Geology · Biology and Earth Sciences

Types of Rocks (Igneous Rocks)

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Multiple choice questions — 102 questions

1 In the continuous reaction of Bowen's reaction series, the first mineral to crystallize from the melt is .....

(A) olivine
(B) potassium feldspar
(C) calcium feldspar
(D) sodium feldspar

2 Which of the following rocks is the last to crystallize from lava?

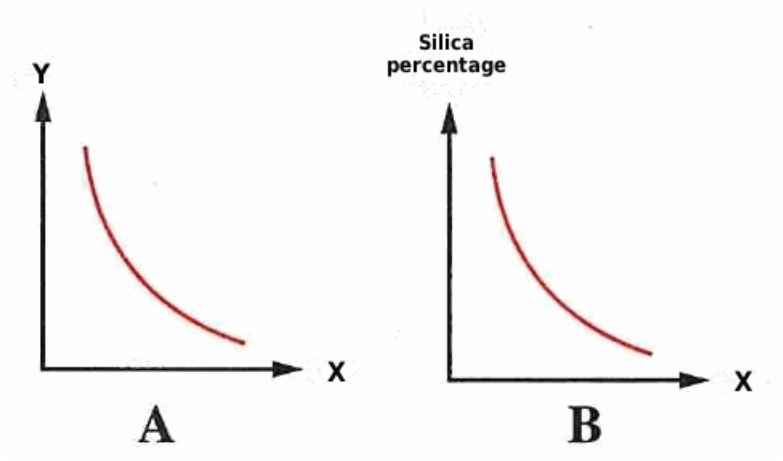


(A) Peridotite
(B) Gabbro
(C) Andesite
(D) Rhyolite

3 The last of the following minerals to crystallize in the discontinuous reaction of Bowen's reaction series is .....

(A) amphibole
(B) biotite
(C) quartz
(D) olivine

4 By studying the two opposite graphs (A) and (B), we conclude that (Y) may represent .....



(A) the melting temperature
(B) the percentage of magnesium
(C) the percentage of iron
(D) the percentage of potassium

5 The highest percentage of iron is found in the minerals .....

(A) olivine and quartz
(B) amphibole and muscovite
(C) olivine and pyroxene
(D) amphibole and orthoclase

6 The opposite mineral, which forms from the crystallization of the elements of magma, belongs to the group of .....



(A) carbonates (B) sulfides (C) sulfates (D) silicates

7 Olivine and pyroxene crystals formed as a result of .....

(A) the cooling of acidic melt
(B) the cooling of acidic lava
(C) the cooling of basic magma
(D) the cooling of intermediate lava

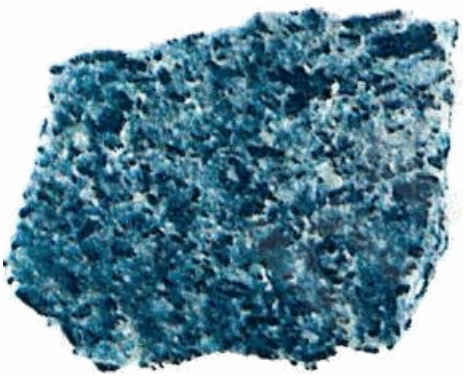
8 As the temperature of the melt decreases .....

(A) the percentage of iron increases and the percentage of silicon decreases
(B) the percentage of magnesium decreases and the percentage of sodium increases
(C) the percentage of magnesium decreases and the percentage of potassium decreases
(D) the percentage of calcium increases and the percentage of magnesium decreases

9 From your study of Bowen's reaction series, we find that .....

(A) most minerals crystallize at the same temperature
(B) most minerals of acidic rocks crystallize before the minerals of basic rocks
(C) muscovite and quartz are the last minerals to crystallize when magma cools
(D) biotite is the first mineral to crystallize when magma cools

10 The opposite figure shows a sample of an intermediate igneous rock. Which of the following minerals is rarely found in this rock sample?



(A) Amphibole (B) Quartz (C) Olivine (D) Pyroxene

11 When two thirds of the melt have crystallized, the remaining melt contains a very small percentage of the element .....

(A) calcium (B) silicon (C) sodium (D) potassium

12 Compared to the chemical composition of the feldspar in acidic rocks, the feldspar in basic rocks is .....

(A) rich in calcium, sodium and potassium

(B) rich in calcium and poor in sodium and potassium

(C) poor in calcium and rich in sodium and potassium

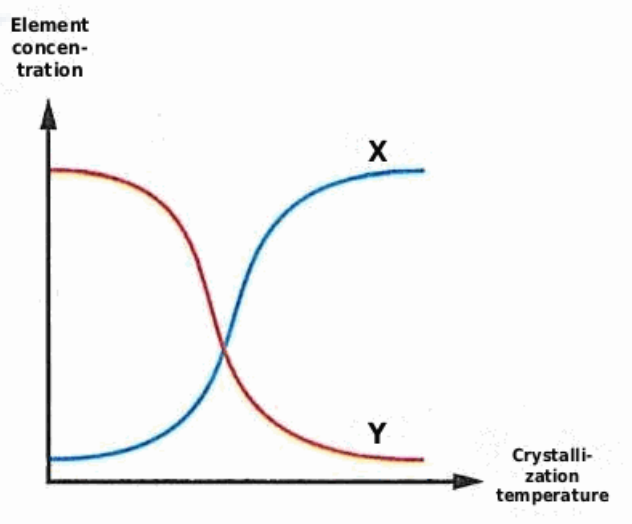
(D) poor in calcium, sodium and potassium

13 Which of the following minerals crystallizes first from basic magma?



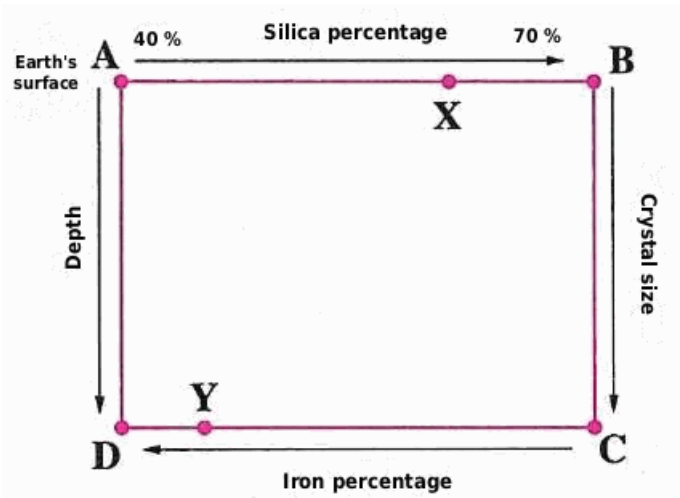
(A) Amphibole (B) Pyroxene (C) Orthoclase (D) Biotite

14 The opposite graph shows the relation between the crystallization temperature and the concentration of an element in igneous rocks. The two elements (X) and (Y) may respectively be .....



(A) (X) iron / (Y) potassium
(B) (X) iron / (Y) magnesium
(C) (X) potassium / (Y) iron
(D) (X) magnesium / (Y) iron

15 The opposite figure shows the crystallization conditions of a group of igneous rocks. Which of the following choices is correct about the types of crystallized rocks?



(A) (A) komatiite - (B) granite
(B) (C) granite - (D) diorite
(C) (A) komatiite - (X) andesite
(D) (B) rhyolite - (Y) diorite

16 The following table shows the percentages of some minerals in four samples of igneous rocks. Study it well, then answer:

Which of the following letters represents ultrabasic igneous rocks?

Rock (Z)	Rock (Y)	Rock (X)	Rock (W)	Mineral composition
–	–	16	30	Quartz
–	–	22	45	Pink orthoclase feldspar
45	7	42	11	Plagioclase feldspar
53	90	15	7	Minerals rich in iron and magnesium

(A) W (B) X (C) Y (D) Z

17 The following table shows the percentages of some minerals in four samples of igneous rocks. Study it well, then answer:

Which of the following may represent diorite?

Rock (Z)	Rock (Y)	Rock (X)	Rock (W)	Mineral composition
–	–	16	30	Quartz
–	–	22	45	Pink orthoclase feldspar
45	7	42	11	Plagioclase feldspar
53	90	15	7	Minerals rich in iron and magnesium

(A) W (B) X (C) Y (D) Z

18 Which of the following choices represents the correct relation between an igneous rock and its most abundant element?

(A) Granite - calcium
(B) Komatiite - magnesium
(C) Rhyolite - iron
(D) Basalt - potassium

19 We have 3 samples of igneous rocks arranged as follows (komatiite, then basalt, then andesite). These samples are arranged .....

(A) in descending order of iron percentage
(B) in descending order of cooling rate
(C) in ascending order of crystallization temperature
(D) in ascending order of calcium percentage

20 If you have 4 rock samples arranged as follows: (obsidian, then andesite, then dolerite, then peridotite), this order is ascending according to .....

(A) the number of crystals, and descending according to the silica percentage

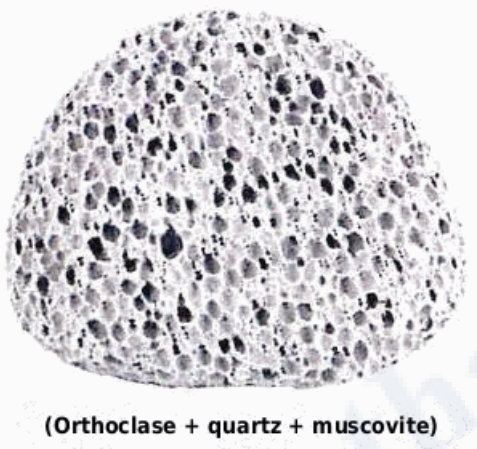
(B) the silica percentage, and descending according to the number of crystals

(C) the percentage of iron and magnesium, and descending according to the sodium percentage

(D) the potassium percentage, and descending according to the specific gravity

---

21 The opposite sample shows an igneous rock with a ..... texture.



(Orthoclase + quartz + muscovite)

(A) fine texture with air holes

(B) fragmental texture of sharp-edged grains

(C) fragmental texture of rounded grains

(D) foliated texture with air holes

---

22 Granite is classified as a plutonic igneous rock because it .....

(A) is rich in quartz and feldspar

(B) is coarse-grained with large crystals

(C) crystallizes from cooling lava

(D) is very hard and light in colour

---

23 Which of the following characterizes a rock formed when a melt loses its heat very quickly while forming crystals?

(A) Large crystal size

(B) A higher iron percentage

(C) A higher potassium percentage

(D) A larger number of crystals

---

24 A melt made of 5 main mineral families, when it crystallizes inside the Earth's crust in two stages, forms the rock .....

(A) granite (B) microdiorite (C) dolerite (D) peridotite

25 When basic lava cools, the rock ..... crystallizes.

(A) gabbro (B) basalt (C) andesite (D) rhyolite

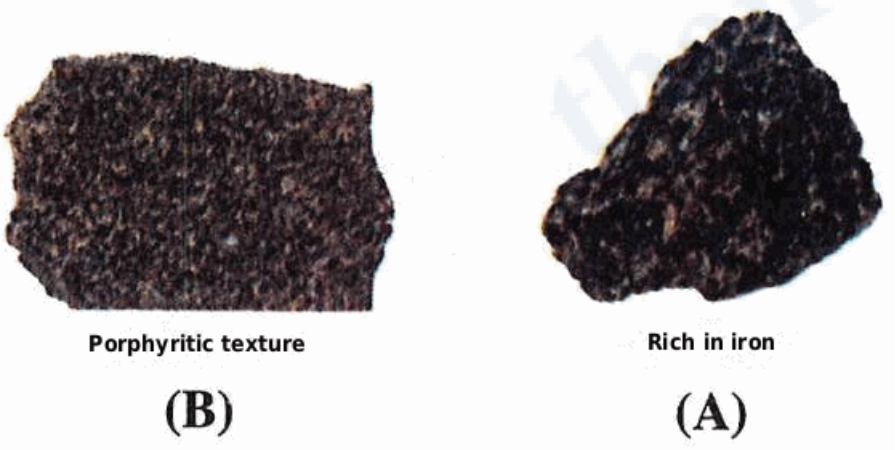
26 When intermediate magma cools, the rock ..... may form.

(A) gabbro (B) granite (C) diorite (D) pumice

27 The first mineral to melt in granite when it is exposed to very high heat is .....

(A) quartz (B) feldspar (C) mica (D) amphibole

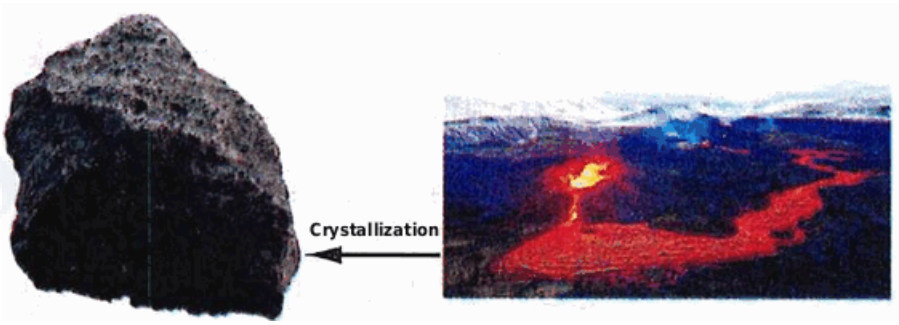
28 The two opposite samples (A) and (B) represent two types of igneous rocks. The two rocks are probably .....



(A) (A) gabbro, (B) dolerite (B) (A) granite, (B) rhyolite

(C) (A) gabbro, (B) rhyolite (D) (A) granite, (B) dolerite

29 The opposite figure shows the formation of basalt from a melt that crystallized .....



(A) slowly, forming minerals rich in calcium
(B) slowly, forming minerals rich in potassium
(C) quickly, forming minerals rich in sodium
(D) quickly, forming minerals rich in iron

30 The rock that contains some large crystals among other fine crystals, of the following, is .....

(A) microgranite (B) gabbro (C) granite (D) andesite

31 The rocks rich in quartz and orthoclase are .....

(A) granite and gabbro
(B) gabbro and basalt
(C) basalt and rhyolite
(D) rhyolite and granite

32 The property that gives the best evidence that granite crystallized at great depths below the Earth's surface is .....

