

INSOLATION FROM

THE SUN:

A. Insolation

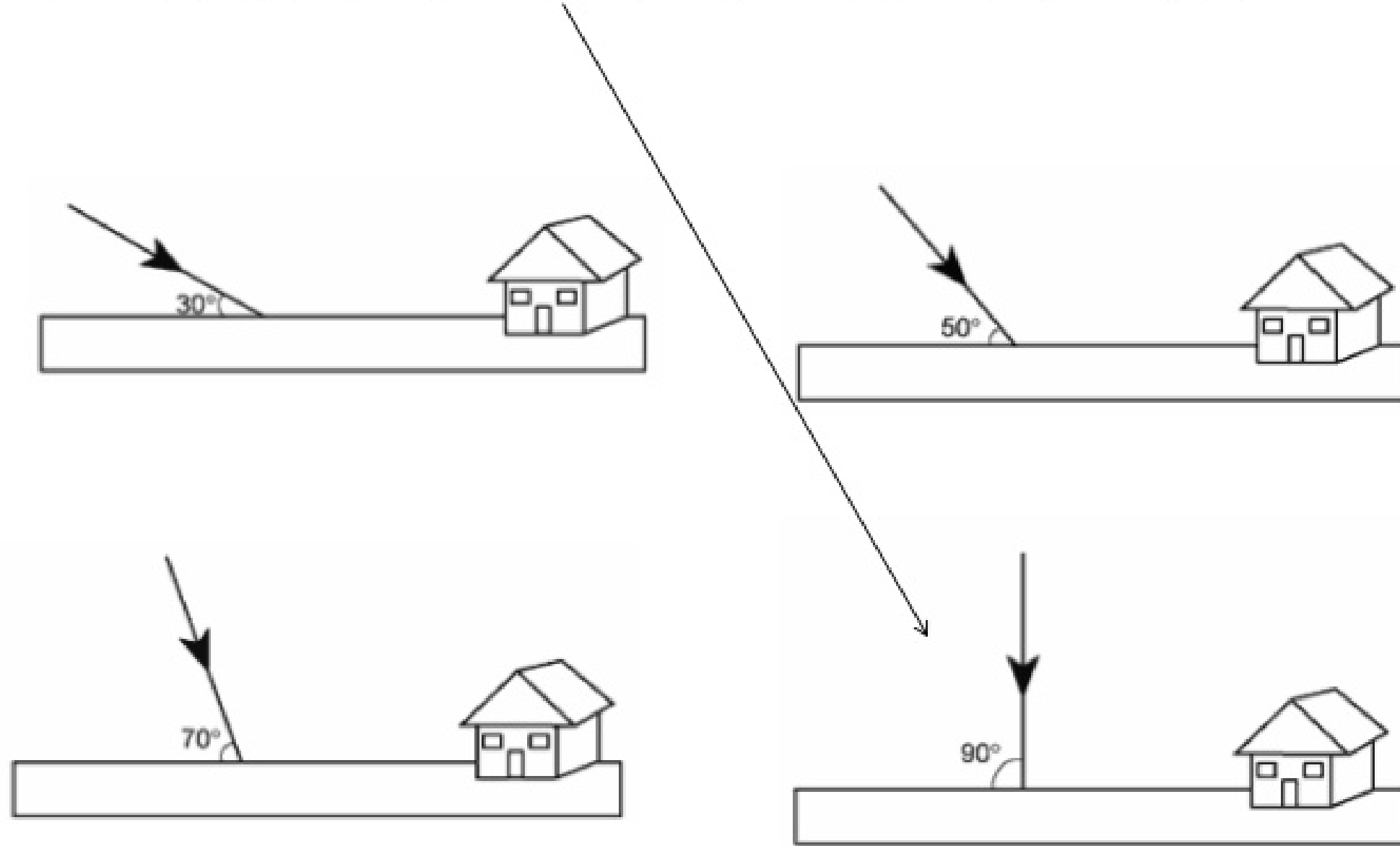
- 1. INcoming Solar radiATION (radiation from the Sun)**
- 2. Main source of energy for the Earth's atmosphere**

B. Three factors affect the amount of insolation received by the Earth:

1. Angle of insolation

- a. The angle (in degrees) of the sun above the horizon (how high the sun is in the sky)
- b. A direct ray of the sun is a ray that strikes the Earth at a 90° angle.
- c. The more DIRECT (vertical) the rays (higher in the sky), the HIGHER the temperature

