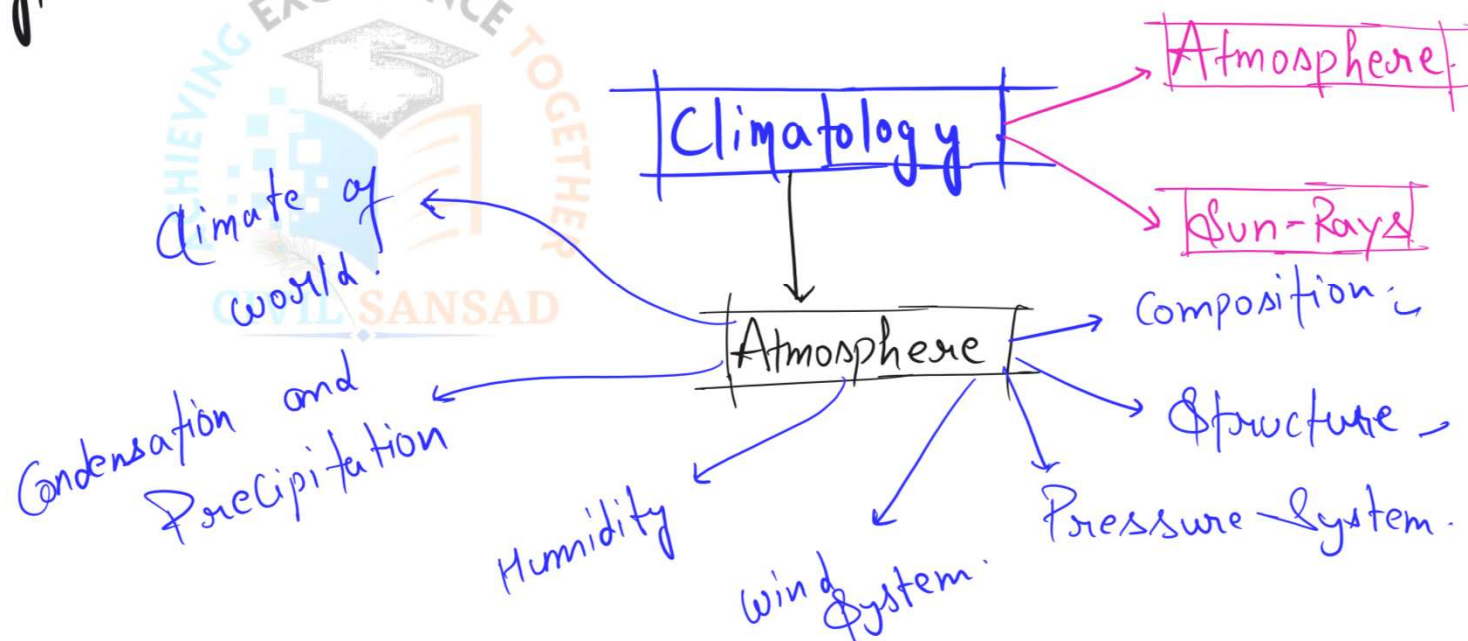
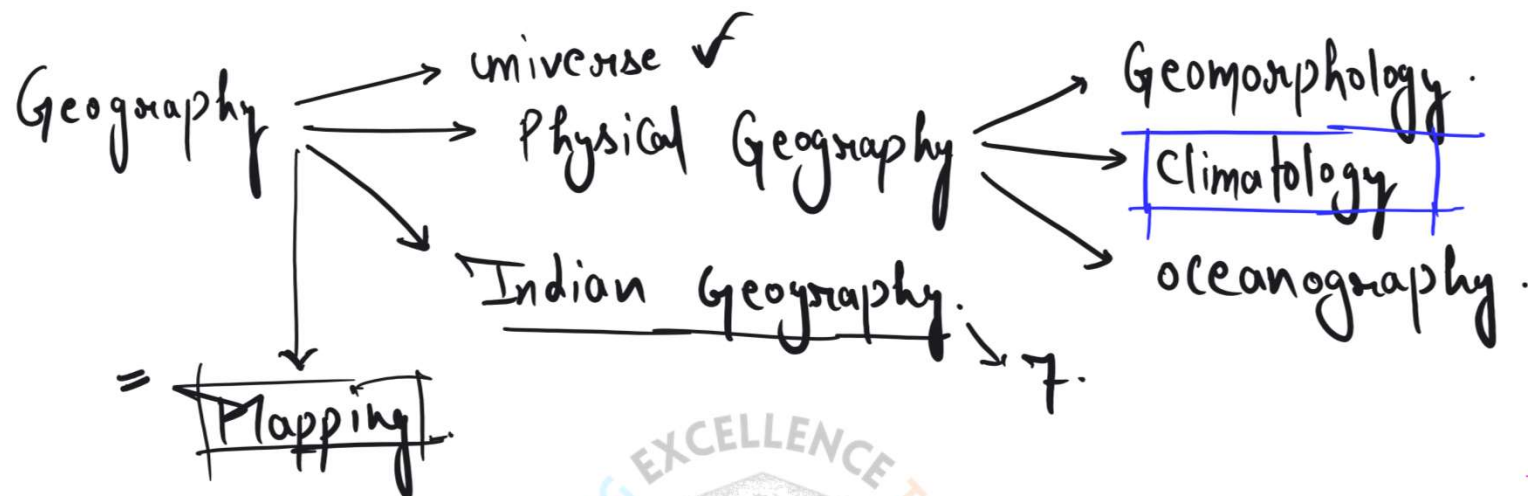




Composition and Structure of Atmosphere

Air / wind

Atmosphere

→ Sphere of Air around Earth.

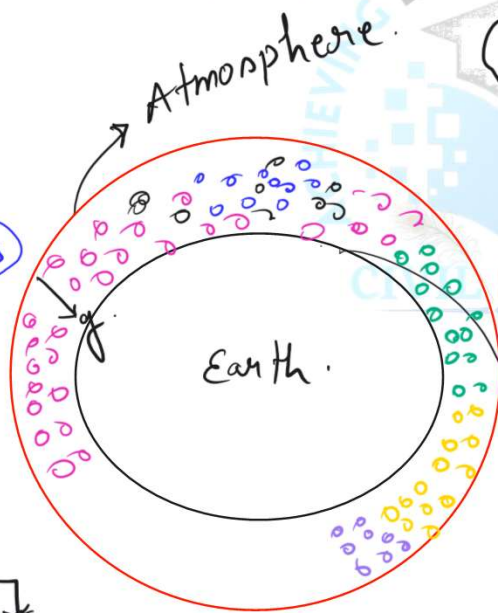
behaves like as "attracted towards Earth"
 like Glass House
 Avg. Temp 15°C
 Due to Gravity.

$$P = \frac{F}{A}$$

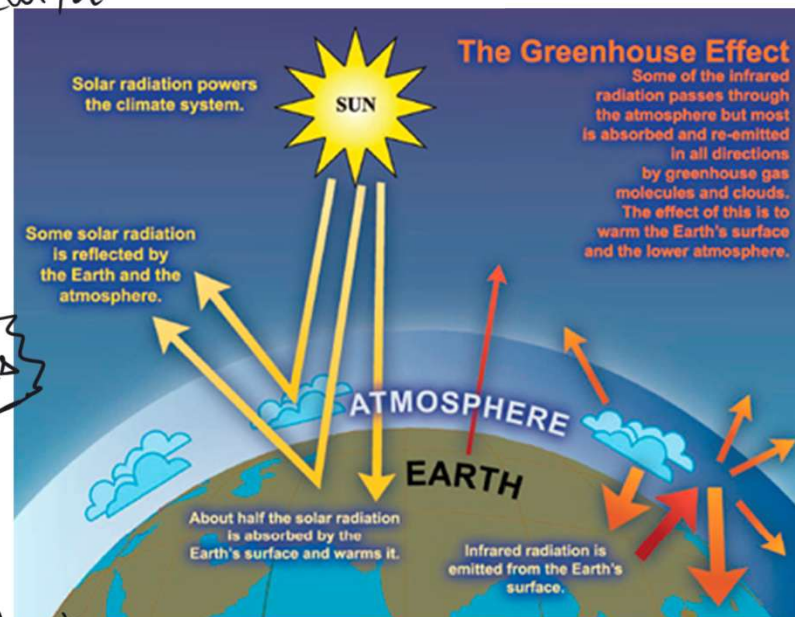
more air molecules
 ↓
 "more air pressure"

$$F = m \times g$$

Air molecules



Heat
 { Air molecules



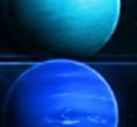
Atmospheric Pressure
 ↓
 decreases as we move vertically upward.
 → Sparse.
 = As we move vertically upward density of air decreases.
 Dense.
 Earth's Surface.

If we remove atmosphere from Earth $\Rightarrow$ Extreme Temperatures

very Hot $\swarrow$ $\searrow$ very cold

Highest Range of Temp.

$\hookrightarrow$ Earth's atmosphere moderates temp. on Earth.

	MERCURY 🌡️ 167°C	Average temperature. 430°C in daylight. Around -180°C at night.
	VENUS 🌡️ 464°C	Hottest planet. Dense atmosphere traps heat.
	EARTH 🌡️ 15°C	Average global surface temperature.
	MARS 🌡️ -65°C	Cold desert world. Thin atmosphere.
	JUPITER 🌡️ -110°C	Cloud top temperature. Violent storms.
	SATURN 🌡️ -140°C	Cloud top temperature. Powerful winds.
	URANUS 🌡️ -195°C	One of the coldest planetary atmospheres.
	NEPTUNE 🌡️ -200°C	Cloud top temperature. Supersonic winds.

Composition

Primary Gases

Ratio is fixed in atmosphere.

Ex. $N_2, O_2, Argon$

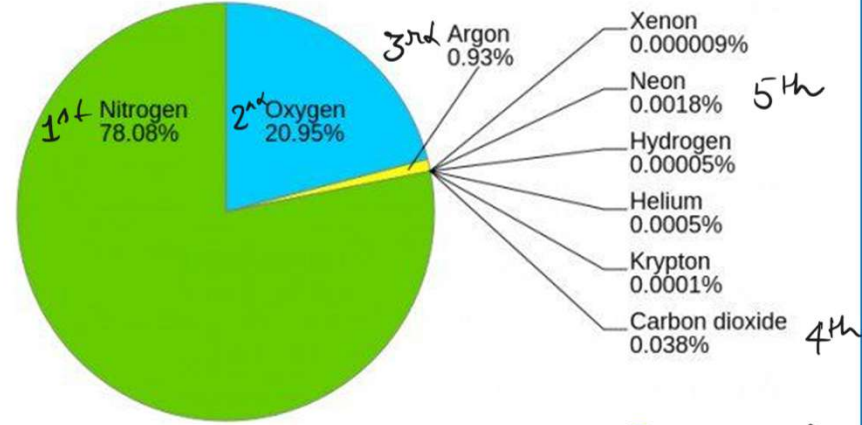
Inert Gases

Secondary Gases

Variable ratio in atmosphere.

Ex. all other than Primary Gases.

Water vapour → most variable Gas of atmosphere



N_2, O_2, Ar, CO_2, Ne
H₂O (w.v.)

Heavy Gases
↓
found near Earth Surface

we found lighter Gases in above atmosphere

- Note :-
- ① 90% of water vapour is found upto 8 kms in atmosphere.
 - ② CO₂ found upto 90 kms in atmosphere
 - ③ O₂ found upto 120 kms in atmosphere

N → 7 → 14
At. No. Atm. Mass

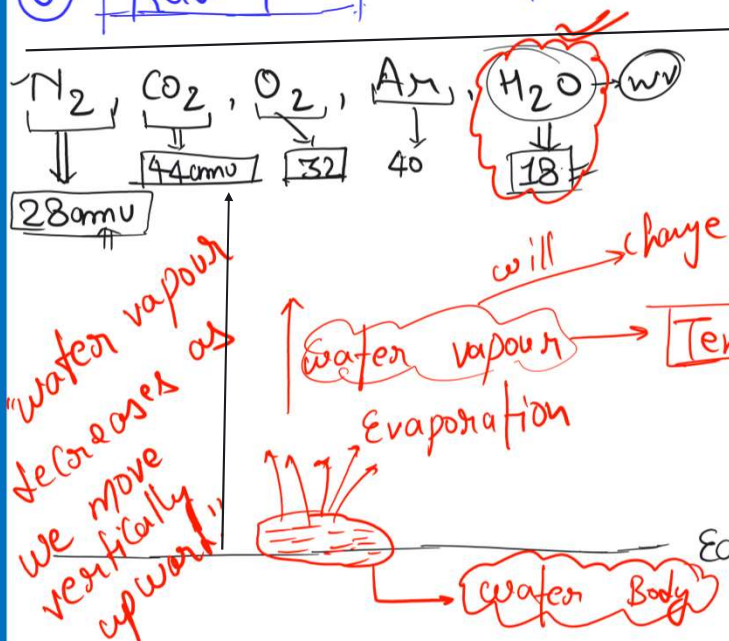
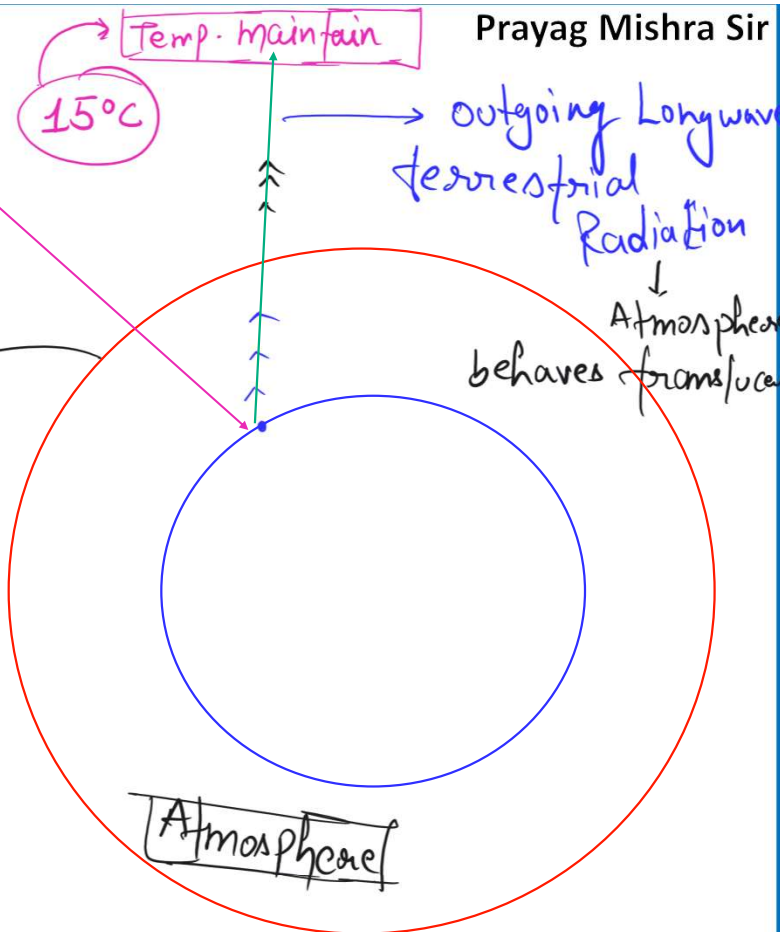
Prayag Mishra Sir

Methods of Heat Transfer.

- ① Conduction → metals
- ② Convection → Fluids.
- ③ Radiation → No medium.

✓ Incoming Short wave
Solar Radiation.

Atmosphere
behaves transparent
for Incoming
Solar Radiation.



- Q. our atmosphere heated due to
- ① Inc. S. Radiation
 - ② out. Terre. Radiation
 - ③ Both.

Alkali Metal

Alkaline Earth Metal

Transition Metal

Lanthanide

Actinide

Metal

Metalloid

Nonmetal

Halogen

Noble Gas

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57-71

72

73

74

75

76

77

78

79

80

81

82

83

84

85

86

87

88

89-103

104

105

106

107

108

109

110

111

112

113

114

115

116

117

118

119

120

121

122

123

124

125

126

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141

142

143

144

145

146

147

148

149

150

151

152

153

154

155

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171

172

173

174

175

176

177

178

179

180

181

182

183

184

185

186

187

188

189

190

191

192

193

194

195

196

197

198

199

200

201

202

203

204

205

206

207

208

209

210

211

212

213

214

215

216

217

218

219

220

221

222

223

224

225

226

227

228

229

230

231

232

233

234

235

236

237

238

239

240

241

242

243

244

245

246

247

248

249

250

251

252

253

254

255

256

257

258

259

260

261

262

263

264

265

266

267

268

269

270

271

272

273

274

275

276

277

278

279

280

281

282

283

284

285

286

287

288

289

290

291

292

293

294

295

296

297

298

299

300

301

302

303

304

305

306

307

308

309

310

311

312

313

314

315

316

317

318

319

320

321

322

323

324

325

326

327

328

329

330

331

332

333

334

335

336

337

338

339

340

341

342

343

344

345

346

347

348

349

350

351

352

353

354

355

356

357

358

359

360

361

362

363

364

365

366

367

368

369

370

371

372

373

374

375

376

377

378

379

380

381

382

383

384

385

386

387

388

389

390

391

392

393

394

395

396

397

398

399

400

401

402

403

404

405

406

407

408

409

410

411

412

413

414

415

416

417

418

419

420

421

422

423

424

425

426

427

428

429

430

431

432

433

434

435

436

437

438

439

440

441

442

443

444

445

446

447

448

449

450

451

452

453

454

455

456

457

458

459

460

461

462

463

464

465

466

467

468

469

470

471

472

473

474

475

476

477

478

479

480

481

482

483

484

485

486

487

488

489

490

491

492

493

494

495

496

497

498

499

500

501

502

503

504

505

506

507

508

509

510

511

512

513

514

515

516

517

518

519

520

521

522

523

524

525

526

527

528

529

530

531

532

533

534

535

536

537

538

539

540

541

542

543

544

545

546

547

548

549

550

551

552

553

554

555

556

557

558

559

560

561

562

563

564

565

566

567

568

569

570

571

572

573

574

575

576

577

578

579

580

581

582

583

584

585

586

587

588

589

590

591

592

593

594

595

596

597

598

599

600

601

602

603

604

605

606

607

608

609

610

611

612

613

614

615

616

617

618

619

620

621

622

623

624

625

626

627

628

629

630

631

632

633

634

635

636

637

638

639

640

641

642

643

644

645

646

647

648

649

650

651

652

653

654

655

656

657

658

659

660

661

662

663

664

665

666

667

668

669

670

671

672

673

674

675

676

677

678

679

680

681

682

683

684

685

686

687

688

689

690

691

692

693

694

695

696

697

698

699

700

701

702

703

704

705

706

707

708

709

710

711

712

713

714

715

716

717

718

719

720

721

722

723

724

725

726

727

728

729

730

731

732

733

734

735

736

737

738

739

740

741

742

743

744

745

746

747

748

749

750

751

752

753

754

755

756

757

758

759

760

761

762

763

764

765

766

767

768

769

770

771

772

773

774

775

776

777

778

779

780

781

782

783

784

785

786

787

788

789

790

791

792

793

794

795

796

797

798

799

800

801

802

803

804

805

806

807

808

809

810

811

812

813

814

815

816

817

818

819

820

821

822

823

824

825

826

827

828

829

830

831

832

833

834

835

836

837

838

839

840

841

842

843

844

845

846

847

848

849

850

851

852

853

854

855

856

857

858

859

860

861

862

863

864

865

866

867

868

869

870

871

872

873

874

875

876

877

878

879

880

881

882

883

884

885

886

887

888

889

890

891

892

893

894

895

896

897

898

899

900

901

902

903

904

905

906

907

908

909

910

911

912

913

914

915

916

917

918

919

920

921

922

923

924

925

926

927

928

929

930

931

932

933

934

935

936

937

938

939

940

941

942

943

944

945

946

947

948

949

950

951

952

953

954

955

956

957

958

959

960

961

962

963

964

965

966

967

968

969

970

971

972

973

974

975

976

977

978

979

980

981

982

983

984

985

986

987

988

989

990

991

992

993

994

995

996

997

998

999

1000

Alkali Metal

Transition Metal

Actinide

Metalloid

Halogen

Alkaline Earth Metal

Lanthanide

Metal

Nonmetal

Noble Gas

Periodic Table of Elements

1

2

3

4

5

6

7

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

2

3

4

5

6

7

8

9

10

11

12

13

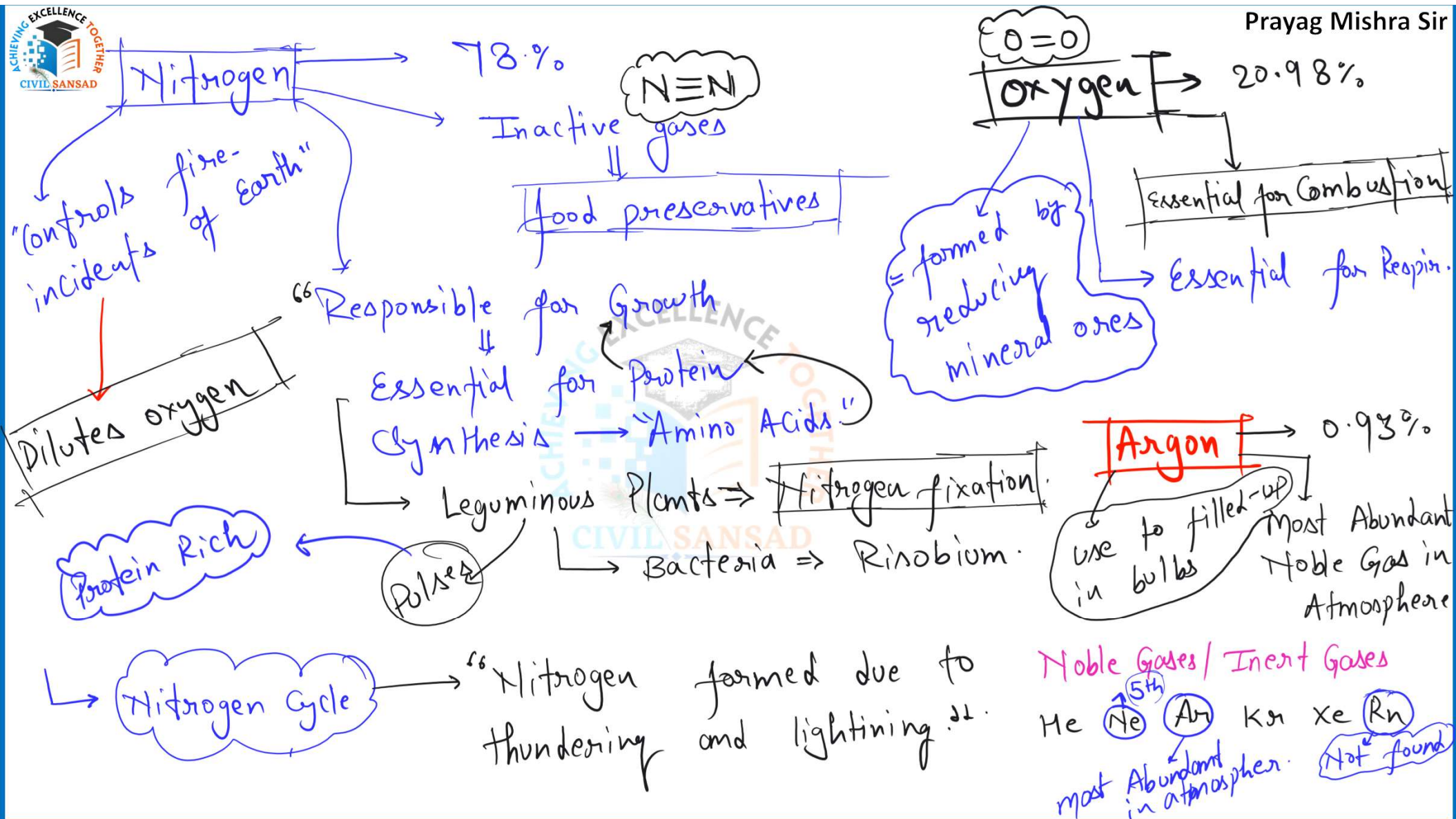
14

15

16

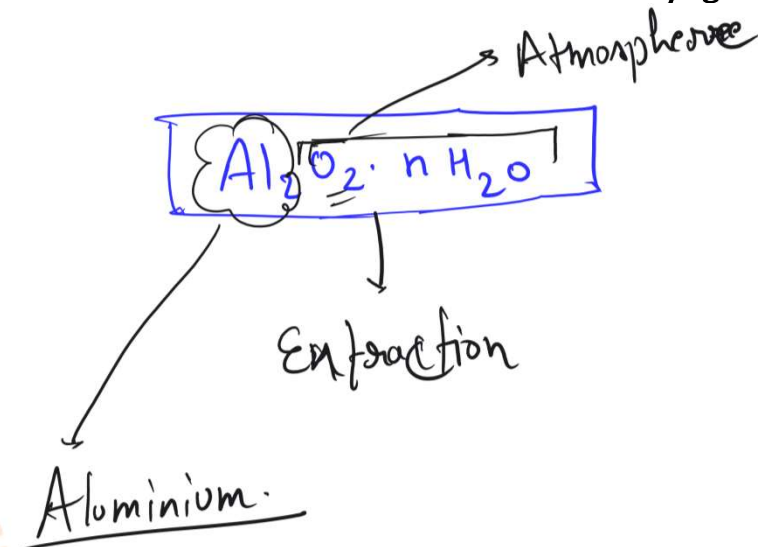
17

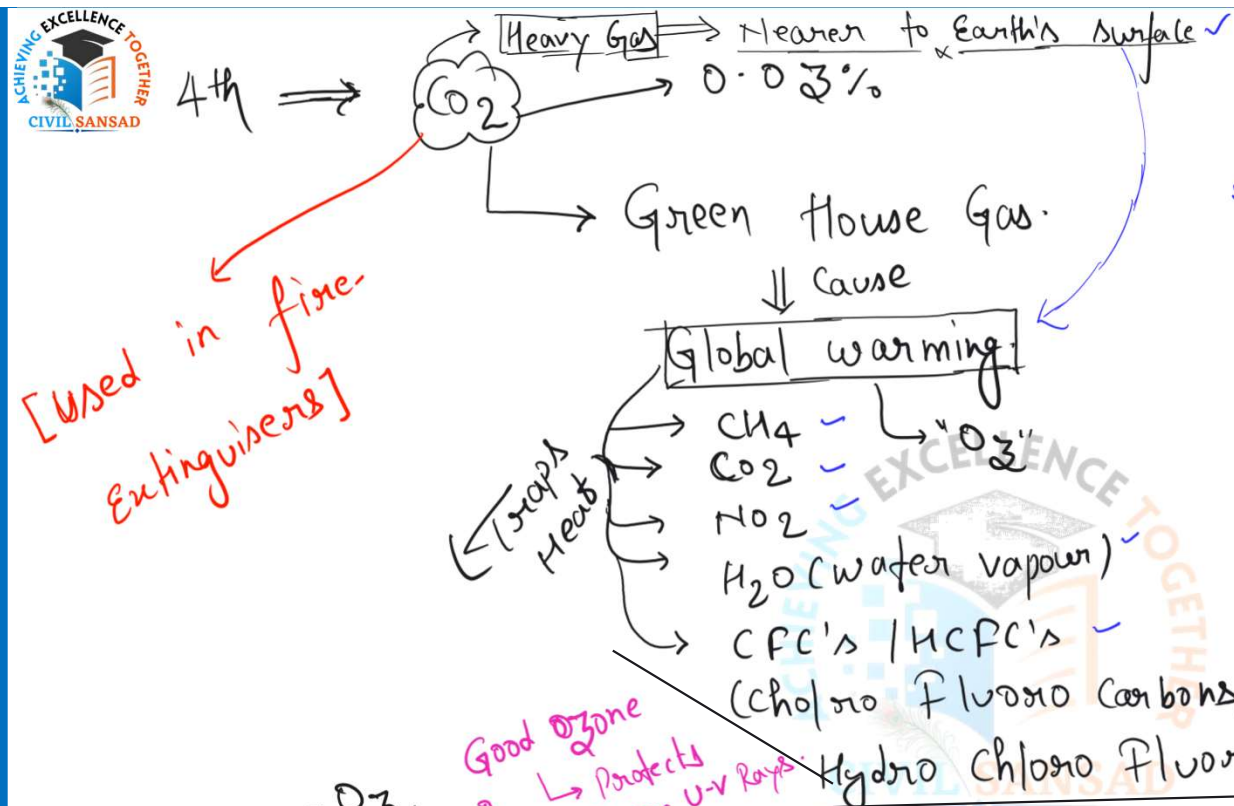
1



Metal	Ore	Composition	Metal	Ore	Composition
Aluminum	Bauxite	$Al_2O_3 \cdot nH_2O$	Zinc	Zinc blende or Sphalerite	ZnS
	Diaspore	$Al_2O_3 \cdot H_2O$		Calamine	$ZnCO_3$
	Kaolinite	$Al_2Si_2O_5(OH)_4$		Zincite	ZnO
Iron	Haematite	Fe_2O_3	Lead	Galena	PbS
	Magnetite	Fe_3O_4		Anglesite	$PbSO_4$
	Siderite	$FeCO_3$		Cerrusite	$PbCO_3$
	Iron pyrite	FeS_2	Tin	Cassiterite (Tin stone)	SnO_2
	Limonite	$Fe_2O_3 \cdot 3H_2O$		Silver glance (Argentite)	Ag_2S
Copper	Copper pyrite	$CuFeS_2$	Silver	Pyrargyrite (Ruby silver)	Ag_3SbS_3
	Copper glance	Cu_2S		Chlorargyrite (Horn Silver)	$AgCl$
	Cuprite	Cu_2O		Stefinite	Ag_2SbS_4
	Malachite	$CuCO_3 \cdot Cu(OH)_2$		Prousitite	Ag_2AsS_3
	Azurite	$2CuCO_3 \cdot Cu(OH)_2$			