(A) its low density
(B) its chemical composition
(C) the acidity of its minerals
(D) its coarse texture

33 Gabbro is an igneous rock that most probably formed from a melt that underwent .....

(A) fast cooling at the Earth's surface
(B) slow cooling at the Earth's surface
(C) fast cooling at great depths below the Earth's surface
(D) slow cooling at great depths below the Earth's surface

34 The extrusive igneous rock with a silica percentage of about 70 % is .....

(A) granite (B) rhyolite (C) microgranite (D) dolerite

35 Basalt has a dark black colour because of the high percentage of .....

(A) potassium (B) silica (C) iron (D) sodium

36 Which of the following rocks contains a small percentage of quartz crystals visible to the naked eye?

(A) Acidic volcanic (B) Acidic plutonic
(C) Intermediate plutonic (D) Basic volcanic

37 A rock with clear crystals made of feldspar, olivine, pyroxene and amphibole is .....

(A) peridotite (B) gabbro (C) granite (D) basalt

38 Here are hand samples of an igneous rock. What are the type and the cooling rate of this rock?

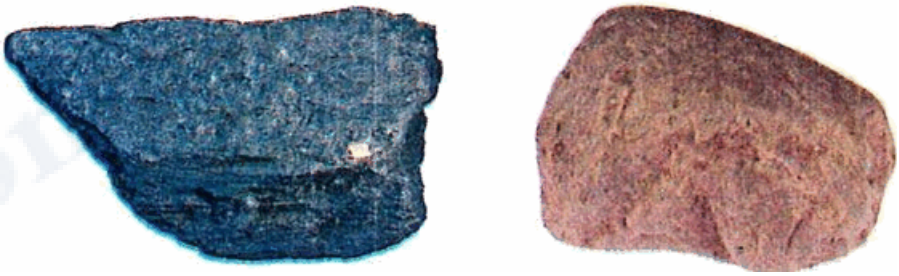


(A) Plutonic, slow cooling (B) Plutonic, fast cooling
(C) Volcanic, slow cooling (D) Volcanic, fast cooling

39 The crystallization of a melt at a low temperature forms a rock that is .....

(A) dark and poor in potassium (B) dark and rich in quartz
(C) light-coloured and rich in silica (D) light-coloured and poor in sodium

40 The two opposite igneous rocks are alike in .....



(A) the place of crystallization
(B) the silica percentage
(C) the crystallization temperature
(D) the calcium percentage

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41 The most accurate statement explaining why olivine is not one of the main mineral components of granite is that olivine crystallizes .....

(A) at a low temperature, while the minerals of granite crystallize at a high temperature
(B) at a high temperature, while the minerals of granite crystallize at a low temperature
(C) only in volcanic rocks, while granite is a plutonic igneous rock
(D) only in intermediate rocks, while granite is an acidic igneous rock

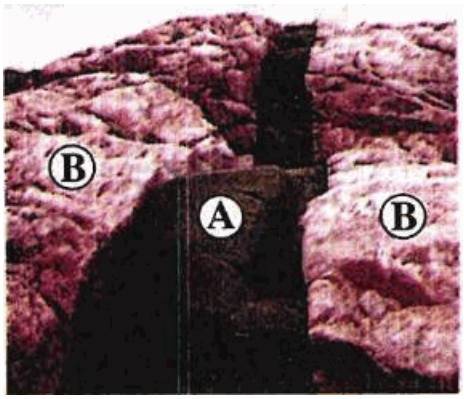
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42 The rocks that form volcanic islands in the oceanic crust are usually made of .....

(A) fine crystals from an acidic melt
(B) fine crystals from a basic melt
(C) coarse crystals from an acidic melt
(D) coarse crystals from a basic melt

---

43 The opposite figure shows a light-coloured igneous rock (B) cut through by a dark igneous rock (A). This fine-grained, light-coloured igneous rock is .....



(A) rhyolite
(B) diorite
(C) basalt
(D) gabbro

---

44 Granite is very poor in iron because .....

(A) it crystallizes inside the Earth

(B) its minerals crystallize at low temperatures

(C) it is a basic rock

(D) its minerals crystallize at high temperatures

45 Quartz, biotite and amphibole crystals formed mainly as a result of .....

(A) chemical reactions between elements in sea water

(B) the cooling and crystallization of a melt

(C) the deposition of sediments by wind

(D) the cementation of lake sediments

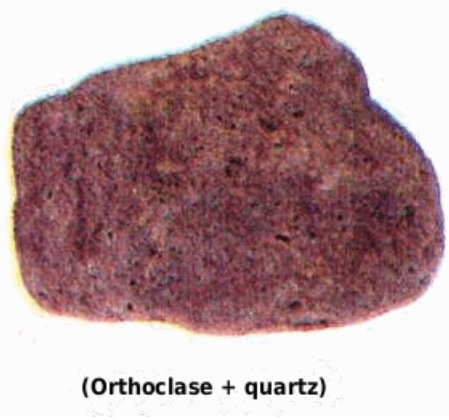
46 The rock formed by the crystallization of a melt with 60 % silica within the surrounding rocks is .....

(A) dolerite (B) diorite (C) microdiorite (D) andesite

47 When iron-rich lava cools, the rock ..... may form.

(A) komatiite (B) andesite (C) peridotite (D) rhyolite

48 The opposite rock sample represents a rock with a silica percentage of about .....



(Orthoclase + quartz)

(A) 72 % (B) 52 % (C) 48 % (D) 43 %

49 The process that leads to the formation of rhyolite is .....

(A) the deposition of transported fragments on the sea floor

(B) the metamorphism of rocks due to pressure and heat

(C) the cooling of magma inside the Earth

(D) the eruption of lava from a volcano and its crystallization

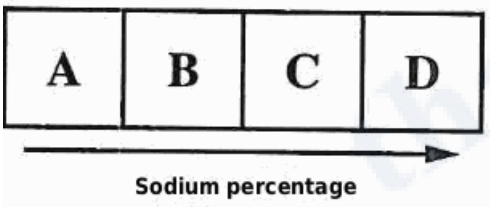
50 The extrusive igneous rock that crystallizes at temperatures below 750 °C is .....

(A) pumice (B) andesite (C) basalt (D) peridotite

51 The light pink intrusive igneous rock is .....

(A) granite (B) microgranite (C) rhyolite (D) dolerite

52 In the opposite figure, hypabyssal rocks are represented by the letters (A), (B), (C) and (D). Which of the following represents these rocks?



(A) (A) peridotite - (B) gabbro - (C) diorite - (D) granite

(B) (A) gabbro - (B) komatiite - (C) diorite - (D) rhyolite

(C) (A) komatiite - (B) basalt - (C) andesite - (D) rhyolite

(D) (A) granite - (B) diorite - (C) dolerite - (D) peridotite

53 The sudden contact of a melt with sea water may lead to the formation of the rock .....

(A) granite (B) basalt (C) dolerite (D) peridotite

54 The opposite sample represents a mineral found in rhyolite; one of its properties is that it splits easily in one direction. This mineral .....



(A) crystallizes at a temperature of about 780 °C
(B) belongs to the group of native (elemental) minerals
(C) crystallizes at a temperature of about 1200 °C
(D) is rich in sodium and calcium

55 The most abundant mineral in peridotite, of the following, is .....

(A) olivine
(B) mica
(C) amphibole
(D) calcium plagioclase

56 When lava cools, the first of the following rocks to crystallize according to Bowen's series is .....

(A) basalt
(B) granite
(C) andesite
(D) peridotite

57 The temperature at which the minerals of a rock crystallize indicates all of the following except .....

(A) the silica percentage of the rock
(B) the colour of the rock
(C) the texture of the rock
(D) the chemical composition of the rock

58 The highest percentage of potassium is found in the rocks .....

(A) rhyolite and pumice
(B) granite and andesite
(C) rhyolite and andesite
(D) granite and gabbro

59 The correct descending order of the rocks formed by the crystallization of a melt according to the crystallization temperature is .....

(A) basalt, then rhyolite, then granite
(B) komatiite, then rhyolite, then andesite
(C) basalt, then andesite, then rhyolite
(D) komatiite, then basalt, then gabbro

60 A rhyolite sample with a uniform mineral composition was divided into two samples (A) and (B), where sample (A) is half the volume of sample (B). The silica percentage in sample (A) is .....

(A) half the silica percentage in the original rock
(B) half the silica percentage in sample (B)
(C) equal to the silica percentage in sample (B)
(D) a quarter of the silica percentage in the original rock

61 The equivalent of the ultrabasic volcanic rock, of the following, is .....

(A) diorite (B) dolerite (C) peridotite (D) komatiite

62 The rock with a porphyritic texture whose silica percentage is 45 : 55 % is .....

(A) dolerite (B) microgranite (C) basalt (D) gabbro

63 The mineral rarely found in basaltic volcanic cones, of the following, is .....

(A) olivine (B) pyroxene (C) plagioclase (D) muscovite

64 Which of the following rocks represents the opposite sample?



(Feldspars + pyroxene + quartz)

(A) Basalt (B) Andesite (C) Rhyolite (D) Komatiite

65 The mineral that is part of the main composition of gabbro, diorite and rhyolite, of the following, is .....

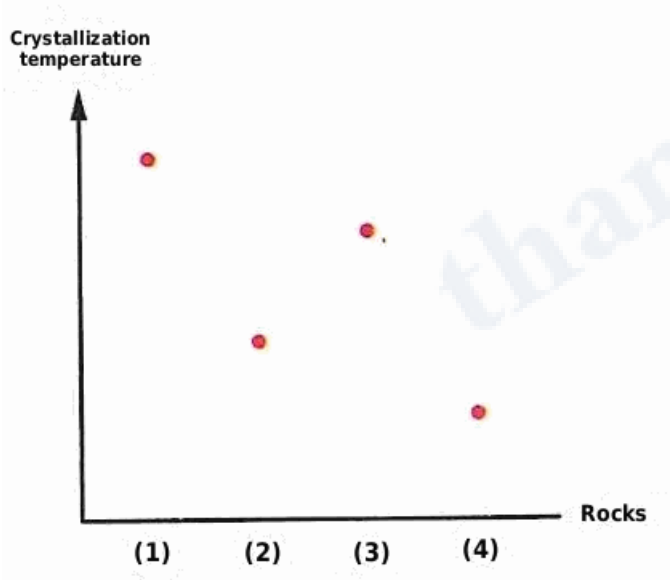
(A) quartz (B) amphibole (C) olivine (D) orthoclase

66 The igneous rocks whose minerals crystallize at the highest temperatures, of the following, are the ..... rocks.

(A) acidic plutonic (B) intermediate extrusive

(C) basic plutonic (D) ultrabasic extrusive

67 The opposite graph shows the crystallization temperature of 4 different types of rocks that differ in chemical composition. If the 4 rocks are (andesite, granite, peridotite, dolerite), their correct order is .....



(A) (1) granite / (2) andesite / (3) dolerite / (4) peridotite

(B) (1) peridotite / (2) andesite / (3) dolerite / (4) granite

(C) (1) dolerite / (2) andesite / (3) granite / (4) peridotite

(D) (1) peridotite / (2) granite / (3) andesite / (4) dolerite

68 We have a hand sample of dolerite. Which of the following statements suits the sample?

(A) It is made of large crystals because of the slow cooling of magma

(B) It is made of large crystals and fine ones, with 60 % silica

(C) It is made of large crystals and fine ones, with 50 % silica

(D) It is made of large crystals because of the fast cooling of magma

69 Biotite and muscovite are mica minerals that differ in chemical composition. Compared to the magma from which biotite forms, the magma from which muscovite forms is usually .....

(A) more basic and less dense
(B) more acidic and less dense
(C) more basic and denser
(D) more acidic and denser

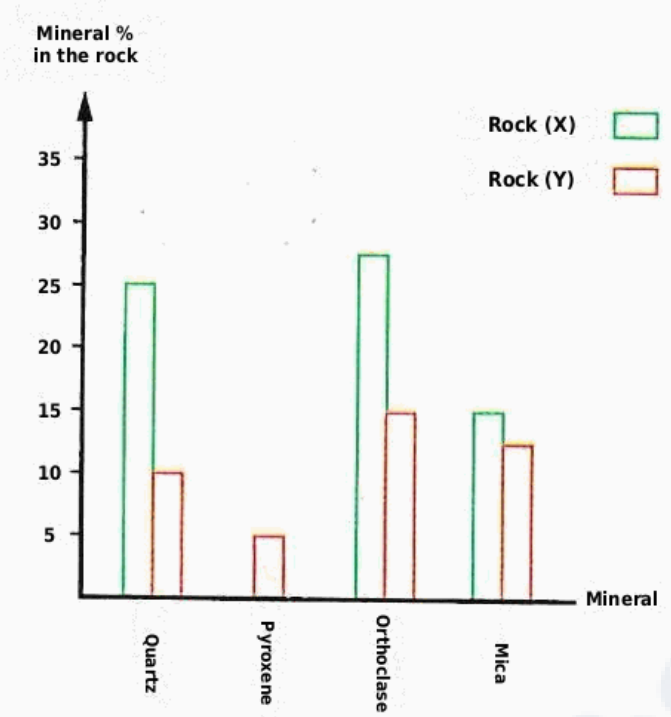
70 The coarse igneous rock made of about 60 % pyroxene, 25 % plagioclase, 10 % olivine and 5 % amphibole is .....

(A) komatiite (B) peridotite (C) gabbro (D) basalt

71 The most accurate statement of the similarity and the difference between diorite and andesite is that they .....

(A) are alike in mineral composition and differ in silica percentage
(B) are alike in mineral composition and differ in texture
(C) are alike in silica percentage and differ in mineral composition
(D) are alike in texture and differ in mineral composition

72 The opposite graph shows the percentages of some minerals in two different rocks (X) and (Y) made of large crystals. Which of the following represents rocks (X) and (Y)?



(A) (X) granite - (Y) diorite
(B) (X) diorite - (Y) microgranite
(C) (X) granite - (Y) gabbro
(D) (X) rhyolite - (Y) andesite

73 Samples of equal volume of peridotite, diorite, granite and gabbro were dropped at the same time into a deep tank filled with water. Which of these rocks is the last to reach the bottom of the tank?

