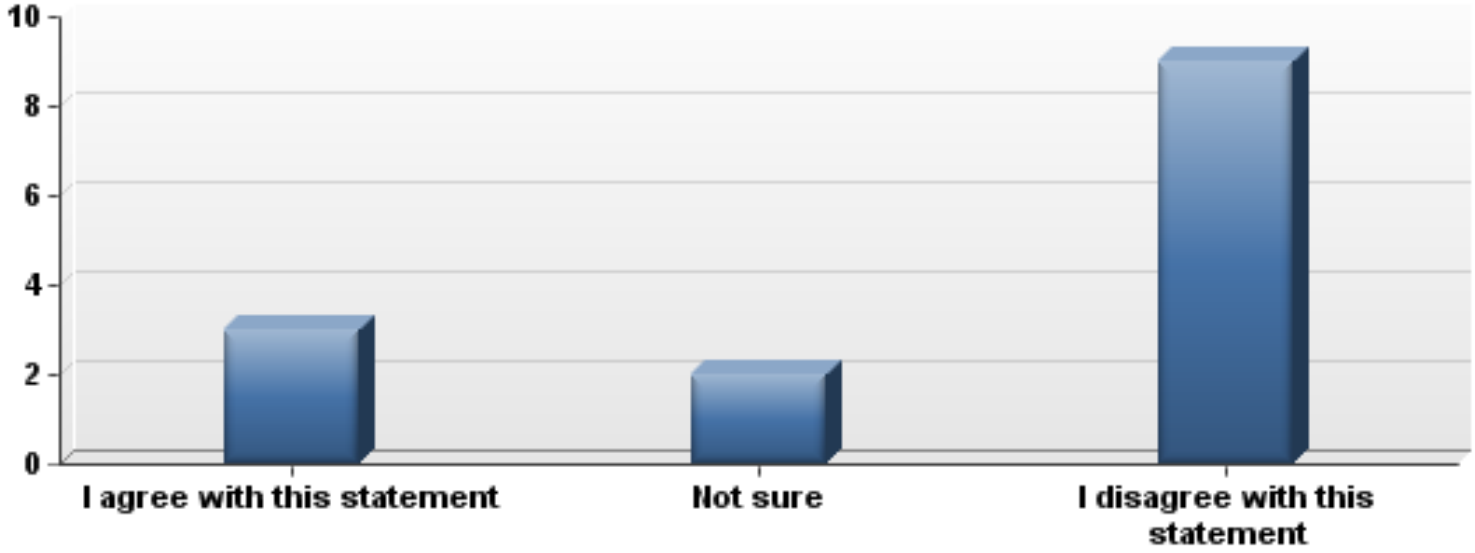
It is not necessary to consider students' prior knowledge when they are brand new to the subject area.



Prior Knowledge

Helps Learning	Hinders Learning
• Activated • Sufficient • Appropriate • Accurate	• Inactive • Insufficient • Inappropriate • Inaccurate

Once individuals have some prior knowledge of a topic, they are ready to apply it to new concepts.