The greatest angle of insolation gets the most sunlight

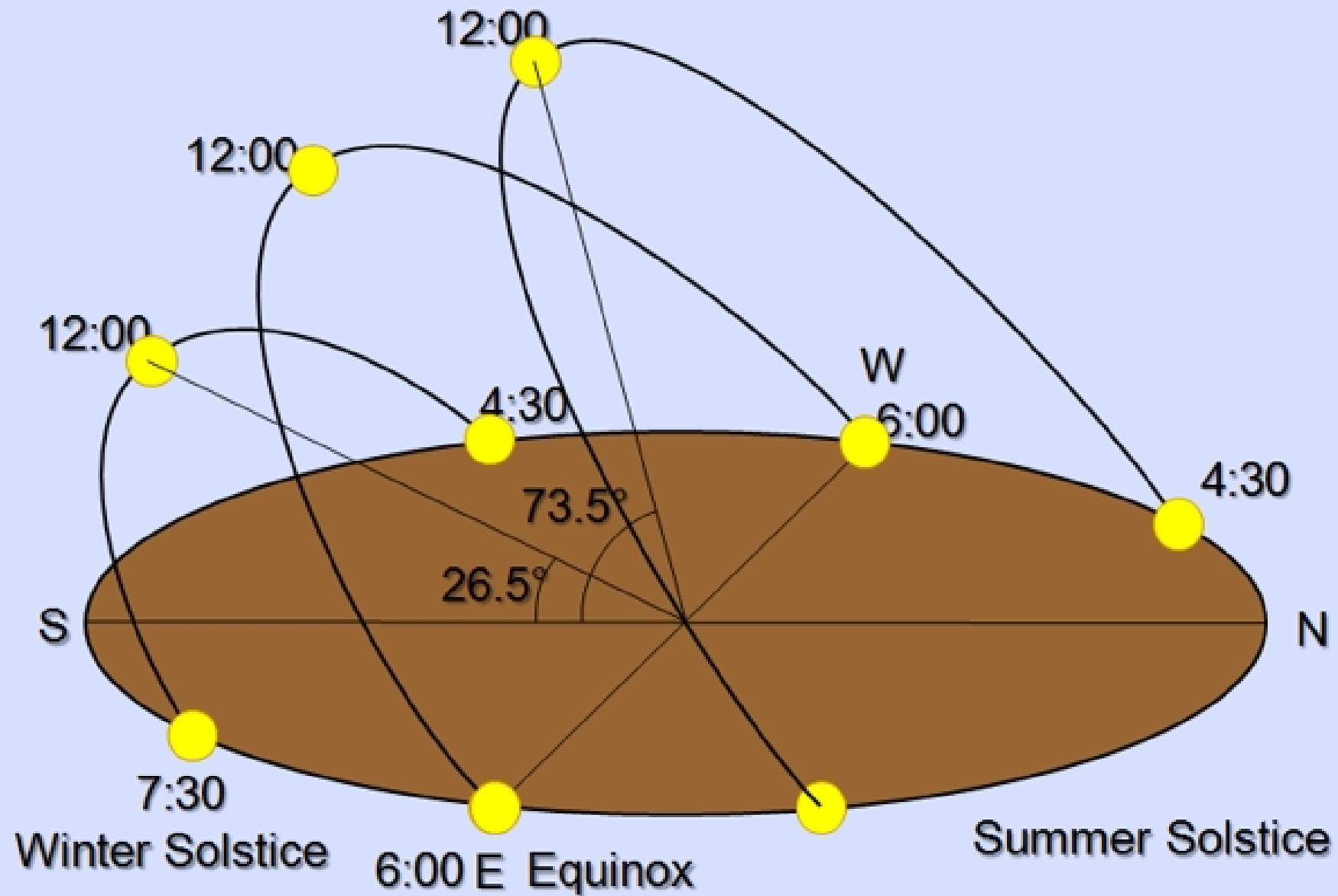


Depends on:

d. Time of day

- LOW angle at sunrise – LOW temperatures
- HIGHEST angle at solar noon – HIGHER temperatures