(A) Peridotite (B) Diorite (C) Granite (D) Gabbro

74 The opposite table shows physical properties of the minerals of a plutonic igneous rock, represented by the letters (A), (B) and (C). Study it well, then answer:

The type of rock texture is .....

Physical properties	Mineral
Pink / hardness (6)	A
White / sheet-like cleavage	B
Transparent / vitreous luster	C

(A) glassy (B) lamellar (C) porphyritic (D) coarse

75 The opposite table shows physical properties of the minerals of a plutonic igneous rock, represented by the letters (A), (B) and (C). Study it well, then answer:

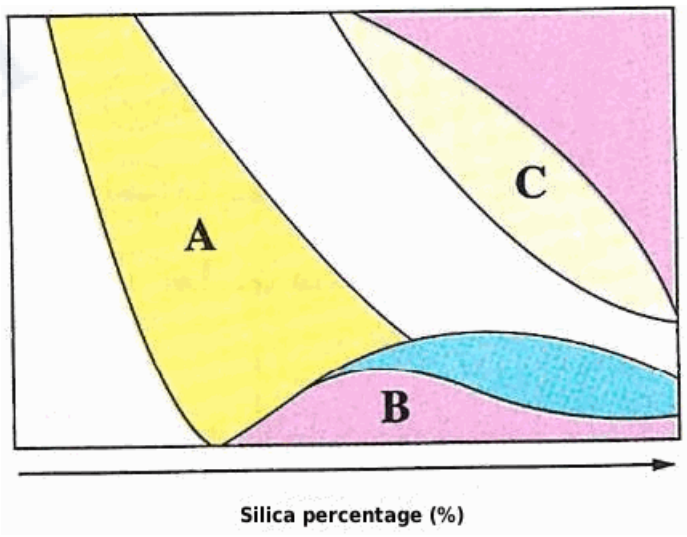
The names of minerals (A), (B) and (C) respectively are .....

Physical properties	Mineral
Pink / hardness (6)	A
White / sheet-like cleavage	B
Transparent / vitreous luster	C

(A) (A) quartz / (B) mica / (C) orthoclase (B) (A) orthoclase / (B) mica / (C) calcite

(C) (A) mica / (B) quartz / (C) calcite (D) (A) orthoclase / (B) mica / (C) quartz

76 The opposite figure represents the mineral composition of igneous rocks. What are minerals (A), (B) and (C)?



(A) (A) olivine - (B) mica - (C) sodium feldspar

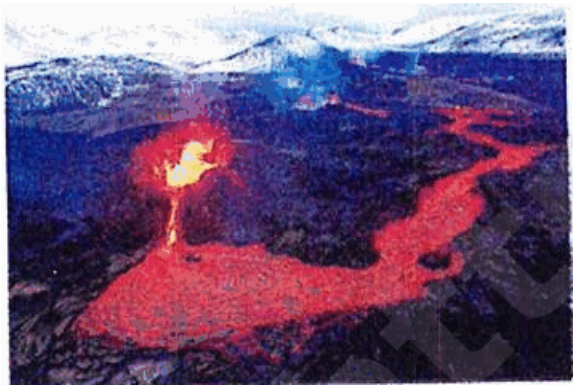
(B) (A) pyroxene - (B) amphibole - (C) quartz

(C) (A) calcium feldspar - (B) mica - (C) orthoclase

(D) (A) mica - (B) feldspar - (C) quartz

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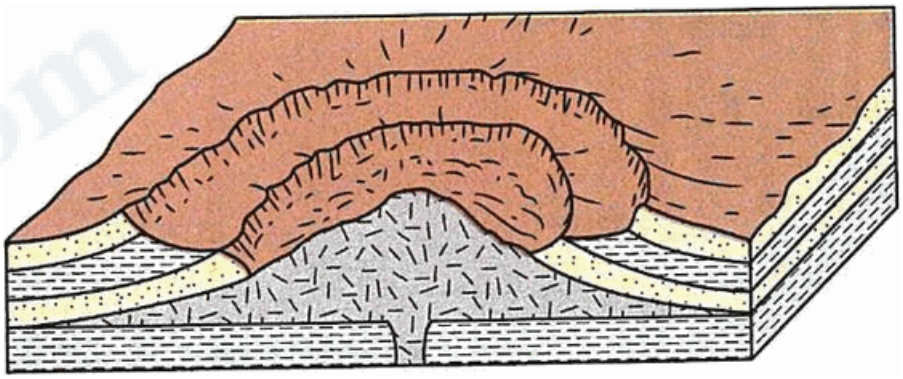
77 If the melt in the opposite figure has 40 % silica, when it cools and crystallizes it forms the rock .....



(A) andesite (B) peridotite (C) komatiite (D) basalt

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78 The opposite model shows an eroded dome. The most accurate order of the geological events in the area, from oldest to youngest, is .....



(A) rising magma, then an anticline, then erosion

(B) rising magma, then erosion, then a syncline

(C) a syncline, then rising magma, then erosion

(D) an anticline, then rising magma, then erosion

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79 The upward folding of rocks may result from .....

(A) a normal dome

(B) an inverted dome

(C) cross-cutting dykes

(D) parallel sills

---

80 Igneous rocks may form a fold under the effect of .....

(A) a batholith (B) sills (C) a lopolith (D) lava flows

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81 A laccolith causes the formation of .....

(A) a fault with horizontal movement

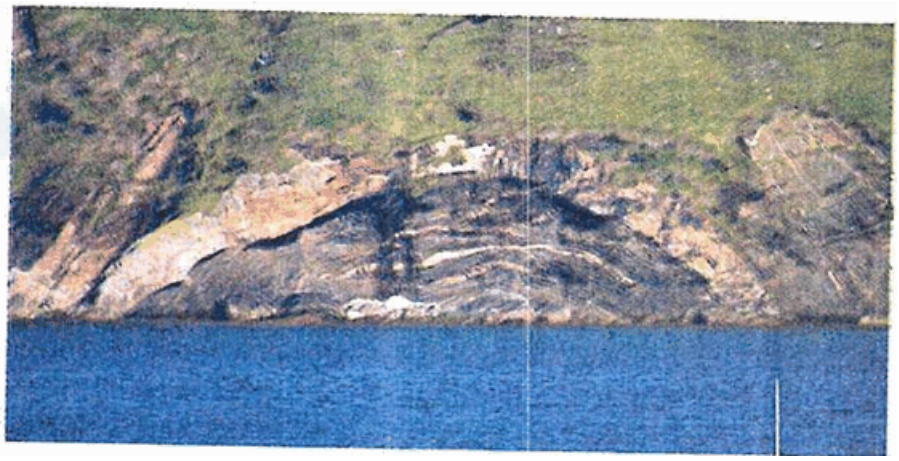
(B) a fold with its oldest layers at the centre

(C) a fault in which the layers are repeated vertically

(D) a fold with its youngest layers at the centre

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82 The geological structure in the opposite figure results from an igneous intrusion that may come from the rise of .....

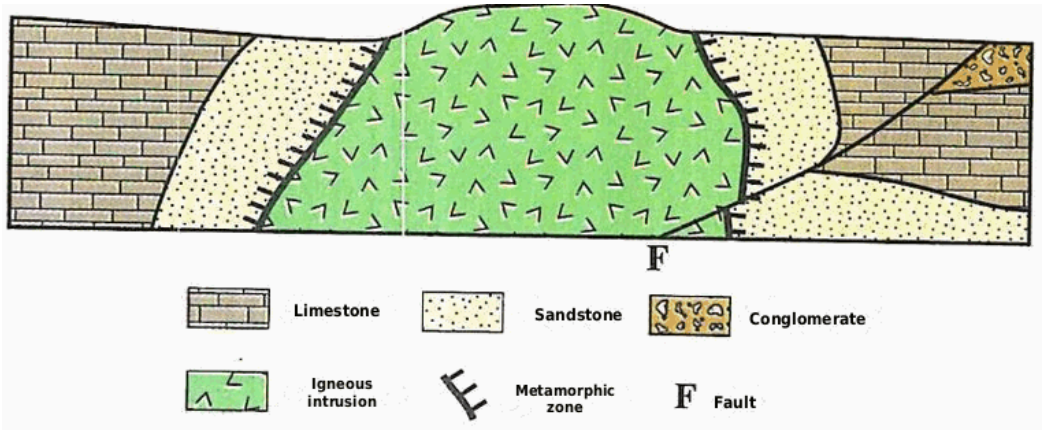


(A) low-viscosity lava
(B) high-viscosity lava
(C) high-viscosity magma
(D) low-viscosity magma

83 The igneous structure that extends for about 200 km below the Earth's surface is called .....

(A) a laccolith
(B) a lopolith
(C) lava flows
(D) a batholith

84 What is the type of igneous intrusion in the following vertical section?



(A) Dyke
(B) Sill
(C) Laccolith
(D) Lopolith

85 Parallel sills are products of .....

(A) the solidification of lava flows
(B) the intrusion of melt
(C) the cooling of lava
(D) the breaking of volcanic necks

86 Magma (A) has a high viscosity and magma (B) has a low viscosity. Their shapes after solidification and their effects on the surrounding rocks respectively are .....

(A) (A) a normal dome with a syncline / (B) an inverted dome with an anticline

(B) (A) an inverted dome with a syncline / (B) a normal dome with an anticline

(C) (A) a normal dome with an anticline / (B) an inverted dome with a syncline

(D) (A) an inverted dome with an anticline / (B) a normal dome with a syncline

---

87 Pyroxene and mica may occur together in all of the following except .....

(A) microgranite sills

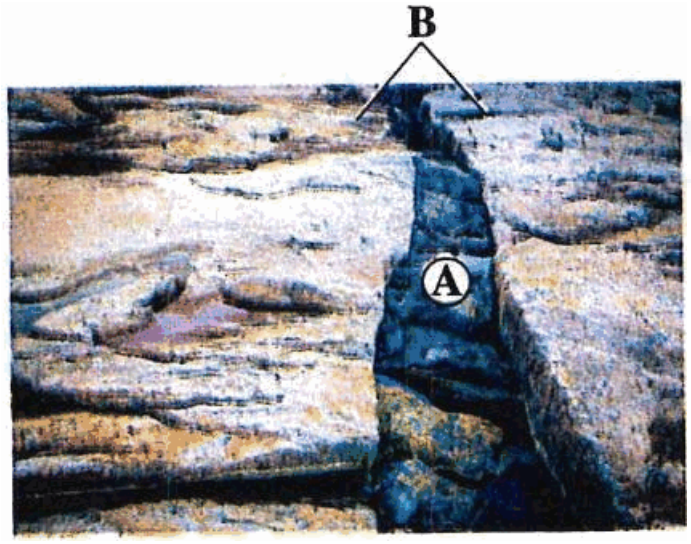
(B) andesite ropes

(C) microdiorite dykes

(D) a diorite batholith

---

88 What does the igneous form (A) intruding into rock (B) in the opposite rock section represent?



(A) A sill

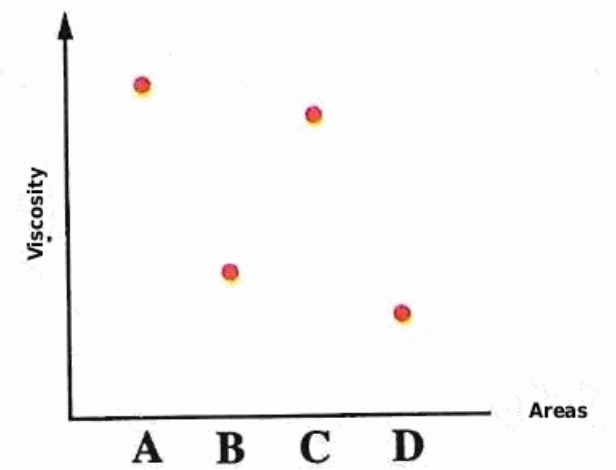
(B) A dyke

(C) Volcanic ejecta

(D) Volcanic breccia

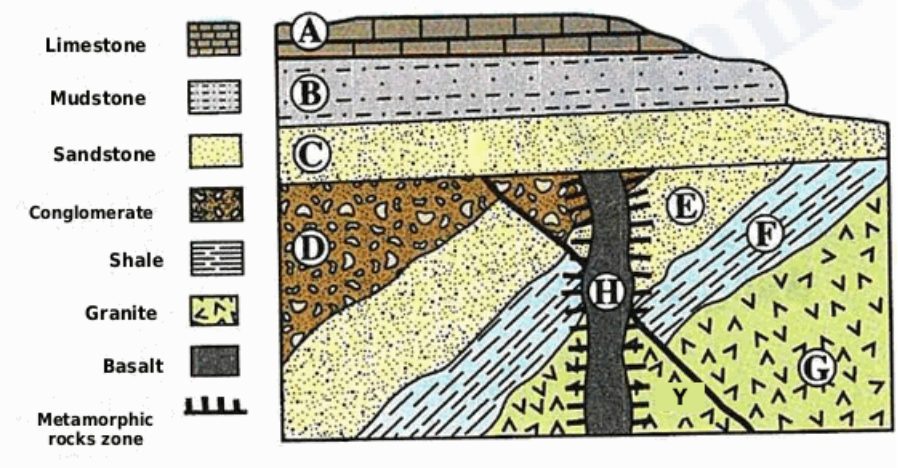
---

89 The opposite graph represents four different areas (A), (B), (C) and (D) in which magma rises.
The areas likely to have anticlines are .....



(A) A, B (B) C, D (C) B, C (D) A, C

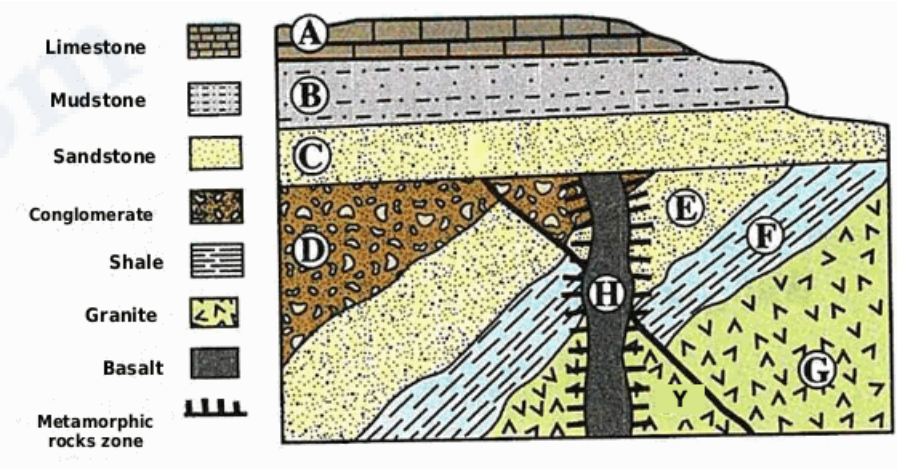
90 Here is a vertical section. Study it well, then answer:
Rock (E) is made mainly of the mineral .....



