1. What is a unifying principle that explains a body of experimental observations?

A. Law

B. Hypothesis

**C.** Theory

D. Phenomena

E. Prediction

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Scientific Method*

*Topic: Study of Chemistry*

2. What is the term used for findings that are summarized based on a pattern or trend?

**A.** Law

B. Hypothesis

C. Theory

D. Phenomena

E. Prediction

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Scientific Method*

*Topic: Study of Chemistry*

3. Which of the following is an example of an *observation*?

A. Gases expand as their temperature increases because the gas molecules are moving more rapidly.

**B.** Paraffin wax begins to melt at 57°C.

C. Three samples of wax are heated to 75°C.

D. The force acting on an object is equal to its mass times its acceleration.

E. Will all waxes melt at the same temperature?

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Properties of Matter*

*Subtopic: Scientific Method*

*Topic: Study of Chemistry*

4. When applying the scientific method, it is important to avoid any form of hypothesis.

**FALSE**

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Scientific Method*

*Topic: Study of Chemistry*

5. Which of these scientists developed the nuclear model of the atom?

A. John Dalton

B. Robert Millikan

C. J. J. Thomson

D. Henry Moseley

**E.** Ernest Rutherford

*Accessibility: Keyboard Navigation*

*Bloom's Level: 1. Remember*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Theories*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

6. Rutherford's experiment with alpha particle scattering by gold foil established that

**A.** protons are not evenly distributed throughout an atom.

B. electrons have a negative charge.

C. electrons have a positive charge.

D. atoms are made of protons, neutrons, and electrons.

E. protons are 1840 times heavier than electrons.

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

7. Who is credited with discovering the atomic nucleus?

A. Dalton

B. Gay-Lussac

C. Thomson

D. Chadwick

**E.** Rutherford

*Accessibility: Keyboard Navigation*

*Bloom's Level: 1. Remember*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Theories*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

8. Rutherford bombarded gold foil with alpha (α) particles and found that a small percentage of the particles were deflected. Which of the following was not accounted for by the model he proposed for the structure of the atom?

A. the small size of the nucleus

B. the charge on the nucleus

**C.** the total mass of the atom

D. the existence of protons

E. the presence of electrons outside the nucleus

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Theories*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

9. Which one of the following statements about atoms and subatomic particles is correct?

A. Rutherford discovered the atomic nucleus by bombarding gold foil with electrons

B. The proton and the neutron have identical masses.

C. The neutron's mass is equal to that of a proton plus an electron.

**D.** A neutral atom contains equal numbers of protons and electrons.

E. An atomic nucleus contains equal numbers of protons and neutrons.

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Atomic Theories*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

10. What is the term for the number of protons in the nucleus of each atom of an element? It also indicates the number of electrons in the atom.

A. Isotope number

B. Mass number

C. Mass-to-charge ratio

**D.** Atomic number

E. Atomic mass units

*Accessibility: Keyboard Navigation*

*Bloom's Level: 1. Remember*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Theories*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

11. The mass of a neutron is equal to the mass of a proton plus the mass of an electron.

**FALSE**

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

12. Almost all the mass of an atom is concentrated in the nucleus.

**TRUE**

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Theories*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

13. The elements in a column of the periodic table are known as

A. metalloids.

B. a period.

C. noble gases.

**D.** a group.

E. nonmetals.

*Accessibility: Keyboard Navigation*

*Bloom's Level: 1. Remember*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

14. Which of the following is a nonmetal?

A. Lithium, Li, *Z* = 3

**B.** Bromine, Br, *Z* = 35

C. Mercury, Hg, *Z* = 80

D. Bismuth, Bi, *Z* = 83

E. Sodium, Na, *Z* = 11

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

15. Which of the following is a metal?

A. Nitrogen, N, *Z* = 7

B. Phosphorus, P, *Z* = 15

**C.** Arsenic, As, Z = 33

D. Thallium, Tl, *Z* = 81

E. Silicon, Si, *Z* = 14

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

16. Which of the following is a metalloid?

A. Carbon, C, *Z* = 6

B. Sulfur, S, *Z* = 16

**C.** Germanium, Ge, *Z* = 32

D. Iridium, Ir, Z = 77

E. Bromine, Br, *Z* = 35

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

17. A row of the periodic table is called a(n)

A. group.

**B.** period.

C. isotopic mixture.

D. family.

E. subshell.

*Accessibility: Keyboard Navigation*

*Bloom's Level: 1. Remember*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