40°N Latitude

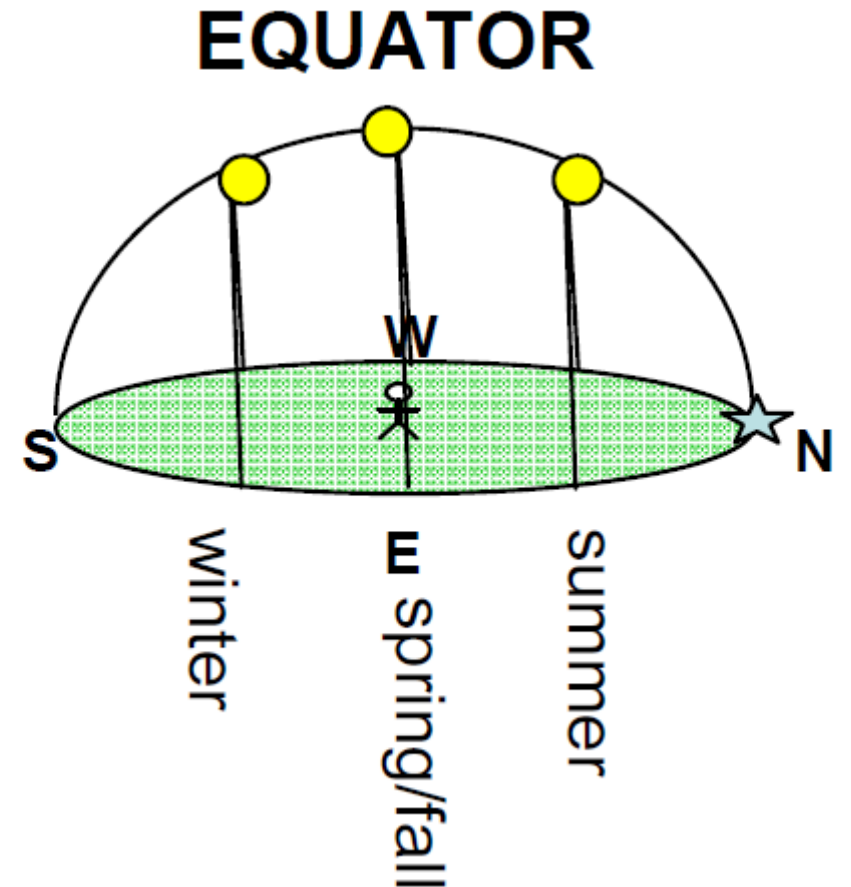


2. Duration of insolation

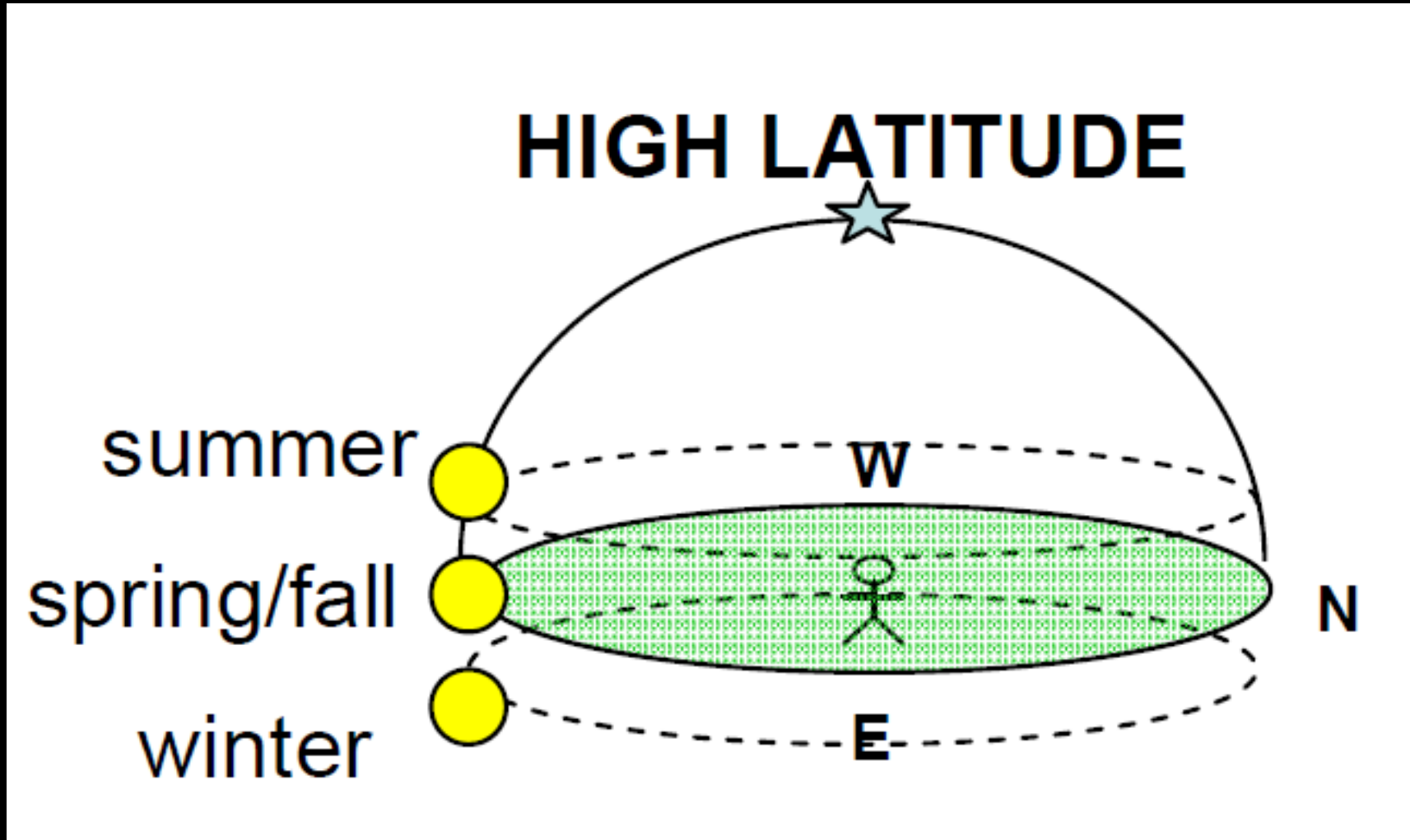
- a. How long the sun is above the horizon
- b. The **LONGER** the sun is above the horizon at a specific location, the **HIGHER** the temperatures .
- c. The more hours of the day the sun shines, the warmer the temperature.
- d. Depends upon:

1. Latitude

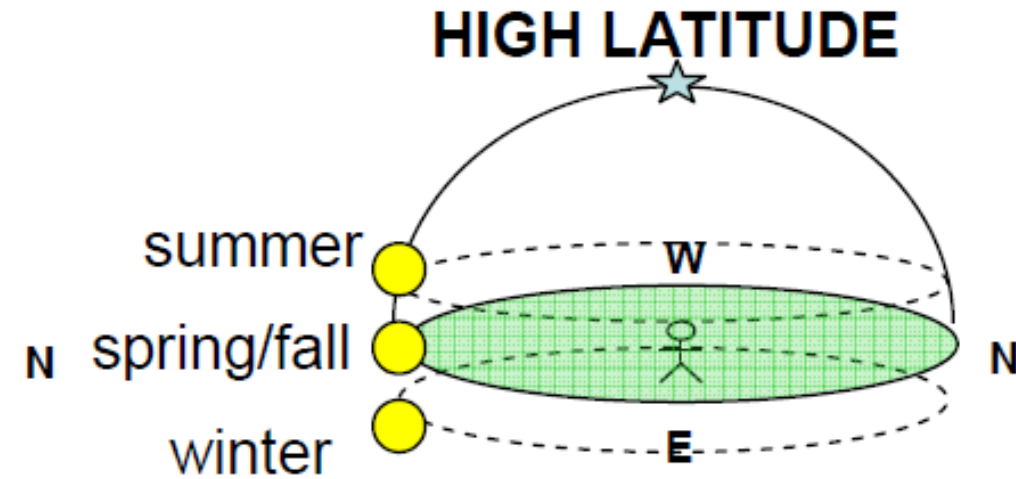
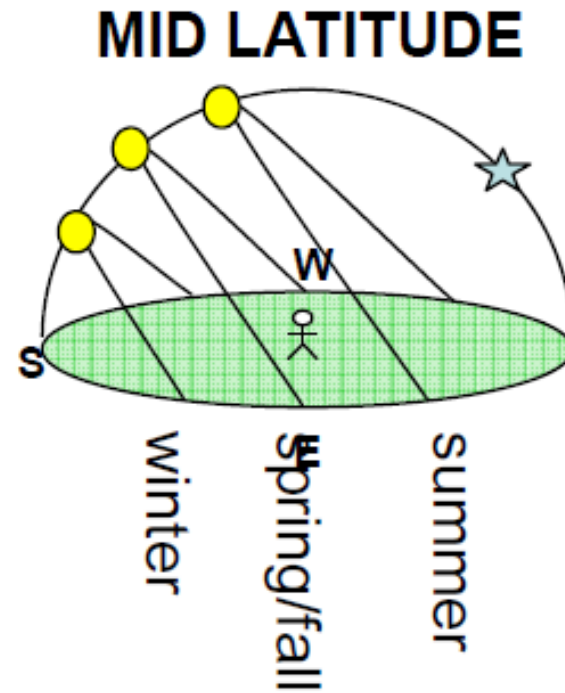
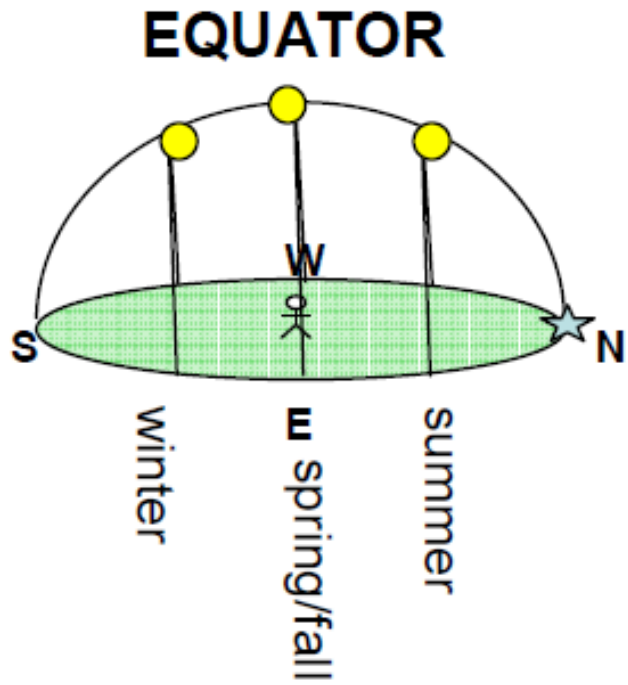
- Equator (0°) – has 12 hours of daylight **EVERYDAY** - warmer temperatures



