

- 1 Fill in the blanks: (1X10=10)
- A
- According to hardness scale _____ one _____ is the hardness of talc.
 - Muscovite mineral crystallizes in _____ monoclinic _____ crystal system.
 - Mineral having only one refractive index is known as _____ isotropic _____ mineral.
 - hypersthene mineral has _____ 2 _____ no. of cleavage.
 - Muscovite shows _____ 3rd order _____ colour under crossed nicol.
 - Quartz shows _____ 1st _____ order of interference colour.
 - _____ olivine _____ Mineral shows olive green colour in hand specimen and forms first in Bowen's reaction series.
 - Heulandite mineral is categorized under _____ zeolite _____ mineral group.
 - Nepheline mineral is categorized under _____ feldspathoid _____ mineral group.
 - Garnet mineral is optically _____ its isotropic _____ type of mineral

- 1 Define the following: (2X5=20)
- B
- Uniaxial and biaxial mineral.
 Ans: **Uniaxial: crystals of tetragonal and hexagonal systems possess only one optic axis which is parallel to the c-axis.**
Biaxial: crystals with two optic axis belonging to orthorhombic, monoclinic and triclinic.
 - Polarized and non-polarized light.
 Ans: polarized: when vibration of the wave motion is confined to one plane only.
 Non-polarized: when vibration of wave motion is confined to more than one plane.
 - Silicate structure of garnet.
 Ans: nesosilicate.
 - Composition and crystallography of plagioclase.
 Ans: $\text{NaAlSi}_3\text{O}_8$ - $\text{CaAl}_2\text{Si}_2\text{O}_8$. Monoclinic system.
 - Birefringence and twinkling effect in mineral.
Birefringence: difference between R.I of O-ray and E-ray.
 Twinkling to change in relief of calcite.

- 2 Answer any TWO of the following: (2X10=20)
- Define isotropic mineral. Explain the procedure to identify isotropic mineral thin section using a petrological microscope.

2

Ans: definition of isotropic mineral. Isotropic minerals do not show double refraction, if a thin section is viewed in crossed polars, it will appear totally dark.

- ii) Define double refraction and explain working and construction of Nicol prism.

Ans: When ray SM of unpolarised light is incident on face A'B, it splits into two refracted rays viz O-ray and E-ray. The ordinary ray goes from calcite to Canada Balsam is travelling from optically denser medium to rarer medium can be totally internally refracted and extraordinary ray is travelling from optically rarer to denser medium is transmitted.

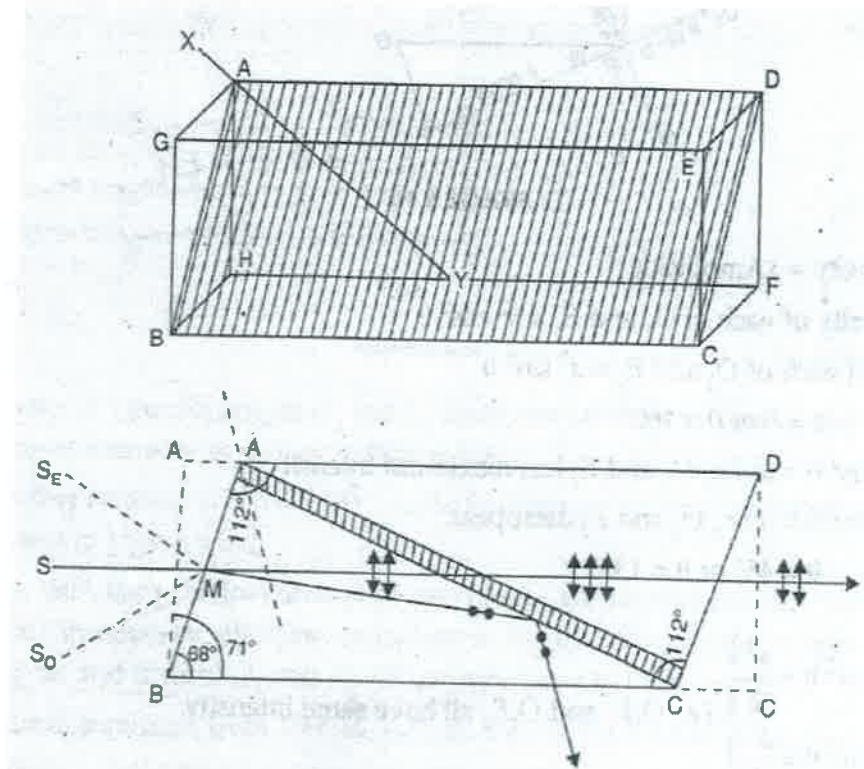
The critical angle for ordinary ray will be