TOGETHER



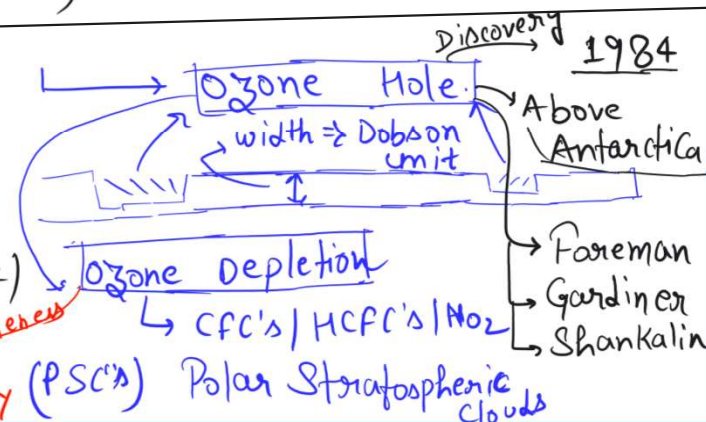
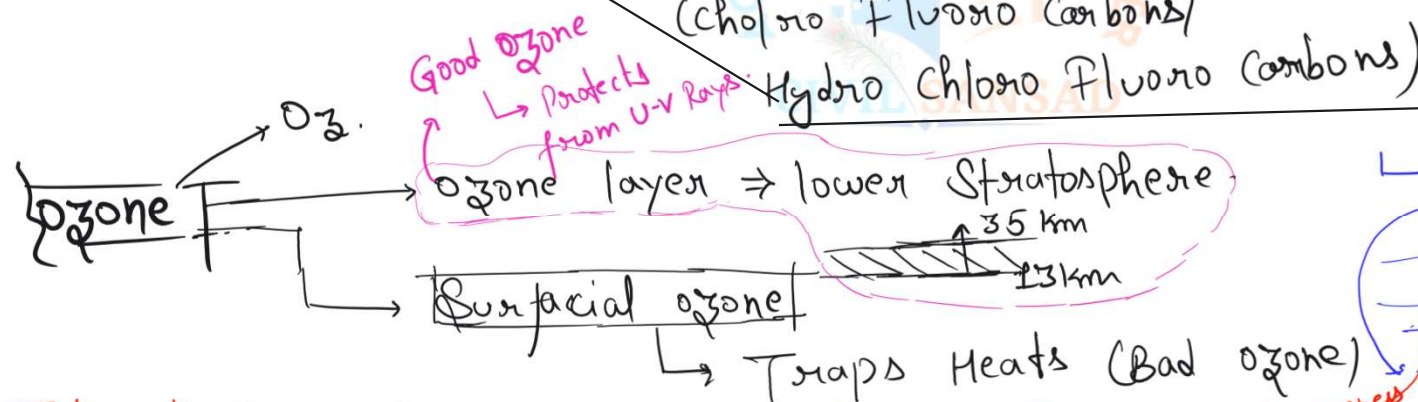


Emissions $\rightarrow$ Control

= ① Kyoto Protocol (1997)

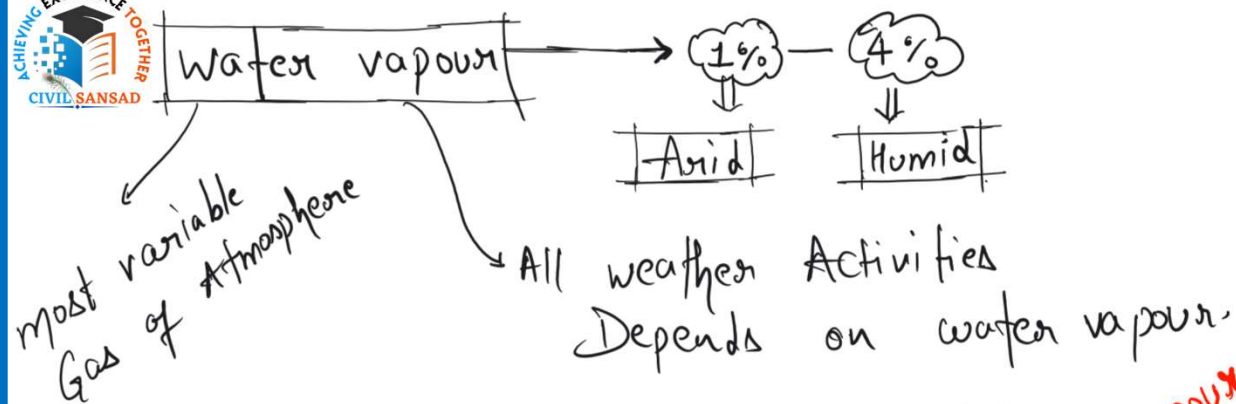
= ② Paris Climate Action (2015)

Note:- 5th most Abundant Gas in atmosphere is Neon.



International Convention $\Rightarrow$ ① Montreal Protocol (1987)

② Kigali Treaty (2016)



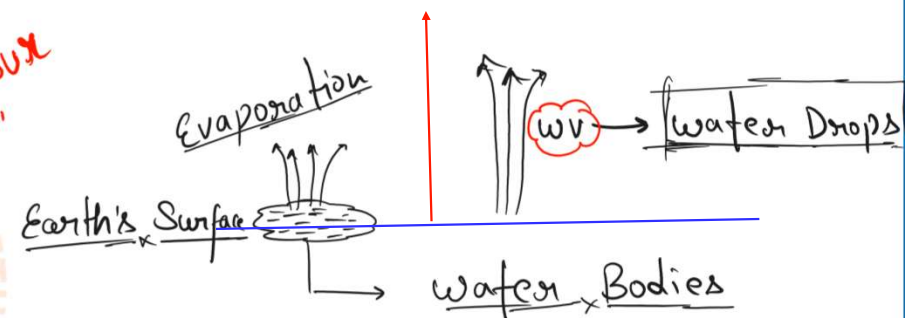
* water vapour → Temp ↑
└→ more vapour.

① Equator → Pole } "water vapour decreases."
② vertically upward.

→ 90% of water vapour is found upto 8kms in atmosphere.

→ Halo Effect due to water Drops and Ice Crystals

→ Rainbow effect



Aerosols → Solid Particles + water Drops

They are necessary for rainfall.

Scattering of light → Blue Sky

Structure of Atmosphere.

on the basis of Temperature

Exosphere	800 kms	Temp. Rapidly increases.
Ionosphere	400 kms / 320 kms	Temp. Increases.
Mesosphere	80 kms	Temp. decreases.
Stratosphere	50 kms	Temp. is constant.
Troposphere	13 kms	Temp. Decreases

Earth's Surface.

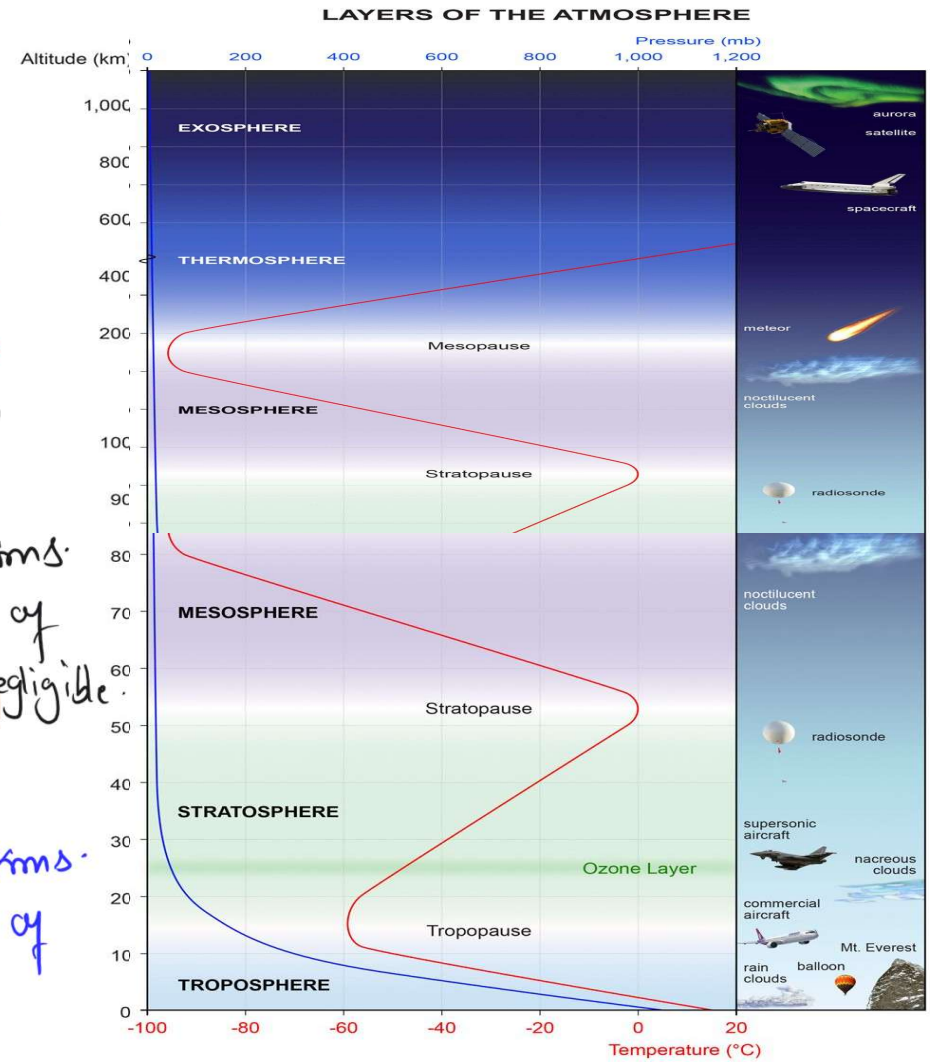
on the basis of Composition

Homosphere

upto 90 kms.
variability of Gases is negligible.

Heterosphere

above 90 kms.
variability of Gases.

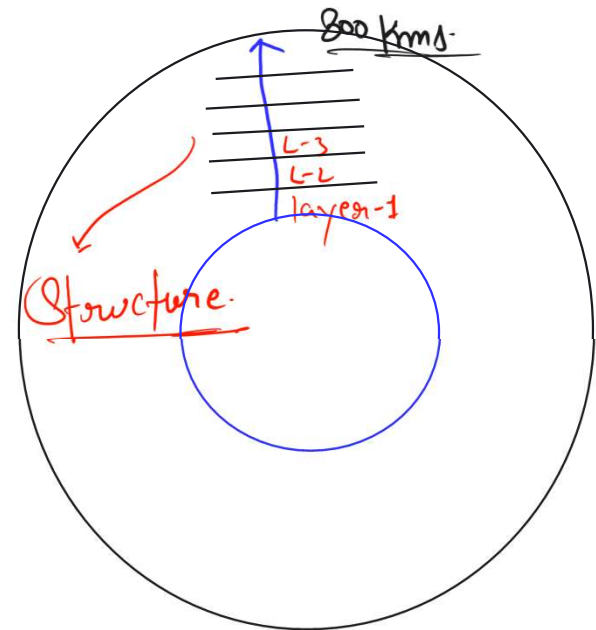


Earth's atmosphere.

↓ Extended.

Invariably very high but thins as we move vertically upward??

"We studied out atmosphere till 800 kms."



① Troposphere

Note: If we move vertically upward by 165mts $\Rightarrow$ 1°C temp. decreases.

Avg. Height $\Rightarrow$ 13Kms.

(Tropopause)

1km $\rightarrow$ 6.5°C

165mts $\rightarrow$ 1°C $\Rightarrow$ Normal lapse rate / Environment lapse Rate.

$\rightarrow$ In troposphere winds are horizontal as well as vertical.

$\rightarrow$ "Most Dense layer of Atmosphere." $\rightarrow$ Not easy to fly.

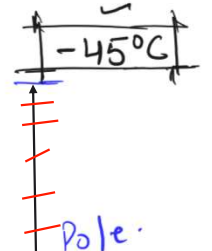
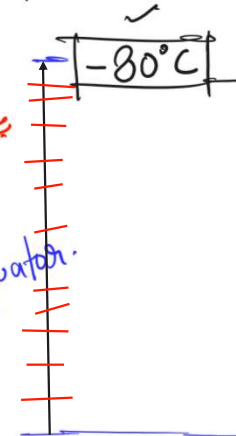
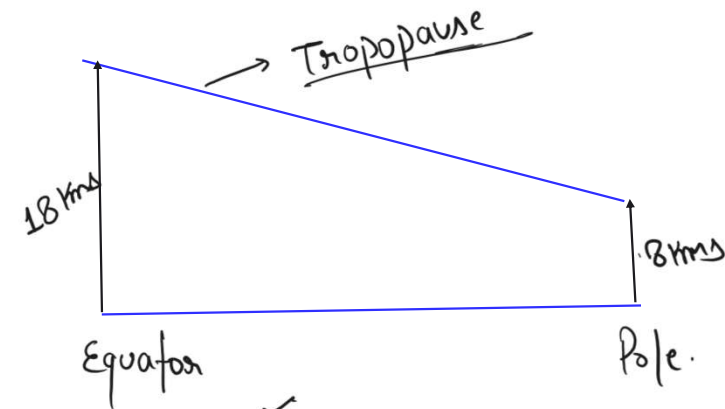
75%

All weather Activities cause in this layer.

Heat $\rightarrow$ Expand

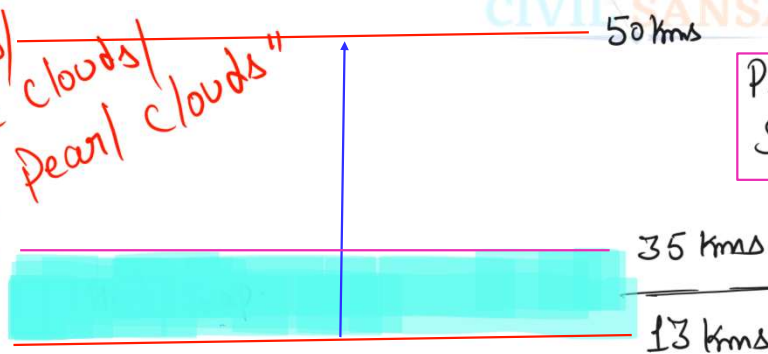
$\Rightarrow$ Troposphere is high on Equator (18kms) and low on Poles (8kms).

Q. on Tropopause at Equator and Pole, where temperature is high? $\Rightarrow$ on Poles



2. Stratosphere $\rightarrow$ Temp. is Constant or lightly increasing $\Rightarrow$ Flying is Easy (Horizontal winds)

"Nacreous clouds/
Stratospheric clouds/
Mother of Pearl clouds"



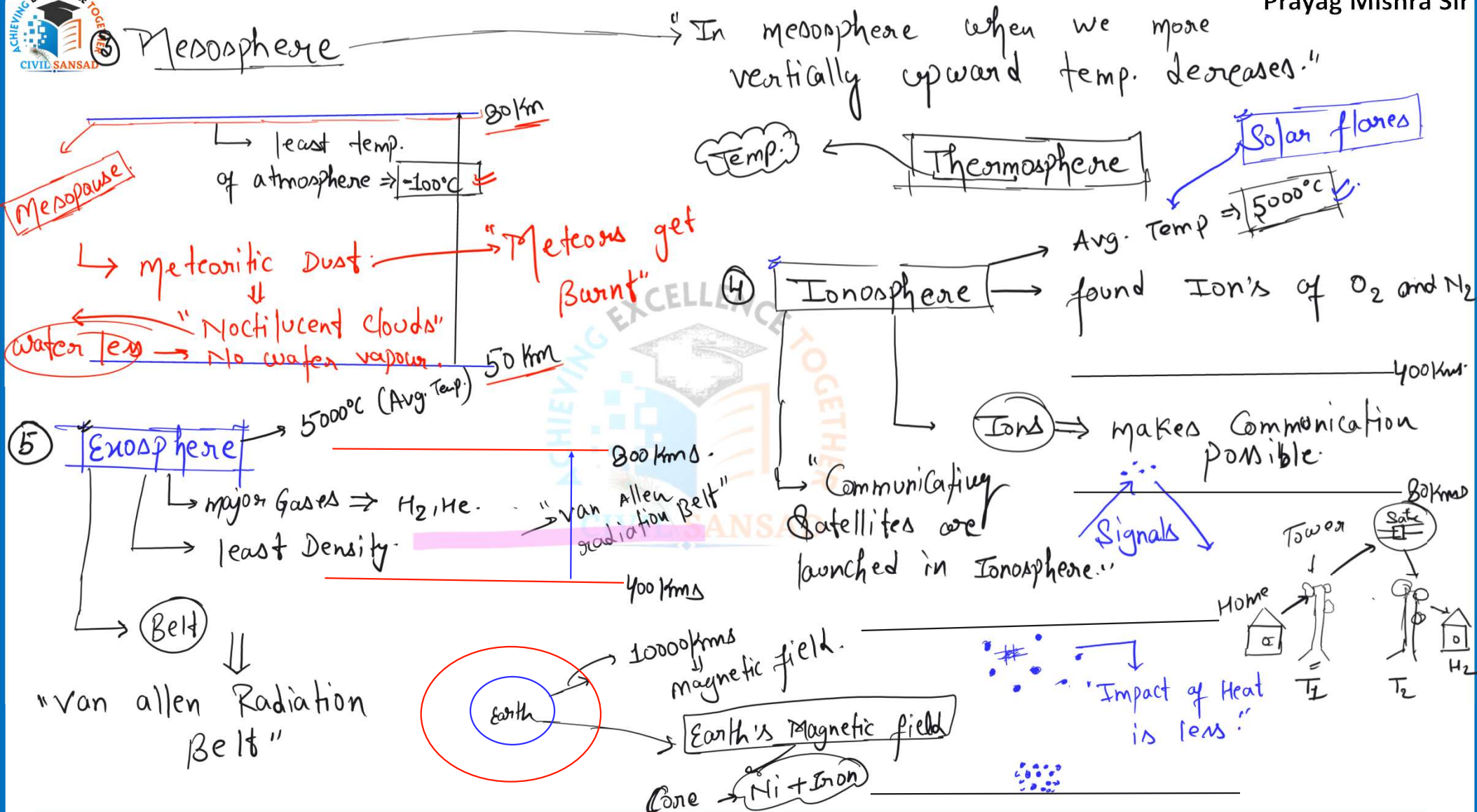
PSC's $\rightarrow$ Surface $\Rightarrow$ Sulphur.

"Depletion of Ozone"

Ozone layer

Lower Stratosphere

Protects us from U-V rays



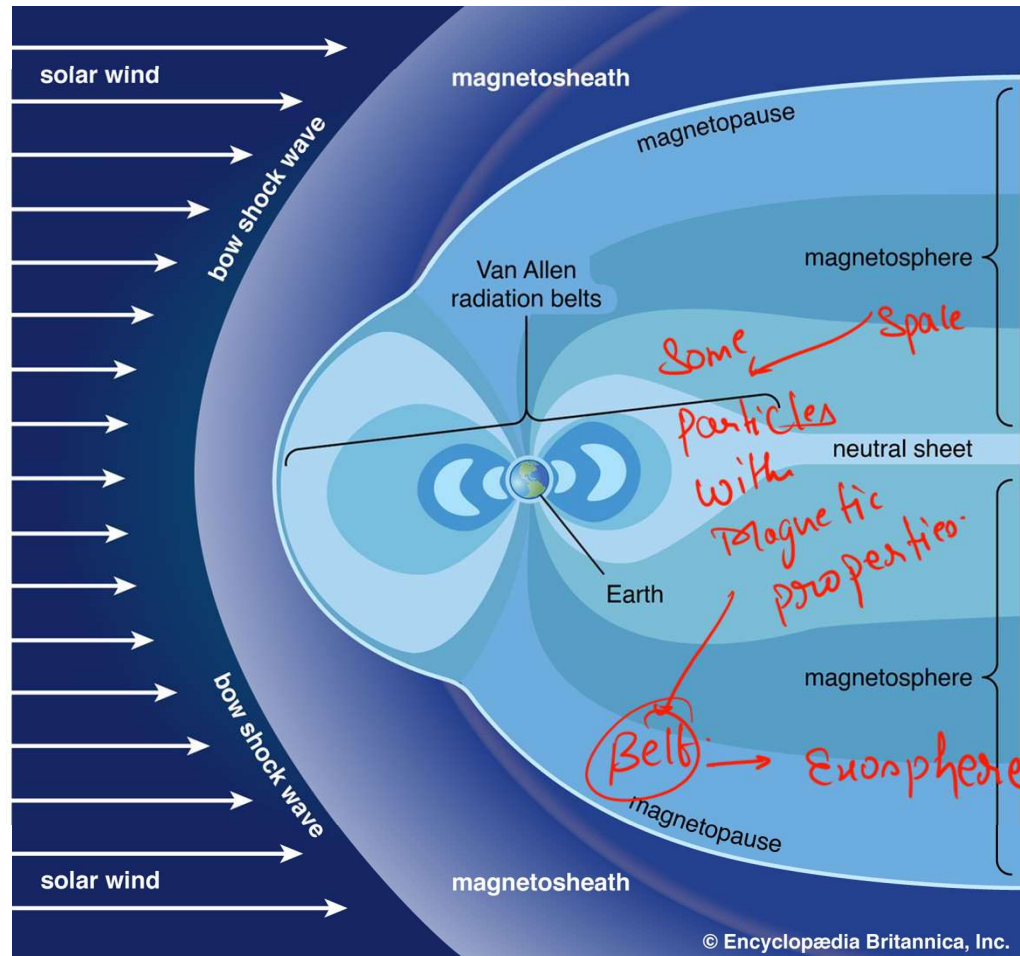
Fe + Ni → Molten State

↓

"Rotating inside the Earth."

↓

upto 10000 kms



"Due to Earth's Magnetic field"

↓

"magnetic particles or Radiations"

↓

Belt

Atmosphere Pressure

Due to

Air Molecules

unit

"Force due to Gravity of Air Molecules Per unit area is called Atmospheric Pressure."

Troposphere

"Mercury"

Borometer

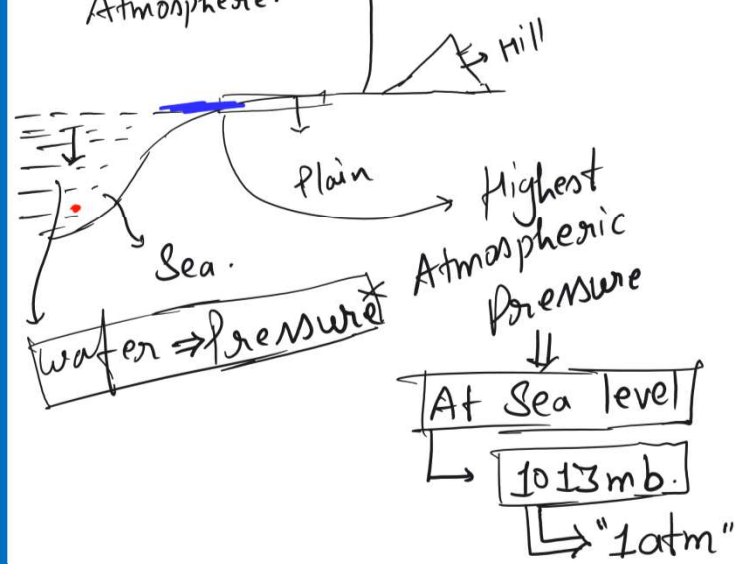
Fortins

Aneroid
Spring

$$P = \frac{F}{A}$$

Pascal, mb, Torr, atm.

Atmosphere.



Distribution of atmospheric Pressure.

- ① Vertical Distribution
- ② Horizontal Distribution.

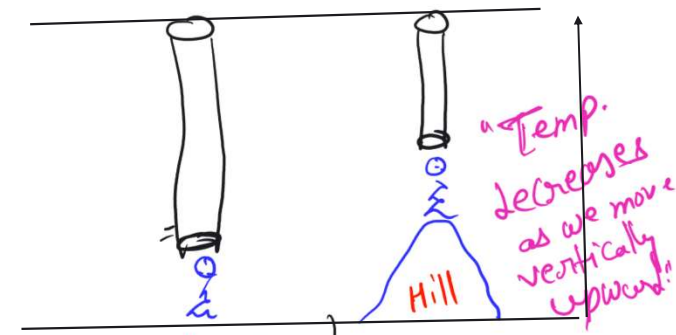
"Vertical Distribution of Atm. Pressure"

Examples
① uncle chips.
② Human body ⇒ Bleeding

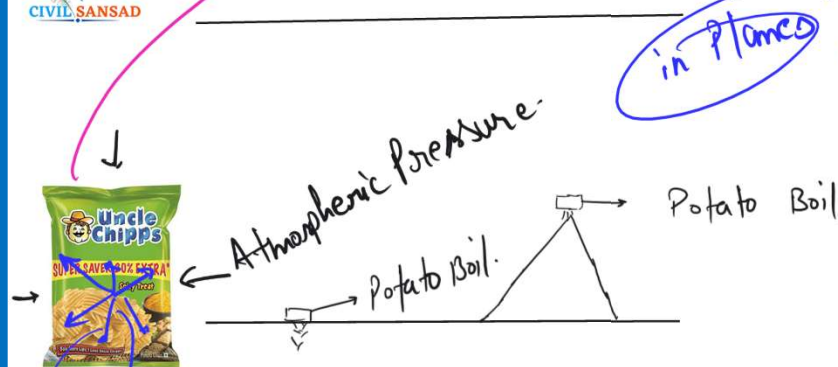
Space.

"Atmospheric Pressure decreases as we move vertically upward"

B.P. ↔ Atm. Pres.



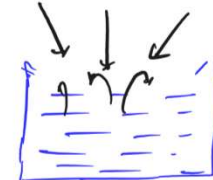
high altitude $\Rightarrow$ chips packet will swell-up.



Boiling Point $\Rightarrow$ vertically upward

Atmospheric Pressure.

Decreases



Air Molecules it has air molecules.
"Exert pressure on walls of packet"

Pressure $\rightarrow \frac{F}{A}$

Air molecules

Air molecules

Temp. $\uparrow$

water vapour $\uparrow$

"It's Easy to cook food on plains."