18. In the periodic table, atoms are arranged in order of

A. increasing atomic mass.

**B.** increasing atomic number.

C. physical properties.

D. periodicity.

E. chemical reactivities.

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Elements and the Periodic Table*

*Topic: Components of Matter*

19. The elements in Group 7A are known by what name?

A. Transition metals

**B.** Halogens

C. Alkali metals

D. Alkaline earth metals

E. Noble gases

*Accessibility: Keyboard Navigation*

*Bloom's Level: 1. Remember*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

20. The elements in Group 2A are known by what name?

A. Transition metals

B. Halogens

C. Alkali metals

**D.** Alkaline earth metals

E. Noble gases

*Accessibility: Keyboard Navigation*

*Bloom's Level: 1. Remember*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

21. The alkali metal elements are found in \_\_\_\_\_\_\_ of the periodic table.

**A.** Group 1A

B. Group 2A

C. Group 3A

D. Period 7

E. Period 1

*Accessibility: Keyboard Navigation*

*Bloom's Level: 1. Remember*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

22. Which element would be expected to have properties similar to calcium?

**A.** Ba

B. K

C. Sc

D. Na

E. Rb

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

23. Which element would be expected to have properties similar to argon?

A. F

B. Cl

C. H

D. Br

**E.** Kr

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

24. Which element would be expected to have properties similar to antimony?

A. Se

B. Sn

C. P

**D.** As

E. Pb

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

25. What elements and groups have properties that are most similar to those of chlorine?

**A.** F, Br, I, and nonmetals in Group 7A

B.Cl, K, C, and metals in Group 1B

C.N, P, As, and lanthanides

D.He, Ne, Xe, and nonmetals in Group 7A

E. O, S, and P

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

26. Which of these elements exhibits chemical behavior similar to that of potassium?

A. magnesium

**B.** sodium

C. sulfur

D. chlorine

E. iron

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

27. Which of these elements exhibits chemical behavior similar to that of oxygen?

A. magnesium

B. sodium

**C.** sulfur

D. chlorine

E. iron

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

28. Which of these elements exhibits chemical behavior similar to that of silver?

A. nickel

**B.** gold

C. sulfur

D. chlorine

E. iron

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

29. In what groups are transition metals located?

A. 1A, 7A, and 1B

B. 2A, 4A, and 7A

**C.** 1B through 8B

D. 2B and 3B through 6B

E. 3A through 6A

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

30. Which one of these elements is a transition element?

A. Sr

B. Pb

C. As

**D.** Fe

E. H

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

31. Which one of these elements is a transition element?

**A.** Nickel

B. Tin

C. Sodium

D. Sulfur

E. Calcium

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

32. Copper (Cu) is a transition metal.

**TRUE**

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

33. Lead (Pb) is a main group element.

**TRUE**

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Chemical Periodicity*

*Topic: Components of Matter*

34. Which of these elements is chemically similar to magnesium?

A. Sulfur

**B.** Calcium

C. Iron

D. Nickel

E. Potassium

*Accessibility: Keyboard Navigation*

*Bloom's Level: 5. Evaluate*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Components of Matter*

35. Which of these elements is chemically similar to oxygen?

**A.** Sulfur

B. Calcium

C. Iron

D. Nickel

E. Potassium

*Accessibility: Keyboard Navigation*

*Bloom's Level: 5. Evaluate*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Components of Matter*

36. Which of these elements is chemically similar to potassium?

A. calcium

B. arsenic

C. phosphorus

D. cerium

**E.** cesium

*Accessibility: Keyboard Navigation*

*Bloom's Level: 5. Evaluate*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Elements and the Periodic Table*

*Subtopic: Periodic Classification of the Elements*

*Topic: Components of Matter*

37. What element is represented by X in the atomic symbol notation ?

A. Iridium

**B.** Platinum

C. Palladium

D. Selenium

E. Magnesium

*Bloom's Level: 4. Analyze*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Elements and the Periodic Table*

