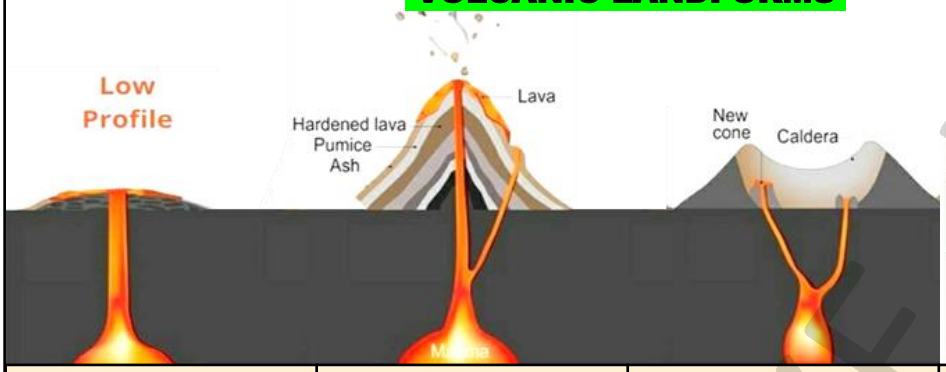
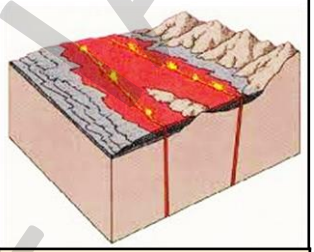
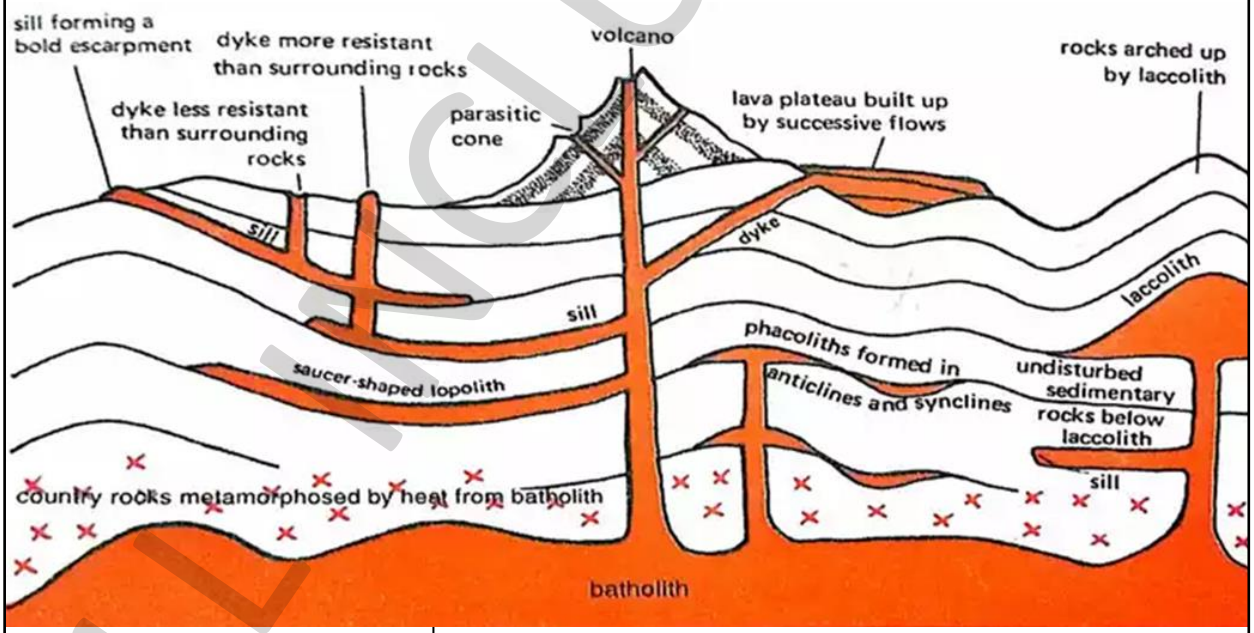
VOLCANIC LANDFORMS





Shield	Composite	Caldera	Flood Basalt
❑ Largest volcanoes ❑ Mostly of Basalt, so not steep ❑ Explosive if water enters vent ❑ Develops into cinder cone ❑ e.g. Hawaii	❑ Lava is cooler, viscous, forms layers ❑ Explosive eruptions (lava + ash + pyroclastic material)	❑ Most explosive volcano ❑ Collapses after exploding ❑ Collapsed depression is called caldera	❑ Very fluid lava covers thousands of sq. km of land ❑ e.g. Deccan traps covering most of Maharashtra



