Answer key radiation, current and wind questions:

 /16 marks **Emg Dev Prf Ext**
 <9 9-11.5 12-14 >14

Why does infrared radiation from the sun merely result in raising the temperature of objects that absorb this energy whereas UV radiation from the sun can be harmful or detrimental to life? /1

Infrared rays create heat in much the same way as rubbing your hands together does. So Infrared rays can cause a burn on the skin surface, possibly cause wrinkles. It can also cause the skin to look pink or blister if skin exposed for extensive amounts of time.

Which type of UV radiation is most harmful to life and why? /2

UV-C contains the most energy and would be the most harmful to life. The energy contained in ultraviolet C rays is higher than UV -B or UV -A, so instead of just causing the molecules to shake, it can knock electrons away from the atoms, or causes molecules to split. This results in a change in the chemical structure of the molecule. This change is especially detrimental to living organisms, as it can cause cell damage and deformities by mutating its genetic code.

How does ozone protect the biosphere from this deadly UV radiation? /1

Fortunately, these rays are absorbed by ozone molecules in the stratosphere of the atmosphere because the energy in these rays is enough to break apart the bonds in this molecule and the energy is absorbed in the process. Therefore, few UV-C rays from the sun ever come into contact with life on earth.

What is sunburn and what type(s) of radiation cause(s) sunburn? /2

The entire spectrum of solar radiation, from the infrared through visible light to ultraviolet causes sunburn. Part of the radiation gets absorbed by the skin and is converted into heat. Sunburn is essentially a thermal burn, not different to what happens to your skin when exposed to any source of heat.

Tanning is caused by UV radiation, as a natural protective response of the skin. The skins turns darker so that the UV radiation is absorbed closer to the surface and does not penetrate as deeply in the tissue.

In terms of skin damage, UV-C is the most damaging because it is the most energetic in the solar spectrum. High energy radiation such as X-ray and gamma rays are emitted in relatively small amounts by the Sun, so they are not significant. Because photons of UV radiation carry much more energy than infrared or visible light, they can cause more damage to the DNA in skins cells, eventually leading to skin cancer.

But sunburn (redness) is mostly caused by infrared (thermal radiation). You will get equally burned if you sit in front of an electric heater, but without the tan.

UVB is considered the "tanning ray." It is strongest in the summer months when the earth tilts towards the sun.

UV-A radiation - Scientists have found that this radiation does the more damage to the body than UVB. UVA is the same strength year-round -- it does not matter how close or how far away the sun is from the earth. The ray remains the same strength and considered a light X ray. It goes through light clothing, wind shields, office windows, hats, etc. UVA overexposure causes sunburn.

Describe some factors which reduce/increase the amount of UV-A and B you are exposed to? Factors not related to the ozone layer! /3

The amounts of UV one is exposed to also **varies with altitude.** As a rule of thumb, UV levels increase about 4% for every 1,000-foot gain in altitude. This increase has nothing to do with being closer to the sun - any elevation you might gain would be miniscule in comparison to the distance from the earth to the sun, and so would have an insignificant outcome on UV levels. Instead, the increase is the result of a thinner atmosphere with a smaller number of molecules being present to absorb or scatter UV.

**Molecules that help scatter or absorb UV radiation thus reducing exposure** are [**tropospheric**](http://uv.biospherical.com/student/page9.html#troposphere) ozone (commonly associated with [**smog**](http://uv.biospherical.com/student/page9.html#smog)) and [**aerosols**](http://uv.biospherical.com/student/page9.html#aerosol), molecules that remain suspended in the air. [**Aerosols**](http://uv.biospherical.com/student/page9.html#aerosol) can be a multitude of substances - dust, soot, sulfates, etc.

On cloudy days, UV levels are usually lower than during clear skies as clouds can deflect rays up into space. Clouds can, however, also lead to increased UV levels. This happens, for example, when the sun is not obscured by clouds but clouds in the vicinity of the sun reflect additional radiation to the ground.

How does a high Albedo of objects like light coloured sand and snow contribute to sunburn?

UV radiation is reflected off these surfaces instead of being absorbed increasing exposure to UV forms of radiation as to exposed to incoming and reflected radiation increasing severity of sunburn.

What processes, forces and/or factors affect the size, shape, speed, and direction of ocean currents? /3

Wind on surface – impacts surface flow up to 400 m

Landforms under water and ocean basin shape – change direction of water flow

Depth of water can affect speed of current

Differences in temperature from deep to surface – colder water sinks and warmer water rises.. sun heats equator more so water near equator is warmer and water at the poles colder and more dense – leads to areas of upwelling and downwelling and convection currents

Changes in salinity – higher salinity water is heavier it sinks

Rotation of Earth – causes circular patterns (Coriolis effect)

What is wind? How does wind form? Why are some winds stronger while some winds are weaker? /3

Wind is the movement of air. Air moves from an area of higher pressure (colder more dense air) to an area of lower air pressure (warmer less dense air)

The greater the differences in air pressure between two air masses the greater the wind speed. These differences in air pressure are caused by the uneven heating of the Earth’s surface