- The poles (90°N & 90°S) – have 6 months of darkness, 6 months of daylight - colder temperatures * remember – at the poles the angle of the sun's rays is very low so it never really heats up, even with 6 months of daylight)



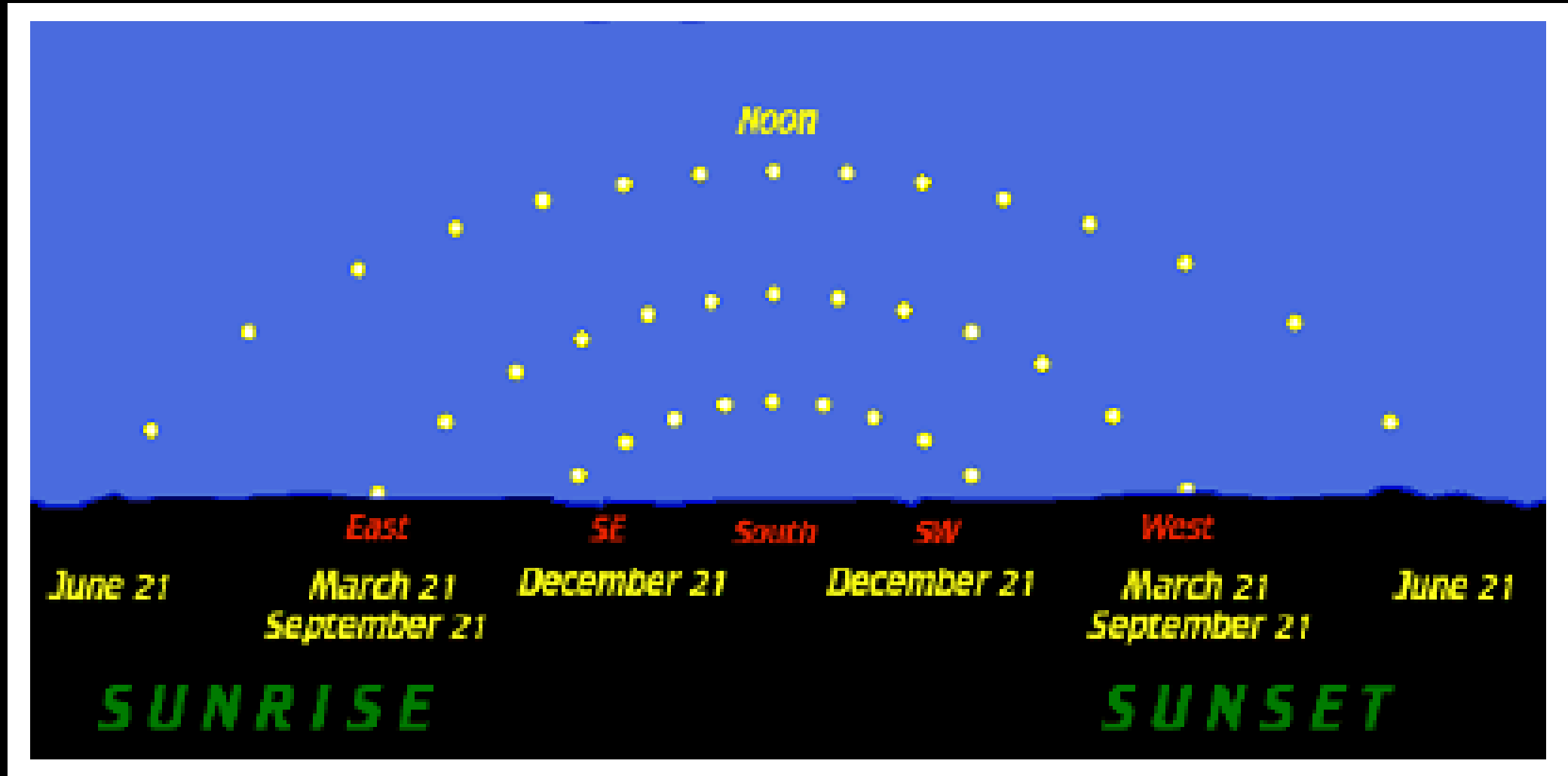
1. highest angle at equator (0°) - warmer temperatures
2. lowest angle at the poles (90°N & 90°S) – colder temperatures

