1 a **Fill in the blanks** 10

i) The core of Earth is divided into two parts. Outer part is **LIQUID** while inner part is **SOLID**

ii) Strike direction of a bed dipping towards $N65^0E$ is **$N155^0$ OR $S25^0E$**

iii) Toposheet immediately North of toposheet no. 46I/12 is **46I/11**

iv) On the map of 1:20,000 scale, an object of 1700 m length will be **8.5** cm.

v) The rectangular world map we normally see in books is a result of **PLANE/PLANAR** projection.

vi) Age of the earth is **4560 0R 4600** million years

vii) Because of Coriolis force the cyclones in southern hemisphere rotate **ANTI-CLOCKWISE** direction.

viii) **EKMAN** spiral is the phenomenon seen in oceans where the surface flow of current is at 90^0 angle to the deeper water flow.

ix) Survey of India toposheets use **POLYCONIC** projection.

x) A fault striking parallel to the strike of the bed is called **STRIKE** fault.

1 b **Define the following** 10

i) Gutenberg and Lehman discontinuity
-The seismic-velocity discontinuity between the Earth's mantle and core.
-Discontinuity present between inner and outer core of the Earth.

ii) Paraconformity and disconformity
-Unconfirmity or break in deposition with beds on either side being parallel
-Unconformity with significant age gap

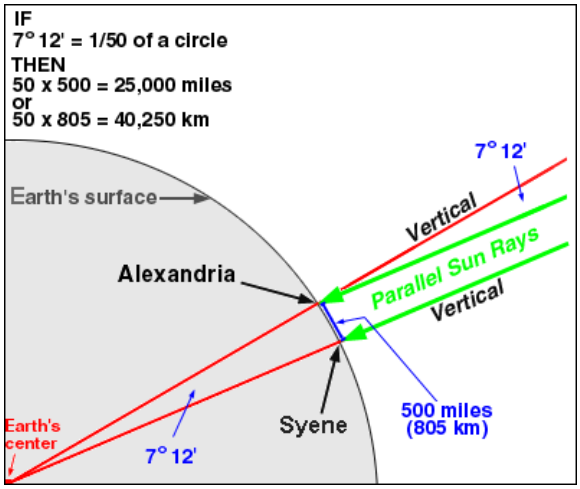
iii) Mantle and core
-The mantle lies between Earth's dense, super-heated core and its thin outer layer, the crust.
-Innermost, superheated, central part of the Earth made up of inner and outer core.

iv) Hydrosphere and biosphere
-The hydrosphere includes water that is on the surface of the planet, underground, and in the air.
-The biosphere is one of the four layers that surround the Earth along with the lithosphere (rock), hydrosphere (water) and atmosphere (air) and it is the sum of all the ecosystems

v) Mesosphere and ionosphere
-The mesosphere is a layer of Earth's atmosphere which is directly above the stratosphere and below the thermosphere.
-The ionosphere is defined as the layer of the Earth's atmosphere that is ionized by solar and cosmic radiation.

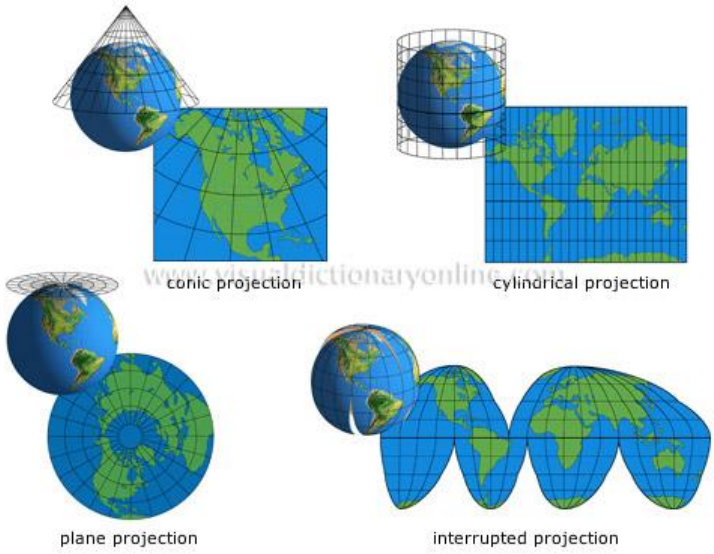
2 **Attempt <u>any two</u> of the following**

a Explain how the circumference of our planet was determined by Eratosthenes. What would the procedure have been if the earth's axis was not tilted to the orbital plane? 10