Small Groups

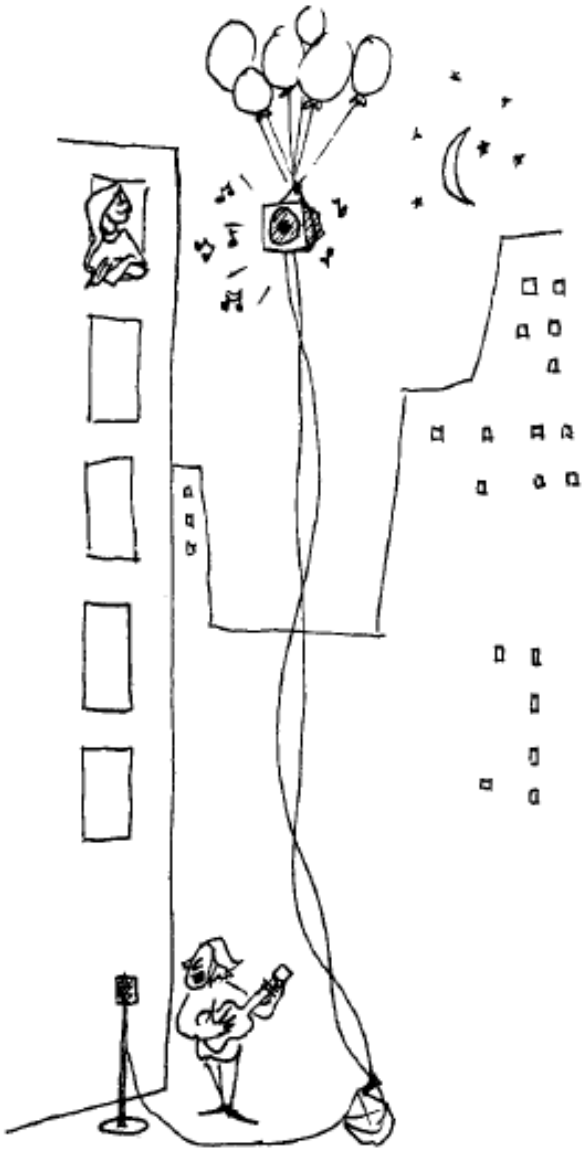
Prior knowledge…

- Can hinder learning
- Lies inert most of the time
- Must be activated to be useful

What we can do…

- Value and engage what students bring to the table
- Actively confront and challenge misconceptions

Knowledge Organization



Example

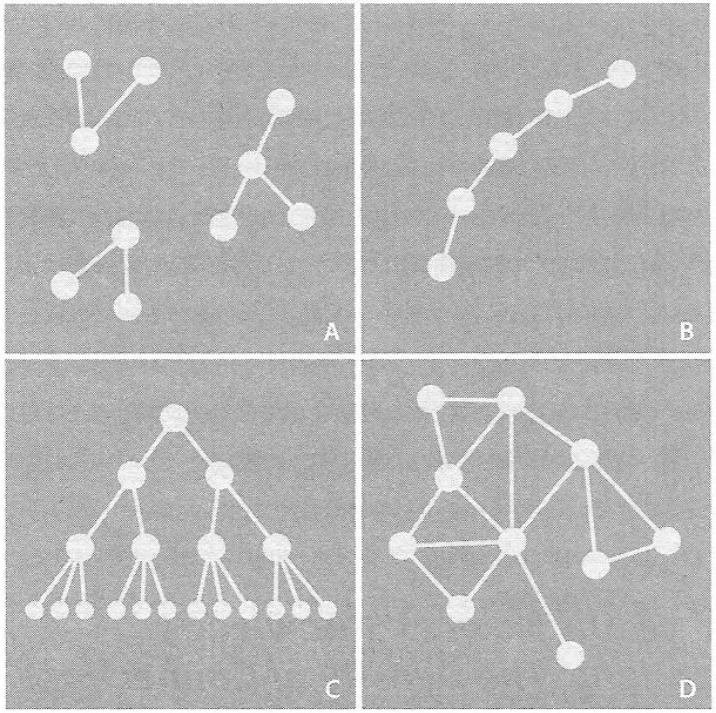
Your comments: An expert…

- has extensive experience with the subject area
- has a significant grasp of the concepts and is able to apply, evaluate, critique and assess them
- can easily, effortlessly solve problems…and make connections to other types of related problems
- is able to understand and apply discipline knowledge to form new ideas or create improvements

Knowledge Organization

Experts

- Rich
- Meaningful knowledge structures



Novices

- Sparse
- Superficial knowledge structures

Concept Maps

A visual means of representing relationships between ideas, concepts, images, or words

Images from: *The Theory Underlying Concept Maps and How to Construct and Use Them*, Joseph D. Novak & Alberto J. Cañas, Florida Institute for Human and Machine Cognition, Pensacola Fl, www.ihmc.us