Lava cools to form igneous rocks:
- ❑ Lava cooled at surface forms Volcanic rocks
- ❑ Lava cooled in crust forms Plutonic rocks

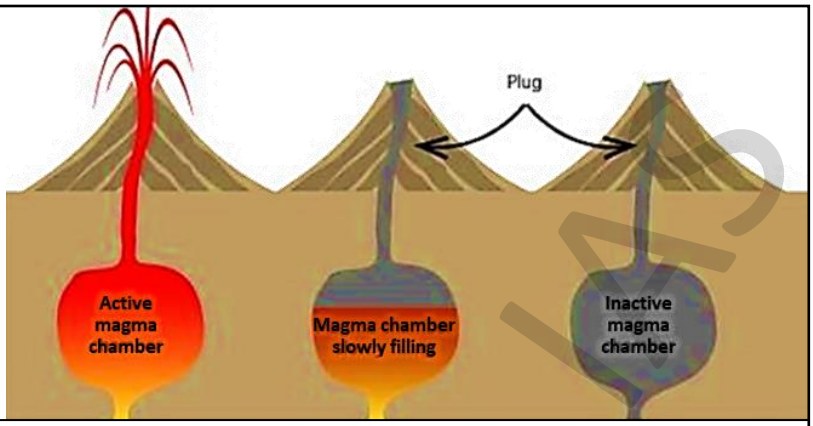
Intrusive landforms of igneous intrusions in volcanic regions
- ❑ Batholith: large cooled magma chamber, granitic in origin
- ❑ Laccolith: dome shape, level base (e.g. domal hills of Karnataka)
- ❑ Lopolith: saucer shape, concave to sky
- ❑ Sill: horizontal (sheet if thin)
- ❑ Dykes: vertical (e.g. feeder to Deccan traps)

Volcanoes can be classified as:

Active:
recent history of eruptions; likely to erupt again.

Dormant:
has not erupted for a very long time but may erupt in future

Extinct:
not expected to erupt in future



Prelims 2001

Consider the following statements:

1. Most magmas are a combination of liquid, solid and gas.
2. Water vapour and carbon dioxide are the principal gases dissolved in magma.
3. Basaltic magma is hotter than the silicic magma.
4. The magma solidified between sedimentary rocks in a horizontal position is known as dike.

Which of these statements are correct?

(a) 1, 2 and 3 (b) 2, 3 and 4 (c) 1 and 4 (d) 1, 2 and 4

Basic/Basaltic Lava

- ❑ Hotter, fluidic, less viscous, spreads as thin sheets, can travel long distance
- ❑ Dark colour, more iron/magnesium, less silica

Acidic/Andesitic Lava

- ❑ Cooler, less fluidic, more viscous, forms steep sides, obstructs flow resulting in loud explosion
- ❑ Light colour, less iron/magnesium, more silica

Correction: page-50
- 450 crore years ago → planet
- 400 crore years ago → oceans

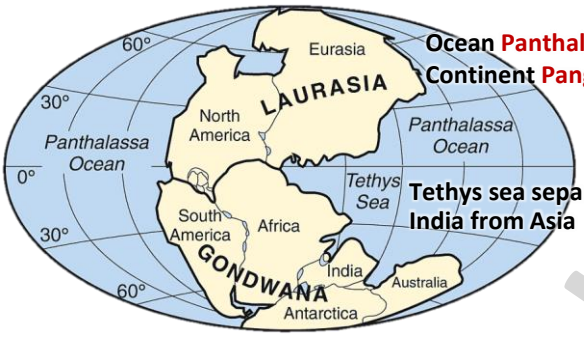
Correction: page-53
SIAL → Silica + Aluminium → Upper layer of crust
SIMA → Silica + Magnesium → Lower layer of crust

DISTRIBUTION OF OCEANS AND CONTINENTS

Theory	Associated people	Main idea
1912 Continental drift	Alfred Wegener	Continents drifted over oceans
1930 Convectional current	Arthur Holmes	Currents in Mantle provide force
1961 Sea floor spreading	Hess	Oceanic crust forms, moves away
1967 Plate tectonics	McKenzie, Parker, Morgan	Lithosphere (divided into plates) moves over Asthenosphere

Continental Drift Theory

- ❑ **Evidence:**
  - Symmetry of coastlines across Atlantic
  - Rocks of same age
  - Placer deposits of gold
  - Similar fossils
- ❑ **Force:** pole-fleeing force and tidal force.