Place-1

Atm. Press $\rightarrow$ 400 mb

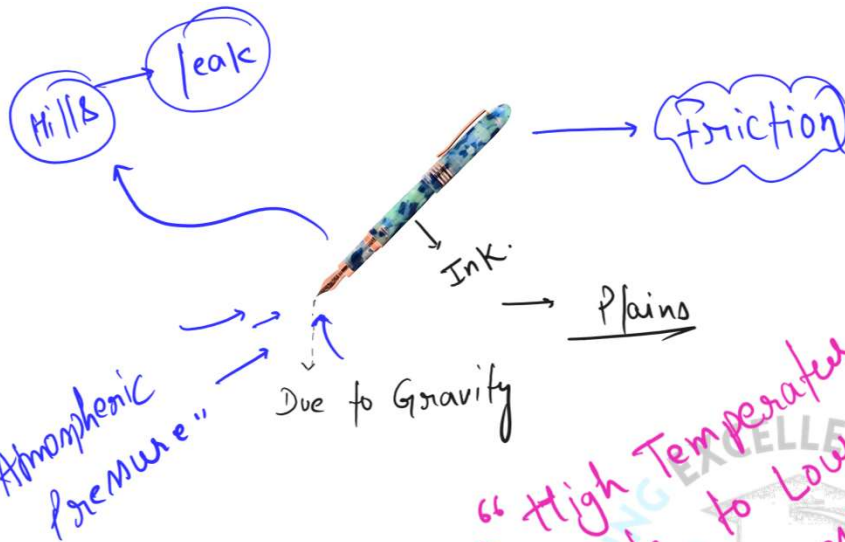
$\rightarrow$ Boiling Point $\rightarrow 80^\circ\text{C}$
5 Potato $\rightarrow$ 10 min

Place-2

Atm. Press. $\rightarrow$ 1000 mb

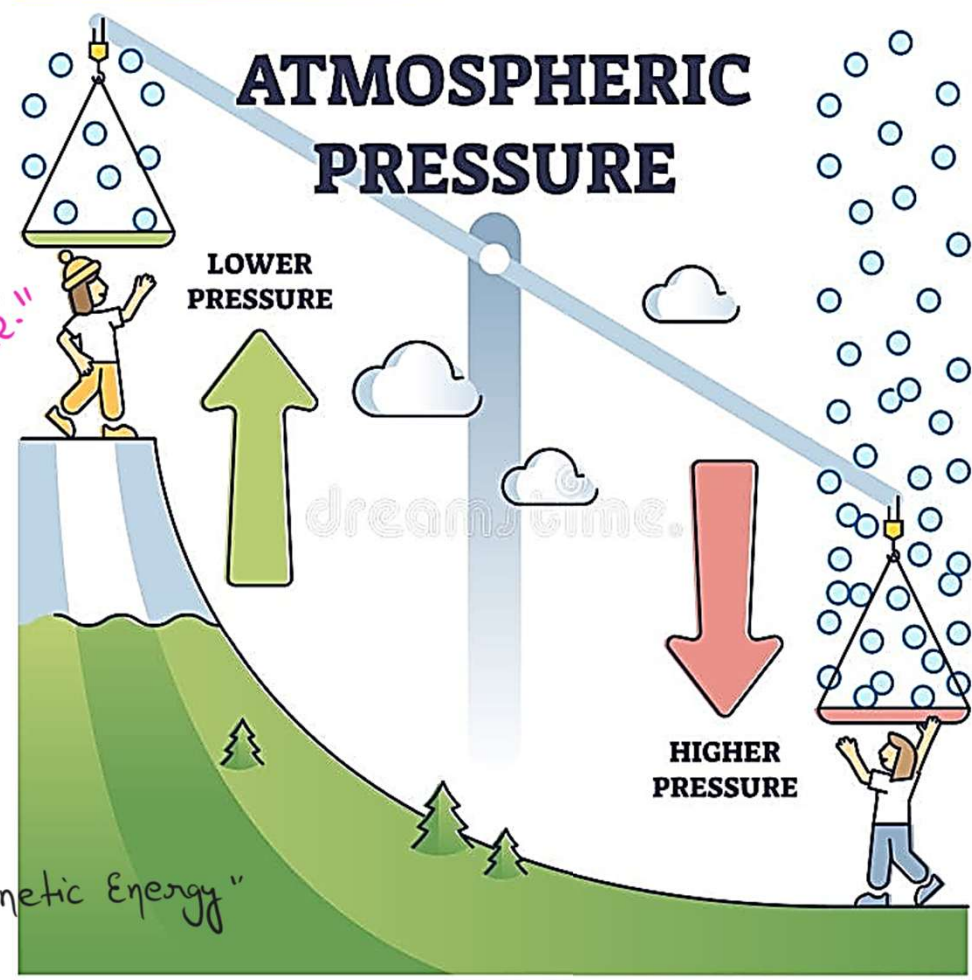
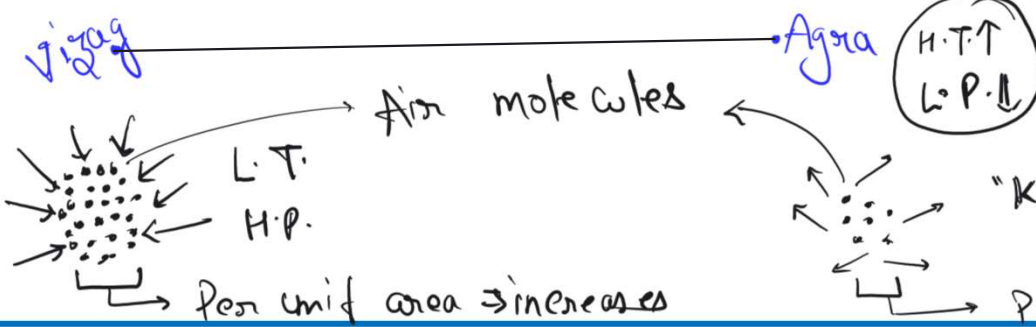
$\rightarrow$ Boiling Point $\rightarrow 120^\circ\text{C}$
5 potato $\rightarrow$ 10 min

Plain

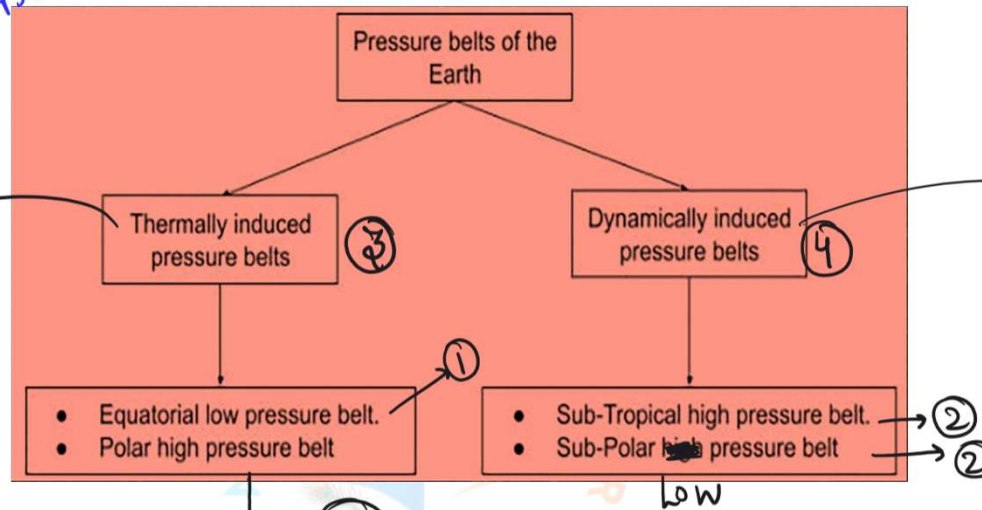


② "Horizontal Distribution of Atmospheric Pressure."

No. of Air Molecules



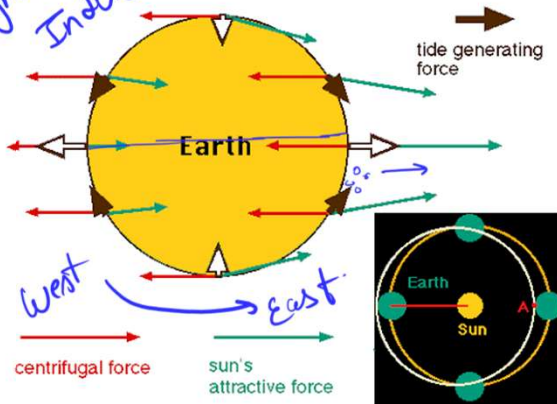
DISTRIBUTION OF PRESSURE BELTS



High Temp. → Low Press.
Low Temp. → High Press.
Due to temperature.

Due to Rotation of the Earth
↓
Centrifugal force.

Dynamically Induced.



Equator → Highest centrifugal force.
Pole → lowest centrifugal force.
"Zero"

Rotation

And

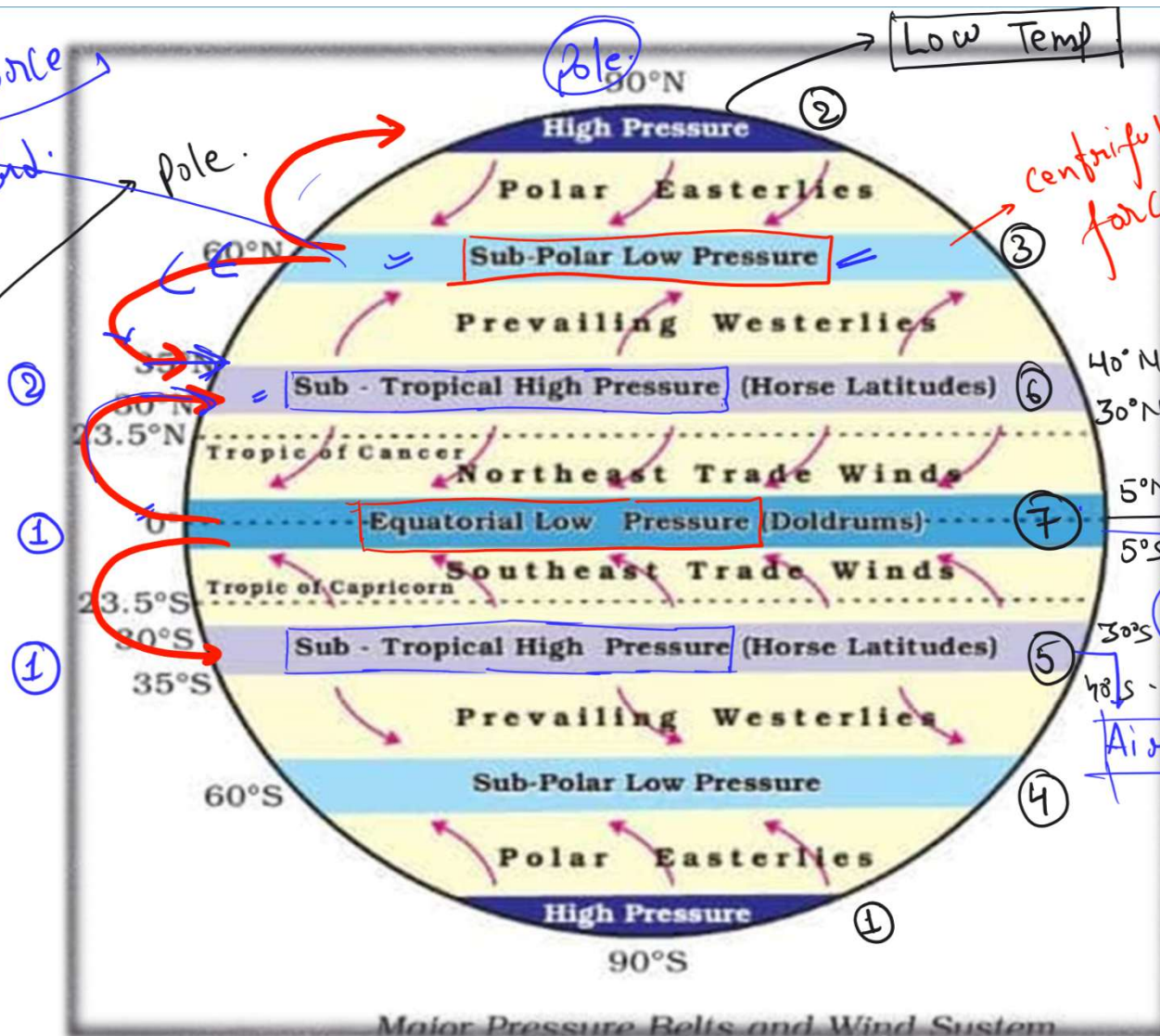
outward

Centrifugal force



Centrifugal force
Air will ascend.

Equator



Prayag Mishra Sir

Air $\Rightarrow$ light $\Rightarrow$ Ascends

H.T.

Water vapour

InCREASES

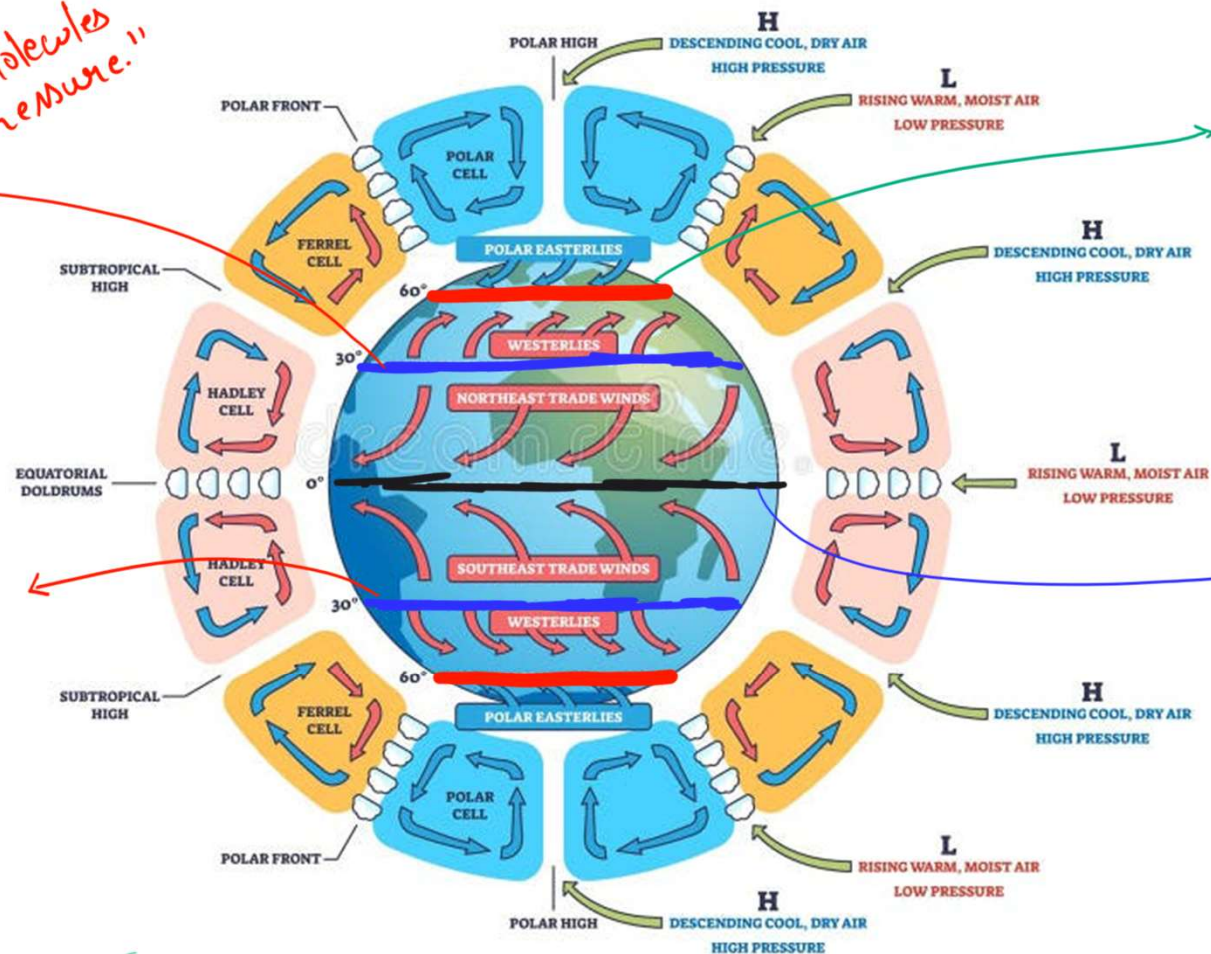
H.T.

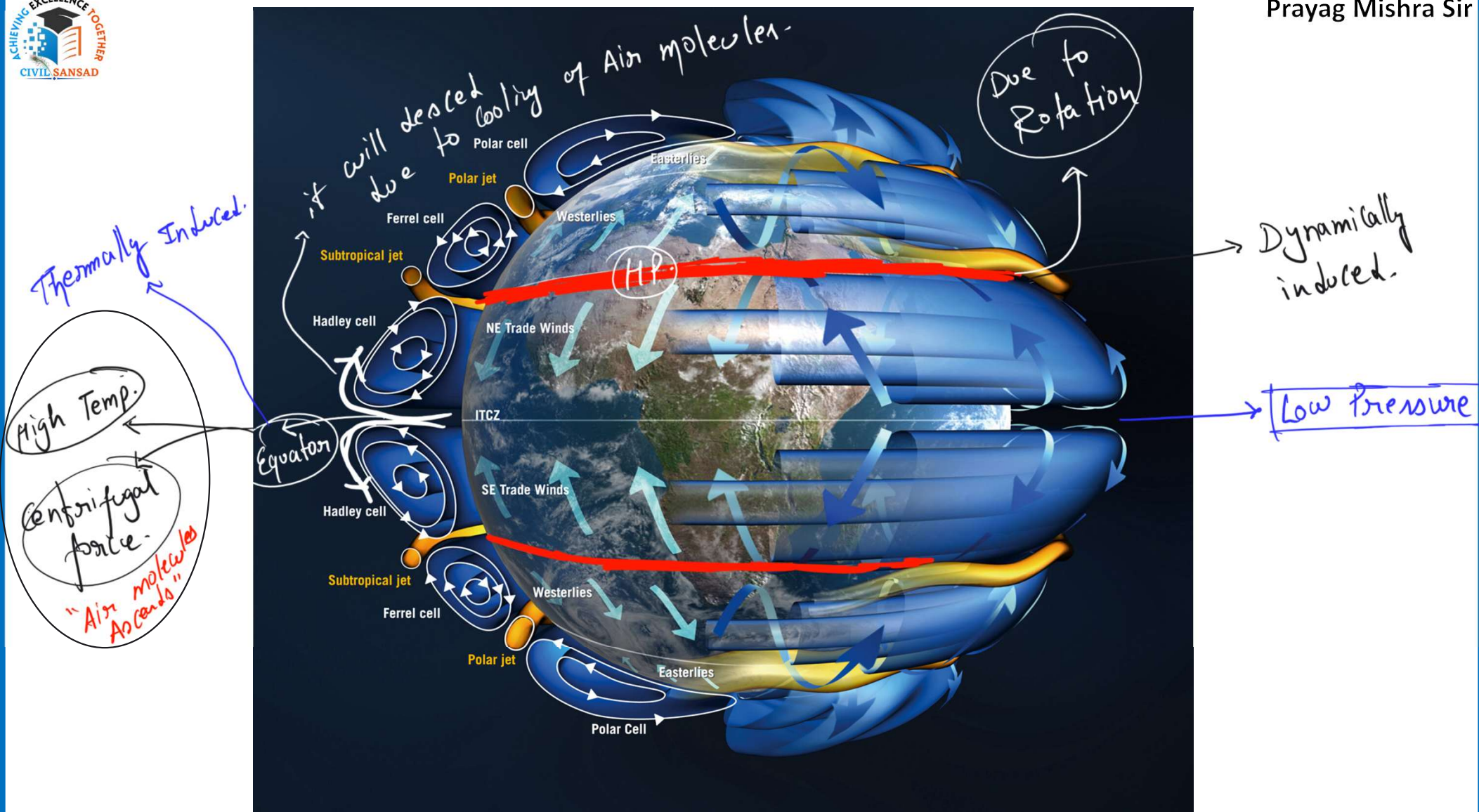
Air Ascends

"Evaporation Rate"

Air Descends

ATMOSPHERIC CIRCULATION





Equatorial Low Pressure Belt :-

5°N to 5°S

Thermally Induced

[Dynamically Induced]

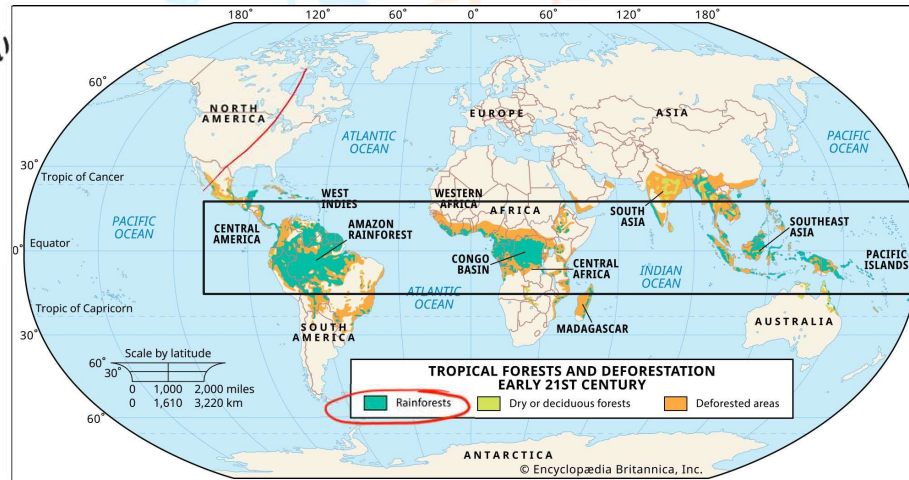
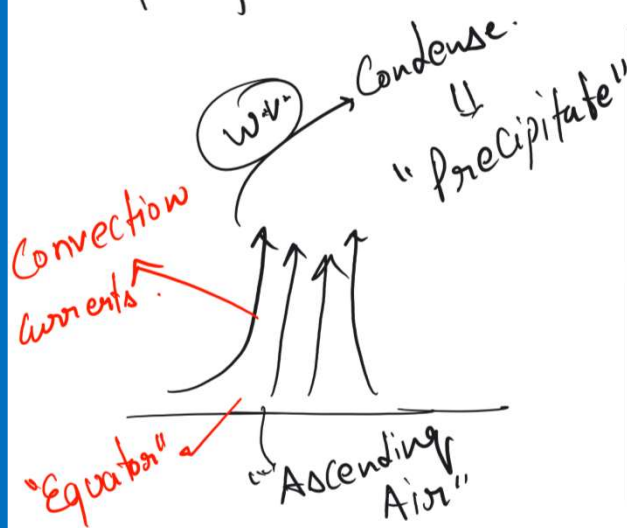
Air Ascends $\Rightarrow$ Convection currents ✓

Condensation (Clouds) $\longrightarrow$ Precipitation (Rainfall).

4 PM Rainfall

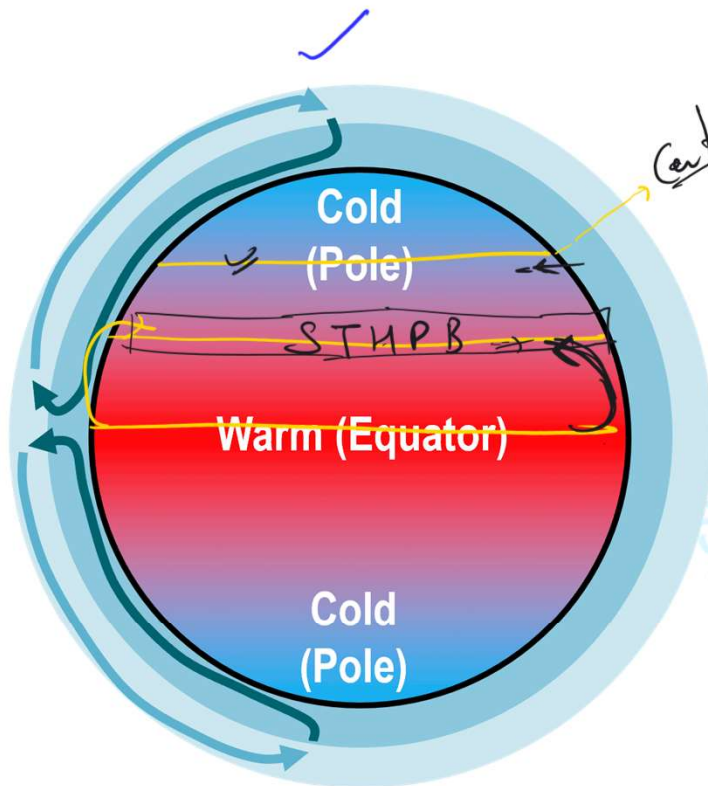
"Convective Rainfall"

Tropical Evergreen Rainforest

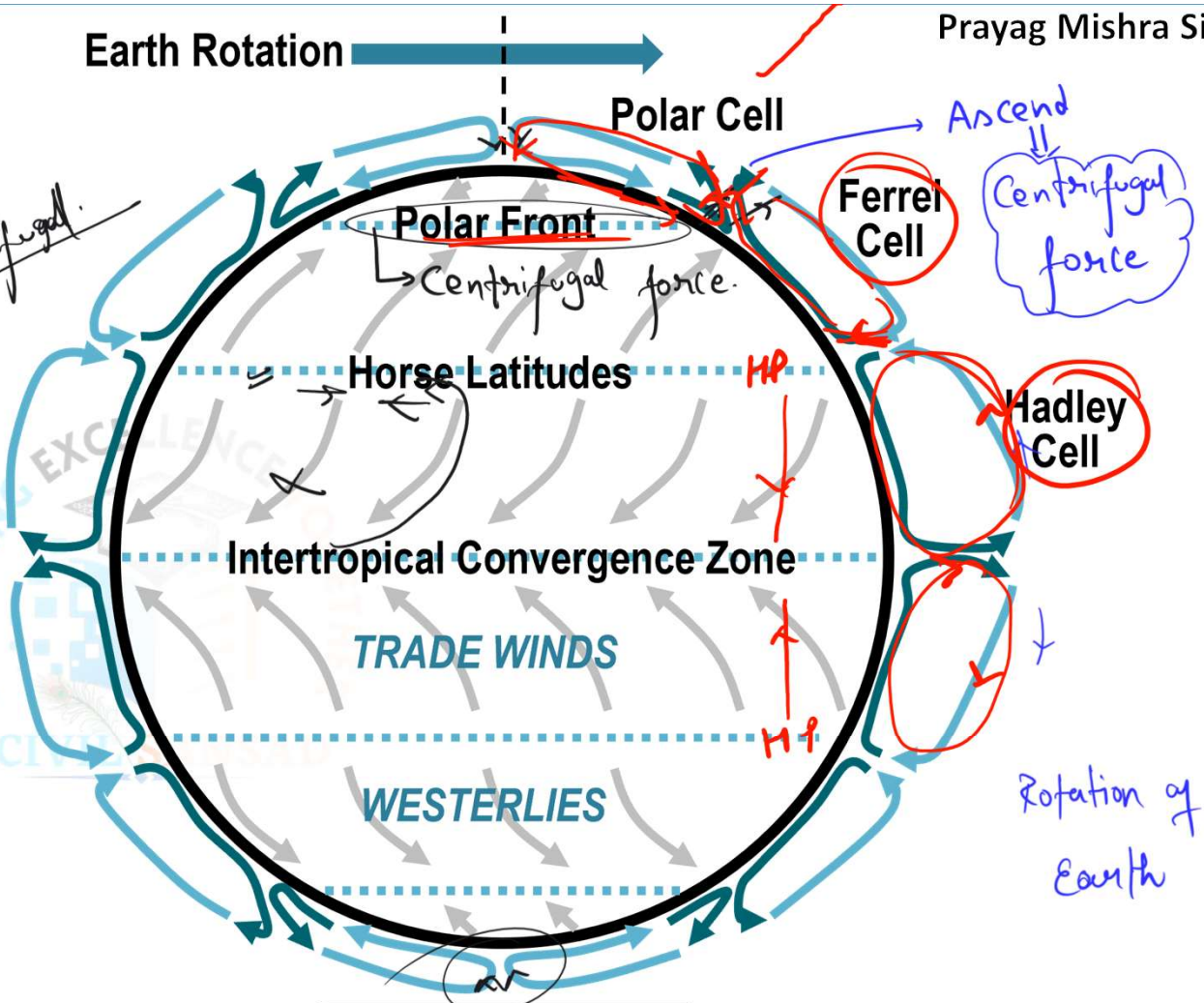


Earth Rotation

Prayag Mishra Sir



Principle



Global Structure

② Sub-Tropical High Pressure Belt :-

Air Descends.

↓
"All Hot Deserts of world are located on this belt"

→ "30° to 40° in both the hemispheres."

→ Dynamically induced (Due to rotation of Earth).

W.V. → WD

Air Descends.

water vapour.
less Air.

Note :- {Descending Air never Rains}

Temperature increases

No Rain

→ "There is no rain on high pressure."