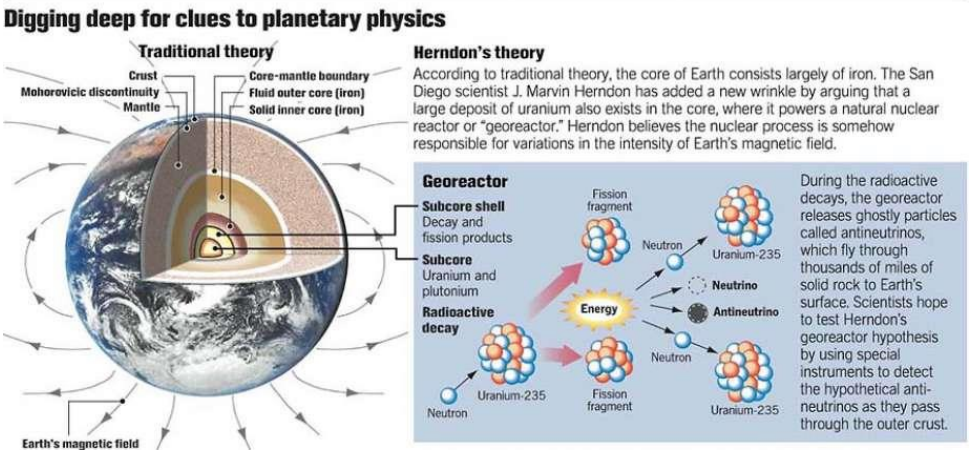


While in Syene, Egypt (known today as Aswan), he noticed that the sun's rays shone directly down a well, casting no shadow at all. From this, he concluded that the sun was directly overhead at Syene. On the same date in Alexandria, a rod perpendicular to the ground cast a shadow that was 7° 12' from perpendicular.
Eratosthenes then divided 360° by 7° 12' and determined that 7° 12' was 1/50th of a circle. Now all he had to do was find the distance from Syene to Alexandria and multiply it by 50 to get the earth's circumference.
Many scholars believe Eratosthenes measured the distance by measuring a single pace and then counting the number of paces from Syene to Alexandria. While this is possible, it is just as likely that he counted the revolutions of a wheel with a known circumference, since this was a common method of measurement in both Egypt and Greece. Either way, he probably hired someone or enlisted a slave to accomplish the task. The distance figure he used was 805 kilometers or 500 miles.
Next, he multiplied this distance by 50 to get 40,250 kilometers (25,000 miles). Today, most scientists set the earth's circumference at 40,096 kilometers (24,901 miles). This gives Eratosthenes' estimate less than a one percent error—an excellent approximation of the earth's circumference

b What are different types of map projections? Explain with the help of suitable examples. 10



c Explain the concept of 'Herndon's Georeactor' and how it explains sustained mantle convection in Earth. 10