(A) quartz (B) gypsum (C) calcite (D) olivine

91 Here is a vertical section. Study it well, then answer:

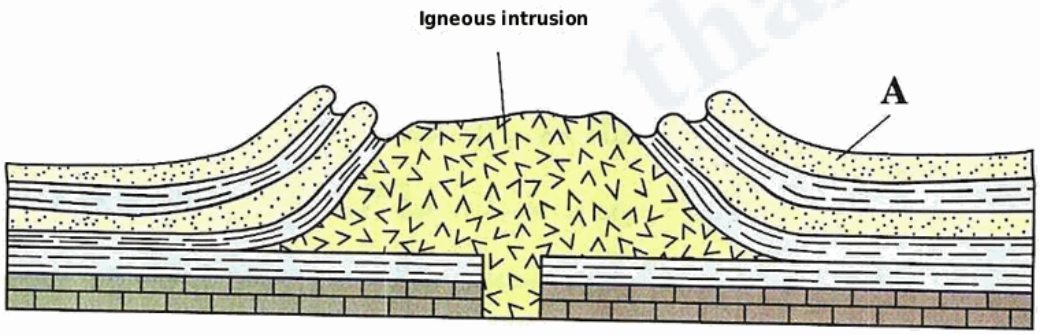
Structure (H) represents .....



(A) a joint (B) a dyke (C) a sill (D) a batholith

92 The following vertical section represents an eroded dome-shaped rock structure in a mountainous area. Study it well, then answer:

The letter (A) in the previous section represents .....

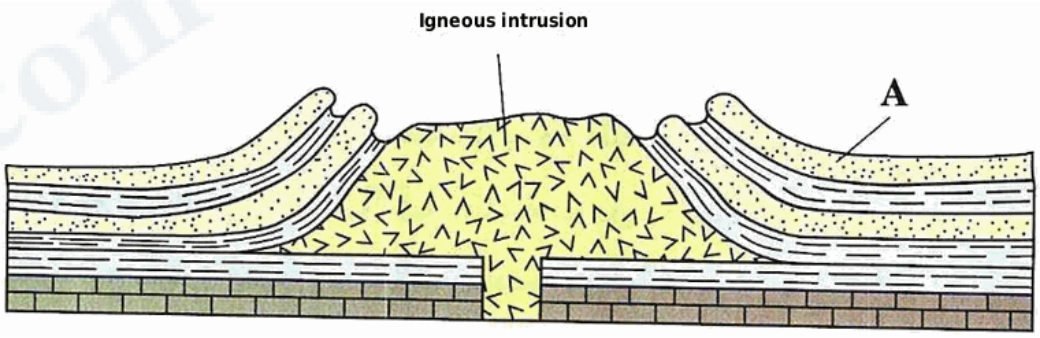


(A) a fold axis (B) a fold limb

(C) hanging wall rocks (D) footwall rocks

93 The following vertical section represents an eroded dome-shaped rock structure in a mountainous area. Study it well, then answer:

The melt that formed this igneous intrusion is .....



(A) of high viscosity
(B) of low viscosity
(C) parallel to the layers
(D) cutting across the layers

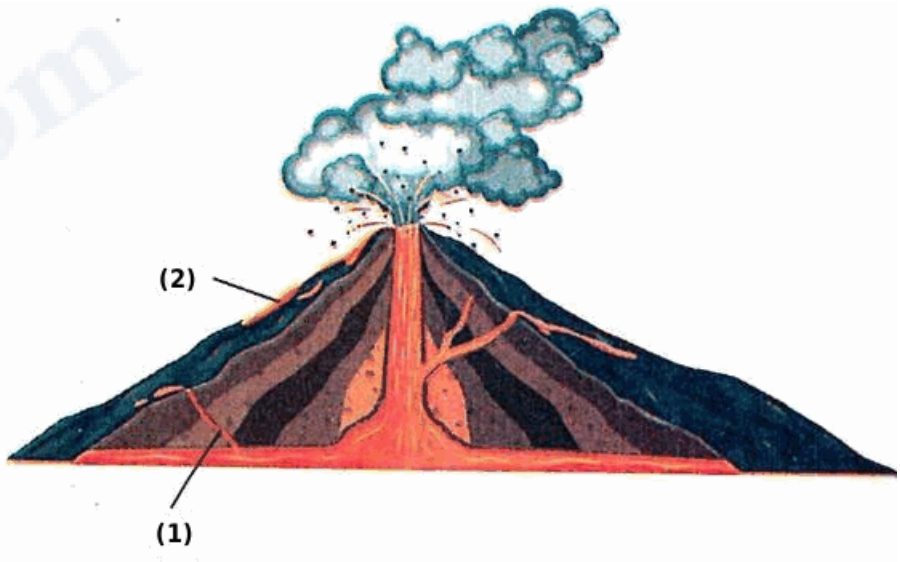
94 A rock sample was taken from a laccolith and heated until it melted completely, then the melt was left to cool and crystallized at a temperature of about 900 - 1000 °C. The rock formed by the crystallization is expected to be .....

(A) basalt
(B) dolerite
(C) microgranite
(D) andesite

95 Molten lava flows over long distances in the form of .....

(A) volcanic fragmental material
(B) volcanic ropes
(C) volcanic breccia
(D) volcanic ash

96 The opposite figure represents an active volcano in an area. The likely rock texture in (1) and (2) respectively is .....



(A) (1) fine-grained / (2) porphyritic
(B) (1) non-crystalline / (2) coarse
(C) (1) coarse / (2) porphyritic
(D) (1) porphyritic / (2) glassy

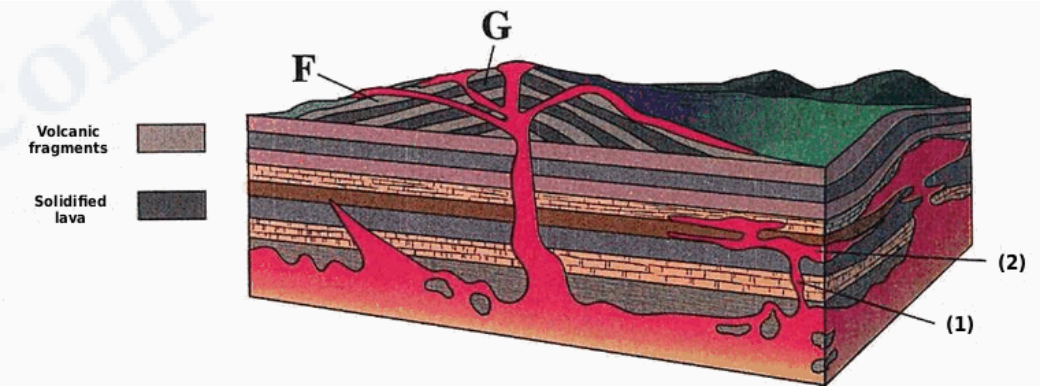
97 What is the opposite volcanic feature formed by viscous lava erupting from the crater of a volcano?



(A) Igneous domes
(B) Igneous dyke
(C) Pillow lava
(D) Volcanic breccia

98 The following model shows a volcanic cone in which different igneous forms appear. Study it well, then answer:

Which of the following choices expresses the igneous forms in (G) and (F) respectively?

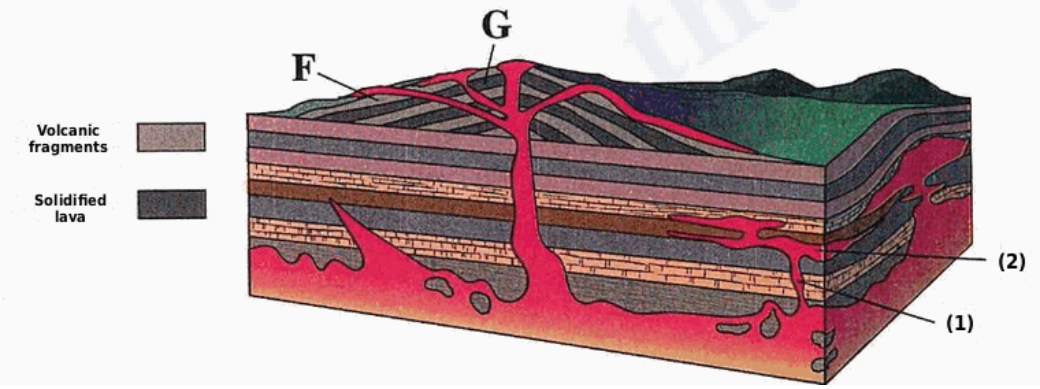


(A) (F) volcanic breccia / (G) lava flows
(B) (F) volcanic ash / (G) volcanic breccia
(C) (F) lava flows / (G) volcanic breccia
(D) (F) volcanic breccia / (G) volcanic ash

---

99 The following model shows a volcanic cone in which different igneous forms appear. Study it well, then answer:

What are the igneous forms (1) and (2) shown in the model?



(A) (1) sill, (2) dyke
(B) (1) laccolith, (2) sill
(C) (1) dyke, (2) sill
(D) (1) laccolith, (2) dyke

---

100 Which of the following forms is made of rocks with a coarse texture?

(A) Sills
(B) Pillow lava
(C) A batholith
(D) Volcanic ropes

---

101 The opposite figure represents one of the products of volcanoes, which is .....



(A) volcanic ejecta (B) volcanic ash (C) volcanic breccia (D) solidified lava

102 The texture of the rocks of volcanic ejecta may be .....

(A) porphyritic (B) fine (C) coarse (D) granular

Essay questions — 10 questions

1 The opposite sample is of an igneous rock. Study it well, then answer:

(1) What are the intrusive (hypabyssal) and plutonic equivalents of this rock?

(2) Why does the rock float when placed in water?

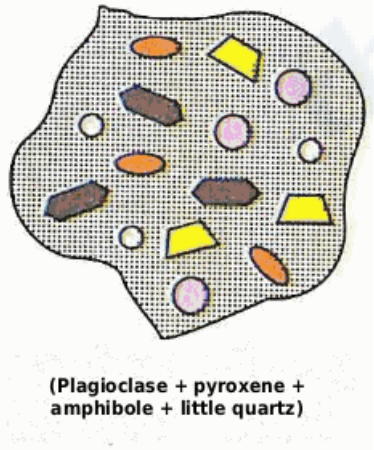


2 Study the opposite figure, then answer:

(1) Deduce the name of the rock.

(2) Classify the rock.

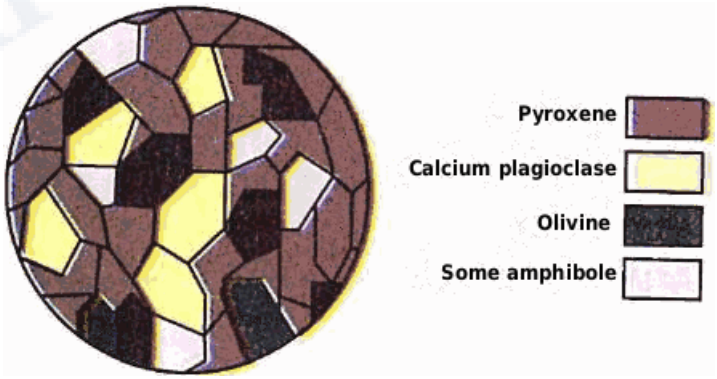
(3) What is the type of texture?



3 The opposite figure shows a sample of a plutonic igneous rock. Study it well, then answer:

(1) Name the rock and its type (in terms of chemical composition).

(2) Deduce the name of its volcanic equivalent, and state its texture.

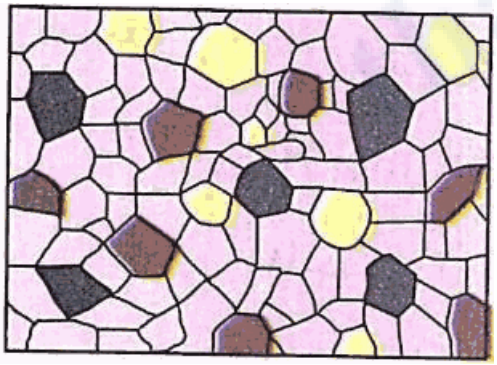


4 The opposite figure shows a sample of an igneous rock whose crystals are visible to the naked eye and which contains about 72 % silica. Study it well, then answer:

(1) What type of rocks has this texture and colour?

(2) What is the mineral composition of the rock shown?

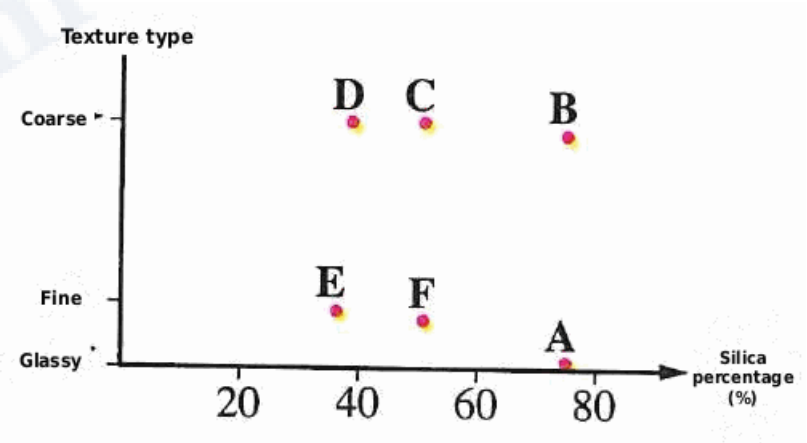
(3) Deduce four different examples of rocks similar to it in chemical composition.



5 Study the opposite graph, then answer:

(1) Deduce an example of samples (A), (C), (D) and (E).

(2) Compare sample (B) and sample (F) in terms of cooling rate.



6 You have three samples of different rocks:

The first sample: dark, with large crystals, and contains some amphibole.

