Exam

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Which of the following statements regarding mineral identification is NOT true? 1) _____
A) Cleavage refers to the tendency of the mineral to break or cleave along distinct planes.
B) Hardness is determined using the Moh's Hardness Scale.
C) Luster refers primarily to whether the mineral appears to shine when its surface is wet.
D) Effervescence refers to the tendency of some minerals to fizz when exposed to acid.

Answer: C
Explanation: A)
B)
C)
D)

2) A rock is best defined as: 2) _____
A) aggregates of several crystals.
B) aggregates of one or more minerals.
C) aggregates of one or more naturally occurring solids of definite chemical composition.
D) aggregates of naturally occurring solids of definite crystalline structure.

Answer: B
Explanation: A)
B)
C)
D)

3) Which of the following statements concerning mineral crystal formation is NOT true? 3) _____
A) The physical space available in which a crystal grows is a limiting factor in the shape of a crystal.
B) Given two elements of equal abundance, the element that contributes more readily to mineral formation is the one that "fits" better on an atomic level.
C) Because the identity of the available atoms remains constant, the formation of crystals is independent of the rate of cooling of the molten rock from which it forms.
D) Atoms of a similar size can often replace one another within a crystal structure without changing the identity of the crystal.

Answer: C
Explanation: A)
B)
C)
D)

4) Which of the following statements concerning hydrogen bonding is NOT true? 4) _____

A) Although weaker than ionic bonding, it can often separate ionically bonded compounds into its component ions.
B) It can be used to explain why so many substances dissolve in water.
C) For geologists, it is the most important type of intermolecular bonding.
D) It occurs because the water molecule is polar; the oxygen side of the water molecule carries a positive charge and the hydrogen side carries a negative charge.

Answer: D
Explanation: A)
B)
C)
D)

5) Which of the following statements concerning crystals is NOT true? 5) _____

A) They are considered crystals only if they are naturally occurring.
B) On a microscopic level, the crystals of any given mineral possess exactly the same structure even if the crystals are not well formed.
C) They possess an orderly arrangement of ions or atoms in a three-dimensional latticework.
D) In well-formed crystals of a given mineral, angles among the planar surfaces are always the same.

Answer: A
Explanation: A)
B)
C)
D)

6) Which of the following statements about gemstones is NOT true? 6) _____

A) Gemstones can form when preexisting rock is subjected to extraordinary pressure and heat.
B) Gemstones can form when molten rock cools and crystallizes deep underground.
C) Gemstones are formed only from very rare minerals.
D) The color in gemstones may result from a few atoms scattered throughout its crystal structure.

Answer: C
Explanation: A)
B)
C)
D)

7) The property that distinguishes an atom to be that of a particular element is: 7) _____

A) the number of protons it has.
B) the number of neutrons and protons together.
C) the number of neutrons it has.
D) the number of electrons it has.

Answer: A
Explanation: A)
B)
C)
D)

8) Which of the following statements concerning diamonds is NOT true? 8) _____

A) Diamonds are formed as a result of extreme pressure on coal that has been buried to a depth of more than 150 kilometers (90 miles).
B) Diamond is the world's hardest natural substance.
C) Diamonds are most often found in kimberlite pipes.
D) Only a few kimberlite pipes produce gem-quality diamonds.

Answer: A
Explanation: A)
B)
C)
D)

9) In a covalent bond, atoms: 9) _____

A) share electrons.
B) must have opposite electrical charges.
C) share protons.
D) become less chemically stable.

Answer: A
Explanation: A)
B)
C)
D)

10) The mineral quartz is distinctive because it consists of: 10) _____

A) a three-dimensional framework in which the silicon atoms are often replaced with atoms of aluminum, potassium, sodium, or calcium.
B) a three-dimensional framework composed entirely of silicon and oxygen.
C) independent tetrahedra composed entirely of silicon and oxygen.
D) independent tetrahedra in which the silicon atoms are often replaced with atoms of aluminum, potassium, sodium, or calcium.

Answer: B
Explanation: A)
B)
C)
D)

11) Diamond cutters have traditionally made use of which mineral property? 11) _____

A) Fracture.
B) Specific gravity.
C) Cleavage.
D) Hardness.