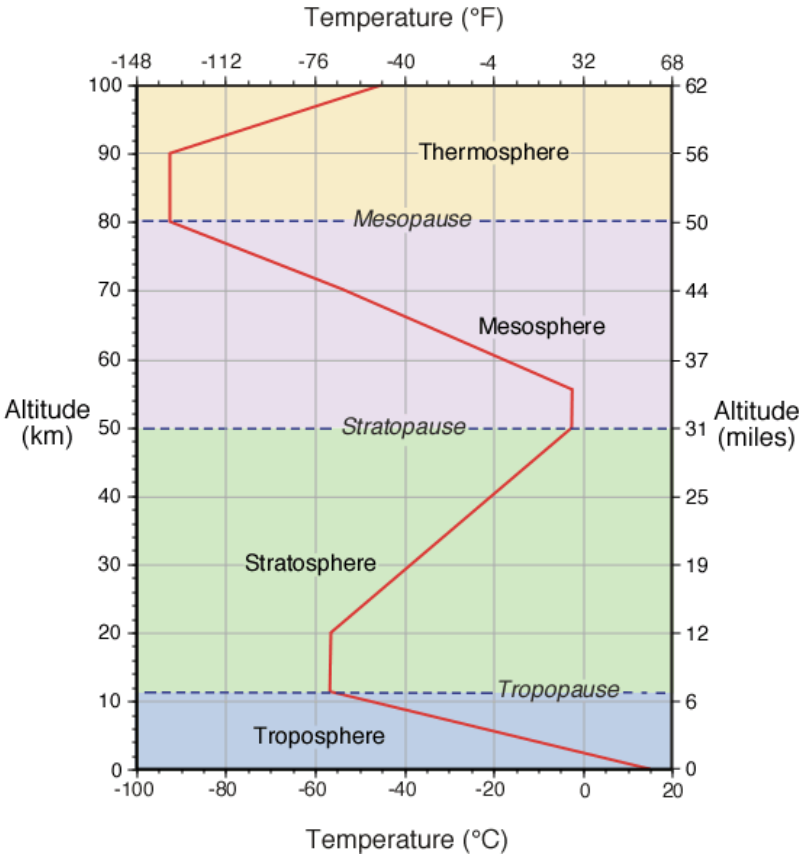
d Explain the variation in temperature with altitude considering the Earth's atmosphere. Explain the significance of covering temperature sensitive electronics of satellites with gold foil reflectors. 10

It is usually not gold. It is actually a material called multi-layer insulation, or MLI.

MLI consists of lightweight reflective films assembled into thin layers that range in thickness. These layers are usually made of polyimide or polyester films (types of plastics) coated with very thin layers of aluminum. The exact composition depends on where the satellite will orbit, what the insulation will be protecting and how much sunlight it will be exposed to.

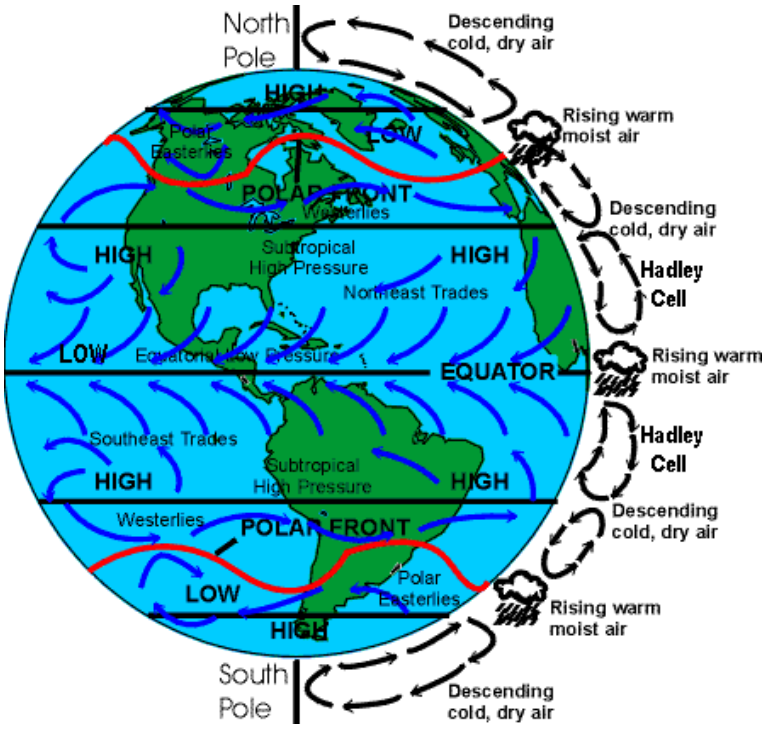
The gold and silver colored sheets you see are often a single layer of aluminized polyimide with the silver aluminum side facing in. The yellowish-gold color of the polyimide on the outside gives the satellite the appearance of being wrapped in gold.