Atoms

Molecules

Heat

Light

Chemical

Electrical

Nuclear

Transformations

Motion

Kinetic energy

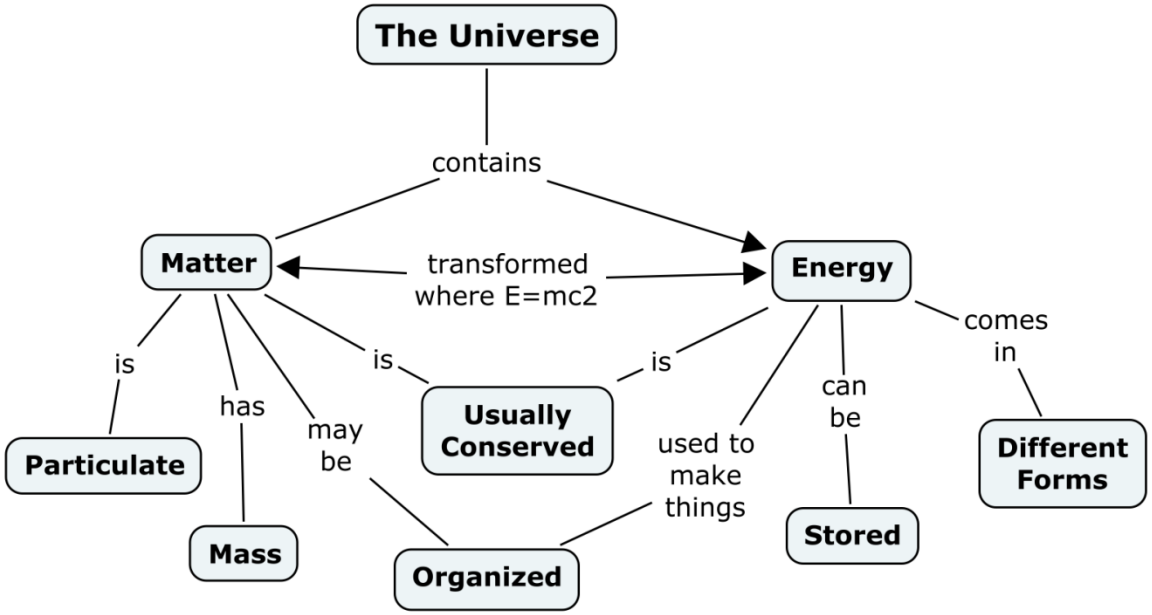
Potential energy

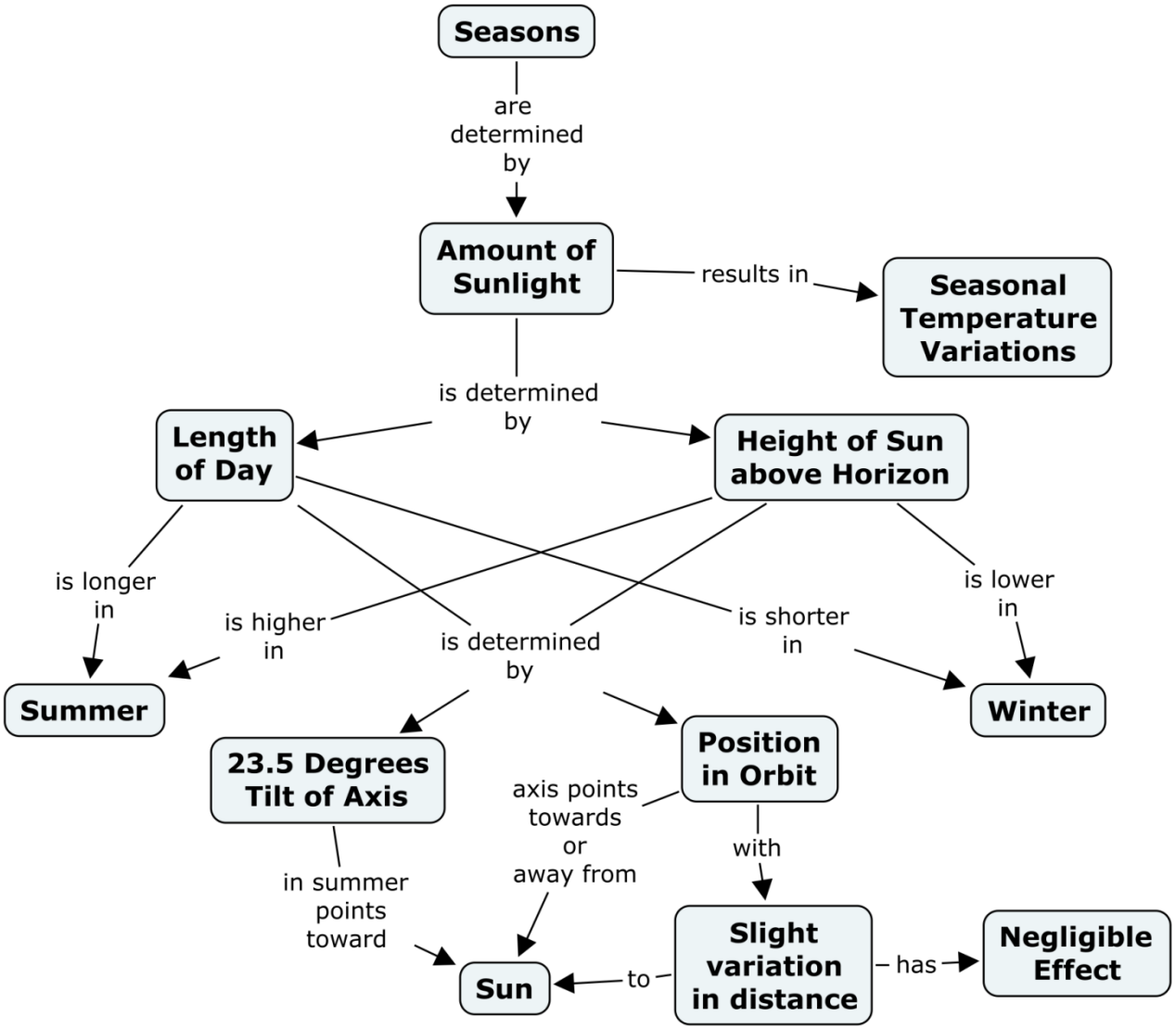
Elements

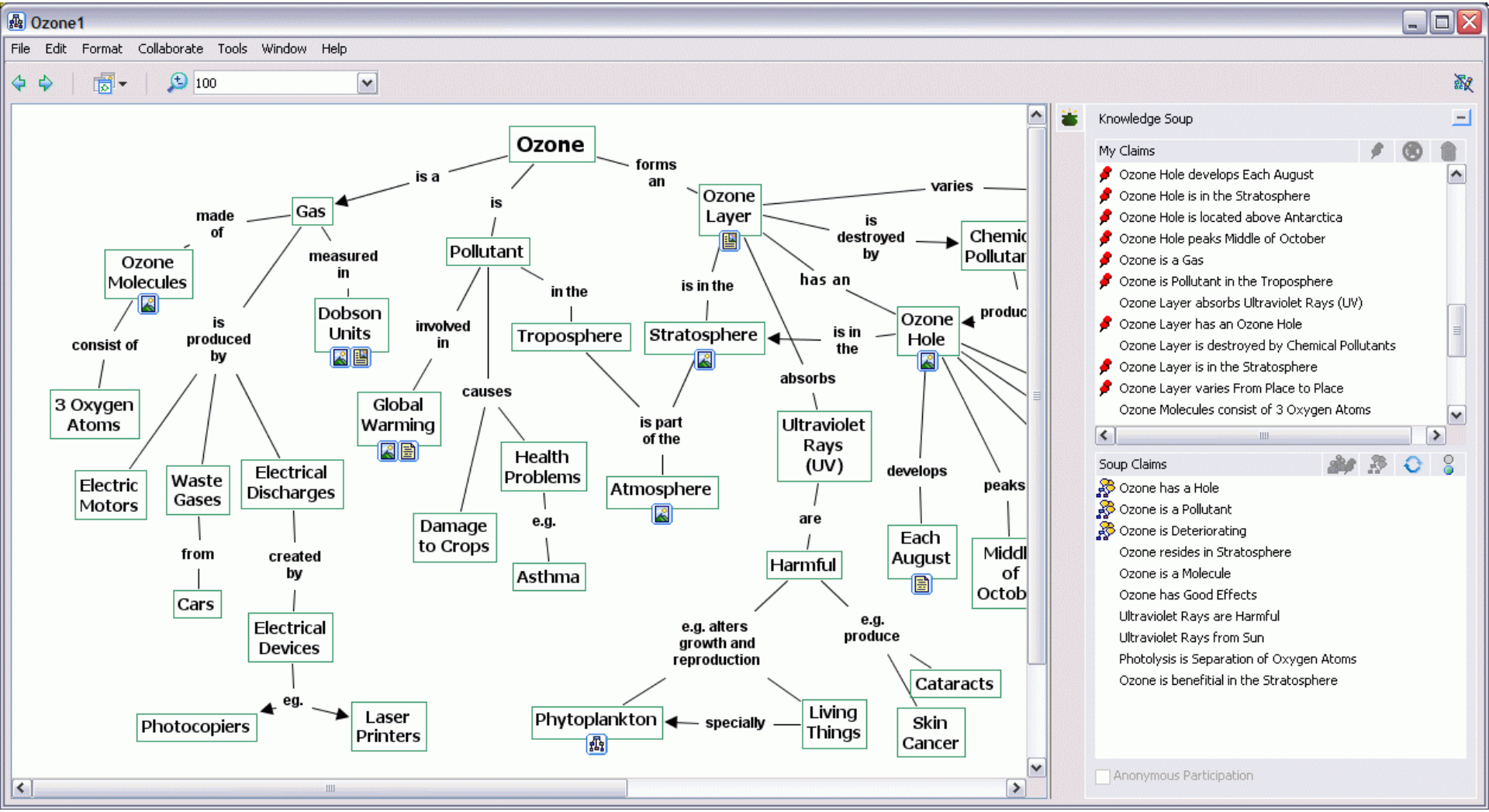
Space

State of Matter

Focus question: What is the structure of the Universe?




Seasons
are determined by
Amount of Sunlight
results in
Seasonal Temperature Variations
is determined by
Length of Day
Height of Sun above Horizon
is longer in
is higher in
is determined by
is shorter in
is lower in
Summer
Winter
23.5 Degrees Tilt of Axis
Position in Orbit
axis points towards or away from
with
in summer points toward
Sun
to
Slight variation in distance
has
Negligible Effect


Ozone1
File Edit Format Collaborate Tools Window Help
100
Ozone
is a
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Gas
made of