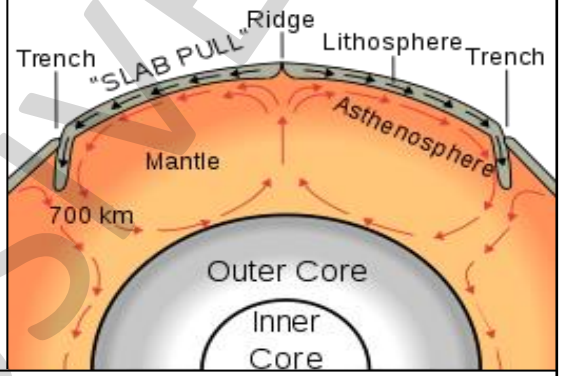


Ocean Panthalassa
Continent Pangaea

Tethys sea separated India from Asia

Convectional current theory

- ❑ Heat within earth creates convection cells.
- ❑ Source of heat:
  - Residual heat
  - Radioactive decay



Sea floor spreading

- ❑ Eruptions push oceanic crust on either side. It gets consumed at oceanic trenches.
- ❑ Rocks equidistant from ridge have similar chemical and magnetic properties.
- ❑ Ocean crust (200 million) is younger than continental crust (3 billion)

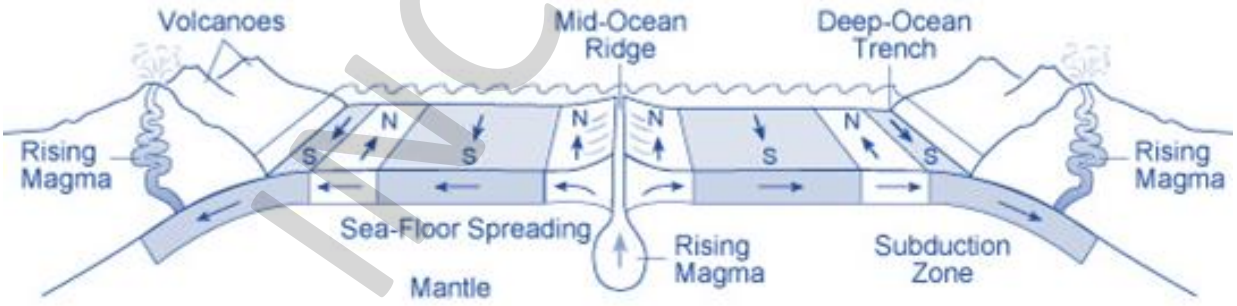
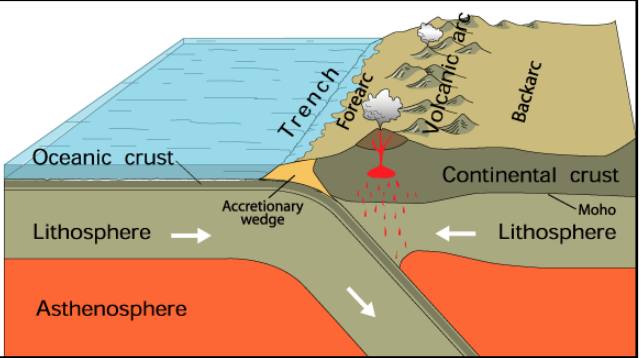
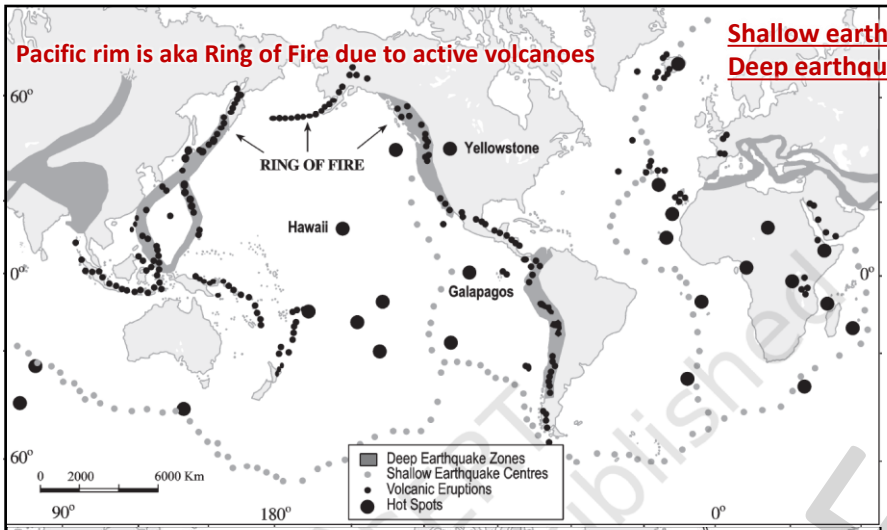


Plate Tectonic Theory

- ✓ Convection cells move tectonic plates over asthenosphere.
- ✓ Plates have both continental and oceanic lithosphere.
- ✓ It is the plates that move, not continents (Wegener believed continents moved)
- ✓ Position of peninsular India is traced by rocks from Nagpur area.