Multi-layer insulation is used on satellites primarily for thermal control and protects the delicate on-board instruments from the extreme temperatures of space. Depending on its orbit, a satellite can experience temperatures from below -200°F to well above 300°F, sometimes at the same time! Not to mention the high temperatures the onboard instruments can produce



3 **Attempt <u>any two</u> of the following**

a Describe the Global Wind Circulation cells. Explain how the Coriolis effect impacts these circulation cells. 10



Winds are created by the uneven heating of the Earth's surface due to the Earth's tilt on its axis and its rotational pattern. The amount of heat a given area receives from the Sun will depend on the Earth's angle and where it is in its rotation cycle at a specific moment. Winds develop as hot air expands and cold air compresses. By circulating the air, the winds help to redistribute energy and regulate the Earth's temperatures.

Along with other vital processes, global wind patterns help to create a hospitable environment for life on Earth. The Earth's rotation and constantly changing angle toward the Sun are responsible for creating the wind we experience every day.

b Explain the numbering and naming scheme for the 'toposheets' by Survey of India. 10

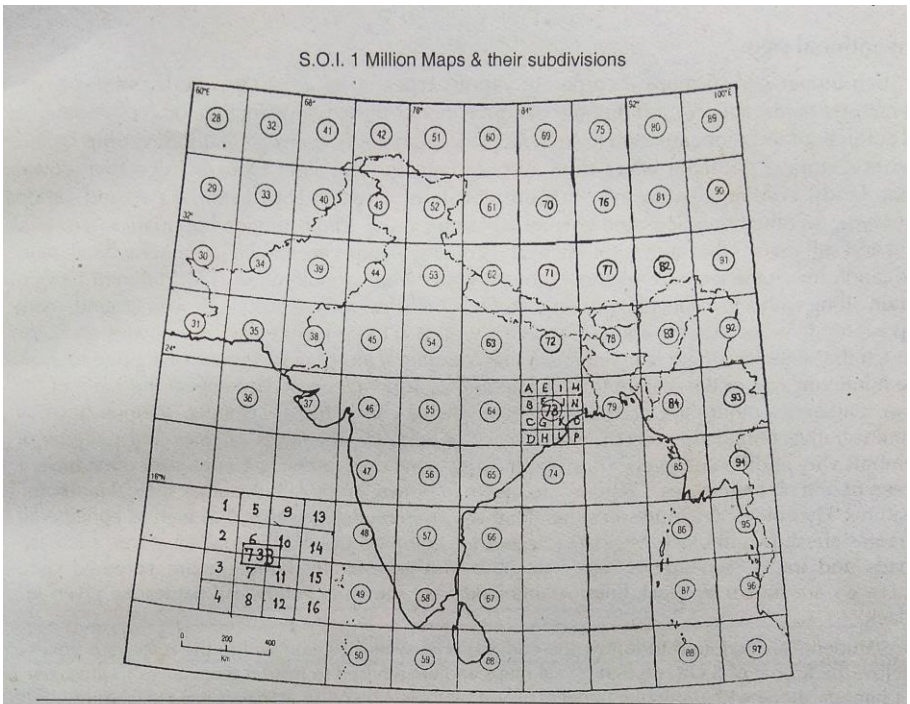


Fig. 3.11 Index Map for S.O.I. Toposheets

into 16 sheets of 1° × 1° rectangles, each of which is further subdivided into 16 rectangular sheets. All of these sheets have been designated by a letter and a number. The table below shows the system of topographical sheet hierarchy. The reference number allotted to various categories of sheets is itself an indicator of the scale and surface-extent of the sheets. In table 3.4 below the map hierarchy has been shown according to the system adopted (fig. 3.11).