Major Deserts of the World

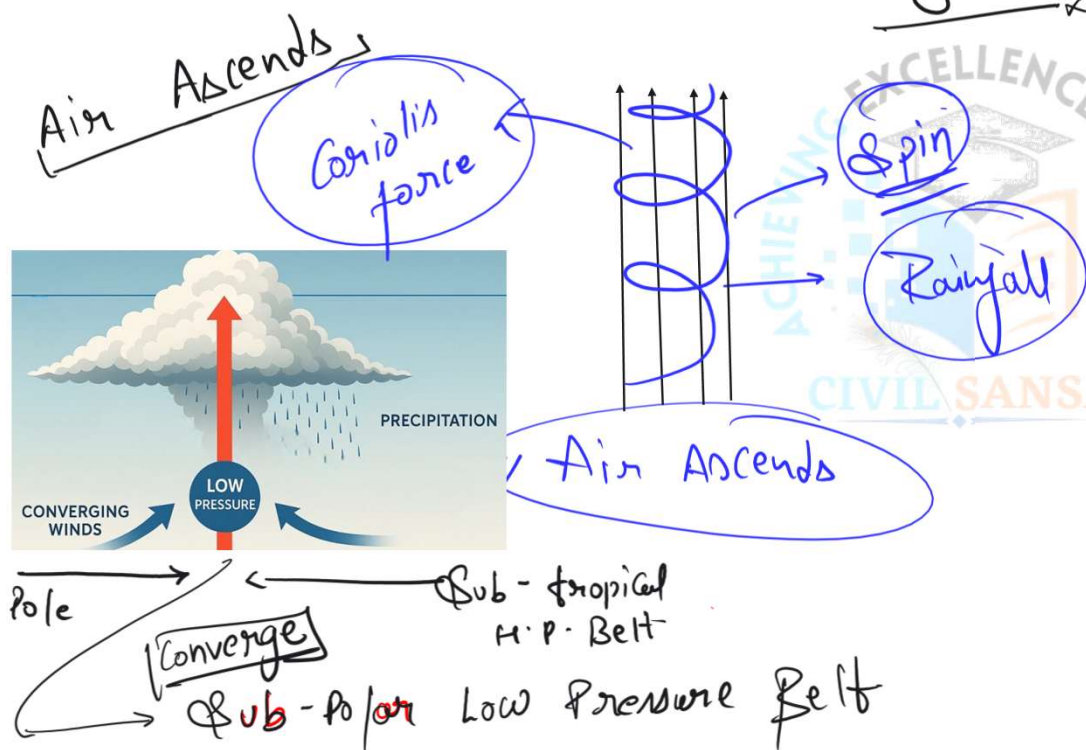


20 Cm → Annual Rainfall
Less Rainfall

③ Sub-Polar low Pressure Belt :-

60° to 70° in both the Hemispheres

Dynamically induced (Due to rotation of the Earth).
Cyclonic Rainfall



④ Polar High Pressure Belt :-

80° to 90° in both the Hemispheres.

Air descends → High Pressure

"No Rain"
Cold Deserts

Cells → ③

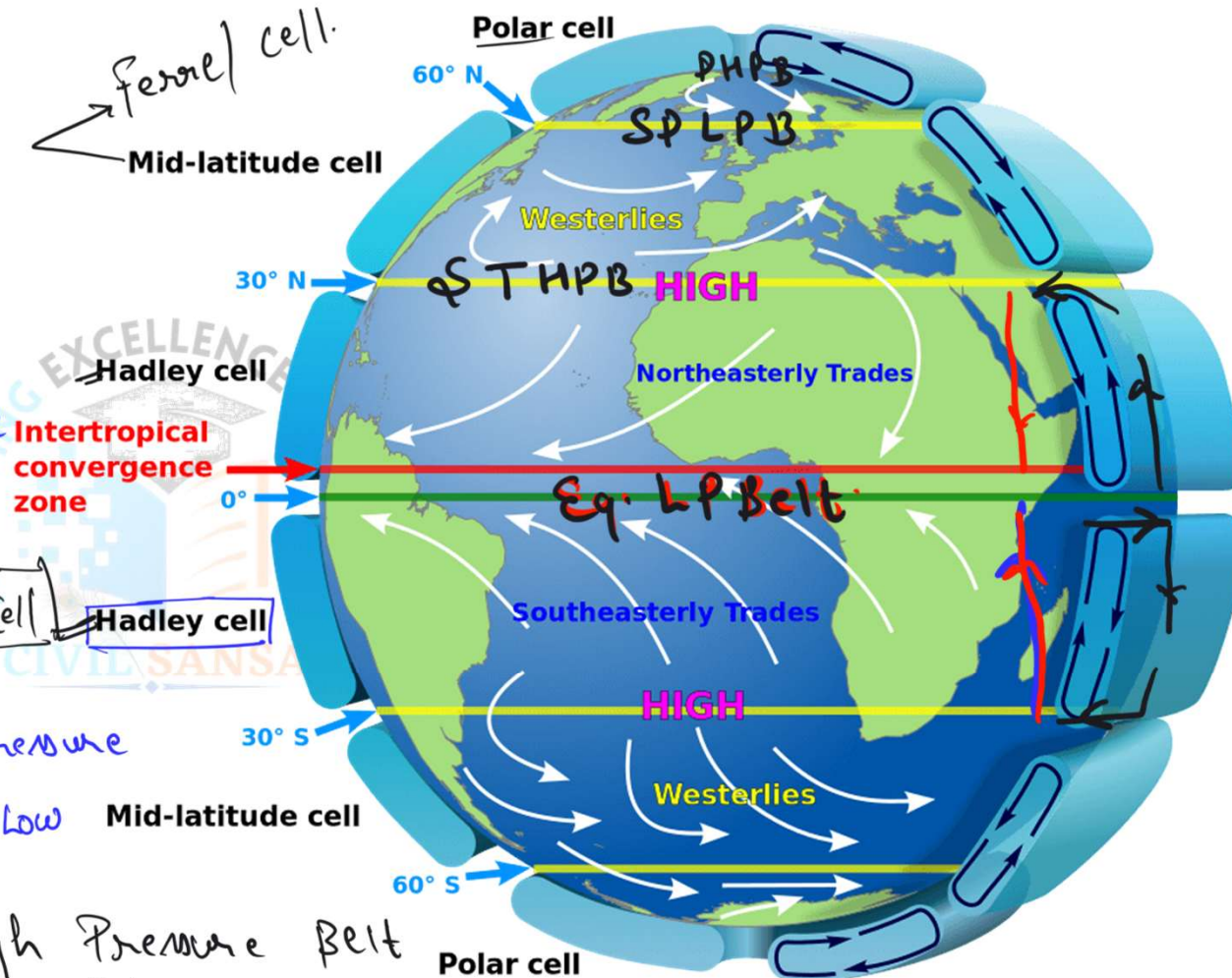
① Hadley Cell

"Equatorial low Pressure Belt and Sub-tropical High Pressure Belt."

② Ferrel Cell or Mid-latitude Cell

→ Sub Tropical High Pressure Belt and Sub-Polar low Pressure.

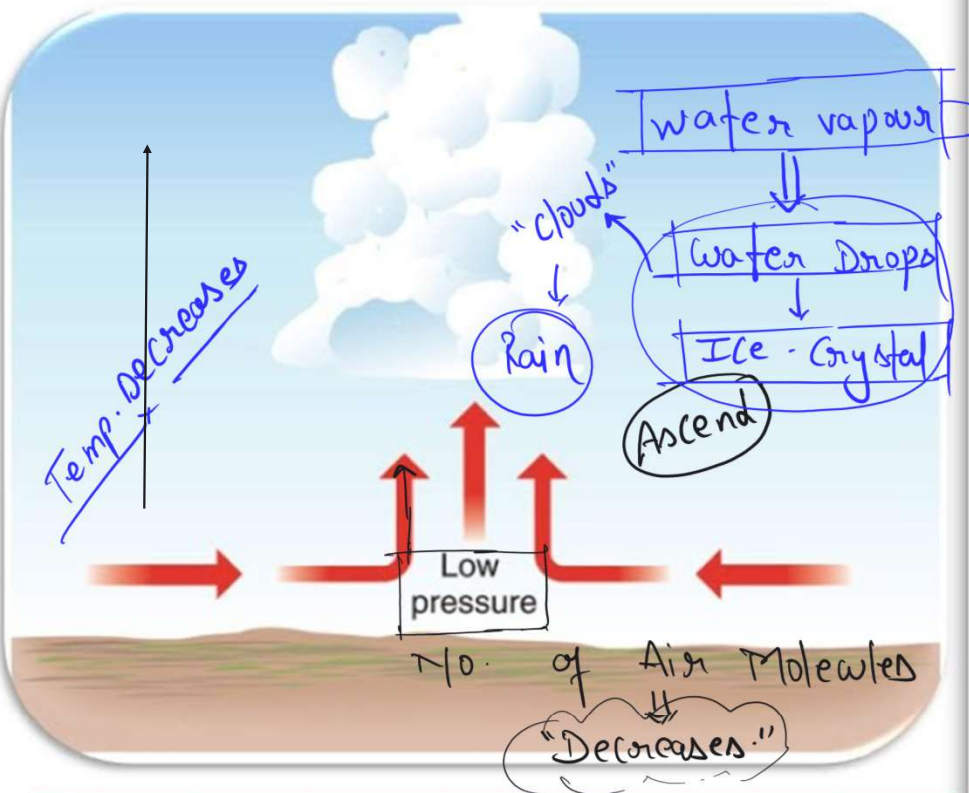
③ Polar Cell → Polar High Pressure Belt and Sub-Polar low Pressure Belt.



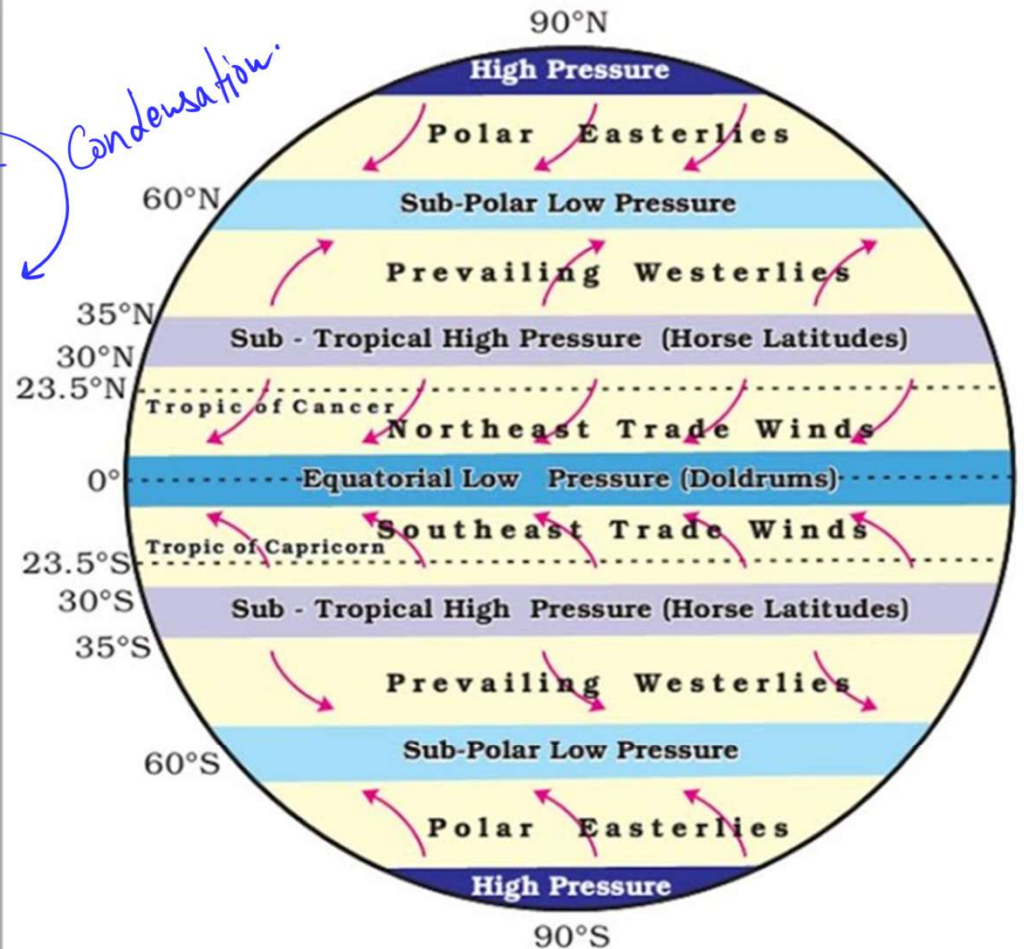


/

Sub-Tropical High Pressure Belt or Horse Latitudes



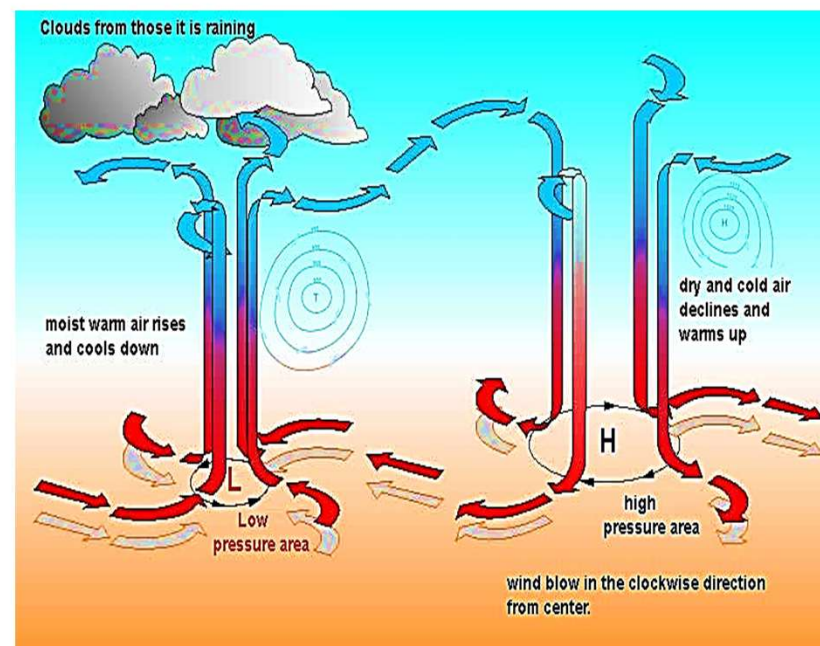
Major hot deserts in northern hemisphere are located between 20-30 degree north and on the western side of the continents. Why?

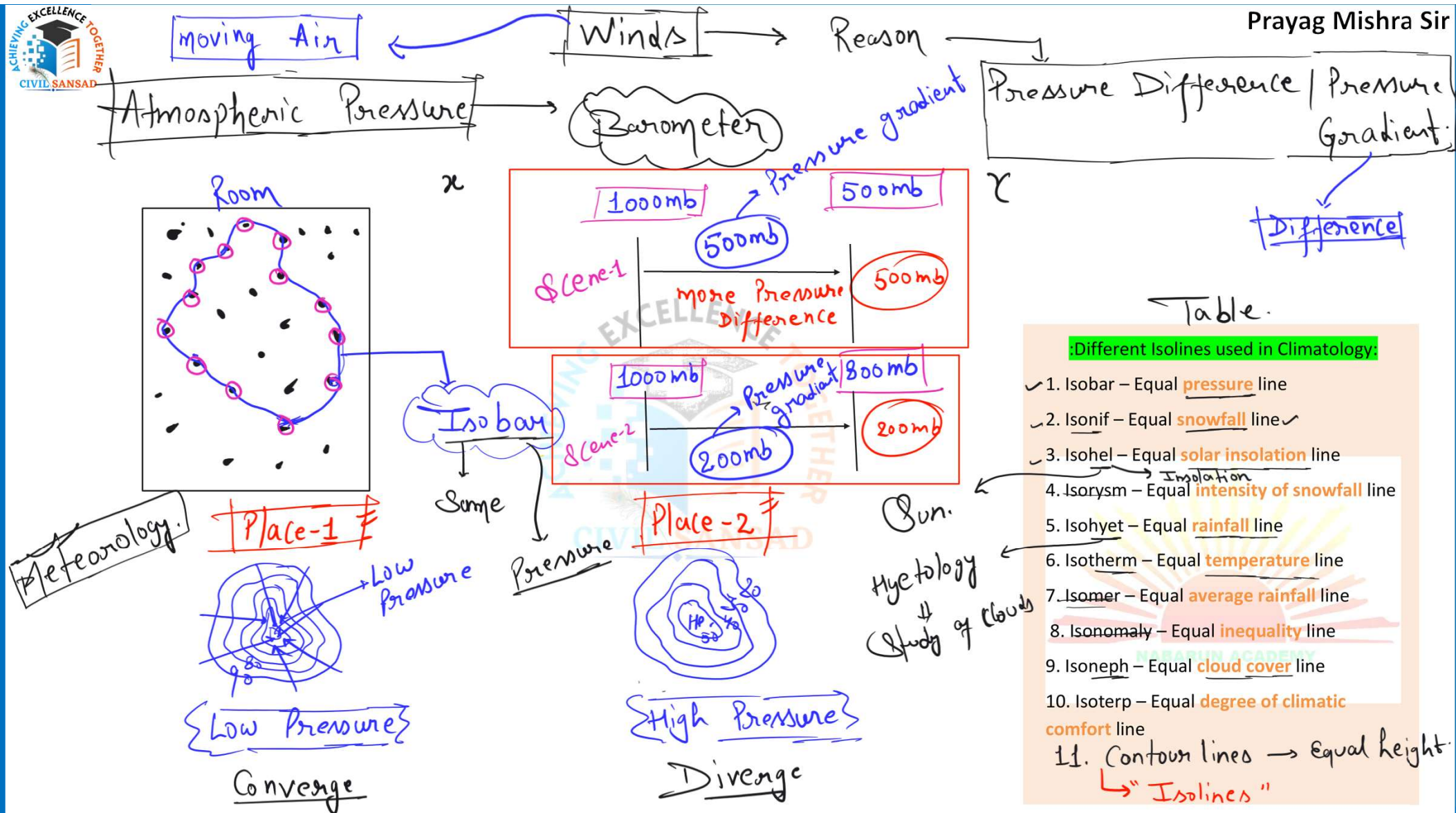


Major Pressure Belts and Wind System

*. If we compare Atm. Pressure on Equator and Pole, it is more pressure is on Poles.

Prayag Mishra Sir





Coriolis Force

G. G. Coriolis

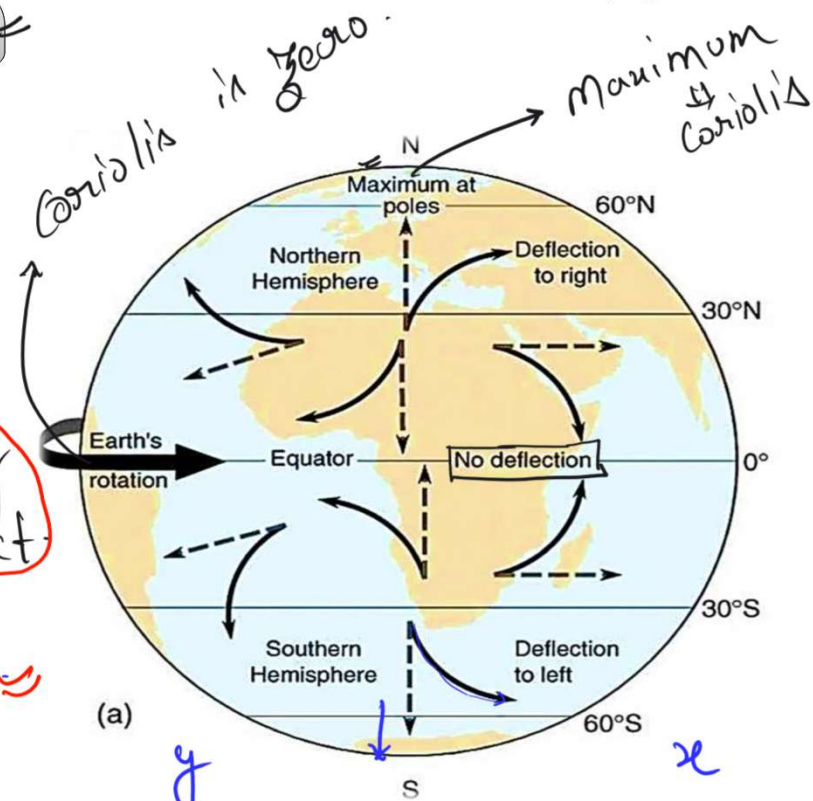
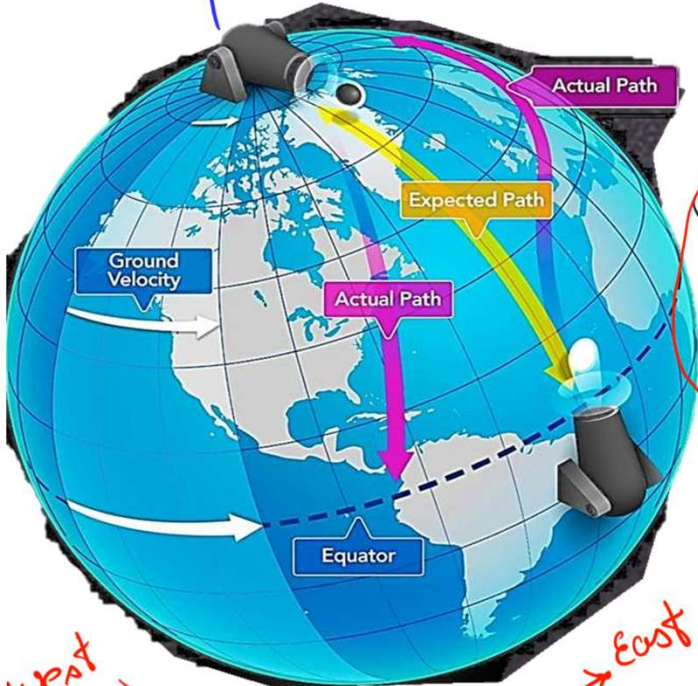
Effects

Due to Coriolis force Every flying object will deflect.

Deflection

NH $\Rightarrow$ Right

SH $\Rightarrow$ Left



face $\rightarrow$ moving object

- Due to Rotation of Earth low pressure is created on right hand in Northern Hemisphere and left hand in Southern Hemisphere.



Low Pressure

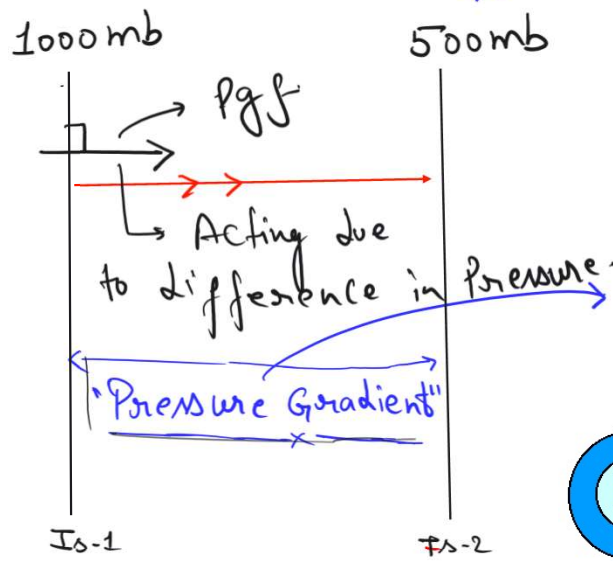
High Pressure
Smiley Balls
↓
Air Molecules

High Pressure → Low Pressure

Corridor
Balls
No Smiley Balls

H.P. → L.P.

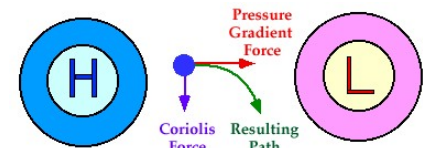
Air molecules will flow



Pressure gradient force
"pgf"

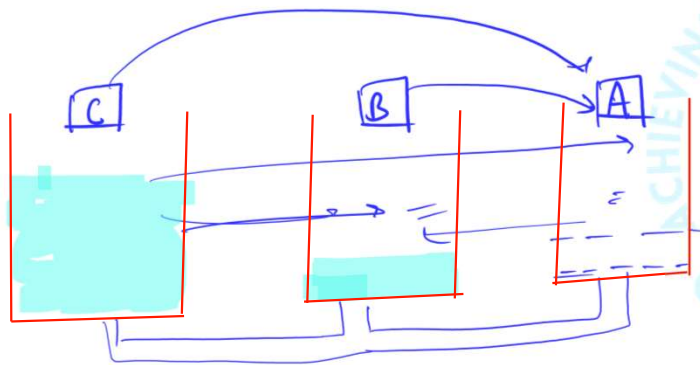
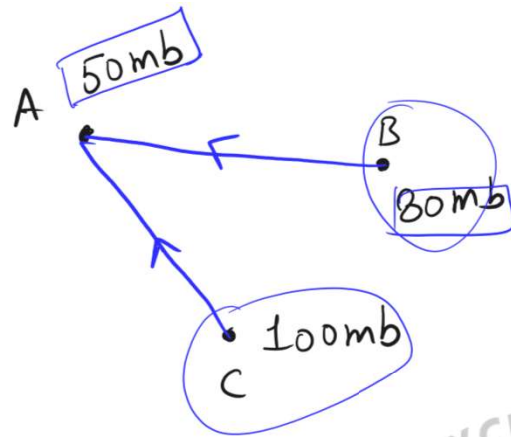
Responsible for origination of winds, speed of wind and its direction.

"Pressure gradient force acts $\perp$ to isobars."



Note:- flow of winds makes acute angle to isobars. (Due to Coriolis).

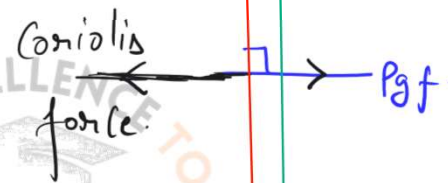
Ex. ①



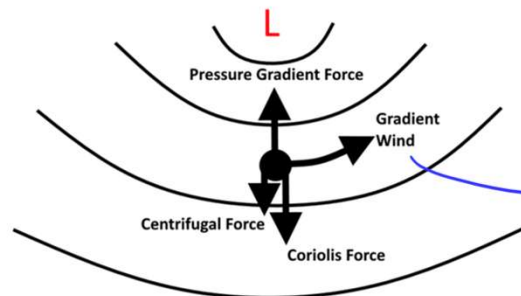
Geostrophic winds.

minimum 600 mts
above Earth's
surface.

Ex. Jet Streams



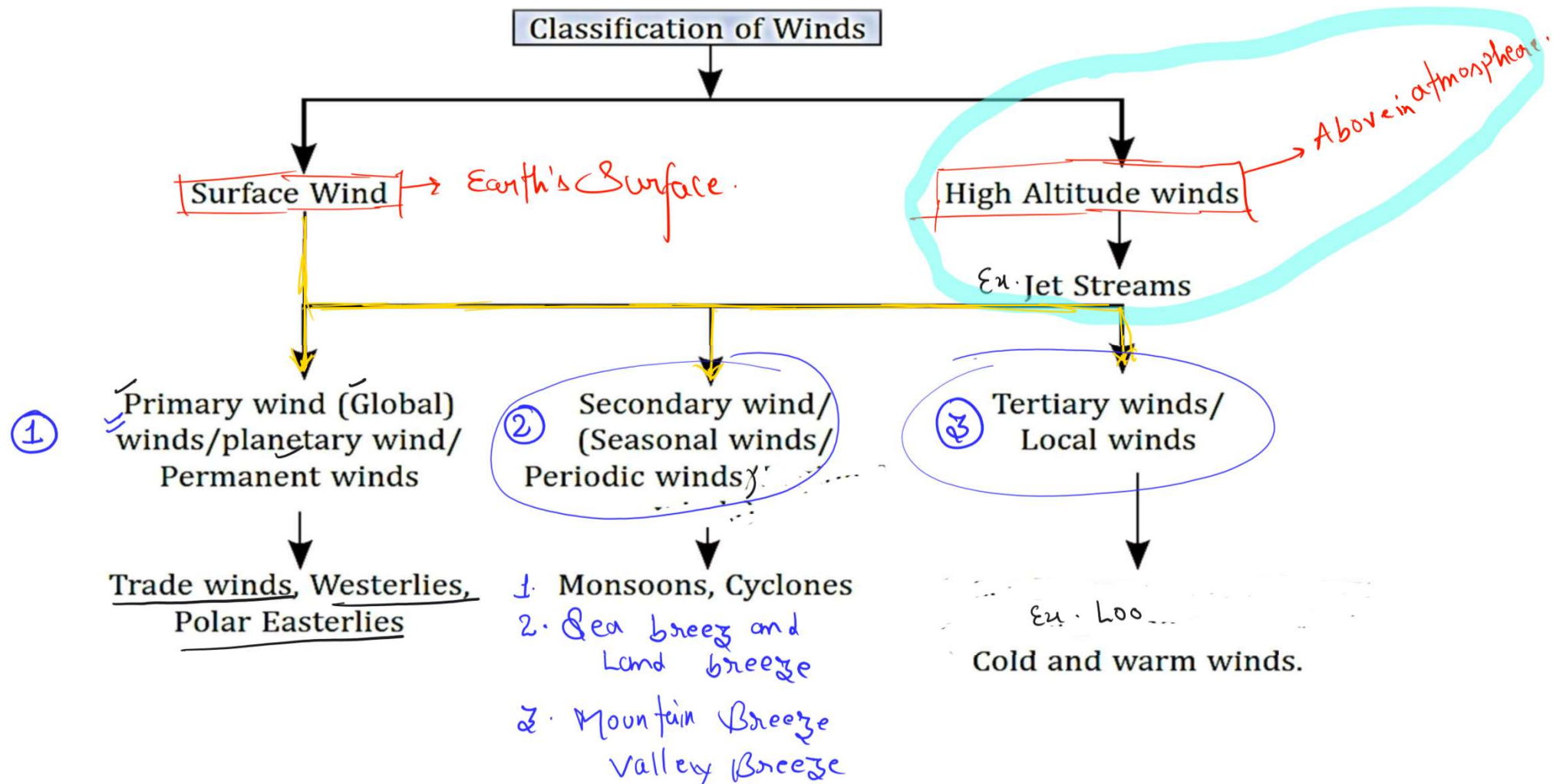
"Wind flows $\parallel$ to isobar if
pgf and Coriolis force acts
opposite each other."