$$\sin C = \mu_o = 1.55/1.66 = 0.933$$

$$C = 69^\circ$$

The angle of incidence on Canada Balsam depends upon the angle which A'B makes with blunt edge BC' and also on breadth of length ratio of the crystal. This was the only reason that length of crystal is chosen thrice of breadth and natural angle 71° is reduced to 68° . Because by doing so, O-ray falls on Canada Balsam layer at an angle greater than critical angle C so it is totally internally reflected and absorbed, whereas E-ray is transmitted. The transmitted extraordinary ray is plane polarised having vibrations parallel

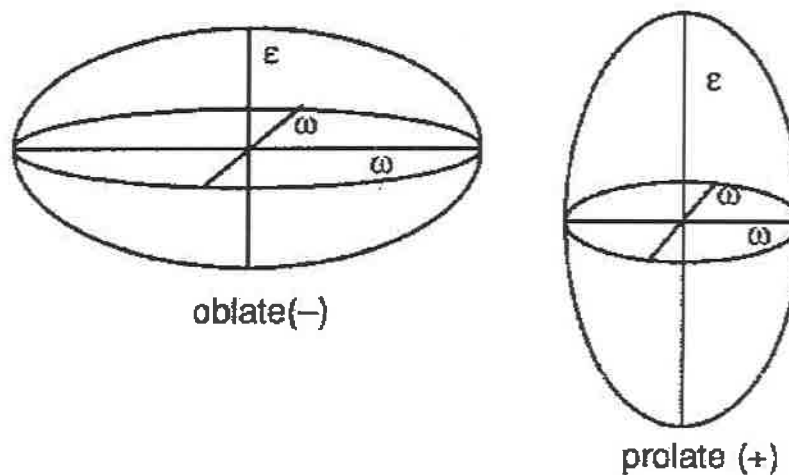
to principal section of the Nicol prism. Thus, Nicol prism act as a polariser.



- iii) Describe optical indicatrix for uniaxial mineral, and explain its

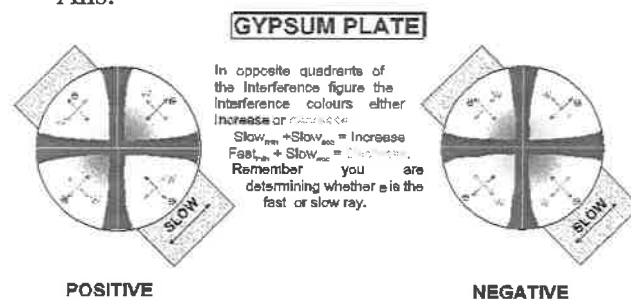
3

relationship in explaining determination of optical sign of uniaxial mineral.



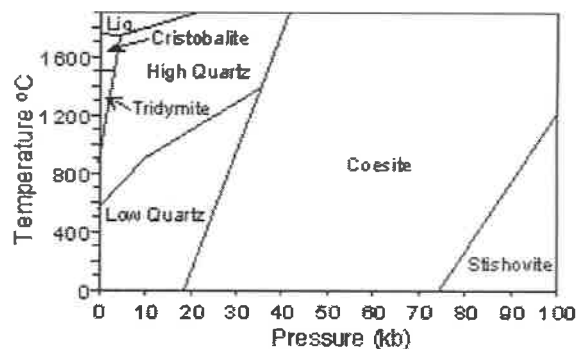
iv) Define accessory plates and explain importance of gypsum plate in determining optic sign of a mineral.