The second sample: light-coloured, light in weight and rich in gas bubbles.

The third sample: light-coloured with clear crystals.

Name the three samples.

7 Study the following table, which shows the classification of igneous rocks, then answer:

(1) Which rocks are represented by the letters (D), (C) and (B)?

(2) Which rock in the table forms from the crystallization of lava at a temperature of about 900°?

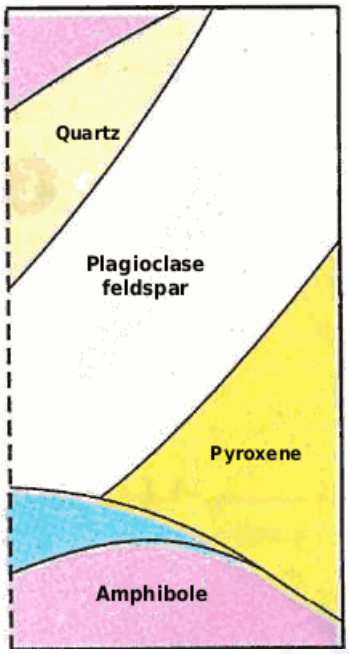
Peridotite	B	A	Granite	Crystals larger than 2 mm
–	Dolerite	Microdiorite	C	Crystals 0.2 mm and others 2 mm
Komatiite	E	D	Rhyolite	Crystals smaller than 0.2 mm
–	–	10 %	25 %	Quartz percentage

8 The opposite figure shows the mineral composition of a type of igneous rock. Study it well, then answer:

(1) What type of rocks has this mineral composition?

(2) Deduce the name of a volcanic rock that belongs to this type of rock.

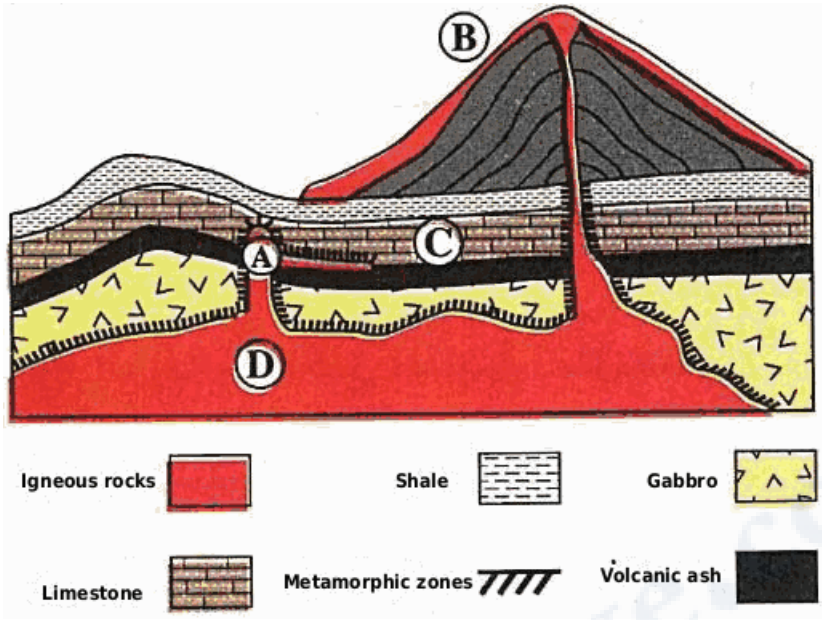
(3) What is the silica percentage in this type of rock?



9 Study the opposite vertical section, then answer:

(1) Explain the difference in texture between rocks (D) and (B).

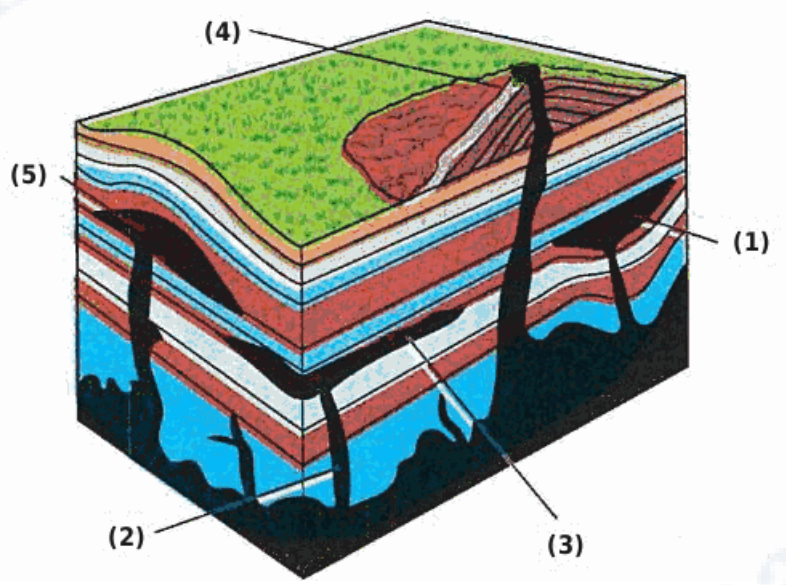
(2) Which is older, rock (A) or rock (C)?



10 The opposite model shows the forms of igneous rocks in nature. Study it well, then answer the following:

(1) Identify structures (2) and (3).

(2) What tectonic structure forms under the effect of structure (1) and structure (5)?

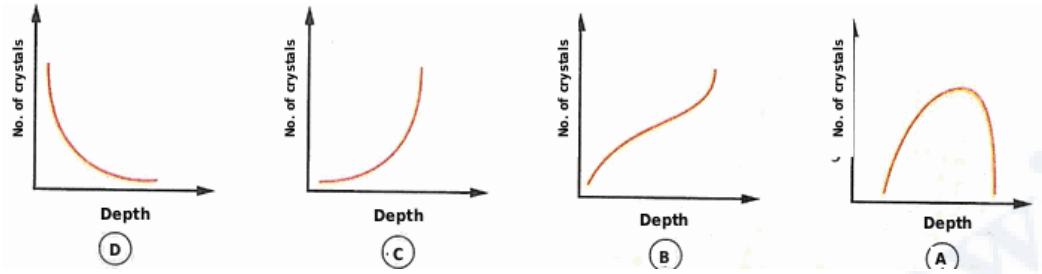


Past exam questions — 50 questions

1 During your visit to a quarry exhibition, you found a statue made of a rock in which the colours of its minerals appear: olivine, pyroxene and amphibole. What is the name of this rock? (Trial exam / May 2021)

(A) Basalt (B) Diorite (C) Gabbro (D) Peridotite

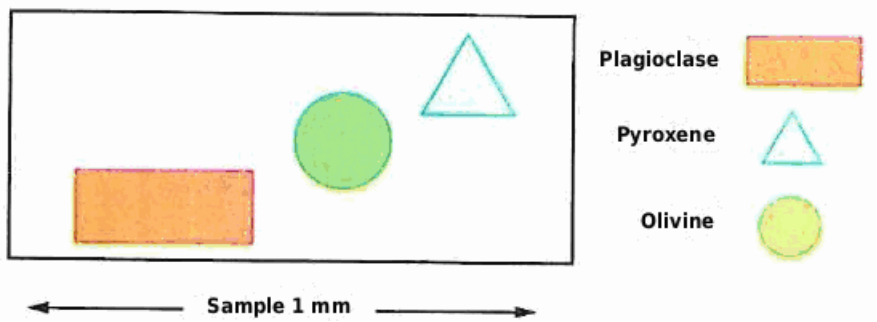
2 Which of the following graphs expresses the relation between the number of crystals in an igneous rock and the depth at which this rock crystallizes? (Trial exam / May 2021)



3 What is the correct ascending order of the hypabyssal igneous rocks in terms of silica percentage? (Trial exam / June 2021, Sample exam 2025)

(A) Dolerite → diorite → microgranite (B) Peridotite → microgranite → diorite
(C) Peridotite → diorite → gabbro (D) Basalt → andesite → rhyolite

4 The sample in the opposite figure represents the rock ..... (1st session 2021)



(A) rhyolite (B) basalt (C) gabbro (D) diorite

5 On a visit to the geological museum, you found a sample of a light-coloured igneous rock with large clear crystals. Which of the following minerals are expected not to be in this rock sample? (1st session 2021)

(A) Olivine and pyroxene
(B) Quartz and amphibole
(C) Quartz and muscovite
(D) Orthoclase and biotite

6 A rock sample with microscopic crystals contains large percentages of olivine and pyroxene. The rock is expected to be ..... (2nd session 2021)

(A) ultrabasic plutonic
(B) basic plutonic
(C) intermediate volcanic
(D) ultrabasic volcanic

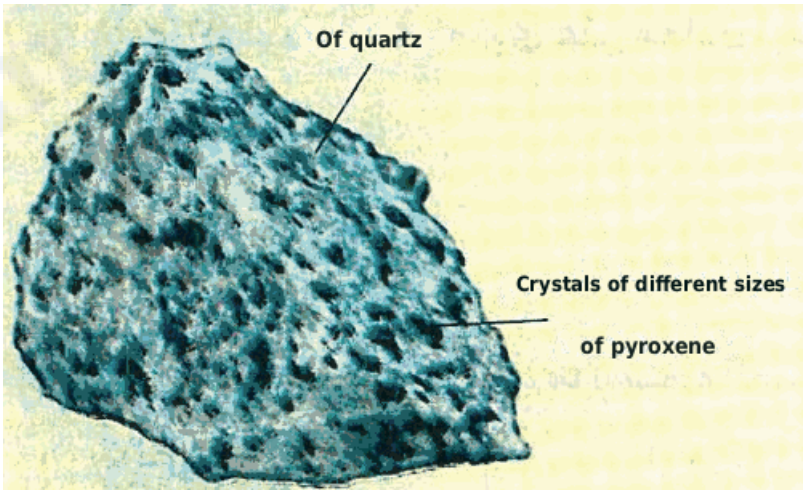
7 Which of the following factors affects the difference in the mineral composition of igneous rocks? (2nd session 2021)

(A) The place of crystallization
(B) The texture of the rock
(C) The crystallization temperature
(D) The cooling rate of the melt

8 You have a dark-coloured igneous rock. This indicates ..... (2nd session 2021)

(A) its silica percentage and its chemical composition
(B) its texture and the conditions of its formation
(C) the place of crystallization and the size of its crystals
(D) its cooling rate

9 What are the type and texture of the rock forming the sample in the opposite picture? (1st session 2022)



(A) Acidic - porphyritic
(B) Intermediate - coarse
(C) Intermediate - porphyritic
(D) Acidic - coarse

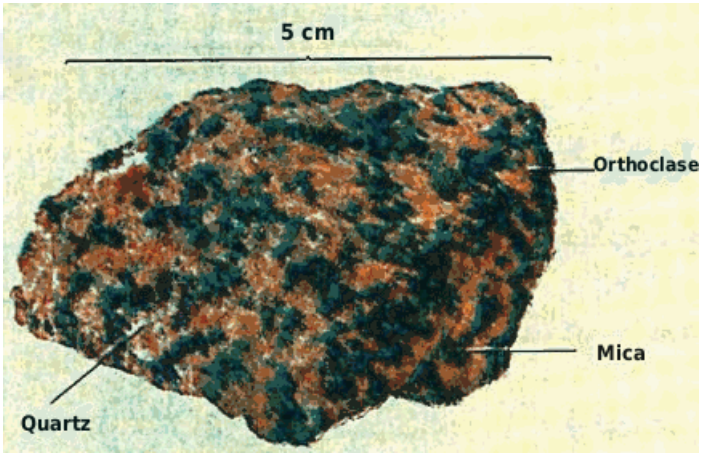
10 What is the type of rock that is rich in sodium and calcium and has crystals of different sizes? (1st session 2022)

(A) Acidic intrusive
(B) Intermediate intrusive
(C) Intermediate plutonic
(D) Acidic plutonic

11 What is the type of rock that has a dark colour and clear crystals? (2nd session 2022)

(A) Ultrabasic extrusive
(B) Acidic plutonic
(C) Intermediate extrusive
(D) Basic plutonic

12 By studying the picture of the rock sample in front of you, what is the type of rock forming this sample? (2nd session 2022)



(A) Acidic, coarse, crystallization temperature 750 °C
(B) Acidic, fine, crystallization temperature 750 °C
(C) Intermediate, coarse, crystallization temperature 1100 °C
(D) Intermediate, fine, crystallization temperature 900 °C

---

13 A rock, a quarter of whose content is a mineral with a conchoidal fracture, formed from the solidification of lava accompanied by escaping gases. What are the type and name of the rock? (Trial exam 2023)

(A) Basic - basalt
(B) Intermediate - andesite
(C) Acidic - pumice
(D) Ultrabasic - komatiite

---

14 You have two samples of granite and gabbro of equal volume. These two samples differ in all of the following except ..... (1st session 2023)

(A) the iron percentage
(B) the colour of the crystals
(C) the crystallization temperature
(D) the texture of the rock

---

15 Arrange the following rocks in ascending order according to the number of crystallization centres in samples of equal volume: (1st session 2023)

(1) Obsidian. (2) Rhyolite. (3) Dolerite. (4) Peridotite.