Geostrophic or gradient
winds.

TYPES OF WINDS

Classification of Winds

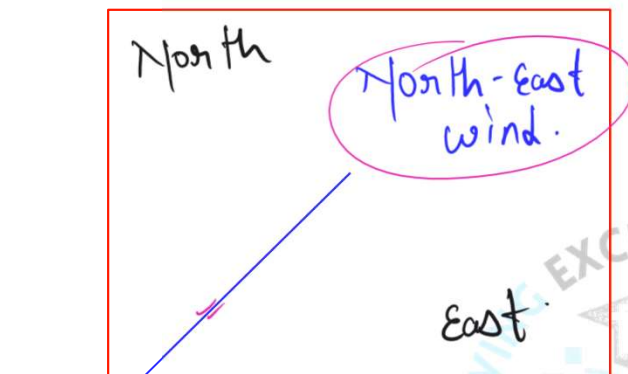


① Primary / Planetary / Global winds

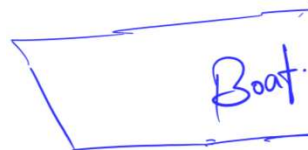
- Ⓐ Easterlies
- Ⓑ westerlies
- Ⓒ Polar Easterlies

Heading

West



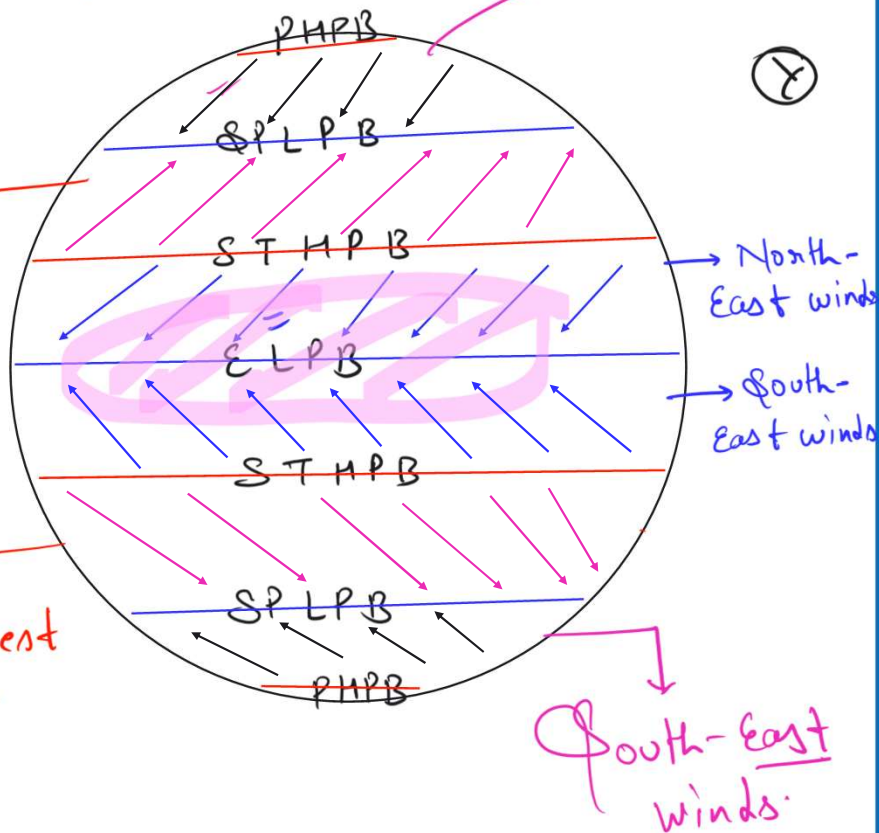
South



②

South-west winds.

North-west winds.
4/11



③

South-East winds.

Primary winds

① Easterlies / Trade winds

Tropical Evergreen Rainforest.

Sub-Tropical High to Equatorial low.
[30° → 0°]

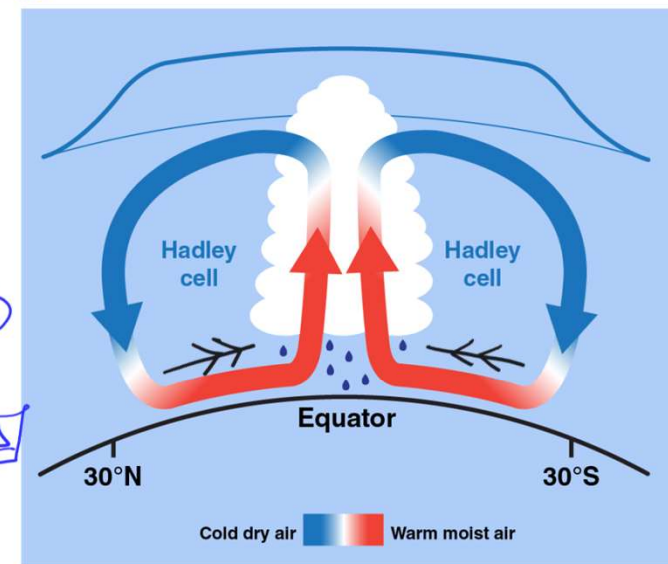
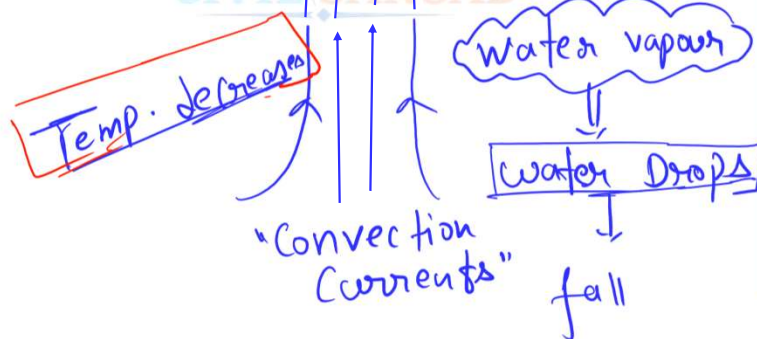
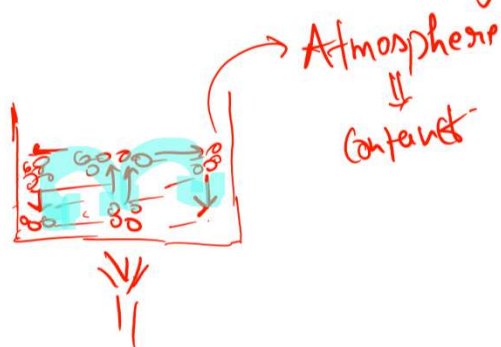
Helps in Trade.

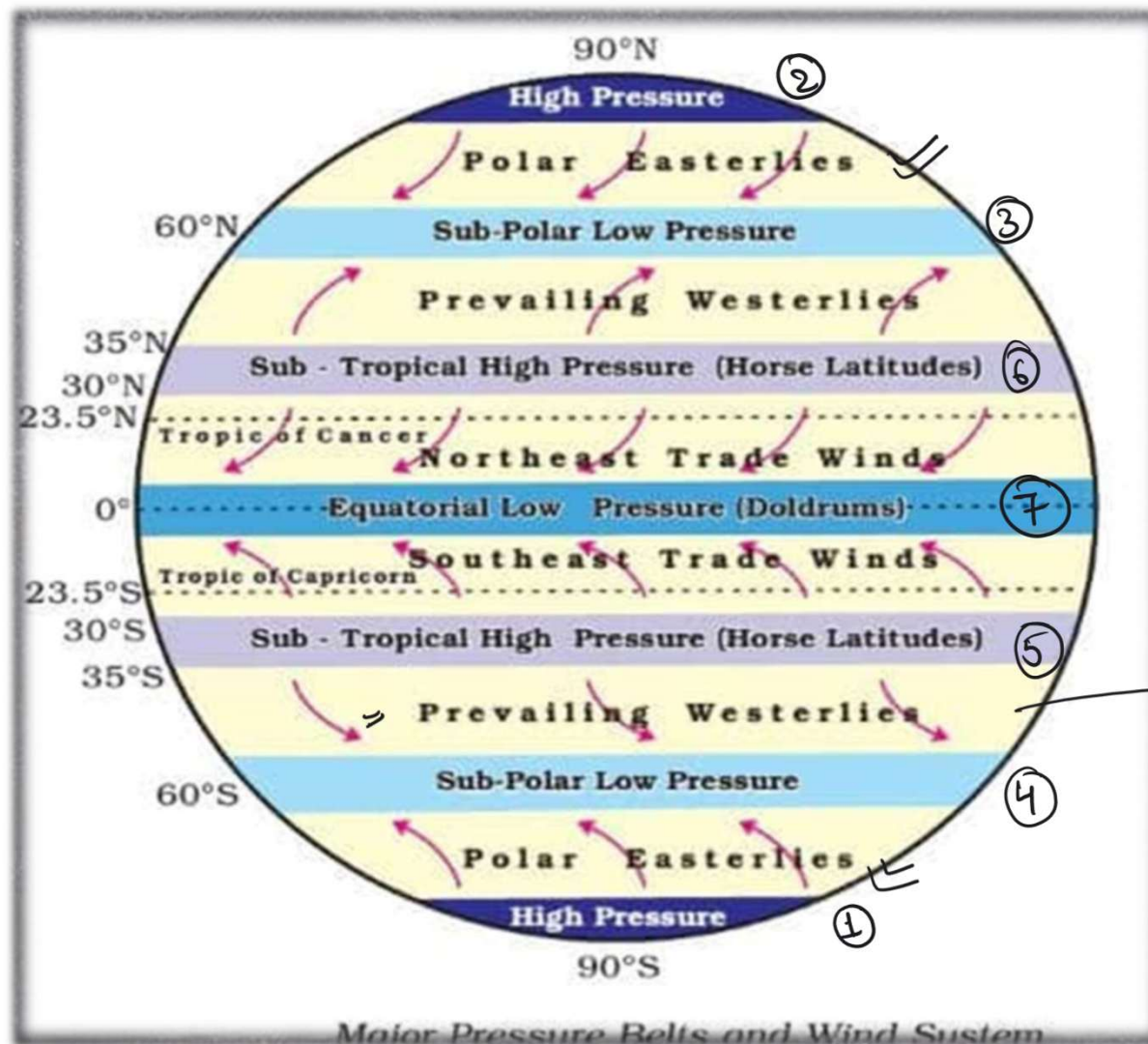
Doldrums (below ITCZ)
→ Calm Region

Inter Tropical Convergence Zone (ITCZ)

4PM Rainfall

Convectional Rainfall





Speedy and Consistent.

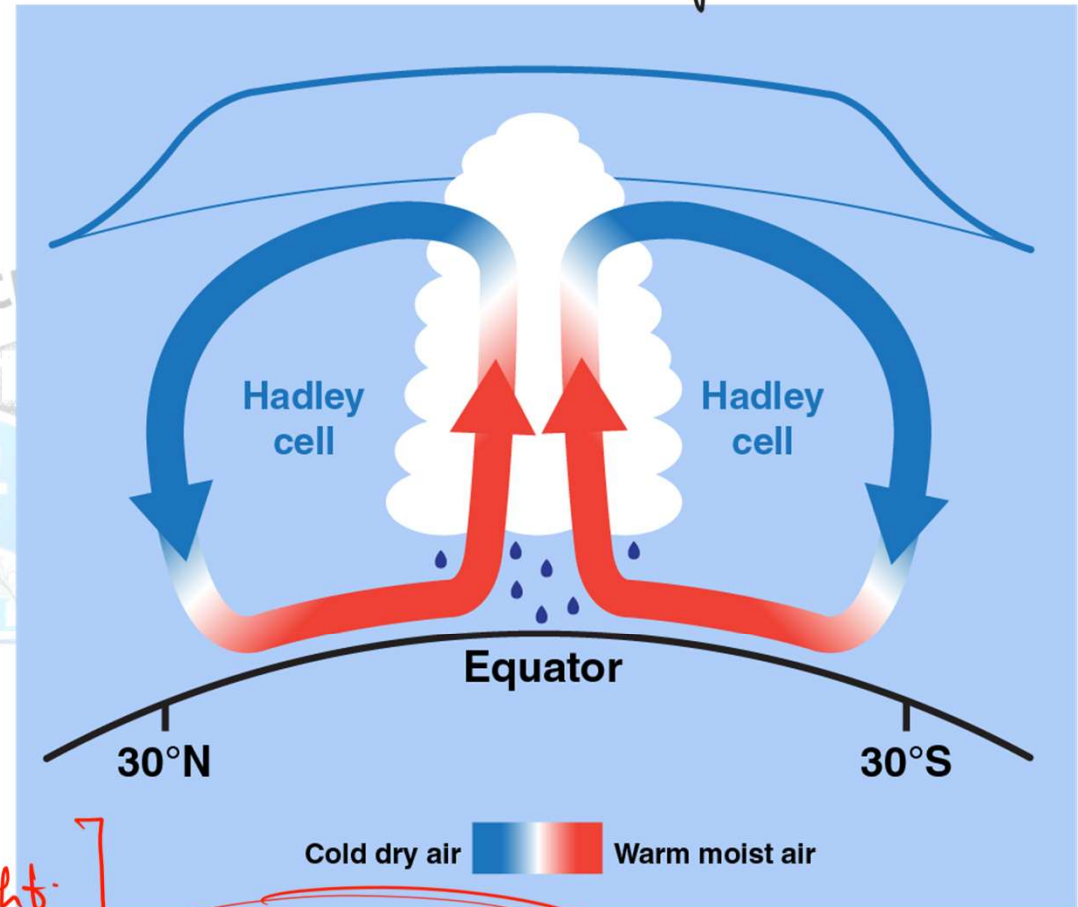
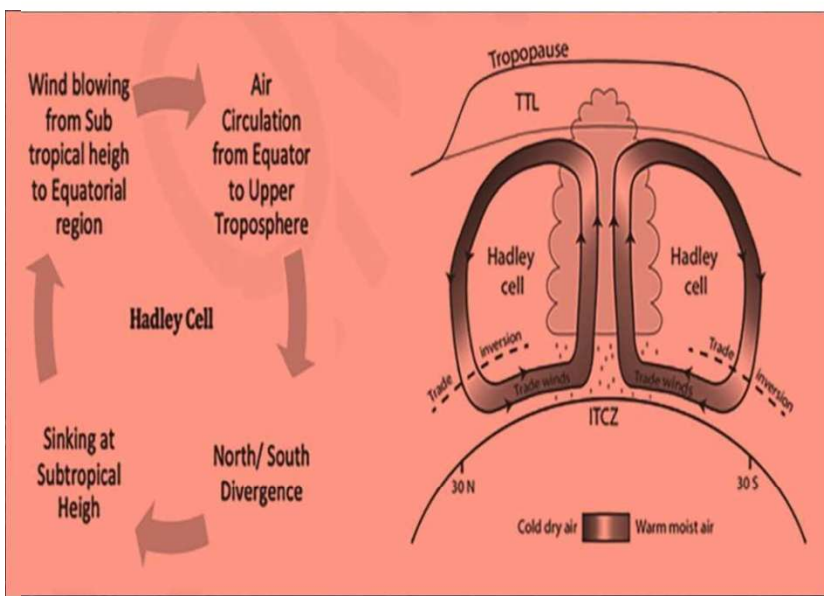
"more consistent"

Sea-Surface

"Slowly heats slowly cools"

Winters

Sea-Surface



Summers

High temp. → Day
Low Temp. → Night

Low Difference

winters

L.P.

② Westerlies:- from Sub-Tropical High to Sub-Polar low. $30^{\circ} \rightarrow 60^{\circ}$ Prayag Mishra Sir

→ Southern westerlies are more
✓ Consistent and Strong. (Due to larger water surface)

Note:- "winds are more
consistent and
strong in winters"

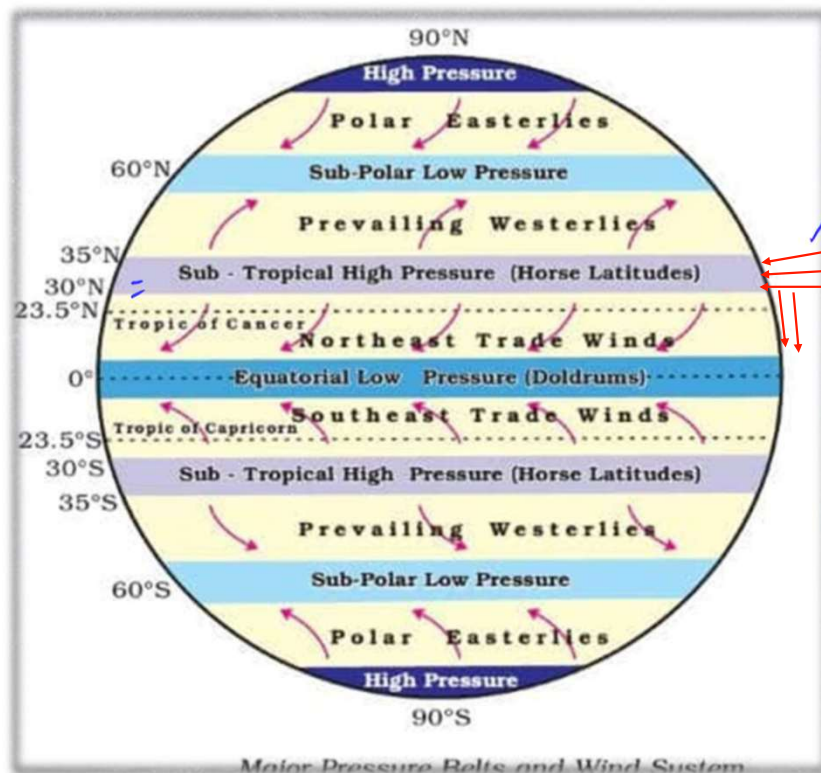
- ① $40^{\circ}\text{s} \rightarrow$ Roaring forties
 - ② $50^{\circ}\text{s} \rightarrow$ Furious fifties
 - ③ $60^{\circ}\text{s} \rightarrow$ Shrieking sixties
- ↓
 70°s

Summers $\rightarrow$ Temp. variations

Winters $\Rightarrow$ Temp. Consistent

③ Polar Easterlies:- from Polar High to Sub-Polar low.
 $90^{\circ} \rightarrow 60^{\circ}$

→ They have less temperature and less humidity.



Vertical

Horse Latitudes $\Rightarrow$ "35° - 30° in both the hemispheres"



Arabs $\Rightarrow$ (Horses)

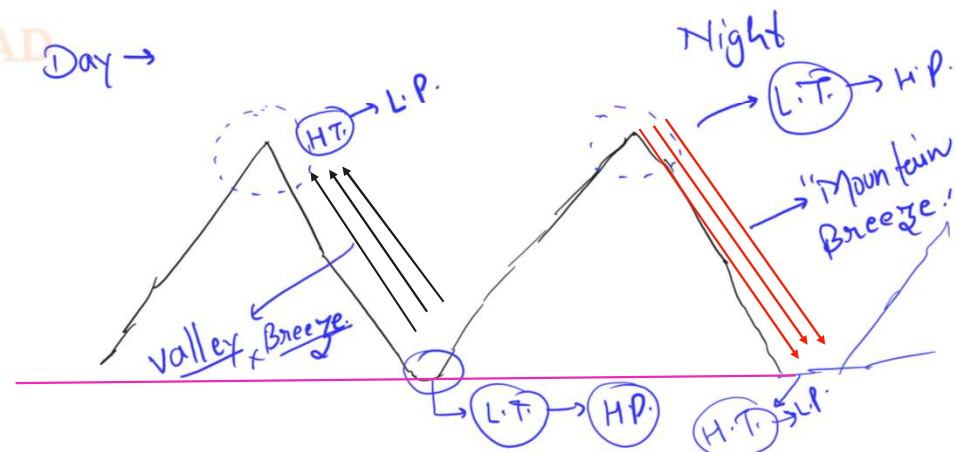
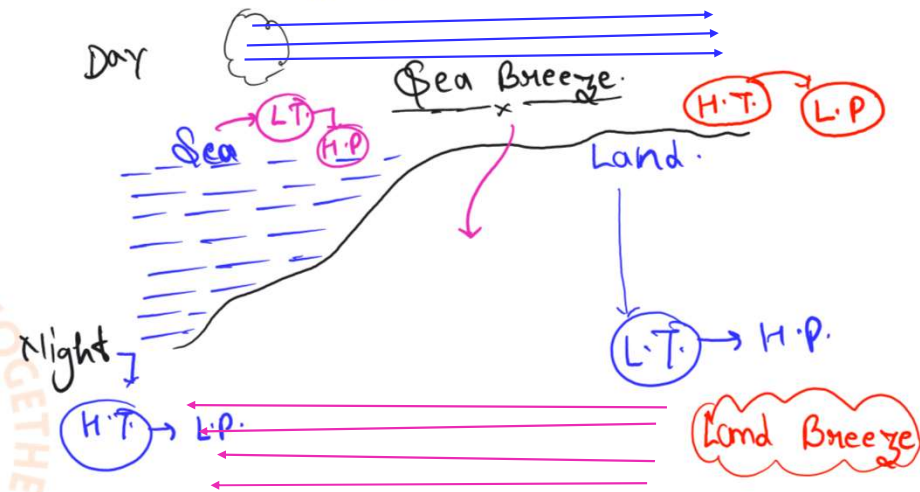
Vertical

Secondary / Seasonal / Periodic winds :- "winds that changes the direction with time."

① Land Breeze and Sea Breeze

② Mountain Breeze and Valley Breeze

③ Monsoon winds





"Strait of Gibraltar"
↓
Atlantic ocean to Mediterranean sea.

Iberian Peninsula

Cap: Lisbon

flows.

A.O.

Africa



Europe
↓
"Peninsula of Peninsulas"

Yugoslavia
↓
Slaves

Local winds → Warm winds.
→ Cold winds.

Warm winds

① Chinook wind → Descends on
East Slopes of Rockies
→ USA and Canada.
Flows in → Hot and Arid.

→ Snow Eater → Animal flux boundary

② Santa Ana → flows towards Gulf of California.

③ Black Roller → Plains of USA.
"wheat and maize" → Prairies Grasslands

④ Zonda → Arid and warm wind that descends on Eastern slopes of Andes mts.
→ Argentina and Uruguay.
→ "Winter Foehn" → locally famous.

Home work:
↓
World Map.
↓
winds

Prayag Mishra Sir

10 → India
10 → world.
↓
Continent
↓
A-4 Political

⑤ Sirocco → North-west of Sahara to Mediterranean Sea
 ↳ Arid, Dusty and warm wind.
 ↳ Blood Rain (in Italy and Adriatic Sea)

⑥ Harmattan wind → South Sahara to North-west Coast of Africa (Gulf of Guinea).
 ↳ Doctor wind (Carries Moisture of Area).
 ↳ Arid and warm wind.

⑦ Khamsin wind → from North-East Sahara to Egypt and Red Sea.
 ↳ Arid and warm wind.

⑧ Haaboo wind → Non-Directional wind in Sudan, Ethiopia. (East Sahara).

⑨ Brickfielder → Victoria Province of Australia.
 ↳ Arid and warm wind.

⑩ Yamo → Arid and warm
 ↓
 Japan

⑪ Karaburam → Tarim Basin of China (Middle Asia)

↳ Arid and warm wind.
↳ Dusty storms.

Cold winds

18

① Blizzard → Cold and Arid wind.
↳ USA and Canada.

② Buran → Siberia Province of Russia.
↳ Cold and Arid.

③ Bora → Cold and Arid wind.
↳ "Italy and Adriatic Sea."

⑫ Föhn / Foehn → Descends on northern slopes of Alps.
↳ Known for ripening of grapes ↑ ↑ ↑ ↑ ↑
↳ Snow Eater

most affected

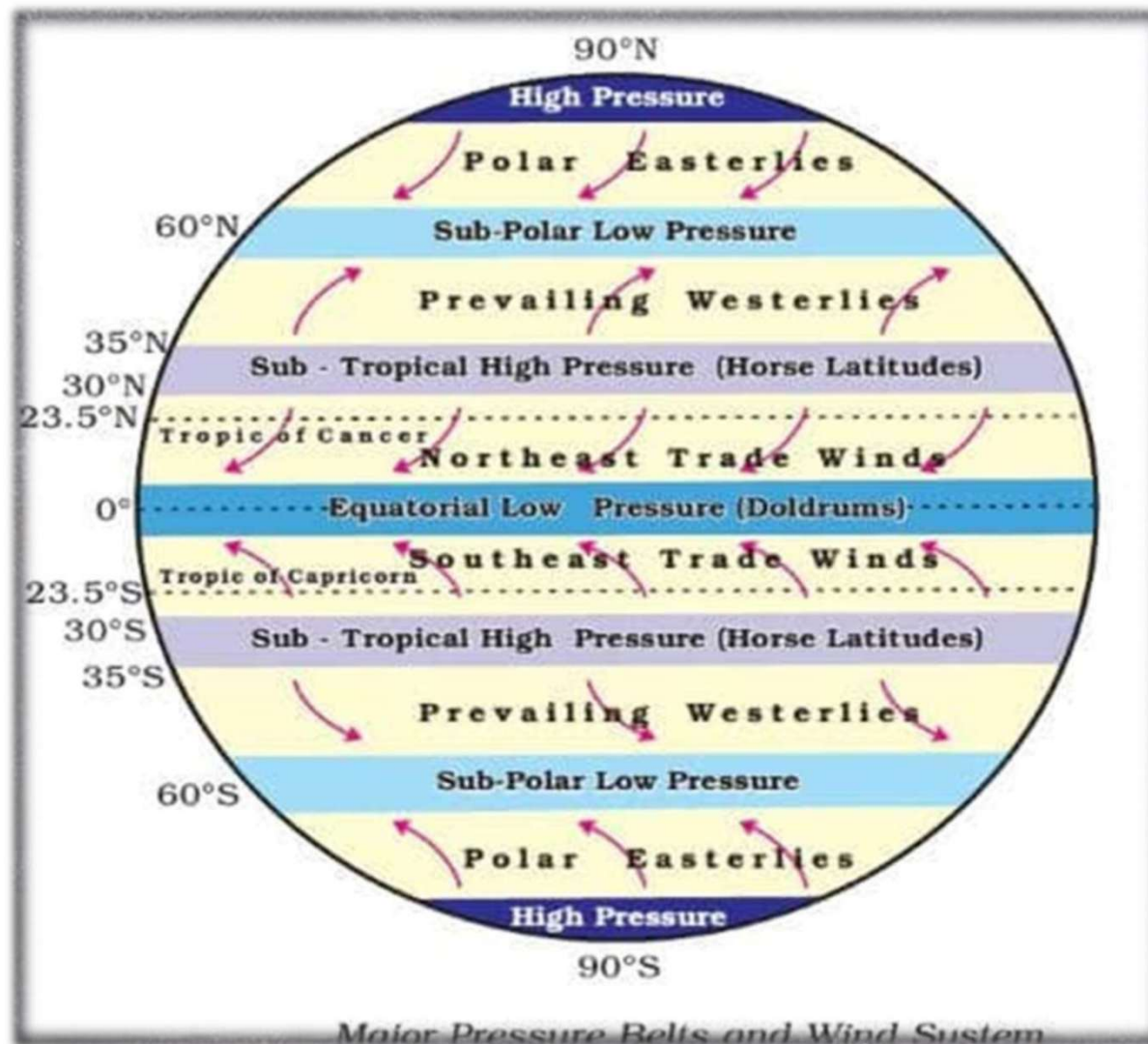
Switzerland

Bern

④ Pampero → Polar Cold wind
↳ affects Argentina and Uruguay.

⑤ Levanter → Cold and Arid wind
↳ Spain and France (flows)

⑥ Mistral → "from Rhone River to Mediterranean Sea"
↳ most affected ⇒ Switzerland, France.





Atmospheric Humidity

water vapour.

instrument.

Hygrometer.

① Specific Humidity ⇒ $\frac{\text{Present Humidity in gms}}{\text{Air Mass in gms}}$

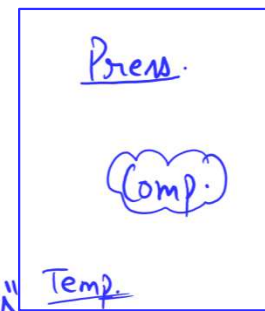
② Absolute Humidity ⇒ $\frac{\text{Present Humidity in gms}}{\text{volume of Air Mass}}$
↓
Absolute Humidity.
↗ volume.