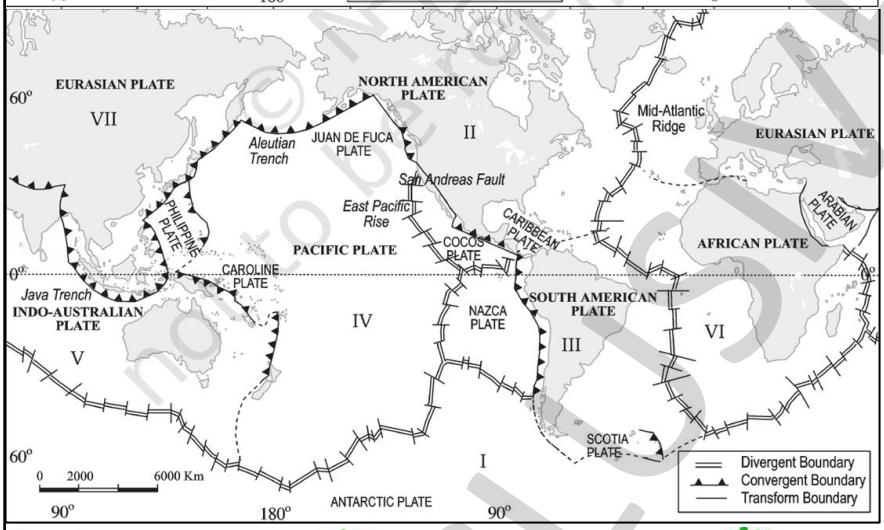
Shallow earthquakes at Mid-ocean ridges
Deep earthquakes at Mountains, Pacific rim

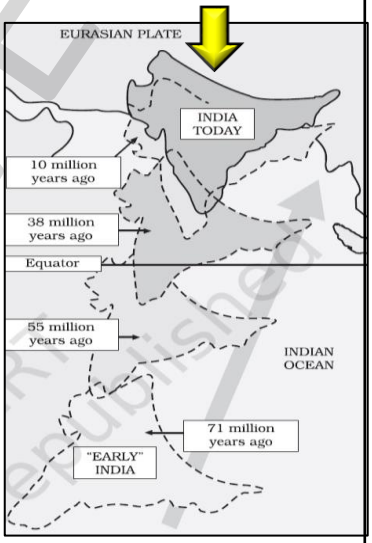
200 mya: (20 crore)
Pangea broke
India started moving north