TABLE 3.4

Name of sheet	Extent covered	FPs scale	Metric scale	Reference No. Example
Million sheet	4° × 4°	1 inch to 16 miles	1 cm to 10 km.	65
Quarter-inch or degree sheet	1° × 1°	1 inch to 4 miles	1 cm. to 2.5 km.	65 G (one of A to P)
Half-inch sheet	30′ × 30′	1 inch to 2 miles	1 cm. to 1 km.	65 G/SE (one of 4 quadrant sheets)
Inch sheet	15′ × 15′	1 inch to 1 mile	2 cm. to 1 km.	65G/15 (one of 1 to 16)
Special	5′ × 7′ 30″	—	4 cm. to 10 km.	65G/15/3 (one of 6 sheets)

c Describe the large scale and small-scale map? Describe the concept of map scale and its applications. 10

Size of Scale	**Representative Franction (RF)**
Large Scale	**1:25,000** or larger
Medium Scale	**1:1,000,000** to **1:25,000**
Small Scale	**1:1,000,000** or smaller

Map scale refers to the relationship (or ratio) between distance on a map and the corresponding distance on the ground. For example, on a 1:100000 scale map, 1cm on the map equals 1km on the ground.
Maps classified on the basis of their aims and objectives:

(a) Physical maps show the relief features of the earth with the help of hachures, contours or colour tints between contour lines (e.g. plains in green; plateaus in yellow; mountains in brown; streams/rivers/lakes/seas/other water bodies in blue).

(b) Political maps present a visual picture of the world, or a continent or a country through bold boundary lines or by tints of colours along with boundaries.

(c) Statistical/Distribution maps are related to sta-tistical .data. They may show physical elements like relief, atmospheric temperature, rainfall, air pressure etc.; they may also be used to show so-cial and economic data e.g. agriculture, indus-try, trade, transport, population, settlements etc.

(d) Topographic maps show physical features of the earth along with cultural aspects like settlements and transportation facilities. Such maps are useful to geographers, military experts etc.

(e) Geological maps show the rock formations, their ages, structures, mineral resources etc. They are prepared on large scales for coal fields, mining areas, engineering, geological features like dams, tunnels etc.

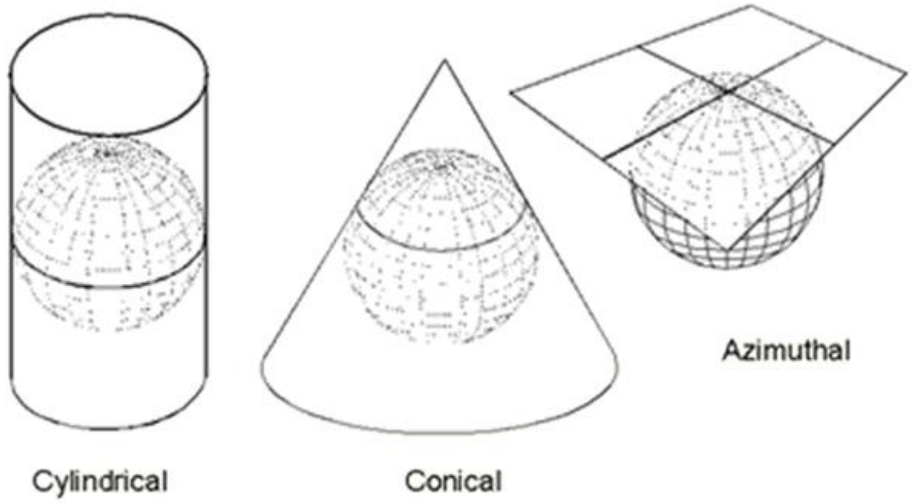
(f) Geomorphological maps show the earth's physical features, their relationship with land, water etc. on earth's surface; some conventional pictorial symbols are used to show relief, landforms etc. They are normally on small scale.

(g) Town plan maps show urban landscape on important towns. These are large scale maps.

(h) Cadastral maps are prepared by government agencies for revenue purposes. They show bound-aries of landed properties, fields, buildings etc.