③ Relative Humidity ⇒ $\frac{\text{Present Humidity}}{\text{Humidity Capacity}} \times 100$
↓
% (No unit)

④ Humidity Capacity ⇒ Capacity of Air Mass to hold water vapour.
↓
 $T \propto H.C.$

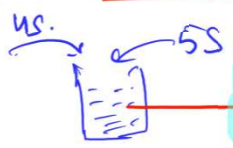
⑤ Air Mass :-

"Bundle of Air having similar physical properties"



Saturated Air Mass
Present w.v. = H.C.

Air Mass → Holds Humidity

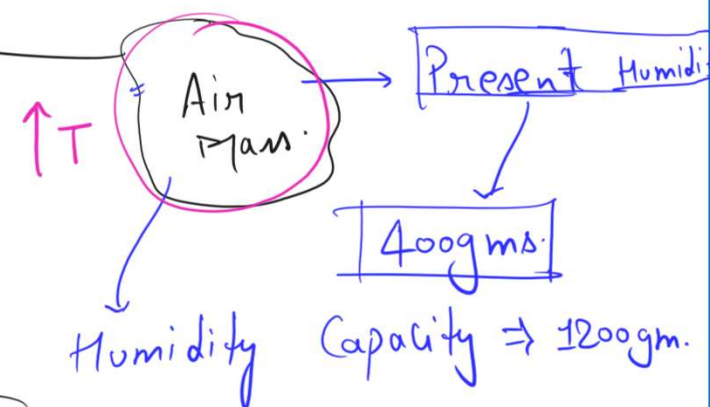
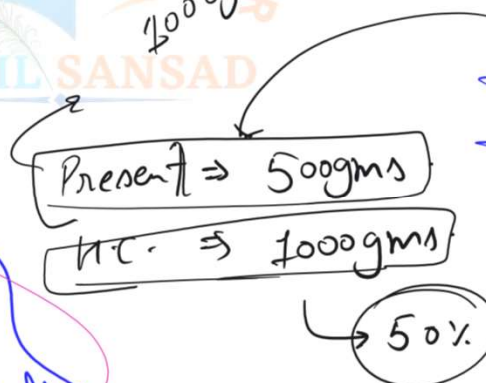
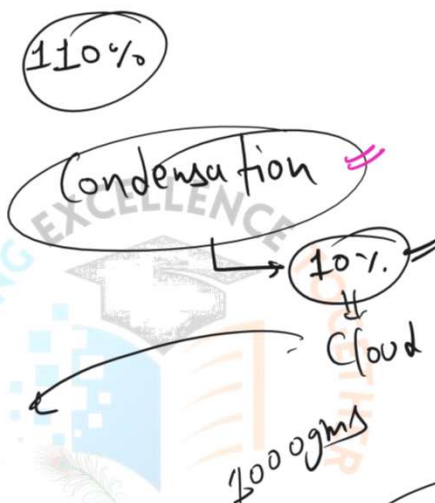
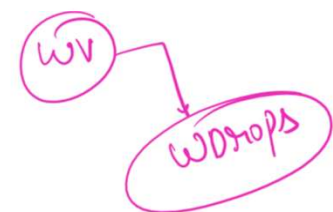
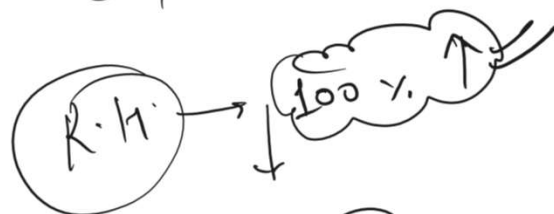
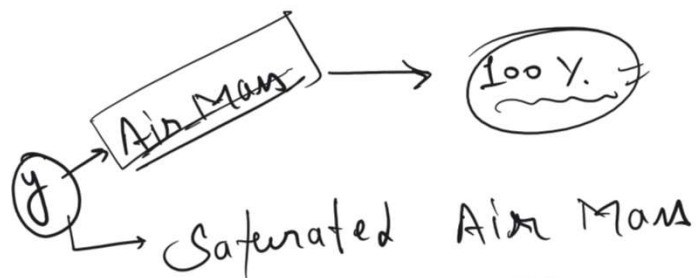


Note : If temp. of Air Mass increases then relative Humidity will decrease.

$$\text{Relative Humidity} = \frac{\text{Present Humidity}}{\text{Humidity Capacity}}$$

Relative Humidity

$\alpha \Rightarrow$ Air Mass

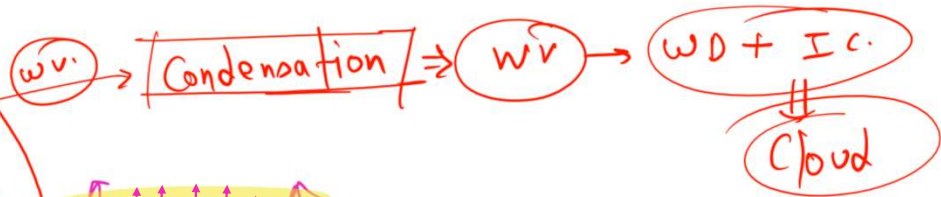


$$R.H. \Rightarrow \frac{\text{Present Hum.}}{H.C.} \times 100$$

$$\Rightarrow \frac{400 \text{ gms}}{1200 \text{ gms}} \times 100 = 33.33\%$$

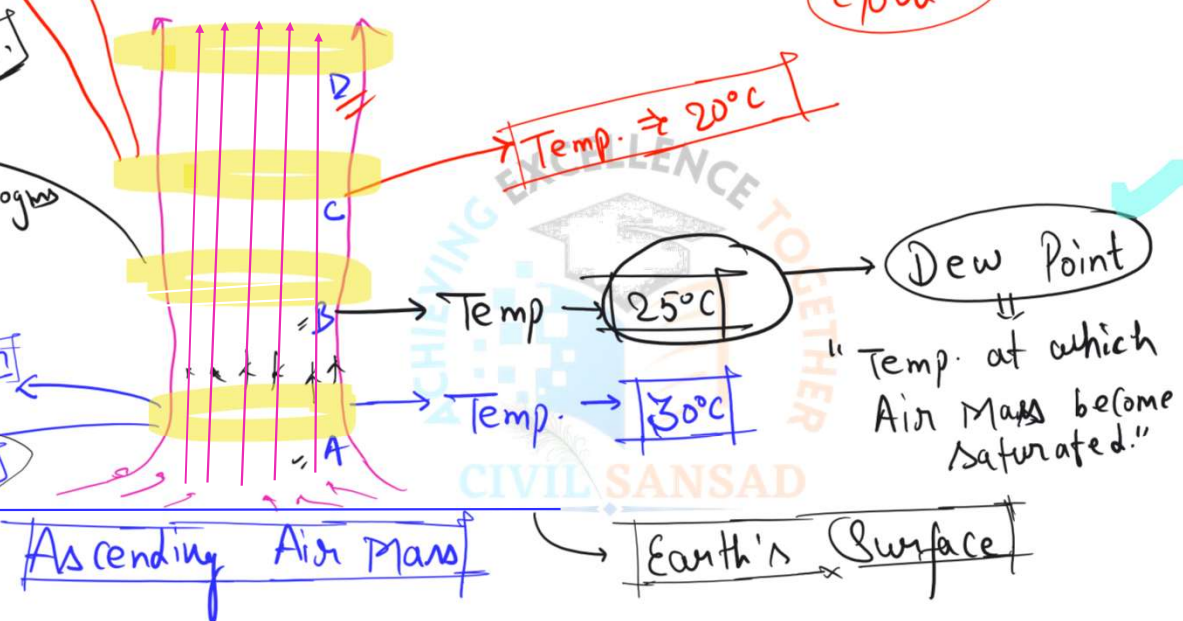
Humidity Capacity = 200gms.
Present Humidity = 200gms + 100gms = 300gms.

How Condensation occurs.



Humidity Capacity ⇒ 300gms.
Present Humidity ⇒ 300gms.

Humidity Capacity = 400gms.
Present Humidity = 300gms.



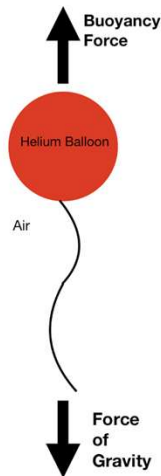
Water vapour
↓ Condensation
Water Drops + Ice Crystals

Air → light

- ① Increase Temp.
- ② water vapour increase.

N ₂ , O ₂ , CO ₂ , Ar, H ₂ O				
28	32	44	40	18

What are clouds? Ans ⇒ Condense water vapour into hair line size water drops and ice-crystals that suspends in Air.



Buoyant force. ↑

Earth's Surface

Earth's Surface

↑ Density of air decreases as we move vertically upward

↑ Density

Condensation
as we move vertically upward

Clouds

WD IC.

Hair line size

Buoyant force

Gravity

Rainfall



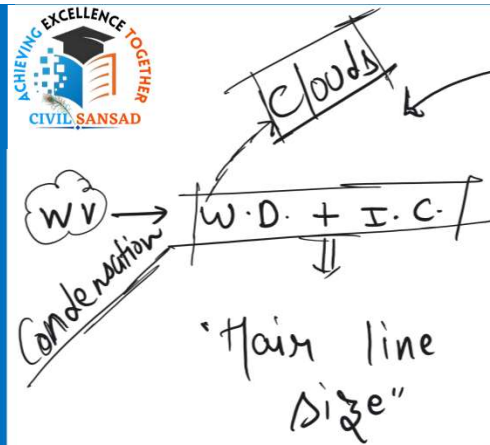
Earth's Surface

More Density

Earth's Surface

Condensation and Precipitation

falling of water in any form.
↳ liquid
↳ solid
↳ Gas.

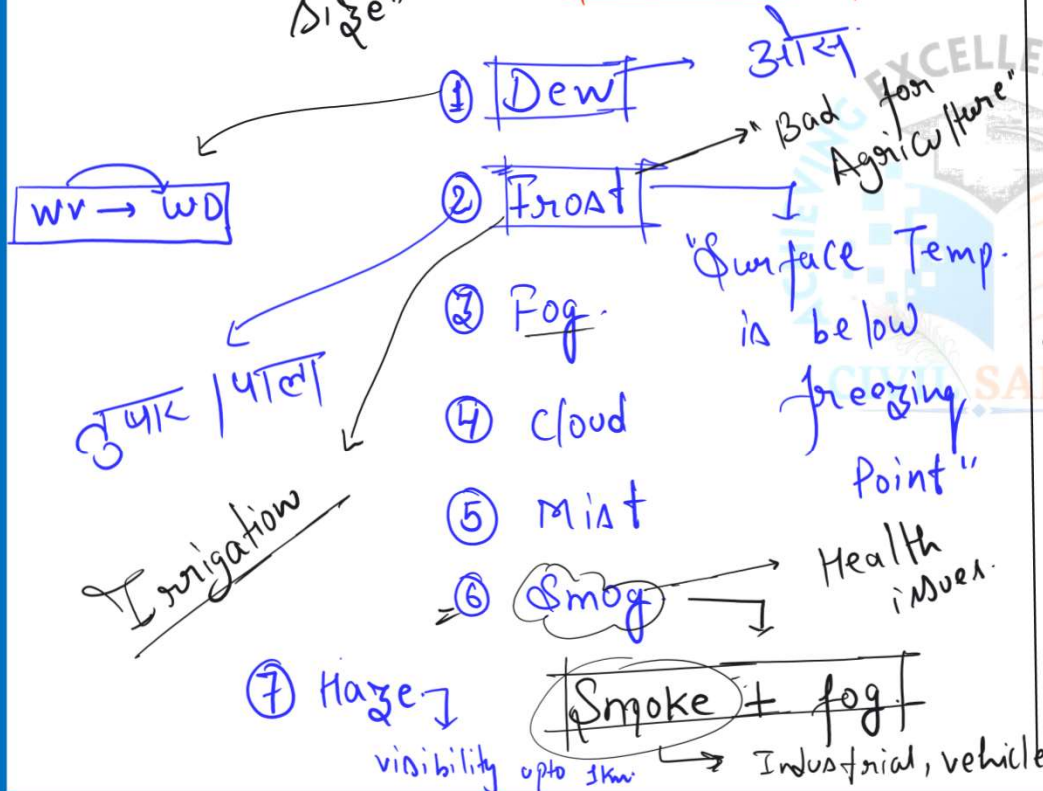


changing of form
W.V. → W.D. → Ice.

Condensation

Precipitation

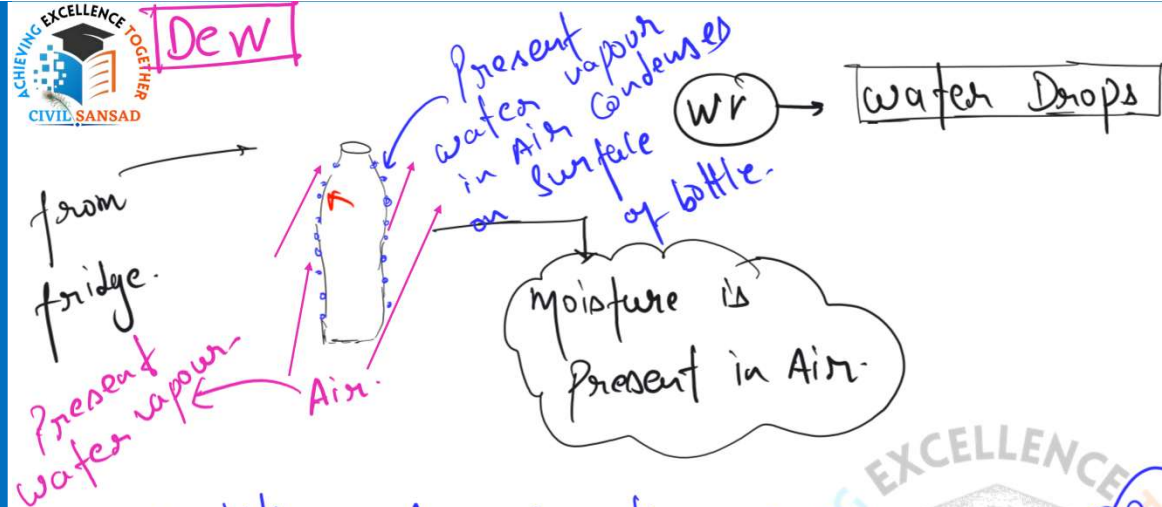
fall



- ① Rainfall → < 0.5 mm. (Drop Size)
- ② Snow fall → > 5 mm (Snowflake),
उपकरण
- ③ Spray → > 0.5 mm (Drop Size)
- ④ Hailstones → < 5 mm (Snowflake)
- ⑤ Sleet → Rain + Hailstone (liquid + solid)
- ⑥ Drizzle → amount of drops is less.
- ⑦ Virage (Gaseous prec.)

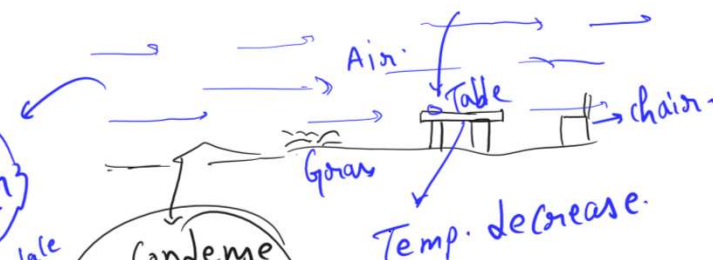
Dew

Prayag Mishra Sir



"Drop → freeze"

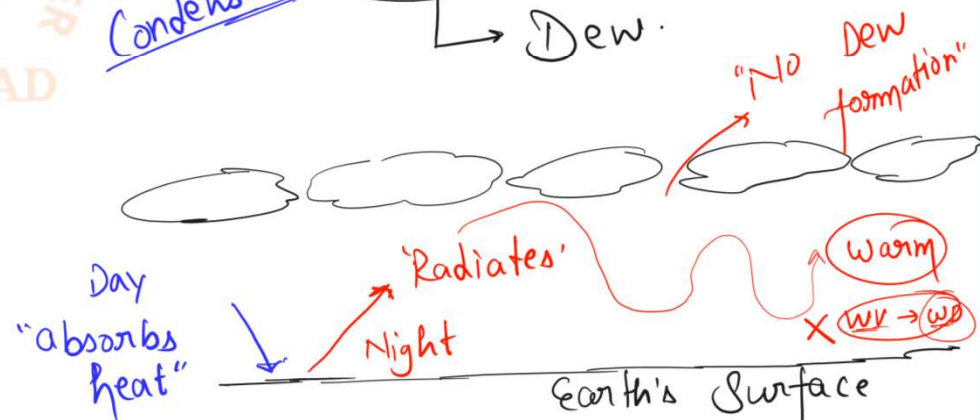
Day → Evening → Temp. ↓



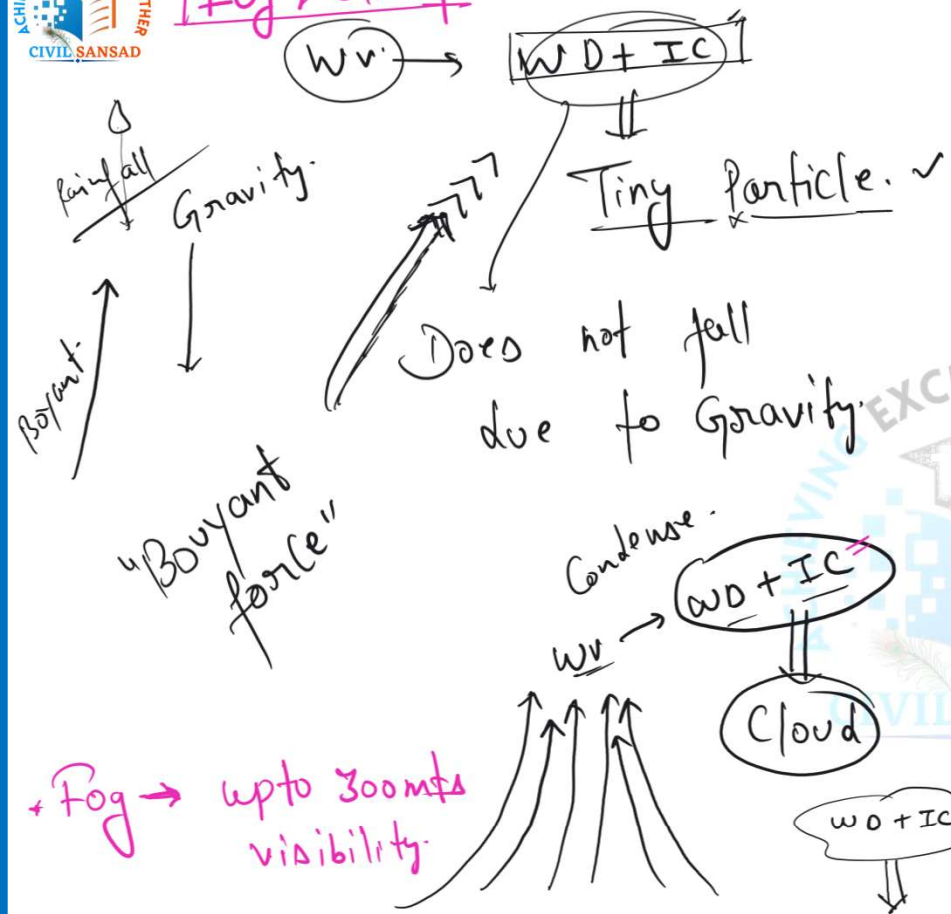
Conditions for formation of Dew.

- ① No wind or slow wind.
- ② Clean weather.
- ③ long Nights
- ④ High Relative Humidity.
- ⑤ Dew point is more the freezing point.

Present water vapour
on surface
Condenses



Fog / Cloud



* Water vapor is present in Air.

Temp. Decrease → fog.

[Fog → Smog → Haze → Mist]

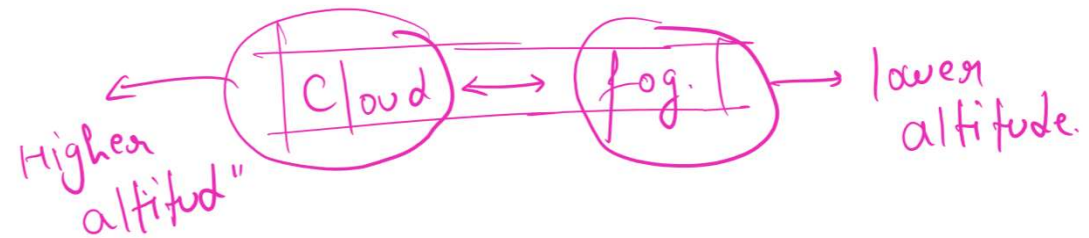


* Fog → upto 300mts visibility.

* Mist → "when water drops are more and large as well."

↓ Hills

1km to 2kms.



Types of fog

① Radiation fog

clean weather

"No winds or slow winds"

"High relative humidity near Earth's surface"

"to release heat to space"

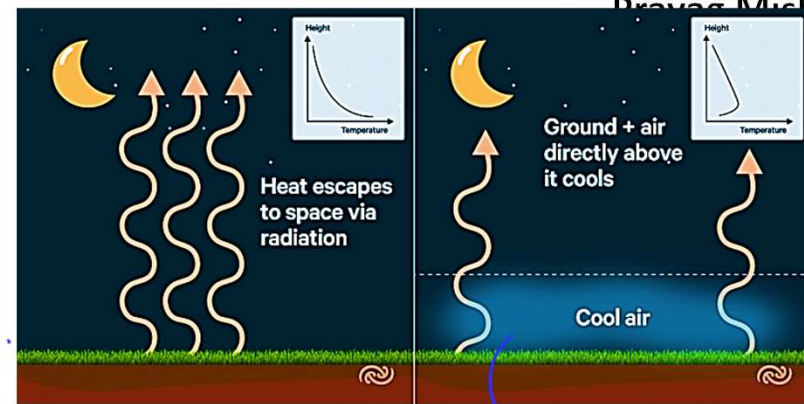
Just Above

"Condenses humidity and changes into fog"

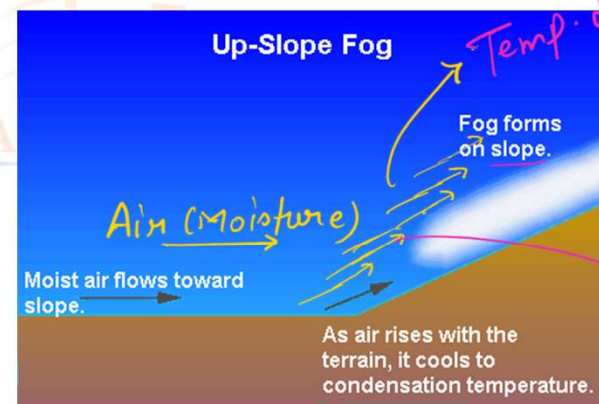
Note:- "Air near Earth's surface should have humidity while above it should be arid."



"in evening or night time Earth's surface will cool down."



"water vapour Condenses due to decrease in temp. of air"



② up-slope / Cheyenne Hill fog.

"water vapour will Condenses."

Note:- "If air ascends its temperature decreases and water vapour Condenses."

Advection warm Air Mass
→ "Transfer heat" →

Place A → Cool → become warm.

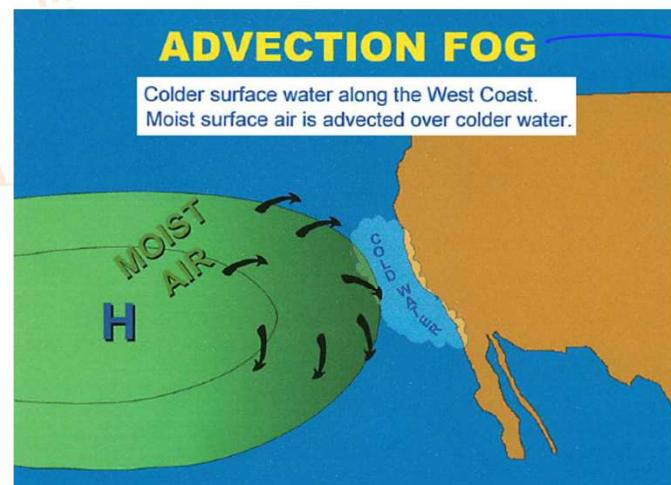
Cool Air Surfaces

③ Advection fog :- when fog forms by horizontal movement of Air on cooler surfaces.

Characteristics

- ① Surface is very cold.
- ② wind speed is fast.
- ③ Relative Humidity must be high.

WV → Condense



Can be formed on land surface as well sea-surface

④ Frontal fog :- Present moisture in warm Air will Condenses to form fog when Comes in Contact to Cold Air.

Diagram showing Cold Air → warm Air → Cold Air. Below this, a diagram shows a cross-section of the atmosphere with a layer of fog forming at the interface between the cold and warm air masses.

Layer of fog.

Fog

Fog is a low-lying cloud consisting of tiny water droplets or ice crystals.