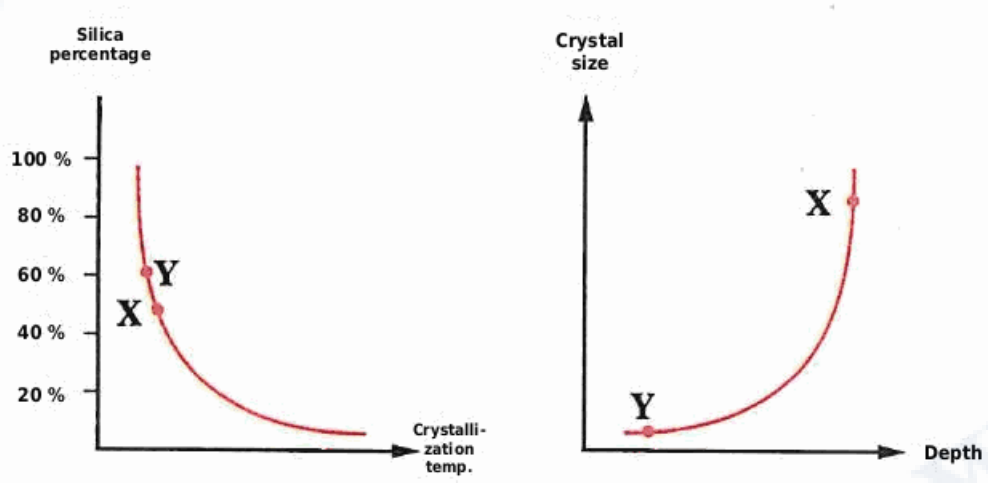
(A) (2), (4), (3), (1)
(B) (1), (3), (4), (2)
(C) (1), (4), (3), (2)
(D) (3), (1), (4), (2)

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16 What is the type of rock that contains minerals that crystallized quickly in the last stages of the cooling of the melt? (2nd session 2023)

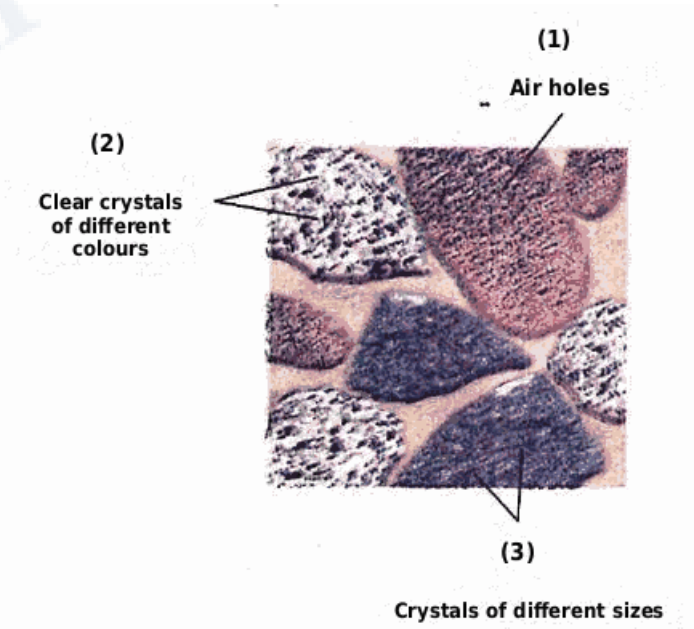
(A) Basic volcanic (B) Acidic volcanic (C) Acidic plutonic (D) Basic plutonic

17 From the opposite graph, what are the names of rocks (Y) and (X)? (2nd session 2023)



(A) (X) gabbro, (Y) andesite
(B) (X) basalt, (Y) diorite
(C) (X) komatiite, (Y) granite
(D) (X) basalt, (Y) granite

18 On a trip to the geological museum, you found the rock samples marked by the numbers (1), (2) and (3). What are the texture and place of formation of the three samples respectively? (2nd session 2023)



(A) (vesicular, extrusive) / (porphyritic, intrusive) / (coarse, plutonic)

(B) (vesicular, extrusive) / (coarse, plutonic) / (porphyritic, intrusive)

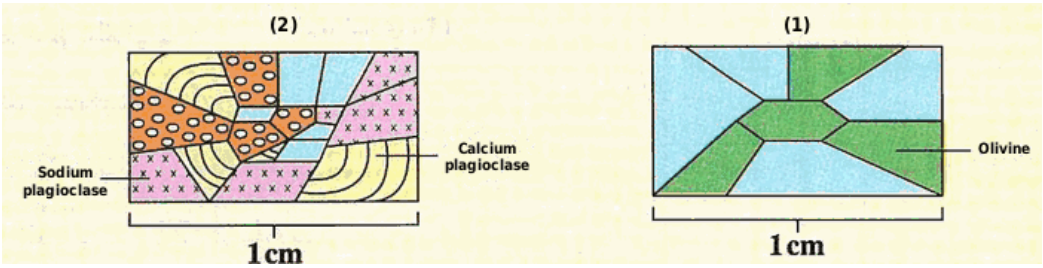
(C) (coarse, plutonic) / (vesicular, extrusive) / (porphyritic, intrusive)

(D) (porphyritic, intrusive) / (vesicular, extrusive) / (coarse, plutonic)

---

19 The figures in front of you represent samples of rocks that crystallized from the cooling of a melt:

What is the texture of rock (1)? And what is the type of rock (2)? (2nd session 2024)



(A) Fine - basic

(B) Coarse - ultrabasic

(C) Fine - acidic

(D) Coarse - intermediate

---

20 If you know that calcium is part of some feldspars, which of the following rocks has a glassy texture and is rich in calcium? (2nd session 2024)

(A) Acidic volcanic
(B) Acidic plutonic
(C) Intermediate plutonic
(D) Basic volcanic

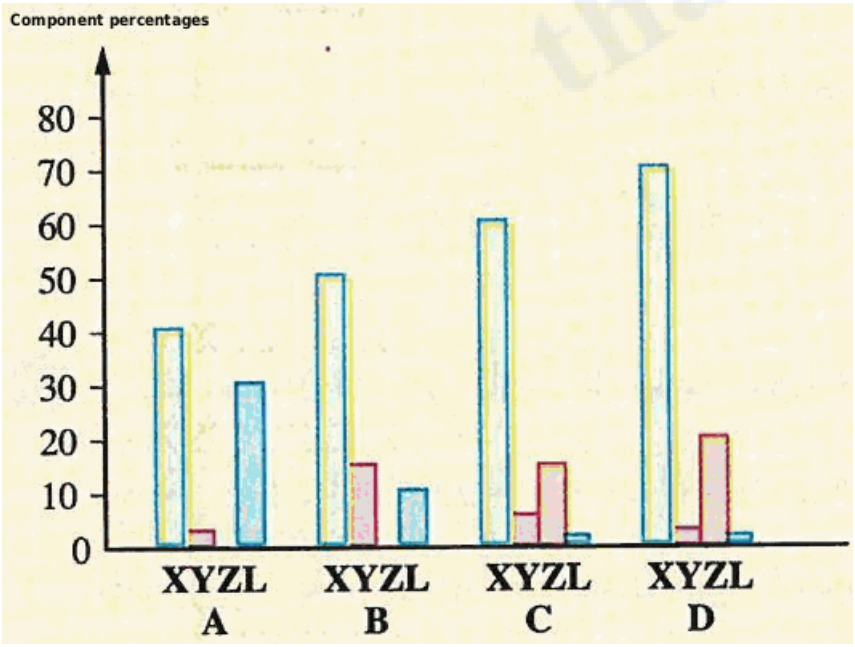
21 When the ions of the elements of the melt react and calcium plagioclase changes into sodium plagioclase, this is accompanied by ..... (Sample exam 2025)

(A) a decrease in temperature
(B) an increase in temperature
(C) an increase then a decrease in temperature
(D) a constant temperature

22 The opposite graph shows the percentages of the components of four groups of igneous rocks (A), (B), (C) and (D), given that: (Sample exam 2025)

(A): ultrabasic rocks, (B): basic rocks, (C): intermediate rocks, (D): acidic rocks.

What do (X), (Y), (Z) and (L) represent respectively?



(A) (X) silica / (Y) iron / (Z) potassium / (L) sodium
(B) (X) silica / (Y) calcium / (Z) potassium / (L) iron
(C) (X) iron / (Y) silica / (Z) potassium / (L) calcium
(D) (X) iron / (Y) sodium / (Z) calcium / (L) potassium

23 What is the ascending order of the following rocks (pumice - microdiorite - komatiite) according to melting temperature? (Sample exam 2025)

(A) Pumice, then komatiite, then microdiorite

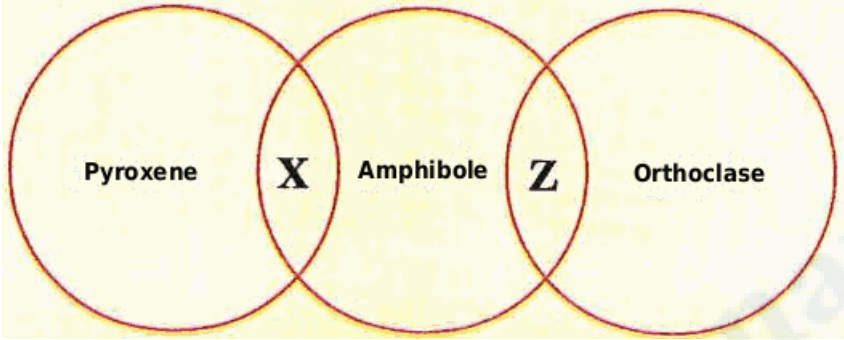
(B) Komatiite, then pumice, then microdiorite

(C) Pumice, then microdiorite, then komatiite

(D) Komatiite, then microdiorite, then pumice

---

24 From the opposite chart, which rocks are represented by the letters (X) and (Z) respectively? (Sample exam 2025)



(A) (X) peridotite / (Z) obsidian

(B) (X) dolerite / (Z) diorite

(C) (X) andesite / (Z) komatiite

(D) (X) pumice / (Z) andesite

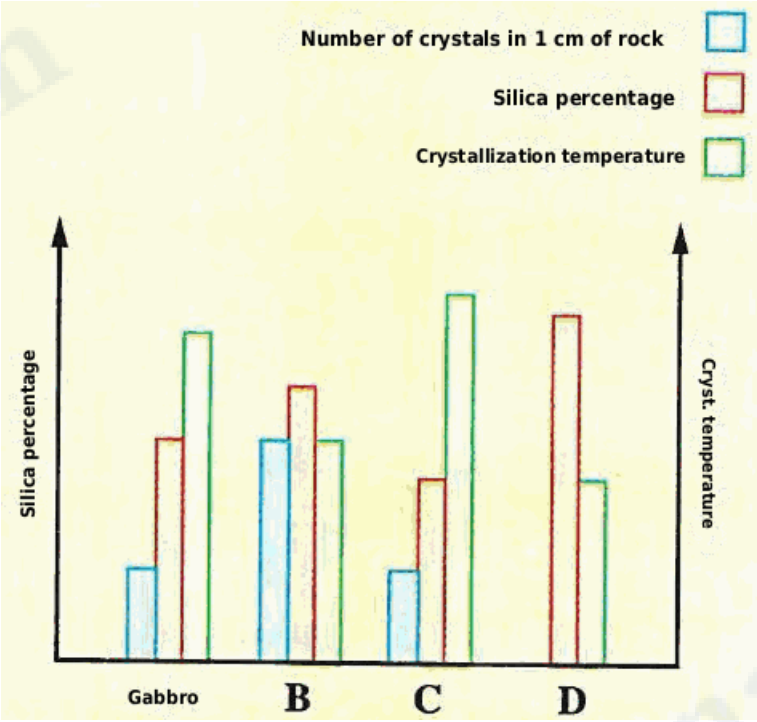
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25 Which igneous rock forms from the cooling of lava and contains olivine and amphibole? (1st session 2025)

(A) Andesite (B) Basalt (C) Rhyolite (D) Gabbro

---

26 From the graph in front of you, which of the following rocks are represented by the letters (B), (C) and (D) respectively? (Sample exam 2026)



(A) (B) basalt - (C) microgranite - (D) komatiite

(B) (B) microgranite - (C) basalt - (D) obsidian

(C) (B) basalt - (C) komatiite - (D) granite

(D) (B) microdiorite - (C) peridotite - (D) obsidian

---

27 You have two samples of igneous rocks, each with crystals of different sizes.
The first sample: contains crystals of olivine, pyroxene and calcium feldspar.
The second sample: contains crystals of pyroxene, quartz, feldspar and mica.
From the above, we can deduce that the two samples respectively are of the rocks ..... (Sample exam 2026)

(A) dolerite and microdiorite

(B) gabbro and microdiorite

(C) dolerite and diorite

(D) basalt and andesite

---

28 Which of the following factors does not play a role in determining the shapes of hypabyssal igneous domes? (1st session 2021)

(A) The viscosity of the magma

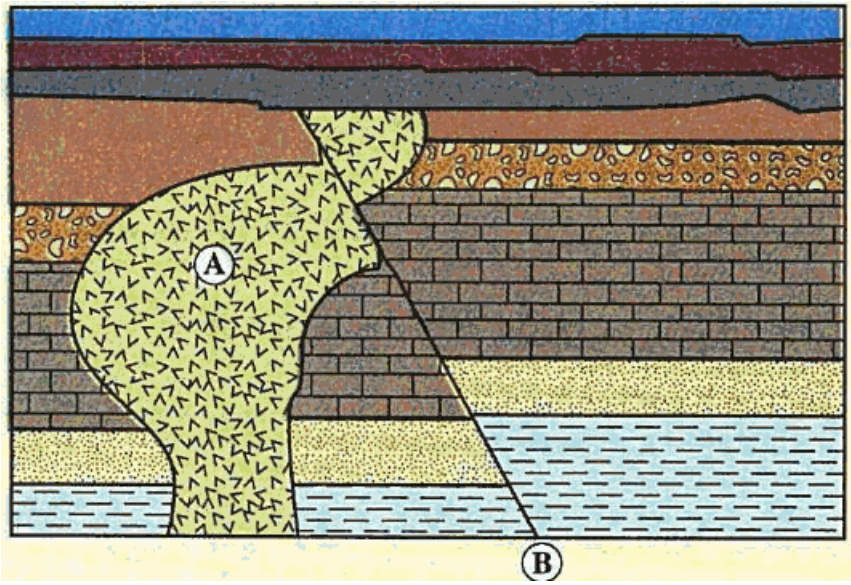
(B) The mineral composition of the magma

(C) The crystallization rate of the magma

(D) The density of the magma

---

29 Which of the following statements is correct about the section in front of you? (2nd session 2021)



(A) The igneous intrusion (A) is younger than the fault (B)

(B) The section has an angular unconformity surface

(C) The fault (B) is younger than the igneous intrusion (A)

(D) The area was affected by tensional forces

---

30 A sedimentary sequence of 3 layers was intruded by high-viscosity magma. What are the characteristics of the tectonic structure formed? (1st session 2023, Sample exam 2025)