Answer: C
Explanation: A)
B)
C)
D)

12) A van der Waals bond is a type of: 12) _____

A) covalent bond.
B) intermolecular bond.
C) metallic bond.
D) ionic bond.

Answer: B
Explanation: A)
B)
C)
D)

13) Mineral cleavage indicates: 13) _____

A) unequal bond strength in the crystal.
B) brittle nature of the mineral.
C) equal bond strength in the crystal structure.
D) strength of the bonds in the crystal structure.

Answer: A
Explanation: A)
B)
C)
D)

14) The purpose of rubbing a mineral across an unglazed porcelain slab, the streak plate, is: 14) _____

A) to remove dirt and corrosion from the mineral so that its true color can be observed.
B) to observe the color of a mineral in its powdered form.
C) to remove the atoms of trace impurities that may exist within the structure of the mineral.
D) to determine if a streak will form on the mineral.

Answer: B
Explanation: A)
B)
C)
D)

15) The term polymorphism refers to: 15) _____

A) two mineral crystals that have the same chemical composition but different crystal structure.
B) two mineral crystals that have the same identity, but whose atomic structure includes ionic substitutions by alternate elements.
C) two mineral crystals that, because of space restrictions, reached different degrees of development.
D) two mineral crystals that have the same identity but different color, shape, or texture.

Answer: A
Explanation: A)
B)
C)
D)

16) Fracture in a mineral indicates: 16) _____

A) brittle nature of the minerals.
B) unequal bond strength in the crystal structure.
C) strength of the bonds in the crystal structure.
D) equal bond strength in the crystal structure.

Answer: D
Explanation: A)
B)
C)
D)

17) Which of the following statements about mineral hardness is NOT true? 17) _____

A) Hardness is dependent on the strength of a mineral's weakest bonds.
B) Hardness refers to how easily or how resistant a mineral is to breakage.
C) Hardness of a mineral is determined by scratching it with a series of other substances of known hardness.
D) Hardness ranges from 1 (the softest) to 10 (the hardest) on a scale called the Mohs Hardness Scale.

Answer: B
Explanation: A)
B)
C)
D)

18) Which of the following statements about mineral identification is NOT true? 18) _____

A) Many types of minerals occur in more than one color.
B) Many different types of minerals may exhibit the same color.
C) Color is one of the most reliable ways by which minerals can be identified.
D) A mineral may receive its color from only minute amounts of specific elements included within its structure.

Answer: C
Explanation: A)
B)
C)
D)

19) If a mineral exhibits cleavage, it: 19) _____

A) always occurs in the same shape.
B) breaks very easily.
C) fractures as a curved, shell-shaped (conchoidal) surface.
D) breaks consistently along distinct planes.

Answer: D
Explanation: A)
B)
C)
D)

20) In an ionic bond, atoms: 20) _____

A) lose or gain electrons.
B) share electrons.
C) become less chemically stable.
D) achieve electrical neutrality.

Answer: A
Explanation: A)
B)
C)
D)

21) One carbon isotope has 6 protons, 8 neutrons, and 6 electrons. Its atomic mass is: 21) _____

A) 6. B) 12. C) 14. D) 20.

Answer: C

Explanation: A)
B)
C)
D)

22) In metallic bonding, which of the following is NOT true? 22) _____

A) A cloud of electrons roams independently, unattached to any specific nucleus.
B) The electron cloud is negatively charged and is attracted to the positively charged nuclei.
C) Metallic bonding is the most common type of bonding among minerals.
D) Atoms are packed tightly together.

Answer: C

Explanation: A)
B)
C)
D)

23) Opal should NOT be considered a mineral because: 23) _____

A) it does not contain silicon-oxygen tetrahedrons.
B) it does not have a definite shape.
C) it does not have a systematic internal organization of its atoms.
D) it is organic in origin.

Answer: C

Explanation: A)
B)
C)
D)

24) Which of the following characteristics is NOT imparted by metallic bonding? 24) _____

A) Extreme hardness. B) High specific gravity.
C) Metallic luster. D) Conductivity of electric current.