Radiation Fog

Forms on clear, calm nights as the ground cools



Advection Fog

Forms when a colder layer of air rests on a body of water



Upslope Fog

Moist air ascends a slope, cooling and condensing



Freezing Fog

Supercooled water freezes onto surfaces upon contact



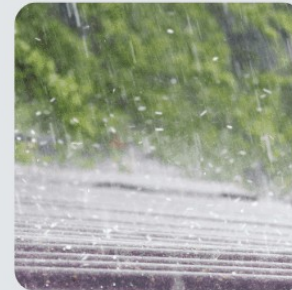
Evaporation Fog

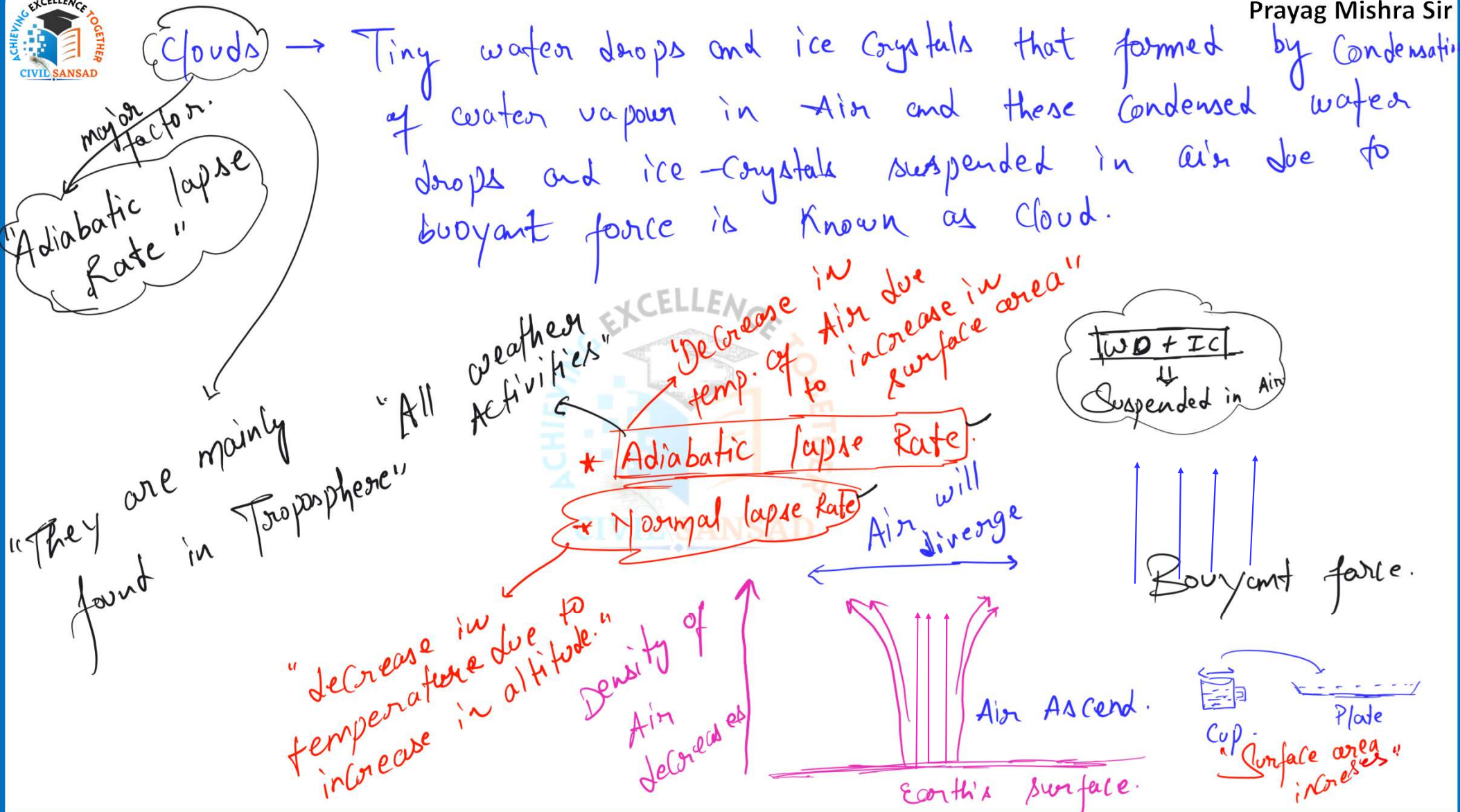
Evaporation raises humidity and moist air mixes with cool air

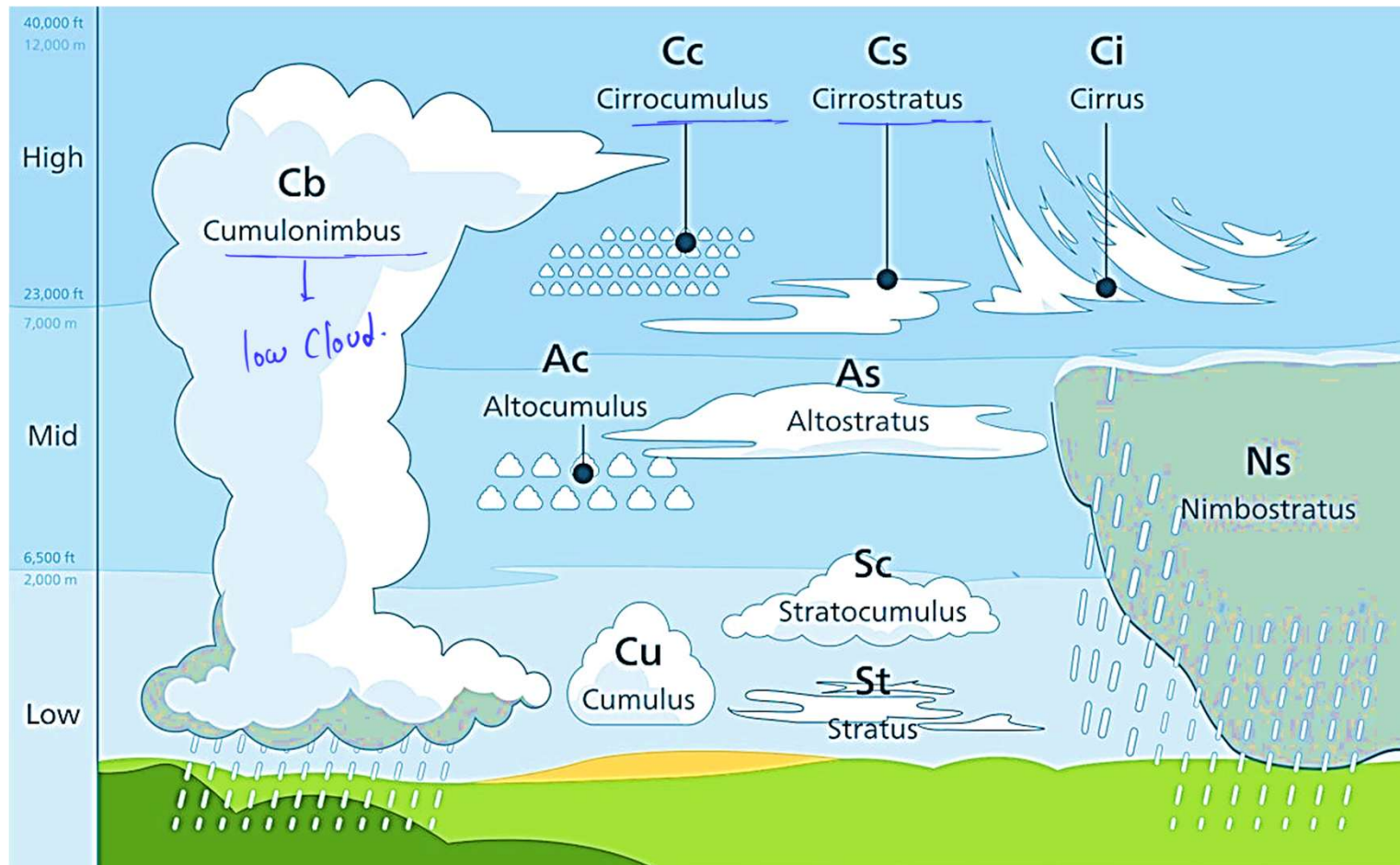


Hail Fog

Hail decreases temperature while increasing humidity









Classification of Clouds

Luke Howard (Britain) 1802

Prayag Mishra Sir

on the basis of altitude.

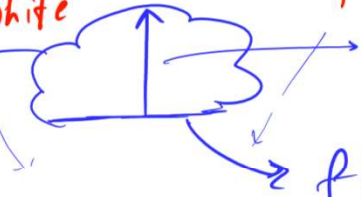
on the basis of Shape and Colour.

Q. which cloud is responsible for global dimming.

↳ Stratus.

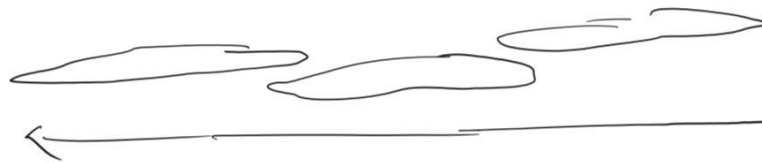
① on the basis of Shape and Colour.

① Cumulus
"Cotton bundle or cauliflower shape"
white
Indicator of clean weather.
vertically extended.
flat base.



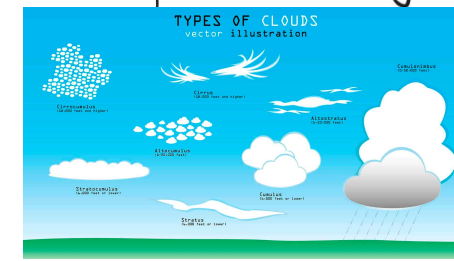
"Mother of pearl"

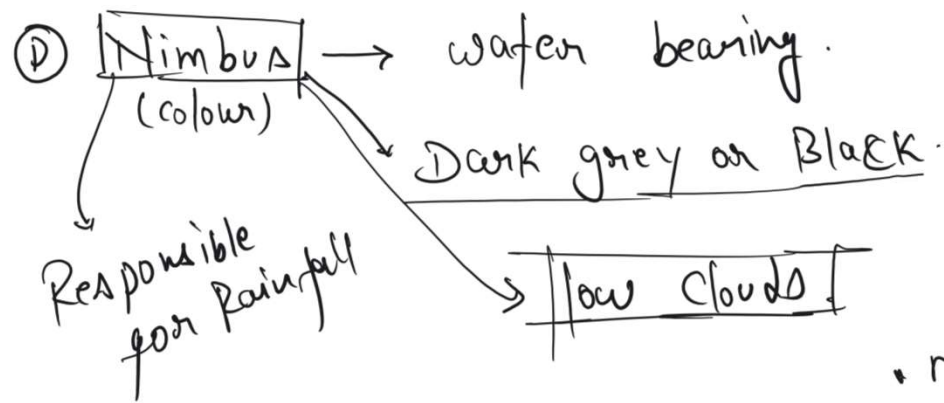
② Stratus



↳ Horizontally extended.
↳ layers.

② Cirrus Clouds :- Highest clouds.
Extreme white.
feathery clouds
more ice-crystals



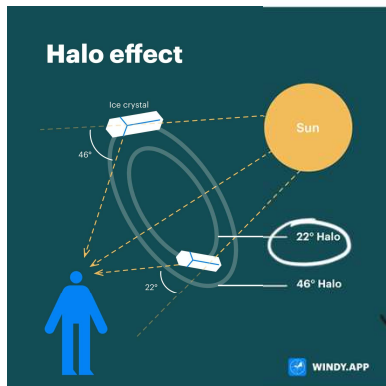
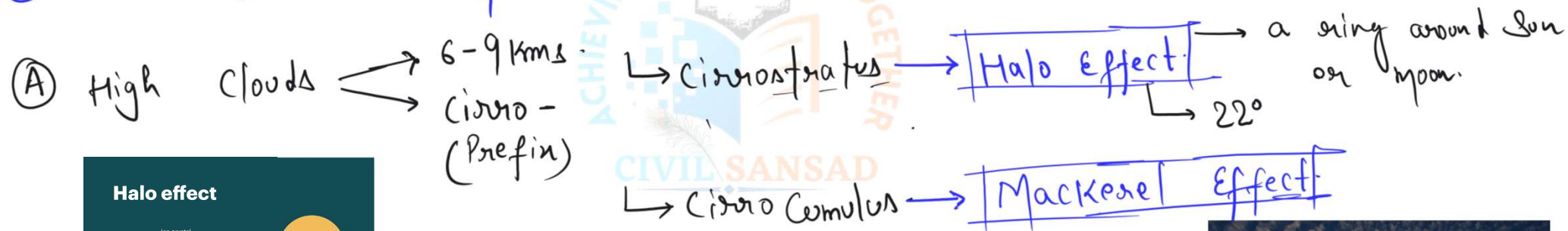


Colourful ring around Sun and moon

• more noticeable around Sun



② on the basis of altitude.



③ Mid-Clouds → 3 to 6 kms
→ Alto - "prepin"

→ Altostratus → light grey clouds
→ may cause rainfall

→ Alto Cumulus → Banner clouds ✓
→ Scenic view

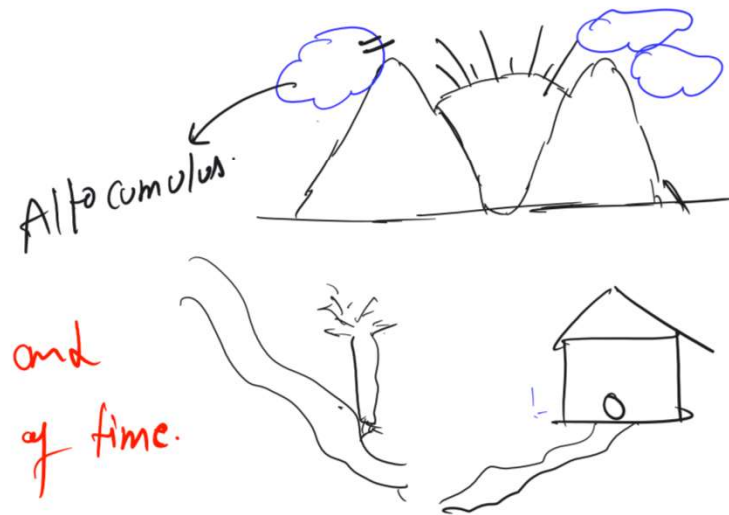
④ Low Clouds → up to 3 kms.

→ Stratus Clouds
→ Cumulus Clouds.
→ ** Strato Cumulus Clouds.

→ ** Nimbostratus → little but continuous rainfall

→ ** Cumulonimbus → heavy rain with thundering and lightning for short period of time.

Rainbow Effect



Precipitation

→ "falling of water in any form."

low clouds.

Spray

0.5 mm less drop size.

Process of Condensation is slow.

① Snowflakes $\xrightarrow{\text{changes to}}$ Drops.

② when two clouds merges.

Snowfall

→ when temperature of atmosphere is below 0°C .

Hailstones

5mm to 50mm.

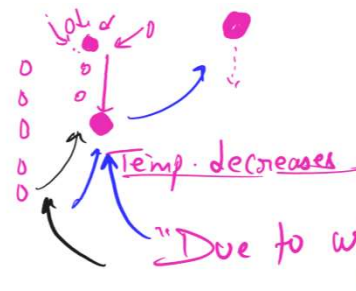
Cumulonimbus clouds.

① when temp. of atmosphere is below freezing.

② when air movement is very fast

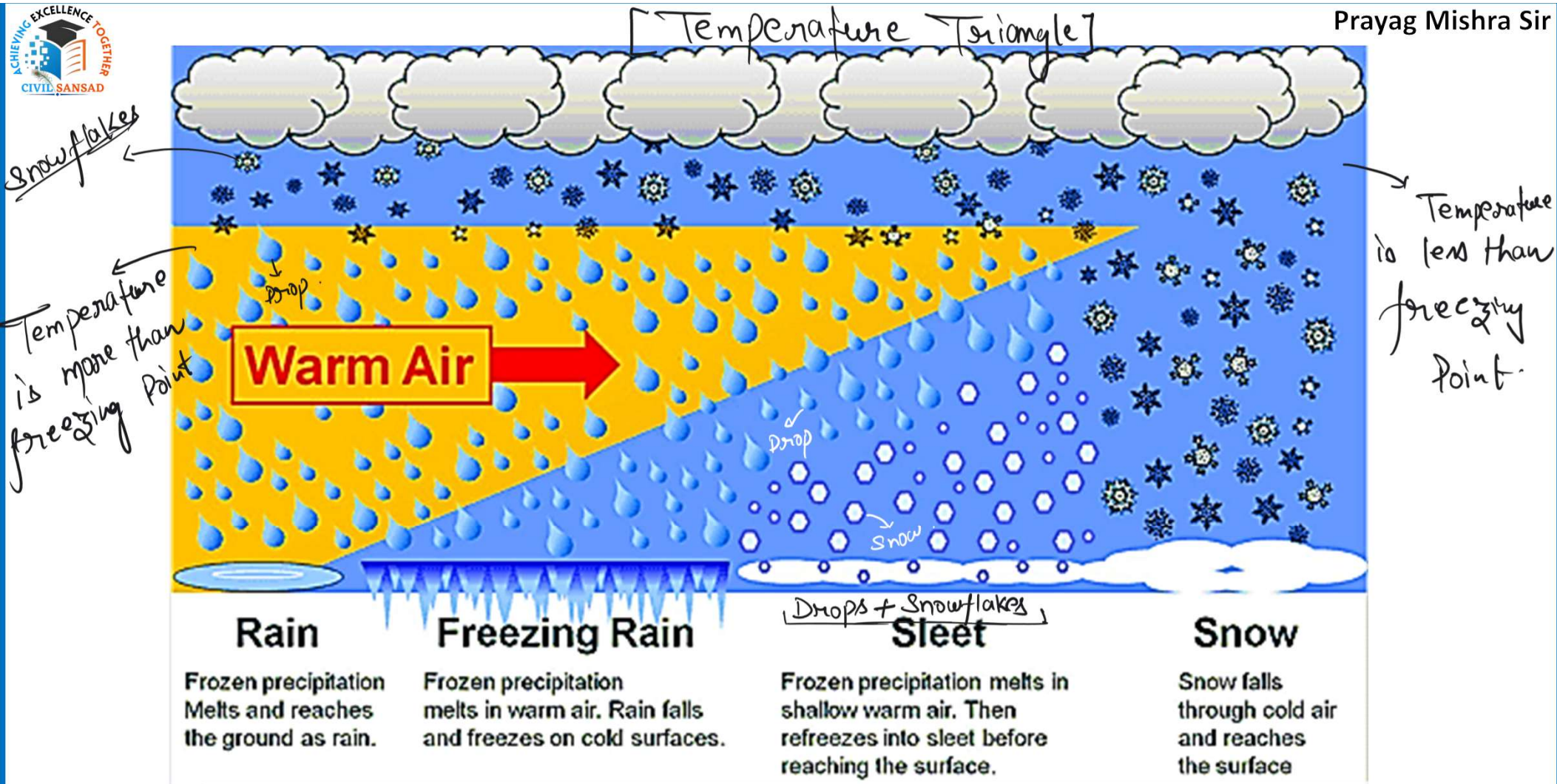
freeze $\leftarrow 0^{\circ}\text{C} \downarrow$

Small size Hailstone



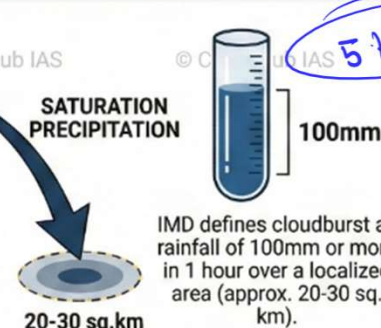
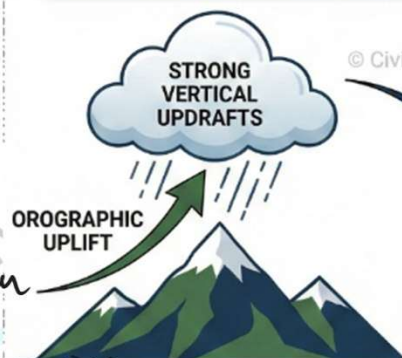
Sleet → liquid + solid precipitation.

→ when drops reaches cool air of atmosphere it gets freeze.



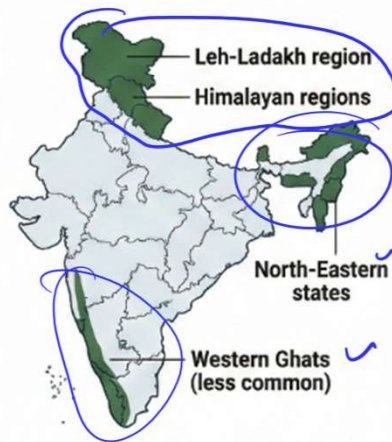
CLOUD BURST

"A cloudburst is a sudden and extreme amount of precipitation in a short time span, often restricted to a small area, leading to flash floods."



MONITORING & PREDICTION
Difficult to predict due to small area and short time frame. Use of Doppler Weather Radars, AWS (Automatic Weather Stations), and satellite-based early warning systems.

GEOGRAPHICAL DISTRIBUTION



CAUSES OF CLOUD BURSTS

Orographic uplift: Moist air rises due to mountains (e.g., Himalayas), cools, and leads to condensation and intense rainfall.	Convection currents: Strong vertical movement of warm moist air, especially in monsoon regions.	Blocked weather systems: Localized pressure zones may trap clouds in an area.	Atmospheric instability
---	---	---	---------------------------------------

IMPACTS

Flash Floods	Landslides	Infrastructure Damage	Casualties & Losses
----------------------------	--------------------------	-------------------------------------	---------------------------------------

Cloud Burst → most Common in hilly areas.
Can be in Plains.

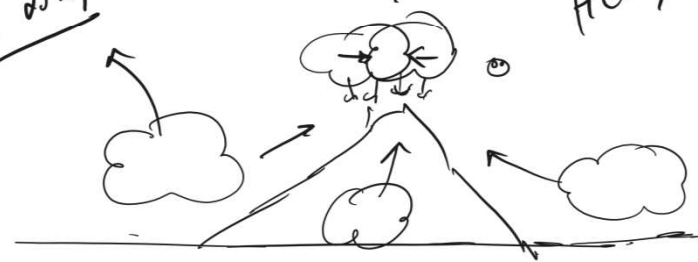
Cumulonimbus

Heavy Rain with thundering and lightning.

Torrential Rainfall

High Condensation
Heavy Precipitation

Small drops

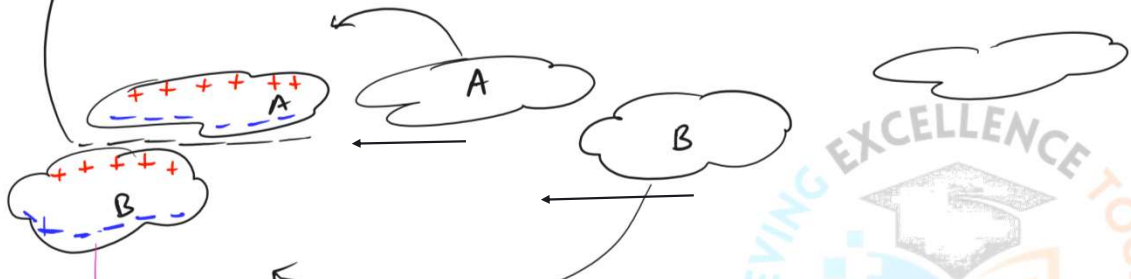


Thundering x and lightning → fast Speed.

Sound → slow speed

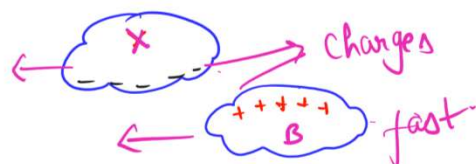
Electrically charged.

friction

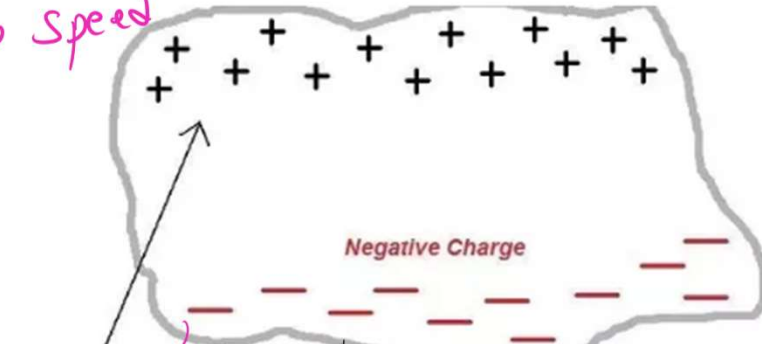


charge will attract towards Earth.

Earth.
+++++ (infinite "+")
----- (infinite "-")



changes will neutralise
↓
* lightning.
* Thundering



Positive Charge

Negative Charge

Stepped Leader

Positive Streamer

Metal

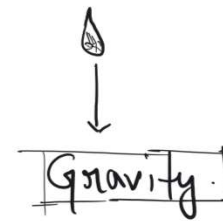
Circuit

Tree Medium



"always in lower"

Rainfall → falling of drops of water



Types of Rainfall

3-types ① Convectional Rainfall ② Orographic Rainfall
③ Cyclonic or frontal Rainfall.

Convectional Rainfall

→ on Equator

→ 4 PM Rain

rising air
Condenses and
causes heavy rain
for short period
of time.

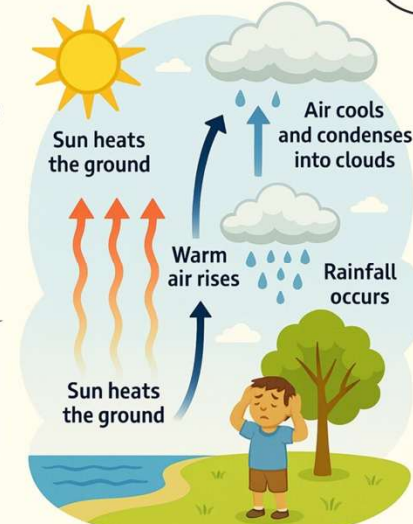
Air Ascends
warms

Earth's Surface

fall

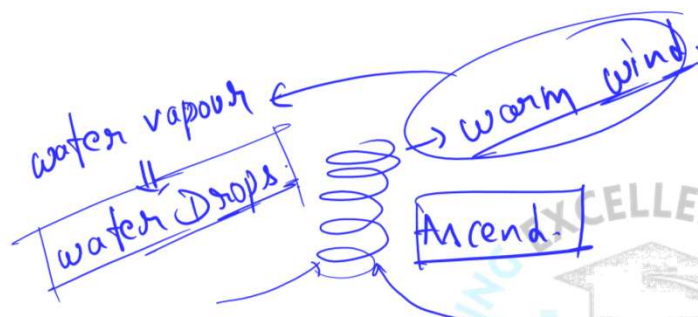
Convection currents

Conventional Rainfall



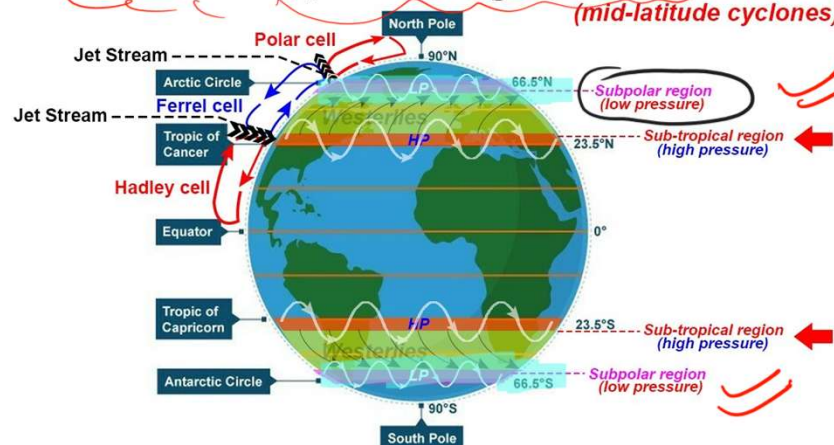
"Adiabatic lapse Rate" ↓
"Temperature decreases Rapidly"

② Cyclonic or frontal Rainfall



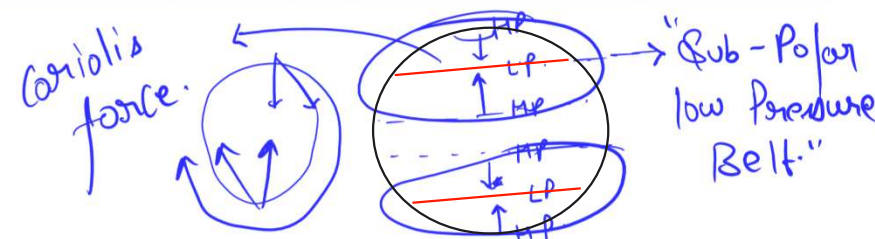
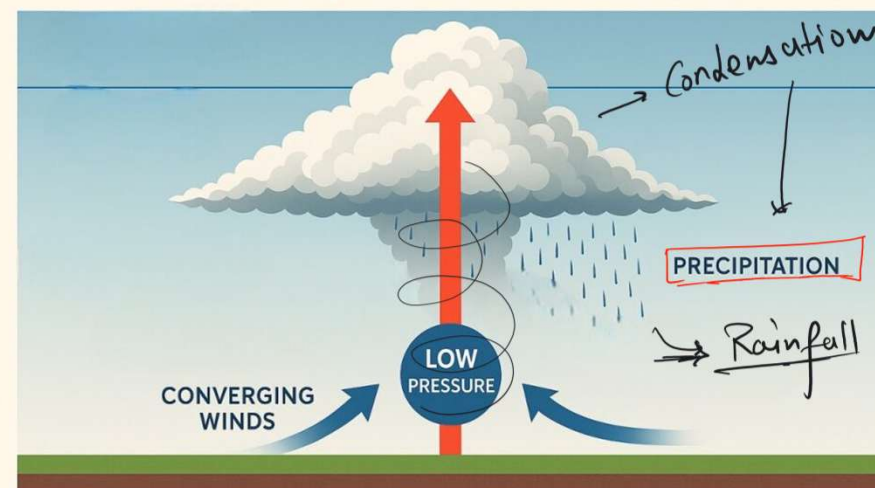
Extratropical Cyclones

(mid-latitude cyclones)



CYCLONIC RAINFALL

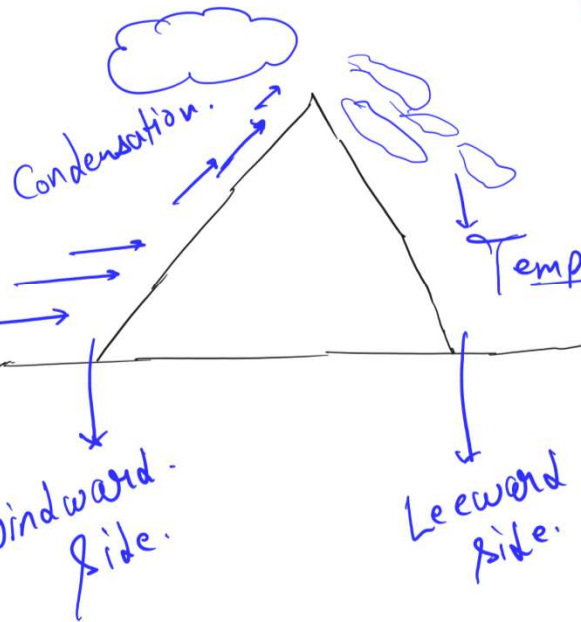
Caused by Rising Moist Air in a Low-Pressure System



③ Orographic Rainfall :-

En.