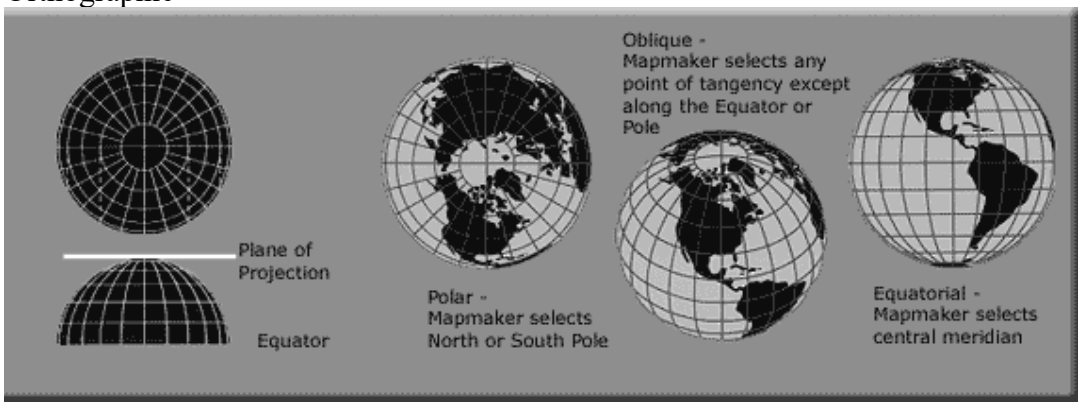
(i) Weather maps are prepared by Meteorological Departments showing weather conditions (distri-bution of atmospheric pressure, wind velocities/ directions, clouds/cloudiness, precipitation etc.).

d With the help of suitable examples explain planar, conical and cylindrical projections. 10



Azimuthal projection methods project geographic data onto a plane. They are typically used to represent data at the poles.

Orthographic

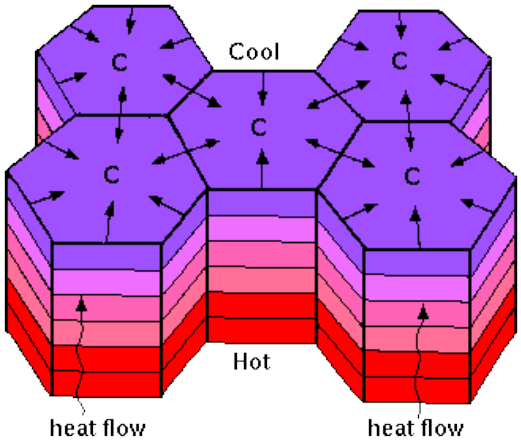


The orthographic projection is a special azimuthal projection that makes it look like we are looking at the earth in a photo graph. GoogleEarth uses this projection. Take a minute and examine the graphic and think about where the distortion is high and where it is low

Cylindrical projections are used for areas near the equator and for the entire earth but with very large distortions. Conical projections are good for mid-latitudes while azimuthal (or planar) are good for the poles.

4 **Attempt <u>any two</u> of the following**

a Describe the process of formation of hexagonal cooling joints in volcanic rocks. Add a note on geometric classification of joints. 10



In stratified rocks, joints are generally classified on the basis of relationship of their attitude with that of the rocks in which they occur.

Three types recognized on this basis are (Fig. 7.28):

1. Strike joints in which the joint sets strike parallel to the strike of the rocks.

2. Dip joints in which the joint sets strike parallel to the dip direction of the rocks;

3. Oblique joints are those joints where the strike of the joints is at any angle between the dip and the strike of the layers. These are also called diagonal joints when they occur midway between the dip and strike of the layers.

In stratified rocks, some joints may develop essentially parallel to the bedding planes. These are simply referred as bedding joints.

In the folded regions, joint orientation is conveniently described with reference to the hinge of the fold. A line running parallel to the hinge-line is assumed as b-axis; the a-axis is normal to it and the c-axis is normal to the plane containing the a and b axis.
The joints running parallel to b-axis are called radial joints. These cut the layers almost perpendicularly. Similarly, joints running parallel to the layers are designated as C-joints. In these areas, joints can also be distinguished into dip joints, strike joints and diagonal joints. (Fig. 7.29).