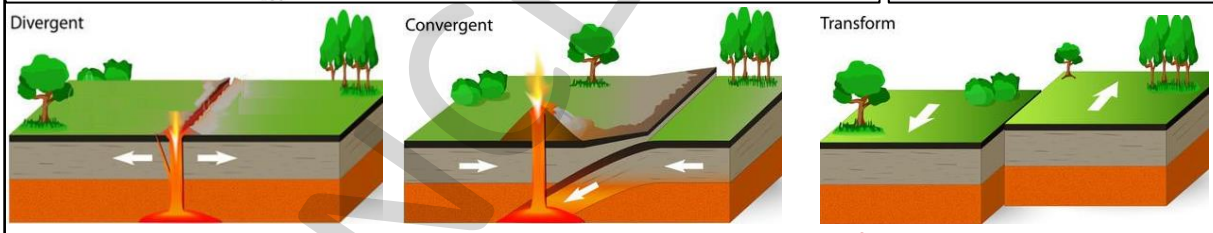
140 mya: (14 crore)
India at 50°S

60 mya: (6 crore)
Outpouring of lava
Deccan traps formed

40 mya: (4 crore)
India collided with Asia



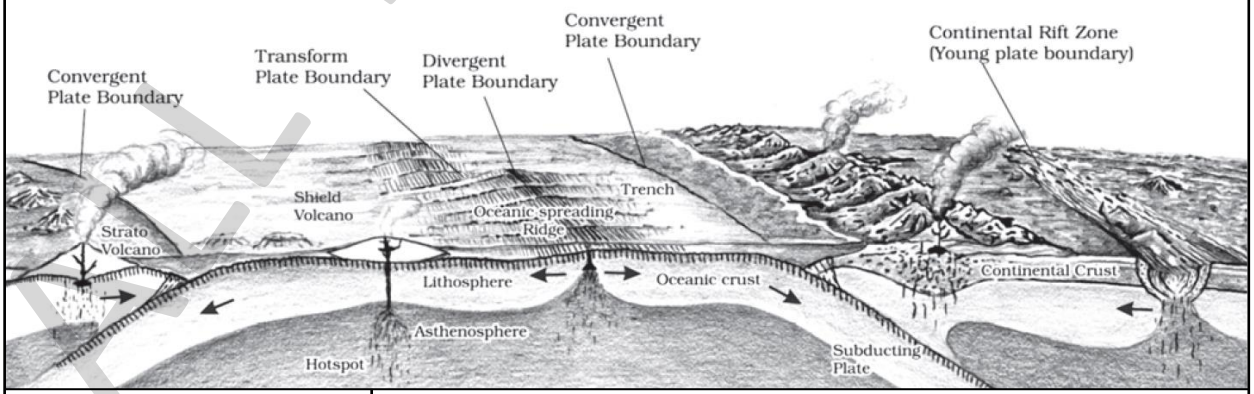




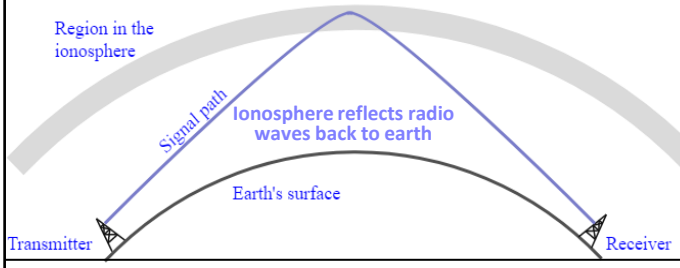
Divergent Boundaries
- aka spreading sites
- new crust is generated

Convergent Boundaries
- aka subduction zone
- crust is destroyed

Transform Boundaries
- Plates slide past each other
- Crust neither produced nor destroyed
- Volcanoes usually don't occur here



ATMOSPHERE



True but not the reason

Prelims 2011

A layer in Earth's atmosphere called ionosphere facilities radio communication. Why?

1. **The presence of ozone causes the reflection of radio waves to earth.**
2. **Radio waves have a very long wavelength.**

Which of the above statements are correct?

(a) 1 only **(b) 2 only**
(c) Both 1 and 2 **(d) Neither 1 nor 2**

Some facts:

- **99% of atmosphere's mass is within 32 km**
- **CO_2 and H_2O are found up to 90 km**
- **Oxygen is found up to 120 km**

Troposphere:

- **Variation of height:**
  - **18 km at equator, 8 km at poles**
  - **Convectional currents transport heat to great heights**
- **Normal lapse rate:**
  - **Fall of 6.5°C/km (or 1°C per 165 m)**

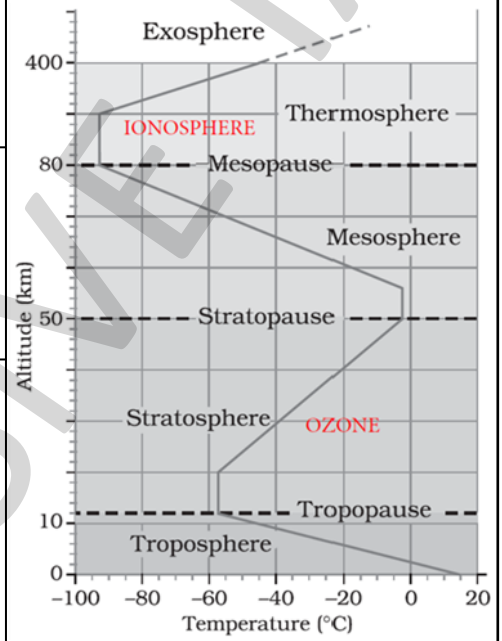
Prelims 2012

Normally temperature decreases with increase in height from earth's surface, because