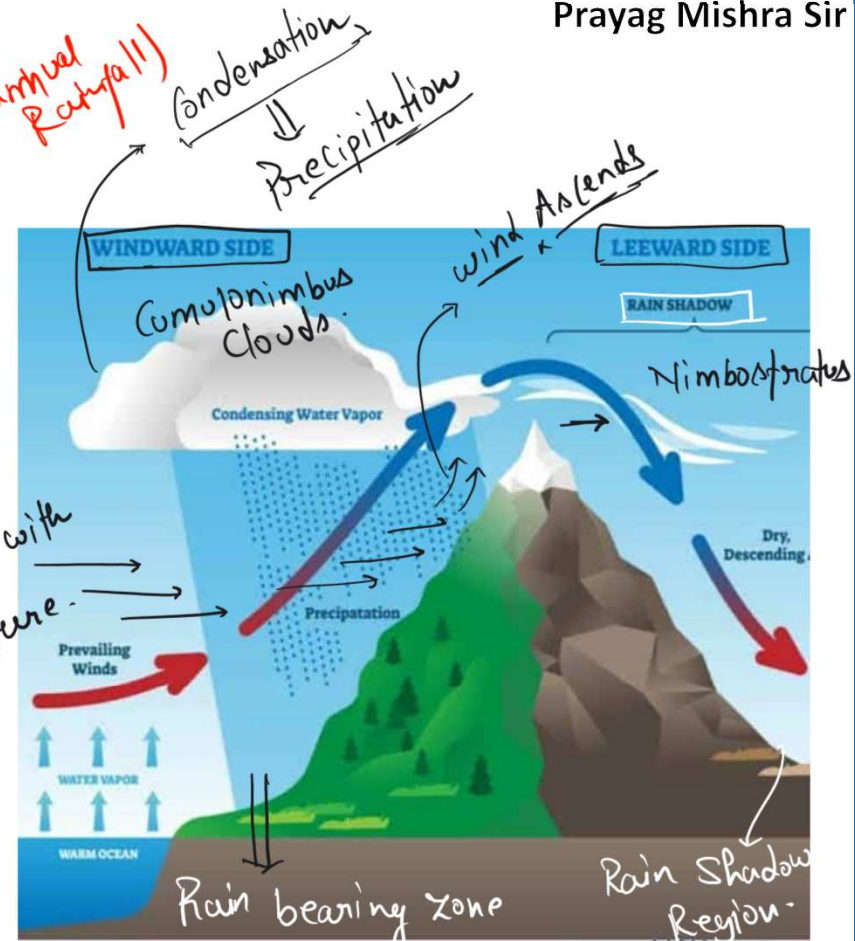
Mountains



western Ghats
Pune (60cm annual Rainfall)
Mahabaleshwar "600cm annual Rainfall"

No precipitation

Winds with moisture





④ Artificial Rainfall

Super cooled.
 used chemicals
 costly.



other chemical.

→ Urea, Dry CO_2 .

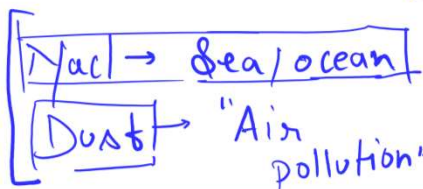
→ KI (Potassium Iodide).

Ex. ① Project Rain Drop → Kutch region of Gujarat.

② Project Varsha Dhari

Karnataka.

Hygroscopic Nuclei.



→ Cool

"attracts humidity"

→ Hygroscopic Nuclei.

→ Salt particle

* Vincent J. Schaefer, Irving Langmuir, Prayag Mishra Sir

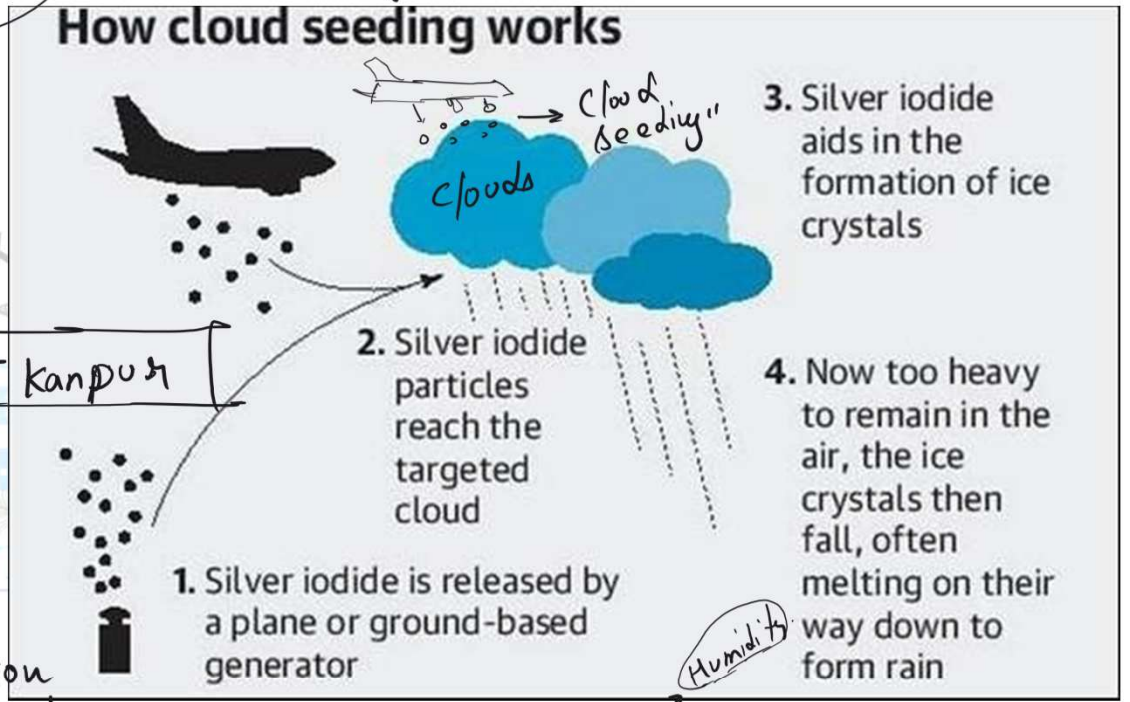
cloud seeding. 1946 (West Massachusetts)

Dry ice

Solid CO_2

IIT Kanpur

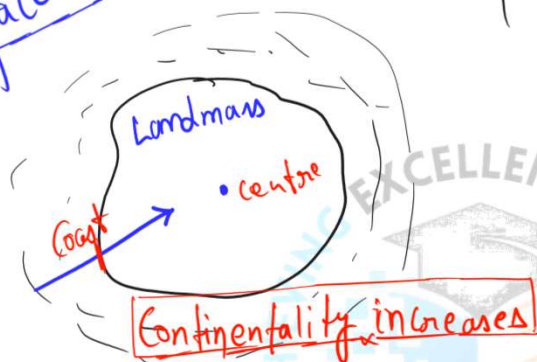
How cloud seeding works



Humidity

Distribution of Rainfall on Earth

"Rainfall is more on Sea surface"



Territorial Distribution

- ① Heavy Rainfall → 200cm or more annually
- ② Medium Rainfall → 100cm - 200cm annually
- ③ Less Rainfall → 50 cm to 100cm annually
- ④ very less Rainfall → below 50cm annually

① Heavy Rainfall [200cm or more annually]

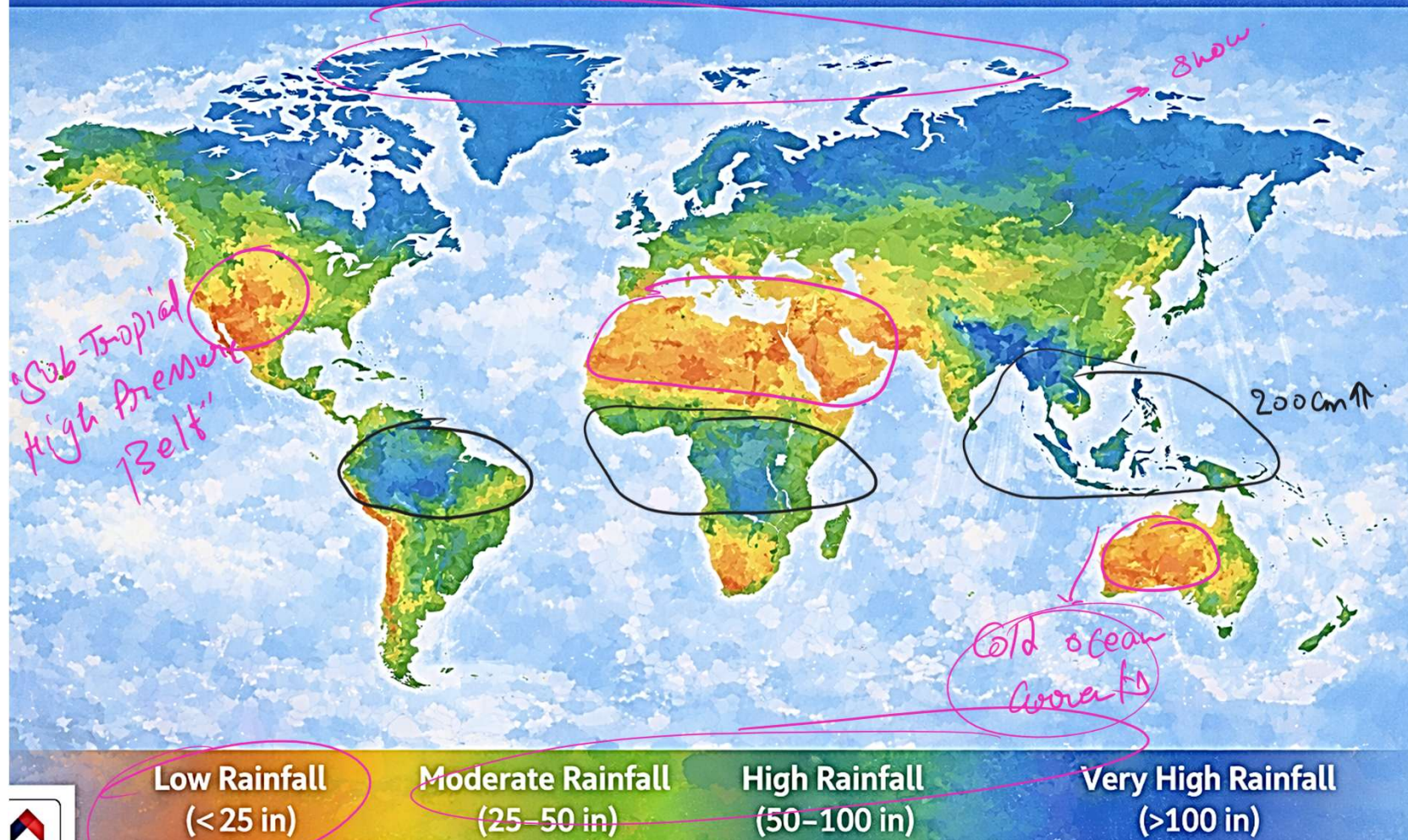
↳ Equatorial Region

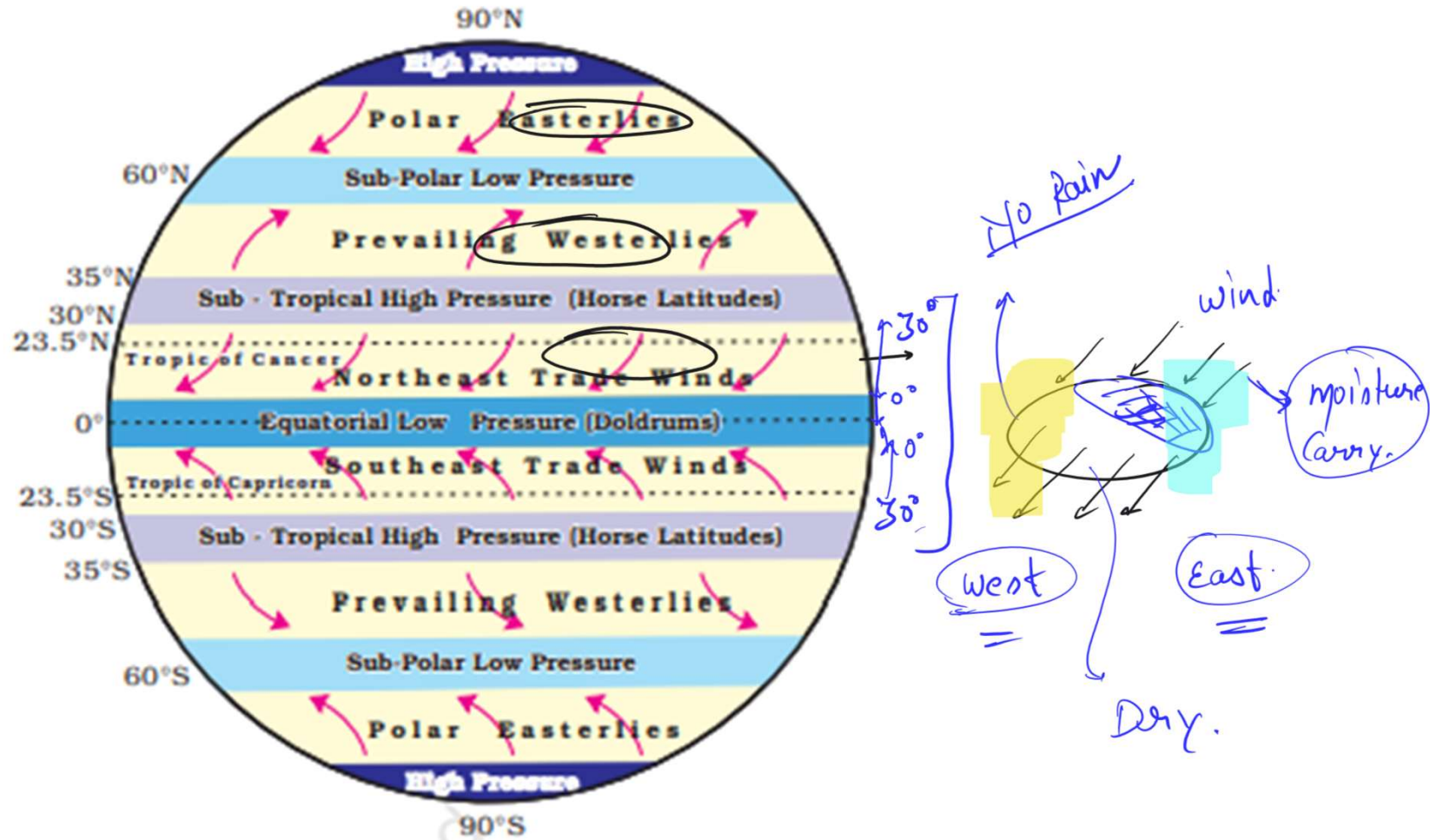
↳ Coastal regions of eastern coast at 30° latitude.

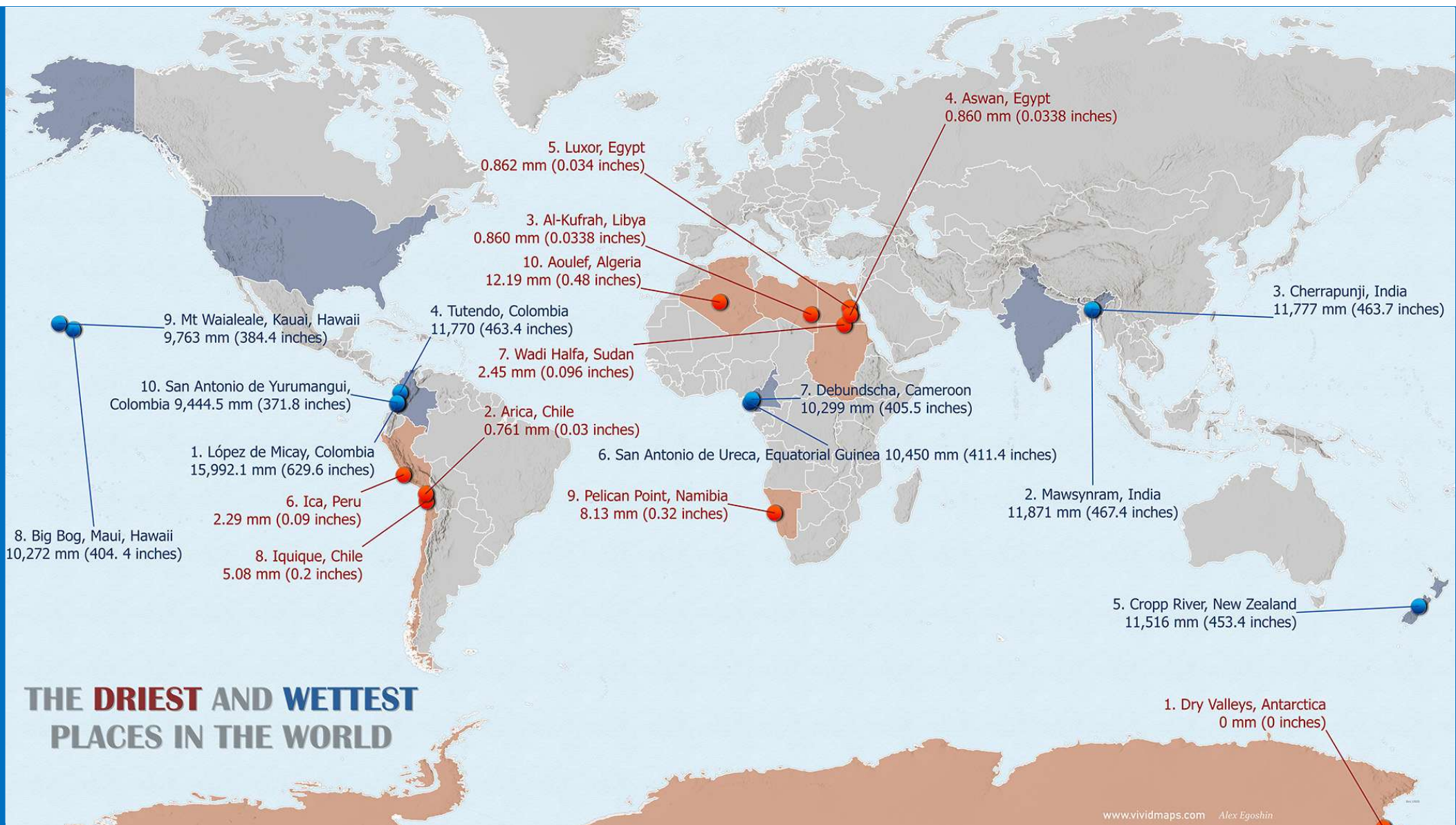
↳ western margins in 40° to 60° latitudes.

↳ Coastal Area.

World Distribution of Rainfall



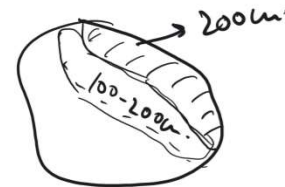




② Medium Rainfall [100 - 200cm annually].

↳ adjoining areas of eastern margins between $[30^\circ \text{ to } 0^\circ]$

↳ adjoining areas of western margins between $[40^\circ \text{ to } 60^\circ]$



③ Less Rainfall [50 to 100cm].

↳ Mid of Continents.

↳ Polar Regions.

↳ western margins of continents b/w $30^\circ \text{ to } 0^\circ$ and eastern margins of continents b/w $40^\circ \text{ to } 60^\circ$.

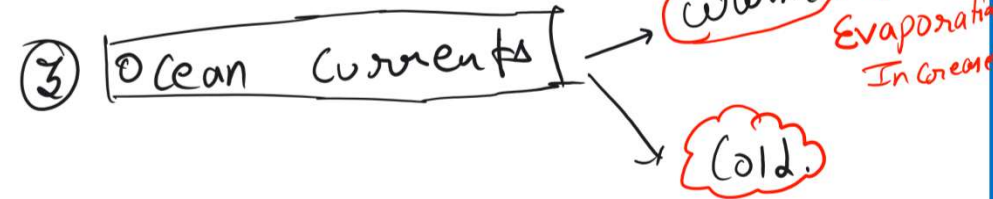
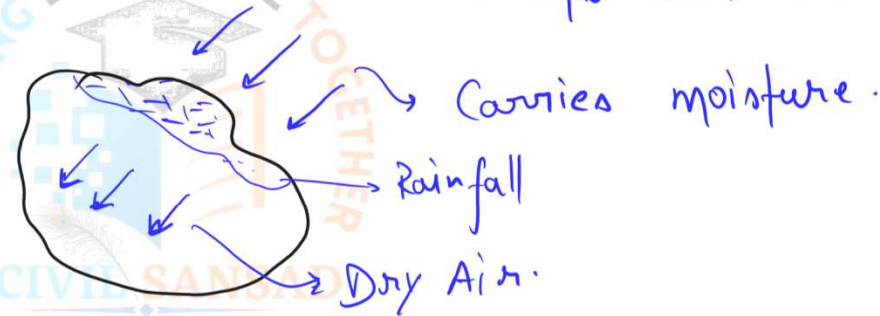
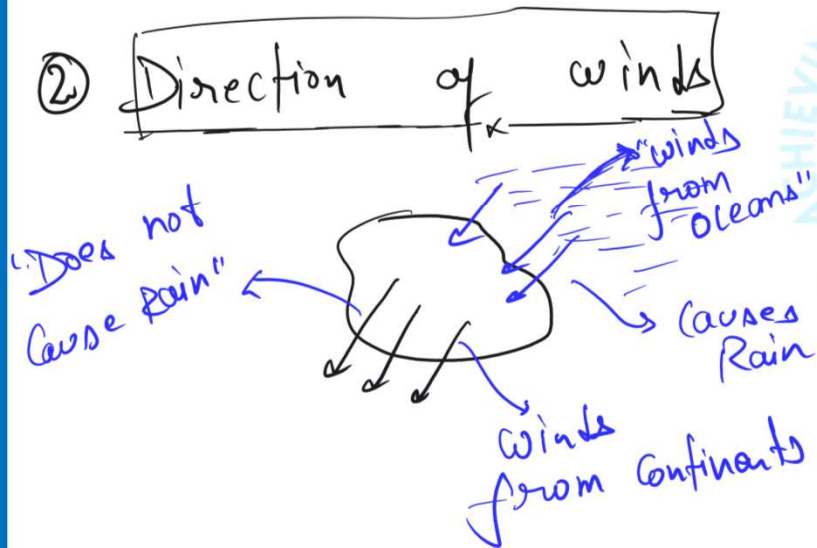
④ Very less Rainfall [below 50cm].

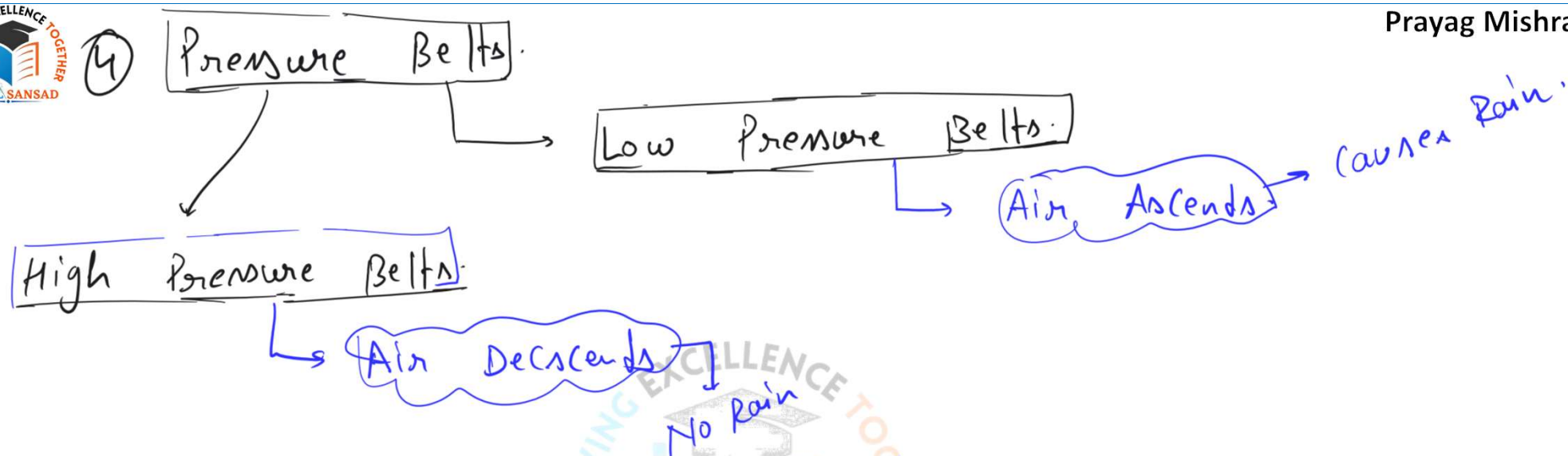
↳ Deserts → Rain Shadow Zone.

↳ Poles (High Pressure).

Factors responsible for Rainfall

- ① Humidity → Should be High
 ↳ Directly related to temp.
 ↳ more on Equator =
 ↳ less on poles.
 ↳ coastal Area (more)
 ↳ Mid-continent (Less).

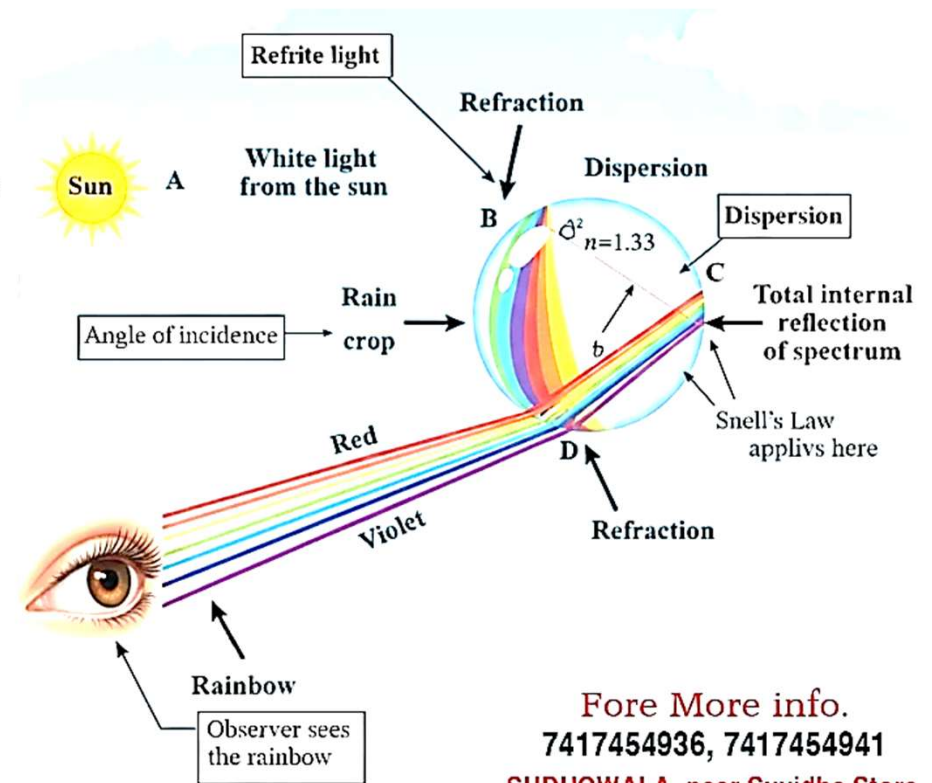
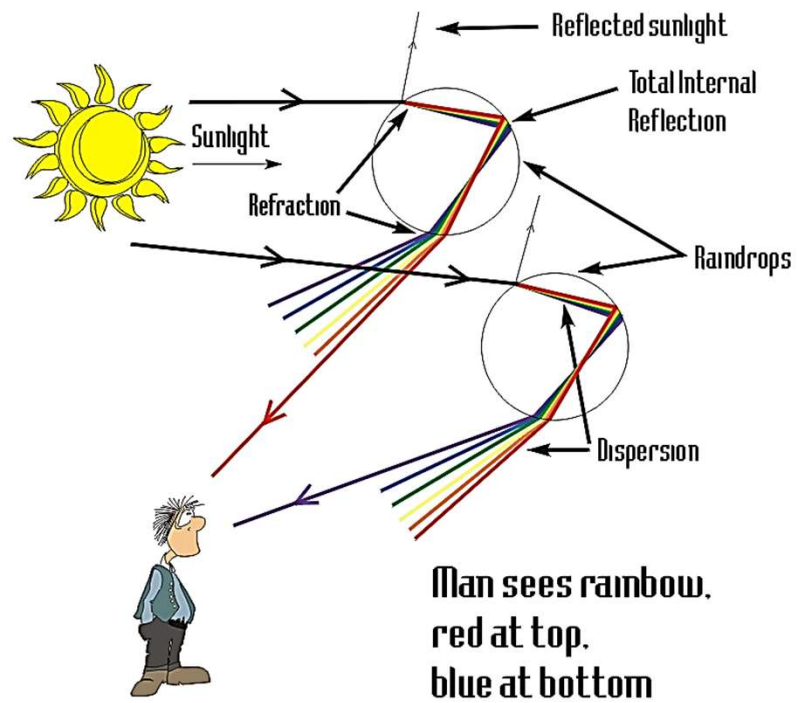




Important Facts

- ① High rain on coast and low Rain in Mid Continent. (Continentality).
- ② Convectional Rainfall is most Common.
- ③ In India highest Rainfall is orographic Rainfall.





Fore More info.
7417454936, 7417454941
SUDHOWALA, near Suvidha Store