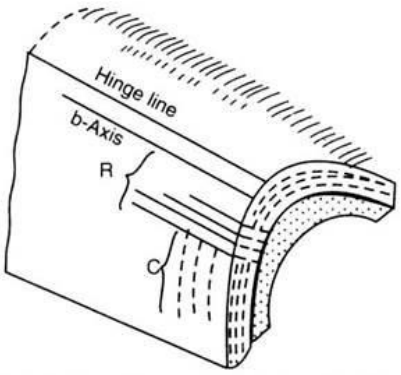
In igneous and metamorphic rocks, the joints may be classified on the basis of their geometric relations with planar structures of those rocks such as lineation or cleavage etc.

Two terms are commonly used in such cases:

Cross or Q joints, which are joints traversing the linear structures at right angles.

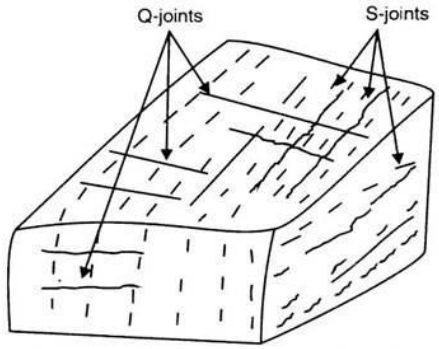
Longitudinal or S joints, are joints traversing parallel to the linear structure. In

these rocks all the joint systems traversing at any other angular inclination with the linear structures are described as diagonal joints (Fig. 7.30).



Radial Joint (R) and Parallel Joint (C)

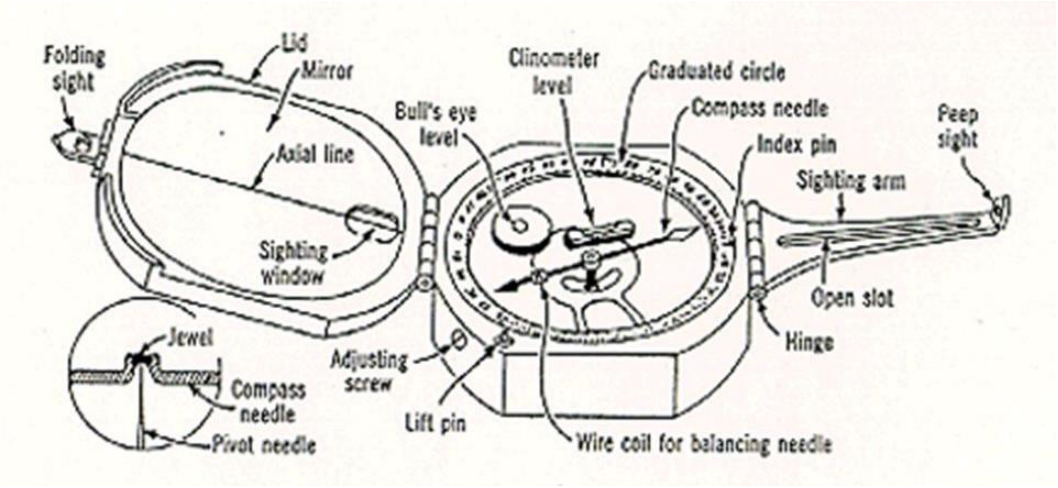
Fig. 7.29.



Longitudinal (S) and Cross Joints (Q)

Fig. 7.30.