Ozone Molecules
consist of
3 Oxygen Atoms
is produced by
Electric Motors
Waste Gases
from
Cars
Electrical Discharges
created by
Electrical Devices
eg.
Photocopiers
Laser Printers
measured in
Dobson Units
is
Pollutant
involved in
Global Warming
causes
Damage to Crops
Health Problems
e.g.
Asthma
in the
Troposphere
is part of the
Atmosphere
Ozone Layer
varies
is destroyed by
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is in the
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Ozone Hole
produc
is in the
absorbs
Ultraviolet Rays (UV)
are
Harmful
e.g. alters growth and reproduction
e.g. produce
Phytoplankton
specially
Living Things
Cataracts
Skin Cancer
develops
Each August
peaks
Middl of Octob
Knowledge Soup
My Claims
Ozone Hole develops Each August
Ozone Hole is in the Stratosphere
Ozone Hole is located above Antarctica
Ozone Hole peaks Middle of October
Ozone is a Gas
Ozone is Pollutant in the Troposphere
Ozone Layer absorbs Ultraviolet Rays (UV)
Ozone Layer has an Ozone Hole
Ozone Layer is destroyed by Chemical Pollutants
Ozone Layer is in the Stratosphere
Ozone Layer varies From Place to Place
Ozone Molecules consist of 3 Oxygen Atoms
Soup Claims
Ozone has a Hole
Ozone is a Pollutant
Ozone is Deteriorating
Ozone resides in Stratosphere
Ozone is a Molecule
Ozone has Good Effects
Ultraviolet Rays are Harmful
Ultraviolet Rays from Sun
Photolysis is Separation of Oxygen Atoms
Ozone is benefitial in the Stratosphere
Anonymous Participation

Small Groups

Experts…

- Have a higher density of connections
- Have structures that rely on deep underlying principles
- Have more flexible structures

What we can do…

- Help students organize their knowledge in productive ways
- Actively monitor students' construction of knowledge