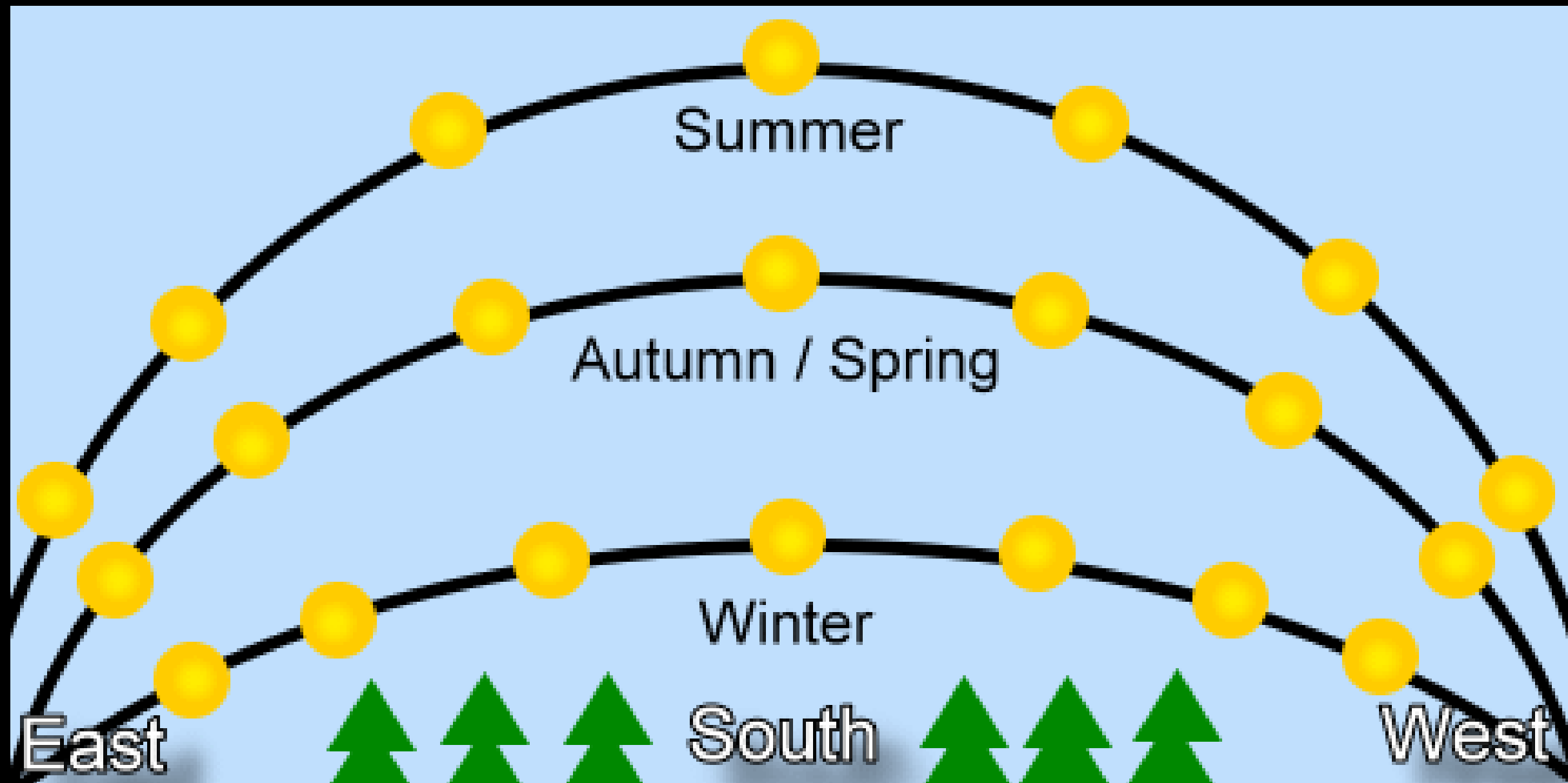


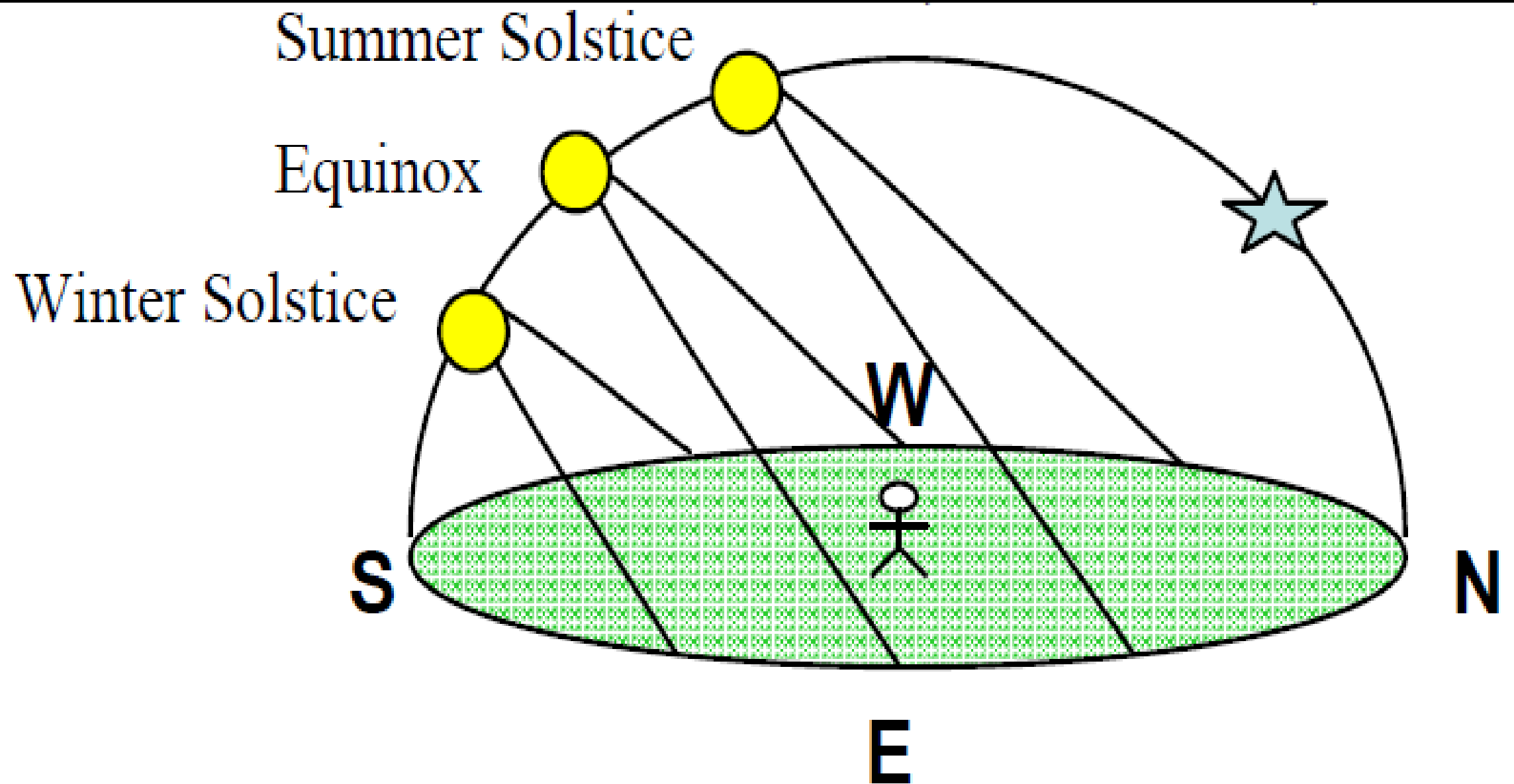
2. Seasons

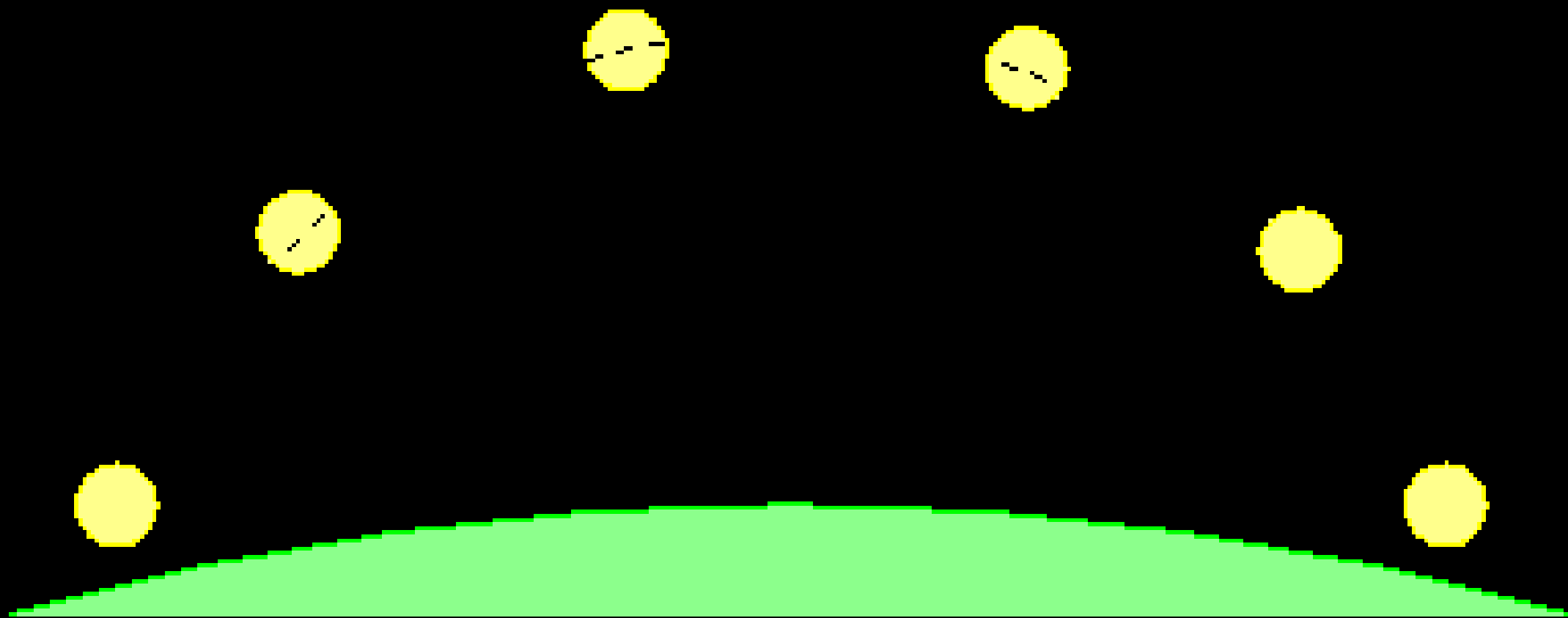
- Summer - “longer” days – duration of insolation is longer – warmer temperatures
- Winter – “shorter” days - duration of insolation is shorter – cooler temperatures