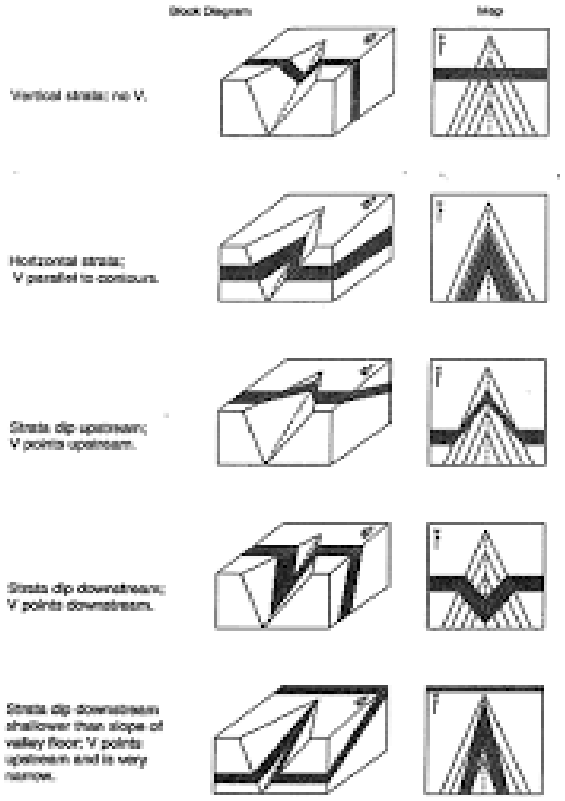
b Explain various uses of Brunton Compass on field. Add a note on various parts of a Brunton compass with neat diagram. 10



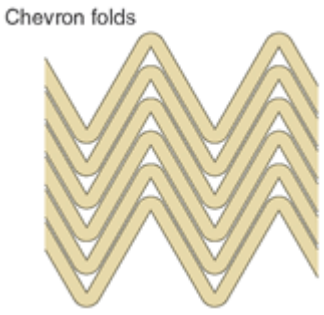
This compass differs from modern compasses, as it utilizes magnetic induction damping rather than fluid to dampen needle oscillation. It is widely used by geologists and surveyors to make accurate degree and angle measurements. The compass may be adjusted for declination angle according to one's location on the earth, in order used by geologists and surveyors to make accurate degree and angle measurements. Bruton compass, precision instrument for a variety of surveying functions such as preliminary surveys, mining works etc. 50 mm needle with 10ernier pivot, vertical graduation 0-90 in both directions with 10ernier reading direct to 10' contains a damper for magnetic needle movement, graduated 0 to 360. Complete in leather sling case

c Draw map views showing how a dipping bed would outcrop in a valley for the following cases: 10

i. dipping upstream,
ii. dipping down-stream
iii. vertical
iv. Horizontal



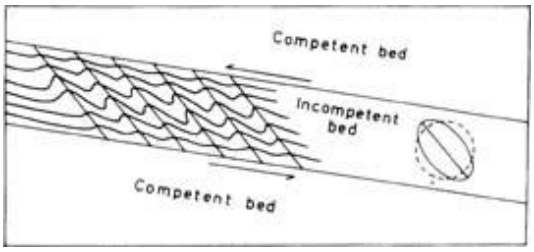
d Describe chevron and drag folds. Comment on the formation of the drag folds. 10



These are characterized by very long limbs and very narrow hinges (Figure) and most of the naturally developed chevron folds have an interlimb angle around 60°. These folds develop in typical turbidite flysch sequences of alternating competent and less competent layers in which the thickness of competent layers does not vary across the complex. de Sitter (1958) developed a chevron fold model consisting of layers of identical mechanical properties sliding over each other with no internal deformation.

A minor fold, usually one of a series, formed in an incompetent bed lying between more competent beds, produced by movement of the competent beds in opposite directions relative to one another. Drag folds may also develop beneath a thrust

sheet.



5 **Write notes on any four of the following** 20

i) Classification of folds based on hinge line and axial plane.
Classification, diagram, description.

ii) Earth's internal structure.
diagram, description.

iii) Outlier and inlier.
Classification, diagram, description.

iv) Nebular hypothesis.
diagram, description.

v) Classification of faults based on rake of net slip.
Classification, diagram, description.

vi) Types of Survey of India maps and their uses.
Classification, diagram, description and use

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