Define Climate:

Draw a diagram of the layers of the atmosphere; label each and identify where the following occurs: weather, stratospheric ozone formation/decomposition (include formulas), tropospheric ozone formation (include formula), ozone depletion (include formulas), and the greenhouse effect.

Which two gases make up the majority of the total composition of the atmosphere? (include percents)

What factors contribute to the atmospheric

circulation patterns?

Summarize the three main convection currents in the atmosphere (include a diagram!)

Hadley cell

Ferrel cell

Polar cell

Explain the Coriolis effect:

Draw a climatogram for Brentwood, CA.

Identify a location & summarize the climate/weather of the following biomes: tundra, deciduous forest, desert, grasslands, rainforest.

What’s the difference between weather and climate?

Climate

What is ozone depletion? (summarize and include chemical equations)

What is the greenhouse effect? List four anthropogenic gases that contribute to the enhanced greenhouse effect (what are their sources?). What gas doesn’t have an anthropogenic source but still contributes?

Summarize the Montreal Protocol:

**POSITIVE AND NEGATIVE FEEDBACK MECHANISMS RELATING TO OUR CLIMATE**

**NEGATIVE FEEDBACK MECHANISMS** – push a system back to its original equilibrium position

*Example: Imagine you are out walking in the country. As you walk, the sun rises higher in the sky and the air temperature increases. Your body senses that your internal temperature is rising above 37°C and you start to sweat, which reduces your body temperature by evaporating water from your skin, returning your temperature to normal.*

**POSITIVE FEEDBACK MECHANISM** – push a system to a new state of equilibrium

*Example: Imagine you are lost on a high snowy mountain. When your body senses that it is cooling below 37°C, various mechanisms such as shivering help to raise your internal temperature again, but if these are insufficient to restore normal body temperature, your metabolic processes start to slow down, as, like most chemical reactions, they happen more slowly at lower temperatures. As a result you become lethargic and sleepy and move around less and less, allowing your body to cool even further. Unless you are rescued at this point, your body will reach a new equilibrium – you will die of hypothermia.*

Both natural and human systems are influenced by feedback mechanisms. Generally, we wish to preserve the environment in its original state, so negative feedback is usually helpful and positive feedback is usually undesirable. However there are other situations where change is needed and positive feedback is advantageous.

*Example: If students enjoy their Environmental Systems lessons, they want to learn more, so attend classes regularly and complete assignments. Consequently they move to a new equilibrium of being better educated about the environment.*

There are a number of examples of how both positive and negative feedback mechanisms might operate in the physical environment. No one can be sure which of these effects is likely to be most influential, and consequently we cannot know whether or not the Earth will manage to regulate its temperature, despite human interference with many natural processes.

**Assignment:** Identify and Label each example as either positive or negative feedback and provide an explanation for your choice.Draw diagrams of one example of positive feedback and one example of negative feedback using the

examples given, to show how feedback affects a system. Include arrows to represent the feedback loops.

**Examples of possible positive and negative feedback in physical systems:**

1. As carbon dioxide levels in the atmosphere rise:

• Temperature of Earth rises

As Earth warms:

• the rate of photosynthesis in plants increases

• more carbon dioxide is therefore removed from the atmosphere by plants, reducing the greenhouse effect and reducing global temperatures

2. As Earth warms:

• Ice cover melts, exposing soil or water • Albedo decreases

• More energy is absorbed by Earth’s surface • Global temperature rises

• More ice melts

3. As Earth warms, upper layers of permafrost melt, producing waterlogged soil above frozen ground:

• Methane gas is released in anoxic environment • Greenhouse effect is enhanced

• Earth warms, melting more permafrost

4. As Earth warms, increased evaporation:

• Produces more clouds

• Clouds increase albedo, reflecting more light away from Earth

• Temperature falls

• Rates of evaporation fall

5. As Earth warms, organic matter in soil is decomposed faster:

• More carbon dioxide is released • Enhanced greenhouse effect occurs

• Earth warms further • Rates of decomposition increase

6. As Earth warms, evaporation increases:

• Snowfall at high latitudes increases • Icecaps enlarge

• More energy is reflected by increased albedo of ice cover • Earth cools

• Rates of evaporation fall

7. As Earth warms, polar icecaps melt releasing large numbers of icebergs into oceans:

• Warm ocean currents, such as Gulf Stream, are disrupted by additional freshwater input into ocean

• Reduced transfer of energy to poles reduces temperature at high latitudes

• Ice sheets reform and icebergs retreat

• Warm currents are re-established