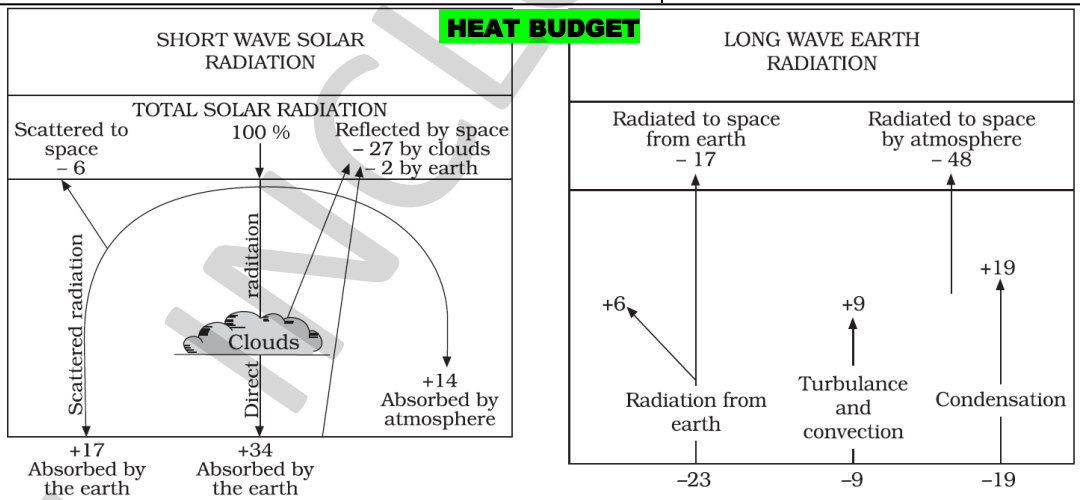
1. **atmosphere can be heated upwards only from Earth's surface**
2. **there is more moisture in upper atmosphere**
3. **air is less dense in upper atmosphere**

Select the correct answer:

(a) 1 only **(b) 2 and 3 only**
(c) 1 and 3 only **(d) 1, 2, 3**



HEAT BUDGET



Heat budget explains why earth neither warms up nor cools down naturally.

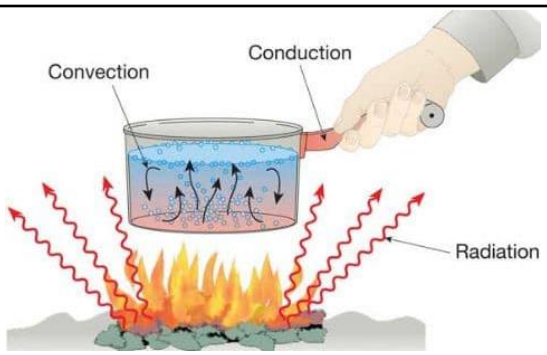
Greenhouse effect:

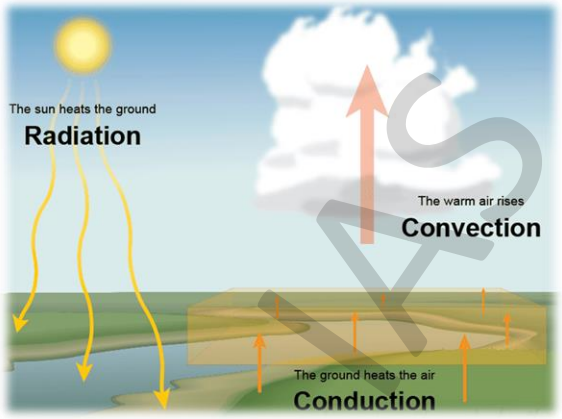
- **A natural phenomenon responsible for heating of earth's surface & atmosphere.**
- **Without it, earth's average temperature will be -18°C instead of present 15°C.**

How GHGs cause global warming?

- **Earth's surface absorbs short wave radiation and emits long wave radiation.**
- **GHGs are transparent to short-wave radiation, but absorb long wave radiation emitted by earth's surface.**

(Sun is extremely hot, so it emits short wave radiation. Earth is cool, so emits long wave radiation)





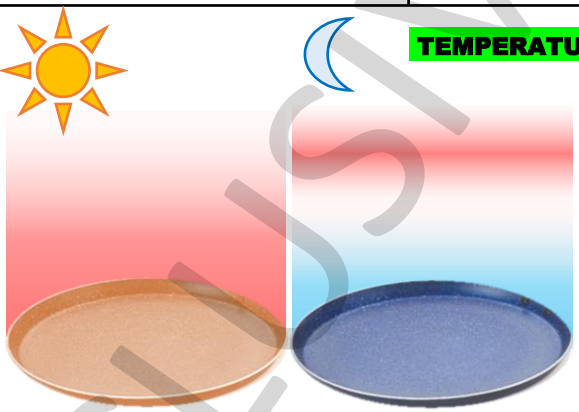
Conduction: Energy is transferred by direct contact
→ Air in contact with land gets heated
Convection: Energy is transferred by mass motion of molecules
→ Air rises and transfers heat to upper layers
Radiation: Energy is transferred by electromagnetic radiation
→ Energy from Sun heats up land