(A) Its two limbs come closer together at the top

(B) Its two limbs move apart at the top

(C) The hanging wall rocks move up

(D) The hanging wall rocks move down

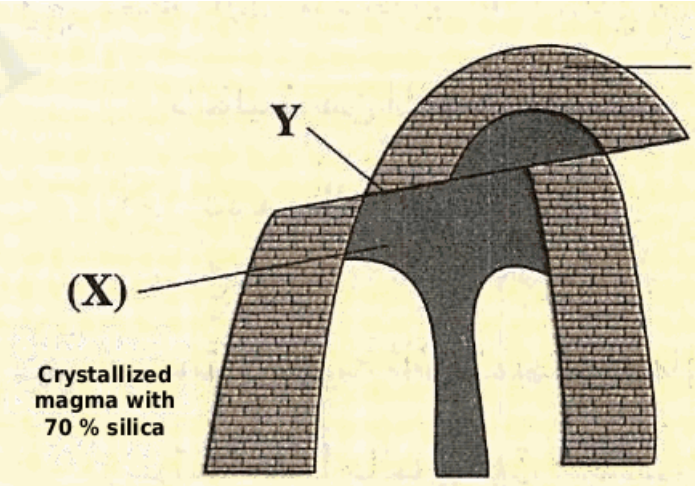
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31 What form results from the accumulation of low-viscosity magma between rock layers? (1st session 2023)

(A) A fold (B) A lopolith (C) A laccolith (D) A sill

---

32 From studying the opposite vertical section, we conclude the presence of ..... (2nd session 2024)



(A) (X) a dolerite lopolith, (Y) a reverse fault
(B) (X) a dolerite laccolith, (Y) a strike-slip fault
(C) (X) a microgranite lopolith, (Y) a reverse fault
(D) (X) a microgranite laccolith, (Y) a thrust fault

---

33 A sedimentary sequence of two layers; the lower layer contains a coral reef fossil that was affected by an igneous intrusion whose upper surface is arched upward. What are the characteristics of the fossil in the lower layer? And what tectonic structure is formed? (2nd session 2024)

(A) Intact - anticline
(B) Deformed - anticline
(C) Intact - syncline
(D) Deformed - syncline

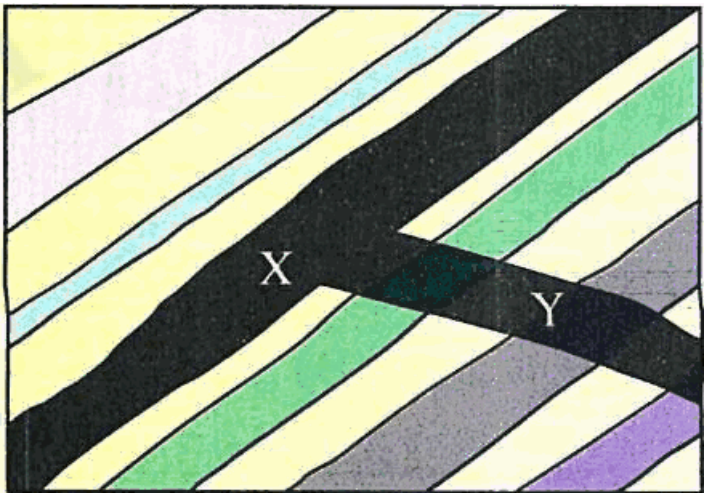
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34 One of the forms of hypabyssal igneous rocks is ..... (1st session 2025)

(A) laccoliths and batholiths
(B) volcanic ejecta and lopoliths
(C) laccoliths and volcanic breccia
(D) ropes and lopoliths

---

35 In the vertical section shown in front of you, what do the igneous forms (X) and (Y), formed from the crystallization of a melt with about 60 % silica, represent? (1st session 2025)



(A) (X) a sill / (Y) a microdiorite dyke
(B) (X) a sill / (Y) a dolerite dyke
(C) (X) a dyke / (Y) a microgranite dyke
(D) (X) a dyke / (Y) a microdiorite sill

36 Folds may form together with some igneous intrusions. Which of the following is a cause and a result of fold formation? (2nd session 2025)

(A) Sill - a fold with its youngest layers at the centre
(B) Lopolith - a fold with its oldest layers at the centre
(C) Laccolith - a fold with its oldest layers at the centre
(D) Dykes - a fold with its oldest layers at the centre

37 Which of the following igneous forms took the longest time to cool? (2nd session 2025)

(A) A diorite batholith
(B) Basalt ropes
(C) Andesite pillows
(D) Rhyolite ropes

38 An igneous rock that extends for about 250 km, formed from a sodium-rich melt that lost its heat slowly, takes the form of ..... (Sample exam 2026)

(A) a microgranite batholith
(B) a granite batholith
(C) a granite sill
(D) a microgranite sill

39 Sedimentary layers were affected by high-viscosity magma that crystallized in a dome shape beneath them, then were subjected to compression that caused breaking and movement of one side over the other. We expect to find ..... (Sample exam 2026)

(A) a syncline and a thrust fault
(B) an anticline and a normal fault
(C) a syncline and a reverse fault
(D) an anticline and a thrust fault

40 Deep plutonic igneous masses such as batholiths form when ..... (Sample exam 2026)

(A) magma is pushed between existing rock layers
(B) magma crystallizes at a very great depth inside the Earth's crust
(C) magma erupts and solidifies on the Earth's surface
(D) magma is pushed into vertical cracks cutting across the layers

41 In which of the following forms can obsidian be found? (Trial exam / June 2021, Sample exam 2025)

(A) Laccolith (B) Dykes (C) Pillows (D) Lopolith

42 What is the difference between dolerite dykes and basalt ropes? (1st session 2022)

(A) The silica percentage
(B) The mineral composition
(C) The crystallization temperature
(D) The texture of the rock

43 A rock sample was taken from the highest point of an island in the Atlantic Ocean. What is the correct rock classification of this sample? (2nd session 2022)

(A) Acidic plutonic igneous rocks
(B) Basic volcanic igneous rocks
(C) Intermediate plutonic igneous rocks
(D) Acidic volcanic igneous rocks

44 What is the result of the repeated eruptions of Mount Etna? (2nd session 2022)

(A) The formation of fine-grained igneous rocks
(B) The intrusion of igneous dykes and sills
(C) The formation of igneous rocks with clear crystals
(D) The intrusion of inverted igneous domes

45 Ropes and pillows rich in potassium are made of the rock ..... (Trial exam 2023)

(A) andesite (B) dolerite (C) granite (D) rhyolite

46 What does the intrusion of magma along the boundary surface between limestone and the sandstone above it indicate? (1st session 2023)

(A) An angular unconformity
(B) A nonconformity
(C) There is no unconformity
(D) A disconformity

47 What rock forms from the solidification of a low-silica melt in the form of pillows? (2nd session 2023)

(A) Dolerite (B) Andesite (C) Gabbro (D) Basalt

48 What type of rocks appears in the form of pillows and is dark black in colour? (1st session 2024)

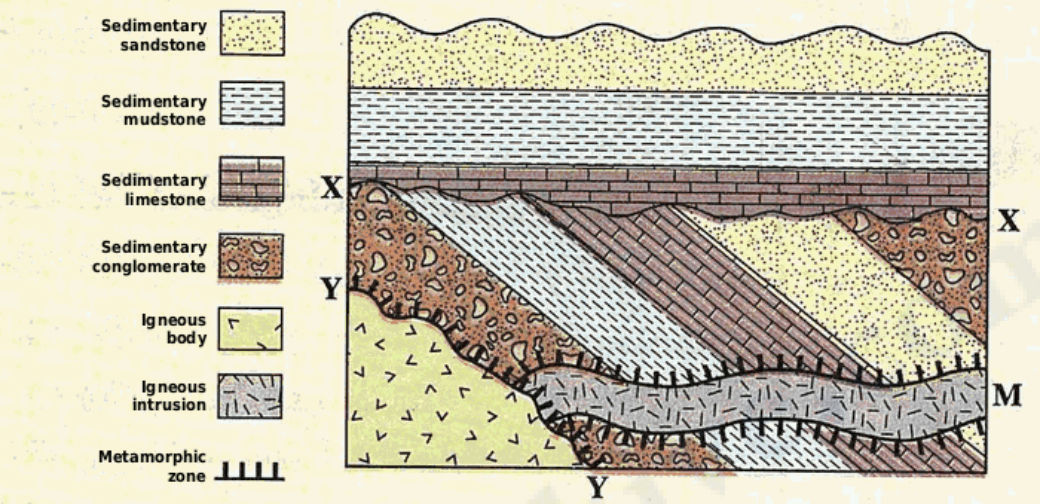
(A) Acidic intrusive
(B) Ultrabasic extrusive
(C) Intermediate extrusive
(D) Basic intrusive

49 Which of the following forms of igneous rocks forms directly on the Earth's surface from the solidification of lava? (Sample exam 2026)

(A) Batholiths and lopoliths
(B) Dykes and laccoliths
(C) Pillows and igneous ropes
(D) Domes and sills

50 The following figure represents a vertical section of sedimentary layers containing igneous intrusions. Study it well, then answer: (2nd session 2024)

(1) What is the type of unconformity surface (X - X)? And why?
(2) Is (Y - Y) an unconformity surface?
(3) What is the shape of the igneous intrusion (M)?



Answer key and solutions

Multiple choice questions

1 C	2 D	3 B	4 D	5 C	6 D	7 C	8 B	9 C	10 C
11 A	12 B	13 B	14 A	15 C	16 C	17 B	18 B	19 A	20 C
21 A	22 B	23 D	24 B	25 B	26 C	27 A	28 A	29 D	30 A
31 D	32 D	33 D	34 B	35 C	36 C	37 B	38 D	39 C	40 A
41 B	42 B	43 A	44 B	45 B	46 C	47 A	48 A	49 D	50 A
51 B	52 A	53 B	54 A	55 A	56 A	57 C	58 A	59 C	60 C
61 C	62 A	63 D	64 B	65 B	66 D	67 B	68 C	69 B	70 C
71 B	72 A	73 C	74 D	75 D	76 B	77 C	78 A	79 A	80 C
81 B	82 C	83 D	84 C	85 B	86 C	87 A	88 B	89 D	90 A
91 B	92 B	93 A	94 D	95 B	96 D	97 C	98 A	99 C	100 C
101 B	102 B								

1 **Answer (C)**

In the continuous reaction, calcium feldspar (calcium-rich plagioclase) crystallizes first.

2 **Answer (D)**

Rhyolite is an acidic rock, and it is the last to crystallize.

3 **Answer (B)**

In the discontinuous reaction, olivine crystallizes first, then pyroxene, then amphibole, then biotite.

4 **Answer (D)**

Silica decreases as the crystallization temperature rises, and so does potassium.

5 **Answer (C)**

Olivine and pyroxene are minerals rich in iron and magnesium.

6 **Answer (D)**

Orthoclase is a feldspar, and feldspars are silicates.

7 **Answer (C)**

Olivine and pyroxene are among the first minerals to crystallize, and they belong to basic rocks.

8 **Answer (B)**

The percentages of iron, magnesium and calcium decrease, while the percentages of silicon, sodium and potassium increase.

9 **Answer (C)**

Muscovite and quartz are the last minerals to crystallize in the series.

10 **Answer (C)**

An intermediate rock does not contain olivine, which is one of the first minerals to crystallize in basic rocks.

11 **Answer (A)**

Calcium is one of the first elements used up in crystallizing minerals, so its percentage in the remaining melt decreases.

12 **Answer (B)**

The feldspar in basic rocks is calcium feldspar, so it is rich in calcium and poor in sodium and potassium.

13 **Answer (B)**

In basic rocks, pyroxene crystallizes before amphibole, biotite and orthoclase.

14 **Answer (A)**

Iron increases in the minerals that crystallize early, and potassium increases in the late ones.

15 **Answer (C)**

(A) is at the surface with a low silica percentage: komatiite.

(X) is at the surface with an intermediate silica percentage: andesite.

16 **Answer (C)**

Ultrabasic rocks are mostly made of minerals rich in iron and magnesium, which matches (Y).

17 **Answer (B)**

Diorite is a rock of intermediate composition between granite (W) and gabbro (Z), so it is (X).

18 **Answer (B)**

Komatiite is an ultrabasic rock, so it is the richest in magnesium.

19 **Answer (A)**

Komatiite, then basalt, then andesite: the iron percentage gradually decreases.

20 **Answer (C)**

From acidic obsidian to ultrabasic peridotite, the percentage of iron and magnesium increases and the sodium percentage decreases.

21 **Answer (A)**

22 **Answer (B)**

Plutonic rocks crystallize slowly inside the crust, so their crystals are large and their texture is coarse.

23 **Answer (D)**

Fast cooling gives a large number of fine crystals.

24 **Answer (B)**

25 **Answer (B)**

Basic lava crystallizes quickly at the surface, forming basalt.

26 **Answer (C)**

Intermediate magma crystallizes slowly inside the crust, forming diorite.

27 **Answer (A)**

The last minerals to crystallize are the first to melt, and quartz is the last mineral of granite to crystallize.

28 **Answer (A)**

29 **Answer (D)**

Basalt is a basic volcanic rock; it crystallized quickly and is rich in iron.

30 **Answer (A)**

Large crystals among fine crystals indicate a porphyritic texture, and microgranite is one of the rocks with this texture.

31 **Answer (D)**

Granite and rhyolite are acidic rocks rich in quartz and orthoclase.

32 **Answer (D)**

A coarse texture indicates slow crystallization at great depths.

33 **Answer (D)**

Gabbro is a basic plutonic rock that crystallized slowly at great depths.

34 **Answer (B)**

Rhyolite is an acidic volcanic rock with about 70 % silica.

35 **Answer (C)**

Basalt is rich in iron and magnesium, so its colour is dark black.

36 **Answer (C)**

37 **Answer (B)**

Gabbro is a basic plutonic rock with clear crystals, made of these minerals.

38 **Answer (D)**

The air bubbles indicate a volcanic rock that cooled quickly.

39 **Answer (C)**

The minerals that crystallize late are rich in silica and light in colour.

40 **Answer (A)**

41 **Answer (B)**

Olivine crystallizes at a high temperature, and the minerals of granite crystallize at a low temperature.

42 **Answer (B)**

Volcanic islands are made of basic lava that cooled quickly, forming fine crystals.

43 **Answer (A)**

Rock (B) is light-coloured and fine-grained, so it is rhyolite (acidic, extrusive).

44 **Answer (B)**

Iron is found in the minerals that crystallize at high temperatures, while the minerals of granite crystallize at low temperatures.

45 **Answer (B)**

The minerals of igneous rocks form from the cooling and crystallization of a melt.

