

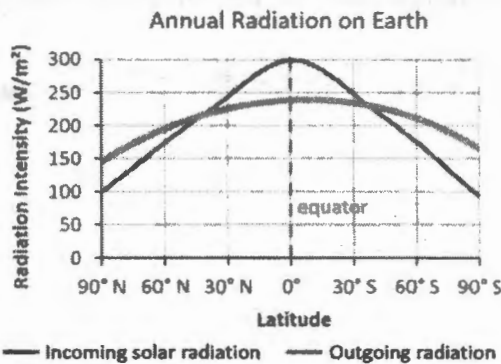
In problems involving calculations, show your work in an organized manner, include the appropriate formula / equation, conversion factors, and units in your answer.

1. In regards to the surface temperature at latitude 0° (@ equator), 90° N (@ north pole), and 90° S (@ south pole). [15 points]

a. What is the relative surface temperature ?

3pt equator > North & south pole

b. What is the rationale / basis of the relative surface temperature based on the below graph from your textbook



the "thin" line = incoming solar radiation, while the "thick" line = outgoing radiation.

6pt
 • @ equator : incoming > outgoing = warm
 • @ pole : outgoing > incoming = cool

c. Rationale / basis of the relative ^{incoming} ~~outgoing~~ radiation

curvature of earth affect surface area exposure, where amount radiative is same
 big area → ↓ radiation/area
 low area → ↑ radiation/area

2. In regards to coral bleaching, [10⁵ points]

a. Describe the term.

2pt expel algae in coral

b. What is / are the cause(s) ?

3 ↑ ocean temperature

3. In regards to albedo, [15 points]

a. Define / describe the term

3 pt 1) incident light reflected

b. What is the relative albedo of snow versus grass?

3 snow > grass

c. It's role & mechanism in determining the surface temperature (in the context of Earth's energy balance)?

4 snow: ↑ albedo → ↑ incident radiation reflection = ↓ incident radiation absorbed
↓
cool

4. Describe the "greenhouse effect" and include: (i) the chemical(s) involved in the process, (ii) impact on earth's temperature, and (iii) it's role in the Earth's energy balance. [10 points]

3 pt i) H_2O , CO_2 , & CH_4 = greenhouse gases
3 ii) ↑ temperature
4 iii) absorb & re-radiated IR from ground

5. Describe the (positive) feedback loop with respect to global warming involving (i) soil microbes and (ii) snow / ice. [10 points]

rate i) ↑ T → ↑ soil microbe metabolism → ↑ CO_2 generation
ii) ↑ T → ↑ melt snow/ice → ↓ albedo → ↓ absorption → ↑
↓ reflection