Ans:



3 Answer any TWO of the following: (2X10=20)

i) Using P-T diagram explain stability relationship between polymorphs of silica minerals.



Ans:

ii) Define crystal system for orthoclase and write its physical properties.

Ans: monoclinic system, colour, fracture, cleavage, luster, diaphaneity, hardness, streak of orthoclase.

4

- iii) Can sodalite mineral behaves as an isotropic mineral? Why? Discuss its optical properties.

Ans: sodalite forms under isotropic mineral. Properties of PPL and XPL.

- iv) Name the mica mineral belt present in Jharkhand state of India. Discuss Biotite physical and optical properties.

Ans: Koderma schist belt. colour, fracture, cleavage, luster, diaphaneity, hardness, streak and Properties of PPL and XPL.

4 Answer any TWO of the following:

(1X20=)2

- i) Name the mineral which shows nesosilicate structure and shows mafic composition. Give its optical properties.

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Ans: olivine mineral its ppl and xpl properties.

- ii) Garnet belongs which crystal system, explain its physical and optical properties.

Ans: isometric system. Properties to be given : colour, fracture, cleavage, luster, diaphaneity, hardness, streak and Properties of PPL and XPL.

- iii) Describe occurrence and physical properties of orthopyroxene group of minerals.

Ans: physical properties: colour, fracture, cleavage, luster, diaphaneity, hardness, streak and occurrence, mafic igneous rocks and high grade metamorphic rock.

- iv) Describe occurrence and physical properties of hornblend mineral.

Ans: physical properties: colour, fracture, cleavage, luster, diaphaneity, hardness, streak and occurrence as accessory mineral in igneous rock and medium grade metamorphic rocks.

5 Write short note on any four of the following:

(4X5=20)

- i) Occurrence and uses of quartz.

Ans: in felsic igneous rock, sedimentary and low to medium grade metamorphic rocks.

Uses as piezo and pyro electricity.

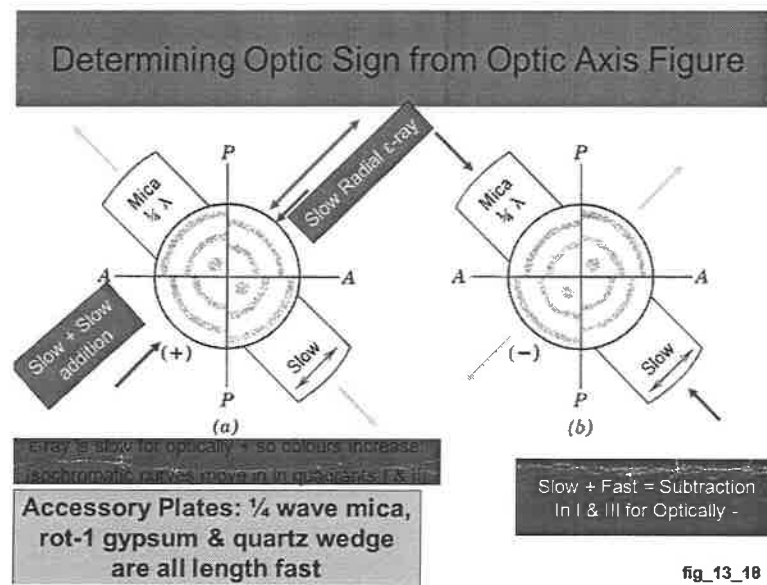
- ii) Chemical formula of muscovite and its properties under crossed polar.

Ans: $KAl_2(AlSi_3O_{10})(OH)_2$. Xpl properties.

- iii) Optic sign determination using Mica plate.

Ans:

57



iv) Comparison of polarizing microscope with normal biological microscope.

Ans; give five differences between polarizing and biological microscope.

v) Physical properties of talc mineral.

Ans: physical properties: colour, fracture, cleavage, luster, diaphaneity, hardness, streak

vi) Becke test for determination of relief of a mineral.

Ans: **The Becke Line is a bright band of light that forms at the edge of crystals due to an edge effect.**