46 **Answer (C)**

60 % is intermediate, and within the surrounding rocks means hypabyssal: microdiorite.

47 **Answer (A)**

Komatiite is an ultrabasic volcanic rock rich in iron and magnesium.

48 **Answer (A)**

Orthoclase and quartz are minerals of acidic rocks, whose silica percentage is about 72 %.

49 **Answer (D)**

Rhyolite is a volcanic rock formed by the crystallization of lava after a volcanic eruption.

50 **Answer (A)**

Pumice is an acidic extrusive rock that crystallizes at low temperatures.

51 **Answer (B)**

Microgranite is a light-coloured acidic intrusive (hypabyssal) rock.

52 **Answer (A)**

The sodium percentage increases from A to D, that is, from ultrabasic to acidic: peridotite, then gabbro, then diorite, then granite.

53 **Answer (B)**

Sudden cooling gives a fine-grained basic volcanic rock: basalt.

54 **Answer (A)**

The mineral is mica (its cleavage is in one direction), and it crystallizes at about 780 °C.

55 **Answer (A)**

Peridotite is an ultrabasic rock made mainly of olivine.

56 **Answer (A)**

Basalt is the first to crystallize from basic lava.

57 **Answer (C)**

The crystallization temperature indicates the chemical composition, the silica percentage and the colour, but the texture of the rock depends on the cooling rate.

58 **Answer (A)**

Potassium increases in acidic rocks: rhyolite and pumice.

59 **Answer (C)**

The lower the silica percentage, the higher the crystallization temperature: basalt, then andesite, then rhyolite.

60 **Answer (C)**

The sample has a uniform composition, so the silica percentage is the same in any part of it.

61 **Answer (C)**

Peridotite matches komatiite in composition (ultrabasic), but it is plutonic.

62 **Answer (A)**

Dolerite is a hypabyssal rock with a porphyritic texture, and its silica percentage is basic to intermediate.

63 **Answer (D)**

Muscovite is a mineral of acidic rocks, and it is rare in basalt.

64 **Answer (B)**

Feldspars, pyroxene and quartz: andesite.

65 **Answer (B)**

66 **Answer (D)**

Ultrabasic rocks crystallize at the highest temperatures.

67 **Answer (B)**

The crystallization temperature decreases as silica increases: peridotite, then dolerite, then andesite, then granite.

68 **Answer (C)**

Dolerite is a basic hypabyssal rock with a porphyritic texture (large and fine crystals), and its silica percentage is about 50 %.

69 **Answer (B)**

70 **Answer (C)**

Plagioclase, pyroxene and olivine in a coarse rock indicate gabbro (basic plutonic).

71 **Answer (B)**

Diorite and andesite have the same mineral composition, but diorite is plutonic and coarse while andesite is extrusive and fine-grained.

72 **Answer (A)**

73 **Answer (C)**

Granite is the least dense rock (acidic), so it is the last to reach the bottom.

74 **Answer (D)**

Clearly visible minerals indicate a coarse texture (plutonic rock).

75 **Answer (D)**

(A) is pink with a hardness of 6: orthoclase.

(B) is white with a sheet-like cleavage: mica.

(C) is transparent with a vitreous luster: quartz.

76 **Answer (B)**

77 **Answer (C)**

A melt with 40 % silica that crystallizes at the surface forms komatiite (ultrabasic volcanic).

78 **Answer (A)**

The rising magma lifts the layers into an anticline (dome), then its surface is eroded.

79 **Answer (A)**

A normal dome results from the upward folding of rocks.

80 **Answer (C)**

A lopolith is a dish-shaped igneous intrusion that bends the layers into a syncline.

81 **Answer (B)**

A laccolith lifts the layers into an anticline, so its oldest layers are at the centre.

82 **Answer (C)**

83 **Answer (D)**

The batholith is the largest igneous intrusion and extends over great distances underground.

84 **Answer (C)**

85 **Answer (B)**

Parallel sills result from the intrusion of melt between rock layers.

86 **Answer (C)**

87 **Answer (A)**

Microgranite is an acidic rock that does not contain pyroxene, so mica does not occur with it in its sills.

88 **Answer (B)**

The igneous rock (A) cuts across the layers of rock (B), so it is a dyke.

89 **Answer (D)**

High-viscosity magma does not move easily, so it lifts the layers into anticlines; this is in A and C.

90 **Answer (A)**

Rock (E) is sandstone, and it is made mainly of quartz.

91 **Answer (B)**

(H) is an igneous rock that cuts across the layers, so it is a dyke.

92 **Answer (B)**

(A) lies on one side of the fold, so it is a fold limb.

93 **Answer (A)**

A dome results from high-viscosity melt that does not spread easily, so it lifts the layers.

94 **Answer (D)**

95 **Answer (B)**

Low-viscosity basic lava flows long distances in the form of volcanic ropes.

96 **Answer (D)**

In (2), at the surface, the lava cools quickly, so it is glassy; (1) cools more slowly, so its texture is porphyritic.

97 **Answer (C)**

98 **Answer (A)**

99 **Answer (C)**

(1) cuts across the layers, so it is a dyke, and (2) is parallel to the layers, so it is a sill.

100 **Answer (C)**

A batholith is a plutonic intrusion that crystallizes slowly, so its texture is coarse.

101 **Answer (B)**

The fine black powder is volcanic ash.

102 **Answer (B)**

Ejecta cool quickly in the air, so their texture is fine.

Essay questions

1 **Model answer**

(1) Intrusive: microgranite; plutonic: granite.

(2) Because of its vesicular (bubbly) texture, which makes the rock light in weight.

2 **Model answer**

(1) Microdiorite.

(2) An intermediate intrusive igneous rock.

(3) Porphyritic texture.

3 **Model answer**

(1) The rock: gabbro / its type: basic igneous.

(2) The volcanic equivalent: basalt / its texture is fine-grained or glassy.

4 **Model answer**

(1) Acidic plutonic igneous rocks.

(2) Quartz (25 %), potassium and sodium feldspar, mica and amphibole.

(3) Microgranite, obsidian, rhyolite, pumice.

5 **Model answer**

(1) Sample (A): obsidian, sample (C): gabbro, sample (D): peridotite, sample (E): komatiite.

(2) (B) granite: slow cooling; (F) basalt: fast cooling.

6 **Model answer**

The first sample: gabbro; the second sample: pumice; the third sample: granite.

7 **Model answer**

(1) (B): gabbro, (C): microgranite, (D): andesite.

(2) Andesite (D).

8 **Model answer**

(1) Intermediate igneous rocks.

(2) Andesite.

(3) 55 : 66 %

9 **Model answer**

(1) (B) fine - glassy - vesicular; (D) coarse.

(2) (C) is older.

10 **Model answer**

(1) Structure (2): an igneous dyke; structure (3): igneous sills.

(2) The structure formed under the effect of structure (1): a syncline; the structure formed under the effect of structure (5): an anticline.

Past exam questions

1 C	2 D	3 A	4 B	5 A	6 D	7 C	8 A	9 C	10 B
11 D	12 A	13 C	14 D	15 C	16 B	17 A	18 B	19 D	20 D
21 A	22 B	23 C	24 B	25 B	26 D	27 A	28 C	29 C	30 A
31 B	32 D	33 B	34 A	35 A	36 C	37 A	38 B	39 D	40 B
41 C	42 D	43 B	44 A	45 D	46 C	47 D	48 B	49 C	50 —

1 **Answer (C)**

The colours of the minerals appear, which means its crystals are large (plutonic).
Olivine, pyroxene and amphibole with calcium plagioclase: a basic plutonic rock, which is gabbro.

2 **Answer (D)**

The greater the depth, the slower the cooling, so there are fewer crystallization centres and the crystals are larger; the number of crystals decreases (D).

3 **Answer (A)**

Dolerite is basic, then diorite is intermediate, then microgranite is acidic, so silica increases in this order.

4 **Answer (B)**

A 1 mm sample with small crystals of plagioclase, pyroxene and olivine: a basic volcanic rock, which is basalt.

5 **Answer (A)**

A light-coloured rock with large crystals is acidic plutonic (granite), and it does not contain olivine and pyroxene because they are minerals of basic rocks.

6 **Answer (D)**

Microscopic crystals indicate a volcanic rock, and the large percentages of olivine and pyroxene indicate an ultrabasic rock.

7 **Answer (C)**

According to Bowen's reaction series, different minerals crystallize at different temperatures, so the crystallization temperature determines the mineral composition.

8 **Answer (A)**

The colour of an igneous rock indicates its chemical composition; a dark colour indicates a low silica percentage and richness in iron and magnesium.

9 **Answer (C)**

Quartz and pyroxene together indicate an intermediate rock, and crystals of different sizes mean a porphyritic texture.

10 **Answer (B)**

A rock rich in sodium and calcium (plagioclase) is intermediate, and crystals of different sizes mean it is intrusive.

11 **Answer (D)**

The dark colour indicates a basic rock, and the clear crystals indicate that it is plutonic.

12 **Answer (A)**

Orthoclase, quartz and mica are minerals of an acidic rock; the crystals are clear (coarse texture), and it crystallizes at about 750 °C.

13 **Answer (C)**

A quarter of its content is quartz (conchoidal fracture), so it is acidic; the solidification of lava with escaping gases gives pumice.

14 **Answer (D)**

Granite and gabbro are both plutonic rocks with a coarse texture.

15 **Answer (C)**

Obsidian is glassy (no crystallization centres), then peridotite is plutonic and coarse, then dolerite is intrusive, then rhyolite is volcanic and fine with many crystallization centres.

16 **Answer (B)**

The minerals that crystallize in the last stages are the minerals of acidic rocks, and fast crystallization means a volcanic rock.

17 **Answer (A)**

(X) has large crystals at a great depth and a silica percentage of about 45 %: gabbro.

(Y) has fine crystals near the surface and a silica percentage of about 60 %: andesite.

18 **Answer (B)**

(1) Air holes: vesicular, extrusive.

(2) Clear crystals: coarse, plutonic.

(3) Crystals of different sizes: porphyritic, intrusive.

19 **Answer (D)**

(1) Large olivine crystals: coarse texture.

(2) Sodium and calcium plagioclase: an intermediate rock.

20 **Answer (D)**

A glassy texture indicates a volcanic rock, and richness in calcium indicates a basic rock.

21 **Answer (A)**

According to Bowen's reaction series, calcium plagioclase changes into sodium plagioclase as the temperature decreases.

22 **Answer (B)**

(X) increases from ultrabasic to acidic rocks: silica.

(L) decreases towards acidic rocks: iron; (Z) increases in acidic rocks: potassium; and (Y) is calcium.

23 **Answer (C)**

Pumice is acidic and crystallizes at the lowest temperature, then microdiorite is intermediate, then komatiite is ultrabasic at the highest temperature.

24 **Answer (B)**

(X) is between pyroxene and amphibole: a basic intrusive rock (dolerite).

(Z) is between amphibole and orthoclase: an intermediate rock (diorite).

25 **Answer (B)**

The rock formed from the cooling of lava is volcanic, and olivine and amphibole are minerals of basic rocks: basalt.

26 **Answer (D)**

(B) has a medium number of crystals and intermediate silica: microdiorite.

(C) has few crystals, little silica and a high crystallization temperature: peridotite.

(D) has no crystals, high silica and a low crystallization temperature: obsidian.

27 **Answer (A)**

Crystals of different sizes mean intrusive rocks.

The first (olivine, pyroxene and calcium feldspar): dolerite; the second: microdiorite.

28 **Answer (C)**

The shape of igneous domes is determined by the viscosity, mineral composition and density of the magma, not by its crystallization rate.

29 **Answer (C)**

The fault (B) cuts the layers surrounding the igneous intrusion (A), so it is younger than it.

30 **Answer (A)**

High-viscosity magma forms a laccolith that arches the layers upward, forming an anticline whose limbs come closer together at the top.

31 **Answer (B)**

Low-viscosity magma accumulates between the layers, forming a lopolith that bends the layers downward.

32 **Answer (D)**

(X) crystallized magma that arches the layers upward: a laccolith, and a silica percentage of 70 % (acidic intrusive): microgranite.

(Y) a fault with a low dip: a thrust fault.

33 **Answer (B)**

The igneous intrusion deforms the fossil by heat, and its upward arching (laccolith) forms an anticline.

34 **Answer (A)**

Laccoliths and batholiths are forms of hypabyssal igneous rocks.

35 **Answer (A)**

(X) is parallel to the layers: a sill, and (Y) cuts across the layers: a dyke; 60 % silica is an intermediate intrusive rock: microdiorite.

36 **Answer (C)**

A laccolith arches the layers upward, forming an anticline with its oldest layers at the centre.

37 **Answer (A)**

A batholith is a huge plutonic mass, so it cools very slowly and takes the longest time.

38 **Answer (B)**

The great extent (250 km) and slow cooling: a plutonic batholith, and rich in sodium means acidic: granite.

39 **Answer (D)**

High-viscosity magma forms a dome (laccolith), so an anticline forms.
Compression with one side moving over the other forms a thrust fault.

40 **Answer (B)**

Batholiths are plutonic igneous masses whose magma crystallizes at a very great depth inside the crust.

41 **Answer (C)**

Obsidian is a glassy volcanic rock, and pillows are a form of extrusive igneous rocks.

42 **Answer (D)**

Dolerite dykes are intrusive with crystals of different sizes, and basalt ropes are extrusive and fine-grained, so they differ in texture.

43 **Answer (B)**

The islands of the Atlantic Ocean are volcanic, made of basic rocks (basalt).

44 **Answer (A)**

Repeated volcanic eruptions form fine-grained volcanic rocks.

45 **Answer (D)**

Ropes and pillows are volcanic rocks, and rich in potassium means acidic: rhyolite.

46 **Answer (C)**

The intrusion of magma along the boundary surface between the two layers forms a sill, not an unconformity surface.

47 **Answer (D)**

A low-silica melt is basic, and pillows are an extrusive form: basalt.

48 **Answer (B)**

Pillows are an extrusive form, and the dark black colour indicates an ultrabasic rock.

49 **Answer (C)**

Pillows and igneous ropes form from the solidification of lava on the Earth's surface.

50 **Model answer**

(1) An angular unconformity, because it lies between older tilted sedimentary layers and younger horizontal sedimentary layers.

(2) No.

(3) A dyke.