Nov 4 2014; AESB1130 Geology 1 – part 3: minerals

Name:

Student number:

MC-questions: indicate the correct answer by ringing A, B, C or D. If you think the correct answer is not given in A, B or C you have the possibility to enter your answer in D.
Note: your answer in D is not checked if the correct answer is given in A, B or C.

The 18 MC-questions provide two points per correct answer. You can obtain up to 4 points for question 14. Up to 10 points can be obtained for question 16.

1 The crystalline structure in a subhedral crystal is

A	Partly surrounded by well-developed crystal faces	A
B	Completely surrounded by well-developed crystal faces	B
C	Not surrounded by well-developed crystal faces	C
D		D

2 The crystalline structure in an euhedral crystal is

A	Partly surrounded by well -developed crystal faces	A
B	Completely surrounded by well -developed crystal faces	B
C	Not surrounded by well -developed crystal faces	C
D		D

3 When van der Waals-bonds form repeating planes within the crystalline structure

A	Cleavage develops only now and then	A
B	Cleavage develops often	B
C	Cleavage does not develop	C
D		D

4 Pyrite and marcasite are polymorphs

A	The chemical compositions are different but the crystalline structures are identical.	A
B	The chemical compositions and the crystalline structures are identical.	B
C	The chemical compositions are identical but the crystalline structures are different.	C
D		D

5 Two types of closest packings exist, the cubic and the hexagonal closest packing. Thus you might expect only 2 Bravais lattices. However, 14 Bravais lattices can be distinguished. How can you explain the occurrence of 14 Bravais lattices instead of only 2?

A	The amount of tetrahedron and octahedron voids is not constant in both types of packing	A
B	The amount of tetrahedron voids is not constant in both types of packing.	B
C	The amount of octahedron voids is not constant in both types of packing.	C
D		D

6 A Bravais lattice

A	Is the smallest unit within the crystalline structure in which all chemical components are present.	A
B	Is one of the smallest units within the crystalline structure in which all chemical components are present.	B
C	Is a small unit within the crystalline structure with as many chemical building blocks as voids.	C
D		D

7 14 Bravais lattices are known. How is it possible that these 14 Bravais lattices can produce 230 different internal structures (space groups)?

A	By combining the 14 Bravais lattices in different ways it is possible to form 230 different stackings and thus 230 different internal structures.	A
B	By varying the possible symmetry operations for one Bravais lattice 230 different stackings are possible and thus 230 different internal structures.	B
C	By linking a combination of different Bravais lattices to a variation of possible elements of symmetry 230 different stackings are possible and thus 230 different internal structures.	C
D		D

8 The habit of pyrite comprises various forms of the isometric crystal system. A typical crystal form consists of 12 regular pentagonal faces. Which Bravais lattice(s) build up this form?

A	An isometric and an orthorhombic Bravais lattice	A
B	An isometric and a tetragonal Bravais lattice	B
C	An isometric and a triclinic Bravais lattice	C
D		D

9 An onefold roto-inversion axis is not an use because

A	This axis corresponds to a onefold rotation axis	A
B	This axis corresponds to an center of inversion	B
C	This axis corresponds to a mirror plane	C
D		D

10 A fivefold roto-inversion axis is not an use because

A	This axis corresponds to a twofold rotation axis plus a threefold rotation axis	A
B	This axis corresponds to a fivefold rotation axis plush a center of inversion	B
C	This axis corresponds to a fivefold rotation perpendicular to a mirror plane	C
D		D

11 We know onefold, twofold, threefold, fourfold and sixfold rotation axis. Why do we not use the eightfold rotation axes?

A	Crystals with an eightfold symmetry do not exist in nature	A
B	It is easier to describe the symmetry with two fourfold rotation axis, both perpendicular to a mirror plane	B
C	The internal structure is not composed of units with an eightfold symmetry for these do not exist in nature	C
D		D

12 The Weiss indices of a face are (2, 1, 1). What are the corresponding Miller indices?

A	(1,3,3)	A
B	(3,5,5)	B
C	(5,9,9)	C
D		D

13 How do we describe the crystalline structure of the minerals of the group of silicates?

A	An isometric closest packing	A
B	A hexagonal closest packing	B
C	An alternation of the isometric and the hexagonal closest packing	C
D		D

14 The minerals are classified according to the chemical composition of the minerals. Which seven main groups were mentioned during the lecture? (4 points)

1		1
2		2
3		3
4		4
5		5
6		6
7		7

15 Crystallographic axes

A	determine the spatial orientation of the crystal.	A
B	determine which elements of symmetry are present in the crystal	B
C	indicate with their specific length ratios the crystal class of the crystal	C
D		D

16 The group of the silicates counts 7 subgroups. Make a drawing of the structure of four of these subgroups. Mention the name of the subgroup, give the basic formula and give an example of a mineral belonging to the illustrated group (name only) (10 points)

17 Quartz is easily recognized by striation on the elongated faces. Pyrite is also recognized by striation on the faces. Explain the formation of these striations.

A	The striations are cross-sections of lamellae – there is a lamellar twin system	A
B	Specific crystal faces grow in alternation. The striations are lines of intersection of these faces.	B
C	Actually these are signs of not well-developed cleavage planes.	C
D		D

18 The colour of a mineral is defined by

A	Absorption of certain wavelengths from the visible light; the non-absorbed wavelengths are reflected and cause a resultant colour.	A
B	Reflection of all wavelengths from the visible light; interference occurs and results in a certain colour.	B
C	Absorption of all wavelengths from the visible; as a result the mineral transmits certain wavelengths and these cause a colour as result.	C
D		D

19 The luster of a mineral is defined by

A	the extent of absorption of wavelengths of the visible light	A
B	the extent of reflection of wavelengths of the visible light	B
C	the extent of absorption and reflection of wavelengths of the visible light	C
D		D

20 Some minerals are characterized by a specific twin form. During the lectures aragonite twins were discussed. How do such twins form?

A	The chemical building blocks are very symmetric and may attach in a wrong way to the existing structure; causing a change in the direction of growth by which twins may develop.	A
B	Aragonite and calcite are polymorphs. By alternating growth of these two minerals twins may develop.	B
C	When two crystals of a mineral do not have enough space to develop completely the crystals may grow against each other to form a twin..	C
D		D

scrap paper