1. lowest angle in the winter (December) – cooler temperatures
2. highest angle in the summer (June) – warmer temperatures









Atmospheric Transparency

a. How much insolation reaches Earth's surface

b. Depends on reflection, refraction, or absorption of insolation

c. Clouds:

- during the day, clouds block insolation, no sun, no heat - therefore cooler temperature**
- if it is sunny during the day and cloudy at night, the clouds insulate Earth (like a blanket) and helps keep the surface warm - therefore warmer temperature**

Specific Heat –

- LAND has a lower specific heat so it heats up and cools down FAST
- WATER has a high specific heat so it heats up and cools down SLOW

Interaction of Insolation and Earth's Surface:

1. When sunlight reaches the Earth it can interact it can be:
 - a. **REFLECTION** - when the sun's rays reflect back into the atmosphere.
 - b. **REFRACTION** - The ray is bent and travels in a new direction
 - c. **SCATTERED** - in various directions
 - d. **ABSORBED** - The suns ray is taken in by the surface.
 - e. Transmitted – passes trough without interference.
 - f. Diffraction - the spreading of waves around obstacles.

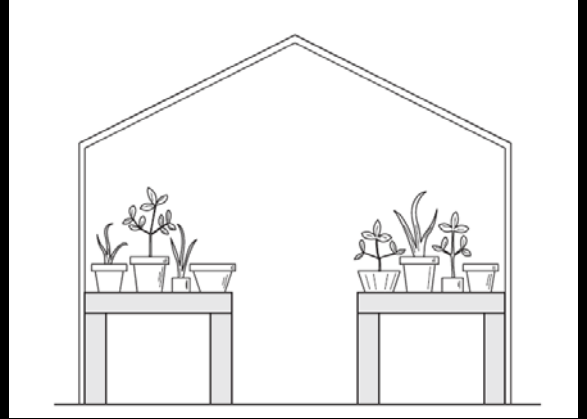
Factors Affecting Absorption of Insolation:

- a. COLOR - darker colors absorb more energy.
- b. SPECIFIC Heat – Lower SH, faster heating and cooling
- c. SURFACE AREA- rough surfaces have more surface area and will absorb more energy.
- d. Type of Surface – Land heats and cools quickly, water heats and cools slowly.
- e. A good ABSORBER of electromagnetic energy (HEAT) is a good RADIATOR of electromagnetic energy
- f. In other words if an object heats fast, it will cool down fast.

RE-RADIATED ENERGY:

1. Energy radiated **BACK** out to the environment or space FROM EARTH.
2. INTAKE - energy from the Sun (sunlight) is short wavelength radiation (**VISIBLE** wavelength).
3. This radiation is absorbed by the Earth's surface.
4. OUTPUT - It is then re-radiated back out towards space in the form of longer wavelengths – **INFRARED** radiation (heat energy).
5. The re-radiated energy from the earth is called **TERRESTRIAL RADITATION**.

THE GREENHOUSE EFFECT



1. Short wave radiation like VISIBLE LIGHT passes through the glass of a greenhouse and is ABSORBED by the objects inside the greenhouse.
2. These objects RE-READIATE the energy as INFRARED, which gets reflected back into the greenhouse and warms the air.

3. In Earth's atmosphere, there are many gases that act like the glass of a greenhouse and **TRAP** long-wave radiation, keeping it in the Earth's Atmosphere. These gases are:

- CO₂

- H₂O

- Methane

- Nitrous Oxide

- absorb infrared that is re-radiated from the surface of the Earth.

Therefore, holding that heat in the atmosphere and raising the global temperature.

4. These gases absorb infrared that is re-radiated from the surface of the Earth. Therefore, holding that heat in the atmosphere and raising the global temperature.
5. Without some greenhouse gases, the Earth would be too **HOT** for us to survive. But an overload of greenhouse gases creates a problem as well!