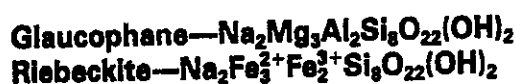


※ 注意：請於試卷上「非選擇題作答區」內依序作答，並應註明作答之大題及其題號。

(礦物部分共 50 分)

- 一、簡答題：下列是摘自礦物學課本對 *Glaucophane* 與 *Riebeckite* 礦物之描述性資料，請在詳細閱讀後按照題號簡單且完整的回答本題的 10 個小題。(注意：照抄英文得零分)【共 20 分】



Crystallography. Monoclinic; $2/m$. In slender acicular crystals; frequently aggregated; riebeckite sometimes asbestiform.

$C2/m$; $a = 9.58$, $b = 17.80$, $c = 5.30 \text{ \AA}$; $\beta = 103^\circ 48'$; $Z = 2$.
 d_s : 8.42(10); 4.52(5), 3.43(6), 3.09(8), 2.72(10).

Physical Properties. *Cleavage* {110} perfect. H 6. G 3.1–3.4. *Luster* vitreous. *Color* blue to lavender-blue to black, darker with increasing iron content. *Streak* white to light blue. Translucent. *Optics*: (–); $\alpha = 1.61$ – 1.70 , $\beta = 1.62$ – 1.71 , $\gamma = 1.63$ – 1.72 ; $2V = 40^\circ$ – 90° ; $Y = b$, $Z \wedge c = 8^\circ$. Pleochroism in blue X , Y , Z .

Composition and Structure. Very few glaucophanes are close to the end-member composition, $\text{Na}_2\text{Mg}_3\text{Al}_2\text{Si}_8\text{O}_{22}(\text{OH})_2$, because of some substitution by Fe^{2+} for Mg and Fe^{3+} for Al . Riebeckite analyses do not conform well with the end-member formulation because the sum of $X + Y$ cations is frequently larger than 7, with Na entering the normally vacant A site. A partial series exists between glaucophane and riebeckite, with intermediate compositions known as *crossite*. The structures of both sodic amphiboles are similar to that of $C2/m$ tremolite.

Diagnostic Features. Glaucophane and riebeckite are characterized by their generally fibrous habit and blue color.

Similar Species. *Arfvedsonite*, $\text{Na}_2\text{Fe}_4^{2+}\text{Fe}^{3+}\text{Si}_8\text{O}_{22}(\text{OH})_2$, is a deep green amphibole similar to riebeckite in occurrence. It is commonly associated with aegirine, or aegirine-augite. In the structure of arfvedsonite, the A site is completely or almost completely filled by Na .

Occurrence. *Glaucophane* is found only in metamorphic rocks, such as schists, eclogite, and marble. The occurrences of glaucophane reflect low-temperature, relatively high-pressure metamorphic conditions typical of those found in paleo-subduction zones, in association with jadeite, lawsonite, and aragonite. It is a major constituent of glaucophane schists in the Franciscan Formation of California. It is also found in metamorphic rocks from Mexico, Japan, Taiwan, Indonesia, and eastern Australia. *Riebeckite* occurs most commonly in igneous rocks, such as granites, syenites, nepheline syenites, and related pegmatites. It is a conspicuous mineral in the granite of Quincy, Massachusetts. It is present in some schists of regional metamorphic origin. The asbestiform variety of riebeckite is known as *crocidolite*.

Use. Crocidolite made up about 4% of the total world production of asbestos. All production from mines in the Cape Province, South Africa, was stopped in 1995. There are extensive reserves of crocidolite in the Hamersley Range of Western Australia, but crocidolite has not been mined there since 1966. The crocidolite is closely interbanded with Precambrian banded iron-formation sequences, both in South Africa and Western Australia. Medical studies have shown that crocidolite is a much greater health hazard than chrysotile asbestos.

In many places in South Africa, oxidized crocidolite fibers occur in quartz. This makes it an attractive ornamental material with a chatoyancy and is widely used for jewelry under the name of *tiger's eye*.

Name. Glaucophane is from the two Greek words meaning *bluish* and *to appear*. Riebeckite is in honor of E. Riebeck.

1. *Glaucophane* 的中文礦物名稱是什麼？臺灣有沒有此礦物？
2. *Glaucophane* 與 *Riebeckite* 具有哪兩個共同的鑑定特徵？結晶構造都與哪一種礦物類似？
3. *Glaucophane* 的結晶構造屬於哪一個晶族？哪一個空間群？
4. 俗名虎眼(*tiger's eye*)且具有貓眼光的珠寶材料是什麼礦物材料？
5. *Glaucophane* 具有什麼解理？硬度是多少？
6. *Glaucophane* 的比重是多少？以中文來說是什麼光澤？
7. *Glaucophane* 的結晶構造(晶胞)中，最長的軸是哪個軸？一個晶胞中有多少個原子？
8. *Glaucophane* 的光學性質具有幾個光軸？條痕是什麼顏色？

見背面

9. *Glaucophane* 只會產於哪類岩石中？生成於何種溫壓條件下？
10. *Riebeckite* 最常產於哪類岩石中？礦物名稱是因何而得名？

二、摩氏硬度 (Mohs hardness) 是以自然界常見的十種礦物之相對硬度訂出。

- (1) 請依序列出硬度由 1 到 10 的十種礦物的英文名稱？【10分】
(2) 其中屬於等軸晶系的是哪兩種礦物？【4分】
(3) 硬度 7 的礦物有何鑑定特徵？【3分】
(4) 硬度 3 的礦物有何光學性質特徵？【3分】

[註：除第(1)小題必須以英文名稱作答外，其他小題得以中文或英文作答。]

三、解釋名詞：【每題 5 分，共 10 分】

- (1) phase rule
(2) crystal

(岩石部分共 50 分)

一、請討論岩漿生成、演化和噴出的過程。【15分】

二、請詳述台灣造山帶岩石種類和分布特徵。【10分】

三、請舉出最少 5 種沉積構造可判定沉積岩層的上下關係？【10分】

四、解釋名詞：【每題 3 分，共 15 分】

- (1) Pseudotachylite
(2) Anatexis
(3) Relief
(4) Skarns
(5) Allogenic grains

試題隨卷繳回