Advection: Transfer of heat by horizontal movement of air

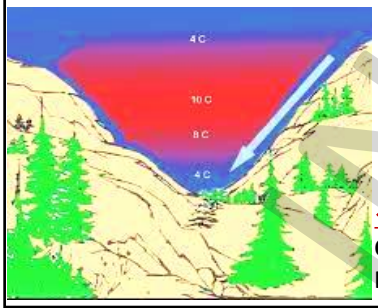
Prelims 1986
Atmospheric temperature increases at higher altitudes due to:
(a) Convection (b) Radiation
(c) Conduction (d) Inversion

TEMPERATURE INVERSION

- Sun heats up land (radiation)
- Land heats up air in contact with it (conduction)
- Lower layers heat up upper layers (convection)
- Result: Temperature falls with height (normal lapse rate)

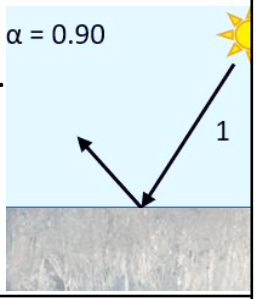


- If night is long, land gives up most of heat, becomes cool, makes air cool.
- If there are no clouds, heat will not reflect back to land.
- If air is still, there is no mixing of air masses.

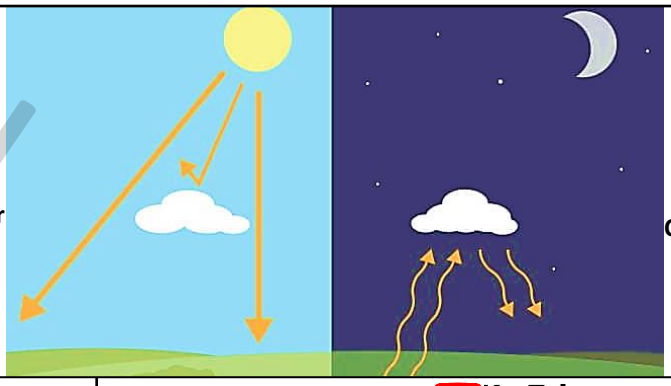


Inversion in Polar areas →
Inversion normally happens throughout the year.
Winters: no Sun, no heating of land, land radiates heat.
Summers: high albedo, land reflects most of the heat.

← Inversion in hills (Air Drainage):
Cold air moves down the slope, into valley.
It protects plants from frost damage.



Clouds make days cooler



Clouds make nights warmer

APPARENT MOVEMENT OF SUN

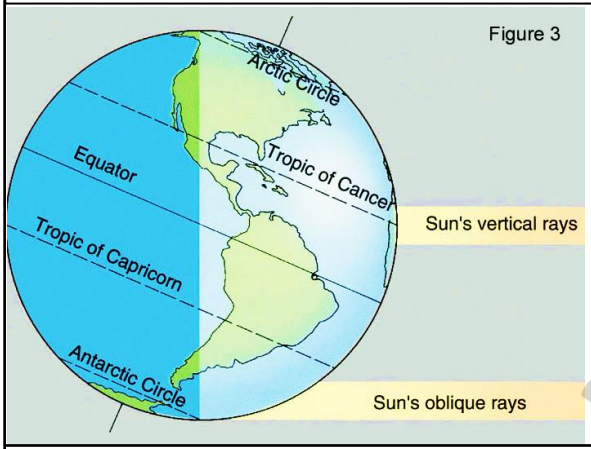
Zero shadow day:

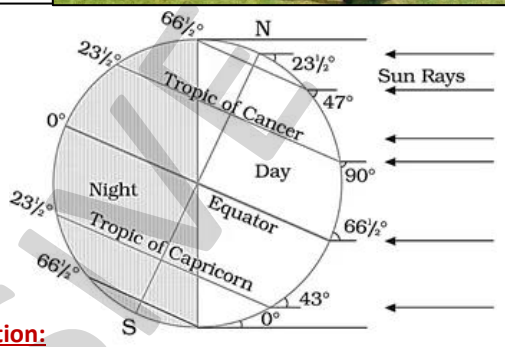
- ❑ happens twice a year for locations between +23.5 and -23.5 degrees of latitude.
- ❑ Date will vary for different locations on Earth.