Answer: A

Explanation: A)
B)
C)
D)

25) Smectite clay is used for all of the following EXCEPT: 25) _____

A) to heal and patch fractures in rock and concrete.
B) as a prime ingredient in kitty litter.
C) as a crucial cleansing agent for large industrial spills.
D) as a common cure for intestinal ailments.

Answer: D

Explanation: A)
B)
C)
D)

26) Which characteristics of an atom determine whether it will bind with other atoms? 26) _____
A) Number of protons and net electrical charge.
B) Number of neutrons and number of electrons in the outer shell.
C) Number of neutrons and net electrical charge.
D) Number of electrons in the outer shell and net electrical charge.

Answer: D
Explanation: A)
B)
C)
D)

27) The element carbon has 6 protons and 6 electrons, and one isotope has 8 neutrons. The atomic number of this isotope of carbon is: 27) _____
A) 6. B) 12. C) 14. D) 20.

Answer: A
Explanation: A)
B)
C)
D)

28) Mineral hardness refers to: 28) _____
A) equal bond strength in the crystal structure.
B) durability of the mineral.
C) inequal bond strength in the crystal structure.
D) strength of the bonds in the crystal structure.

Answer: D
Explanation: A)
B)
C)
D)

29) Which of the following examples of minerals that form under the given environments is NOT possible? 29) _____
A) Deposits of calcite form from the slow cooling of molten rock.
B) Deposits of stishovite form from meteorite impacts.
C) Deposits of halite form from the evaporation of saltwater.
D) Deposits of glaucophane form in deep-sea trenches.

Answer: A
Explanation: A)
B)
C)
D)

30) Silicon-oxygen tetrahedra can form as independent tetrahedra, single chains, double chains, sheets, and frameworks. A list of the minerals corresponding to these, in order, are: 30) _____

A) pyroxene, mica, quartz, amphibole, olivine.
B) olivine, pyroxene, amphibole, mica, quartz.
C) olivine, quartz, mica, feldspar, amphibole.
D) quartz, feldspar, olivine, amphibole, mica.

Answer: B
Explanation: A)
B)
C)
D)

31) In geology, a mineral is defined as: 31) _____

A) a natural substance that is neither animal nor plant, has a specific composition and structure, and contains one or more silicon-oxygen tetrahedra.
B) a naturally occurring, usually inorganic, solid consisting of chemical elements in specific proportions, whose atoms are arranged in a systematic internal pattern.
C) a naturally occurring crystalline inorganic solid that contains only one element.
D) a solid substance or element that is essential to human nutrition.

Answer: B
Explanation: A)
B)
C)
D)

32) The smallest particle of an element that retains all of the element's chemical properties is the: 32) _____

A) proton. B) molecule. C) mineral. D) atom.

Answer: D
Explanation: A)
B)
C)
D)

33) Which of the following is the most appropriate statement regarding the naming of minerals? 33) _____

A) The names of minerals, like those of plants and animals, have been given in Latin for the purpose of international uniformity.
B) The names of minerals are based on the elements that form them.
C) The names of minerals are based on a strict systematic international code, and always begin with successive letters of the Latin alphabet in the order in which the mineral is discovered.
D) The names of minerals are based on geographic locations, distinctive physical characteristics, and so on, rather than on a conventional system.

Answer: D
Explanation: A)
B)
C)
D)

34) An atom with only one electron in its outer shell loses that electron, and does the following EXCEPT: 34) _____

A) become the atom of a different element.
B) become likely to form an ionic bond with another atom.
C) become electrically positive.
D) become more chemically stable.

Answer: A
Explanation: A)
B)
C)
D)

35) A mineraloid is the same as a mineral EXCEPT: 35) _____

A) it does not form from the cooling of molten rock.
B) it is not inorganic.
C) it does not possess an orderly internal arrangement.
D) it is not a naturally occurring substance.

Answer: C
Explanation: A)
B)
C)
D)

36) In a crystal structure, which of the following is true? 36) _____

A) Smaller positive ions occur between larger negative ions.
B) Negative ions bond together by sharing electrons.
C) Smaller negative ions occur between larger positive ions.
D) Negative ions bond proportionally with equal-sized positive ions.

Answer: A
Explanation: A)
B)
C)
D)

37) All of the following statements concerning nonsilicates are true EXCEPT: 37) _____

A) they constitute only about 5% of the Earth's crust.
B) they form the two most abundant minerals in the Earth's crust.
C) the native elements do not combine in nature with other elements.
D) they are the best source for metals.

Answer: B
Explanation: A)
B)
C)
D)

38) Which one of the following properties will distinguish cubic zirconia from real diamond? 38) _____

A) Streak.
B) Luster.
C) Color.
D) Specific gravity.

Answer: D

Explanation: A)
B)
C)
D)

39) In the laboratory, the specific gravity of a mineral can be determined by the ratio of the substance's: 39) _____

A) volume to the volume of an equal weight of water.
B) weight to its mass.
C) weight to the weight of an equal volume of water.
D) size to the weight of an equal volume of water.

Answer: C

Explanation: A)
B)
C)
D)

40) The silicon-oxygen tetrahedron consists of: 40) _____

A) one large silicon atom and four smaller oxygen atoms.
B) one large oxygen atom and four smaller silicon atoms.
C) one small oxygen atom and four larger silicon atoms.
D) one small silicon atom and four larger oxygen atoms.

Answer: D

Explanation: A)
B)
C)
D)

41) All of the following statements concerning synthetic gems are true EXCEPT: 41) _____

A) many synthetic gems are indistinguishable from natural ones except by laboratory analysis.
B) synthetic gems are generally inferior to natural gems.
C) synthetic gems are generally cheaper than natural gems.
D) many of the diamonds used in both industry and in jewelry are synthetic.

Answer: B

Explanation: A)
B)
C)
D)

42) Which of the following atoms would be LEAST likely to bond with other atoms? 42) _____

A) An atom with 7 electrons in its outer shell and the same number of electrons as protons.
B) An atom with 7 electrons in its outer shell and fewer electrons than protons.
C) An atom with 8 electrons in its outer shell and fewer electrons than protons.
D) An atom with 8 electrons in its outer shell and the same number of electrons as protons.

Answer: D
Explanation: A)
B)
C)
D)

43) The most important (i.e., most abundant) mineral group is the: 43) _____

A) carbonates. B) oxides. C) sulfates. D) silicates.

Answer: D
Explanation: A)
B)
C)
D)

44) The best single property by which most minerals can be identified is: 44) _____

A) color, which depends on how much light a mineral's specific chemical makeup and crystal structure cause it to absorb or reflect.
B) hardness, its resistance to scratching or abrasion.
C) streak, the color of the powdered mineral without trace impurities.
D) none of the above, because minerals can seldom be identified on the basis of only one property.

Answer: D
Explanation: A)
B)
C)
D)

45) In the mineral olivine, iron and magnesium can substitute freely in the crystal for all of the following reasons EXCEPT: 45) _____

A) they have the same atomic mass.
B) they are both abundant in the Earth's crust.
C) they have the same charge.
D) they are similar in size.

Answer: A
Explanation: A)
B)
C)
D)

46) The kinds of mineral formed in a particular time and place depend on all of the following EXCEPT: 46) _____
A) the shape of the space in which the mineral forms.
B) the temperature and pressure at the time of formation.
C) the relative abundances of available elements.
D) the relative sizes and fit of the atoms and ions of the available elements.

Answer: A
Explanation: A)
B)
C)
D)

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

47) Why are the names of minerals not based on the elements from which they are made? How are minerals named?

Answer: The names of minerals are not based on the elements from which they are made for two reasons. First, the same elements can be arranged to form more than one type of mineral. Second, the chemical compositions of some minerals are so complex that a name based on their formulas would not be practical. An international commission approves the names proposed for new minerals as they are identified. Mineral names are based on such diverse things as geographical locations, distinctive physical characteristics, and people.

48) Explain why the crystals of any given mineral always form in the same geometric shape if allowed to grow in an unrestricted space.

Answer: Every crystal of a given mineral has the same crystal structure; its internal arrangement of ions or atoms is consistent. For a crystal that grows in an unrestricted space, the shape of a crystal is the external expression of the mineral's microscopic internal crystal structure repeated in three-dimensional units.

49) Discuss what gemstones are and how they form.