Prelims 2019

On 21st June the sun

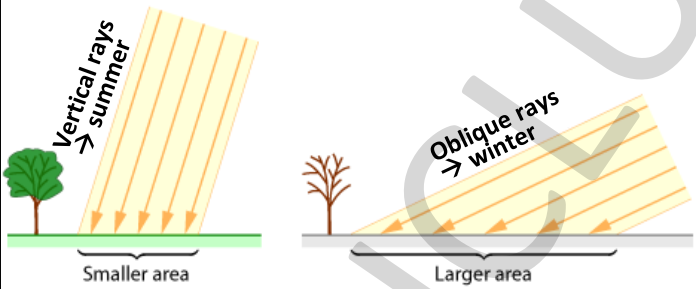
(a) Does not set below the horizon at the Arctic circle
(b) Does not set below the horizon at Antarctic circle
(c) Shines vertically overhead at noon on the Equator
(d) Shines vertically overhead at the tropic of Capricorn





Insolation:

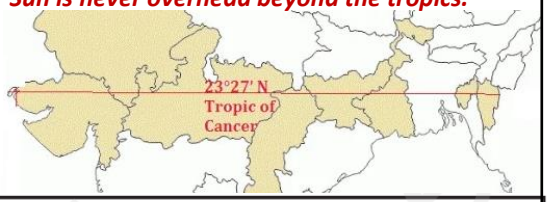
- Varies from 320 Watt/m² in tropics to 70 in poles
- Maximum at subtropical deserts (as cloudiness is least)
- At same latitude, it is more on continent than ocean



Sun shines vertically overhead at :

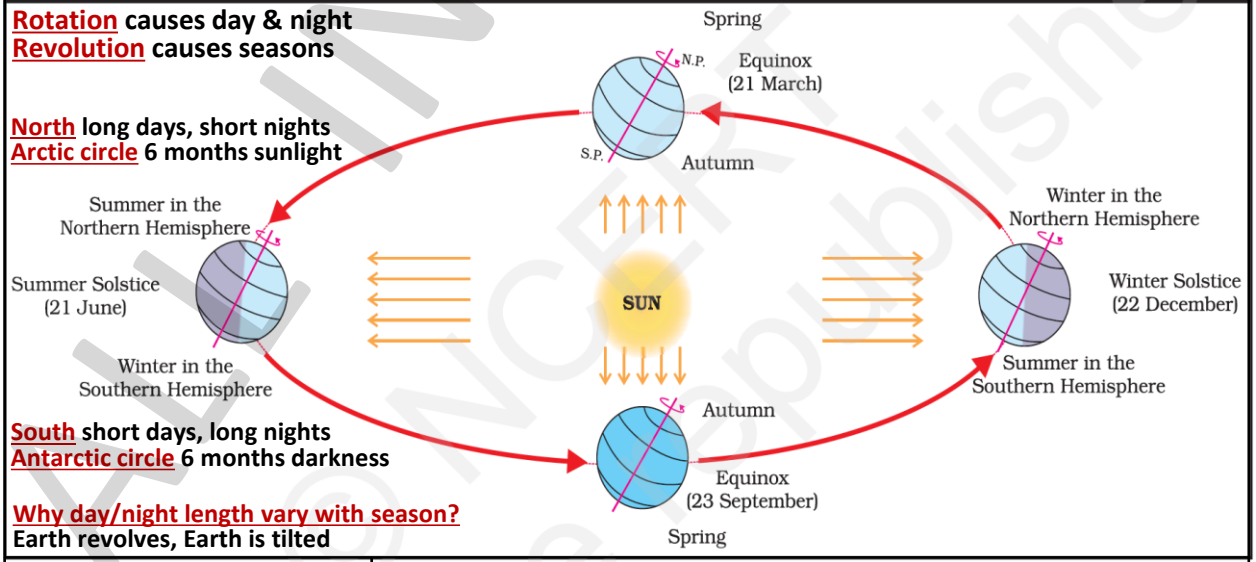
(a) Tropic of Cancer on 21st June
(b) Tropic of Capricorn on 22nd December
(c) Equator on 21st March & 23rd September

Sun is never overhead beyond the tropics.



Rotation causes day & night
Revolution causes seasons

North long days, short nights
Arctic circle 6 months sunlight



South short days, long nights
Antarctic circle 6 months darkness

Why day/night length vary with season?
Earth revolves, Earth is tilted