Answer: Gemstones are precious or semiprecious minerals that display particularly appealing color, luster, or crystal form and can be cut or polished for ornamental purposes. Many gemstones form from rare minerals, but many form from very common minerals that contain small amounts of other elements that alter their color. Gemstones form under conditions that promote the development of perfect, large crystals, either when molten rock cools and crystallizes deep underground or when preexisting rock is subjected to extraordinary pressure and heat.

50) Why is the chemical composition of a mineral such as olivine not consistent?

Answer: Olivine is an example of a mineral in which ionic substitution may take place. Ionic substitution occurs when certain ions of similar size and charge are available and replace one another within a crystal structure during the mineral's formation. As a result, some minerals that have the same internal arrangement of ions may have minor variations in composition.

51) Olivine is a common, iron-bearing silicate mineral, yet iron is mined from oxides such as hematite and magnetite. Why?

Answer: Olivine forms at very high temperatures and would require high temperatures to melt and separate. Oxides have much lower melting points, and are thus easier to separate economically. Iron oxides are more concentrated in the banded iron formations as well.

52) Describe the silicon-oxygen tetrahedron. Why is it important?

Answer: The silicon-oxygen tetrahedron consists of one small silicon atom surrounded and bonded ionically to four large oxygen atoms. The tetrahedron is important because the silicate minerals, which are formed from silicon-oxygen tetrahedra, make up more than 90% of the weight of the Earth's crust.

53) Many minerals are important in our everyday lives. List four of these minerals and their uses.

Answer: (Answers will vary and could include four from among the following.)
Quartz is used in clocks and watches; calcium, phosphorus, fluorine, sodium, potassium, and iron are all important to nutrition; talc is used in talcum powder; sulfur is used in fertilizer, paint, and synthetic fibers; aluminum is used in cans and lawn chairs, and diamonds are in dentists' drill bits.

54) Why does the discussion of minerals include a review of chemistry?

Answer: All minerals are chemical compounds. Their chemical compositions and ordered internal arrangements of atoms determine their distinctive characteristics and properties. We demand these qualities as we seek materials with strength, durability, electrical conductivity, or high reflectivity.

55) Quartz and feldspar are both silicates formed from a three-dimensional framework of silica tetrahedra, but they are completely different minerals. Describe three ways in which they differ.

Answer: Three ways in which quartz and feldspar differ are as follows: 1) Composition: Quartz is the only mineral with a crystalline structure composed entirely of silicon and oxygen, although other ions may be trapped within it. In feldspar, the silicon atoms are often replaced with atoms of aluminum, potassium, sodium, or calcium. 2) Cleavage: A fully developed quartz crystal is a perfect prism with a pyramid on each end, but it displays conchoidal fracture rather than cleavage. Feldspar has two prominent cleavage planes that intersect at a 90° angle. 3) Hardness: Quartz has a hardness of 7; feldspar has a hardness of about 6.

56) Describe three examples of how specific minerals can be used to determine the geologic events and environmental conditions that may have produced them.

Answer: 1) Large deposits of halite (table salt) have been found in Michigan, Kansas, and Louisiana. Knowing that halite forms by the evaporation of saltwater, geologists believe these areas were once covered by ancient saltwater seas. 2) Glaucophane, a blue variety of amphibole, is known to form only in high-pressure, low-temperature conditions. This environment is found only in deep-sea trenches where oceanic plates are subducting at convergent plate boundaries. 3) Stishovite, a polymorph of quartz, forms only at temperatures higher than 1200°C and pressures in excess of 130,000 times that found at sea level. Geologists believe that such extreme conditions probably indicate a meteorite impact.

Answer Key
Testname: C2

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

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51) Olivine forms at very high temperatures and would require high temperatures to melt and separate. Oxides have much lower melting points, and are thus easier to separate economically. Iron oxides are more concentrated in the banded iron formations as well.
52) The silicon-oxygen tetrahedron consists of one small silicon atom surrounded and bonded ionically to four large oxygen atoms. The tetrahedron is important because the silicate minerals, which are formed from silicon-oxygen tetrahedra, make up more than 90% of the weight of the Earth's crust.
53) (Answers will vary and could include four from among the following.)
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