*Topic: Components of Matter*

38. Determine the number of electrons and identify the correct symbol for an atom with 17 protons and 18 neutrons.

**A.** 17 electrons, 

B. 18 electrons, 

C. 17 electrons, 

D. 17 electrons, 

E. 18 electrons, 

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

39. Determine the number of protons, electrons, and neutrons for the isotope gold-118. The symbol for gold is Au.

A. 118 protons, 118 electrons, 79 neutrons

B. 79 protons, 79 electrons, 118 neutrons

**C.** 79 protons, 79 electrons, 39 neutrons

D. 118 protons, 118 electrons, 39 neutrons

E. 79 protons, 39 electrons, 118 neutrons

*Accessibility: Keyboard Navigation*

*Bloom's Level: 4. Analyze*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

40. Determine the number of protons and identify the correct symbol for an atom with 20 neutrons and 20 electrons.

A. 20 protons, 

**B.** 20 protons, 

C. 20 protons, 

D. 40 protons, 

E. 40 protons, 

*Bloom's Level: 4. Analyze*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

41. C(graphite) and C(diamond) are examples of:

A. isotopes of carbon.

**B.** allotropes of carbon.

C. the law of definite proportions.

D. different carbon ions.

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Molecules and Ions*

*Topic: Components of Matter*

42. Bromine is the only nonmetal that is a liquid at room temperature. Consider the isotope bromine-81, . Select the combination which lists the correct atomic number, number of neutrons, and mass number, respectively.

**A.** 35, 46, 81

B. 35, 81, 46

C. 81, 46, 35

D. 46, 81, 35

E. 35, 81, 116

*Bloom's Level: 3. Apply*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Elements and the Periodic Table*

*Topic: Components of Matter*

43. Atoms X, Y, Z, and R have the following nuclear compositions:



**I** **II** **III** **IV**

Which of the following are isotopes of the same element?

A. I & II

B. I & IV

C. II & IV

D. III & IV

**E.** I & III

*Bloom's Level: 5. Evaluate*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Topic: Components of Matter*

44. Which isotope is *not* possible? A.

B.



C.



**D.**



E. All of these isotopes are possible.

*Bloom's Level: 5. Evaluate*

*Difficulty: Hard*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Topic: Components of Matter*

45. Atoms of the same element with different mass numbers are called

A. ions.

B. neutrons.

C. chemical groups.

D. chemical families.

**E.** isotopes.

*Accessibility: Keyboard Navigation*

*Bloom's Level: 2. Understand*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

46. How many neutrons are there in an atom of lead whose mass number is 208?

A. 82

**B.** 126

C. 208

D. 290

E. none of them

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

47. An atom of the isotope sulfur-31 consists of how many protons, neutrons, and electrons? (p = proton, n = neutron, e = electron)

A. 15 p, 16 n, 15 e

**B.** 16 p, 15 n, 16 e

C. 16 p, 31 n, 16 e

D. 32 p, 31 n, 32 e

E. 16 p, 16 n, 15 e

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

48. Give the number of protons (p), electrons (e), and neutrons (n) in one atom of chlorine-37.

A. 37 p, 37 e, 17 n

B. 17 p, 17 e, 37 n

**C.** 17 p, 17 e, 20 n

D. 37 p, 17 e, 20 n

E. 17 p, 37 e, 17 n

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

49. Two isotopes of an element differ only in their

A. symbol.

B. atomic number.

**C.** atomic mass.

D. number of protons.

E. number of electrons.

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Easy*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Structure of the Atom*

*Topic: Components of Matter*

50. Silicon, which makes up about 25% of Earth's crust by mass, is used widely in the modern electronics industry. It has three naturally occurring isotopes, 28Si, 29Si, and 30Si. Calculate the atomic mass of silicon.

|  |  |  |  |
| --- | --- | --- | --- |
| Isotope Isotopic Mass (amu) | | Abudance |  |
| 28Si |  | % |  |
| 27.976927 | 92.22 |  |
| 29Si | 28.976495 | 4.69 |  |
| 30Si | 29.973770 | 3.09 |  |

A. 29.2252 amu

B. 28.9757 amu

C. 28.7260 amu

**D.** 28.0855 amu

E. 27.9801 amu

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Medium*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Elements and the Periodic Table*

*Topic: Components of Matter*

51. Lithium forms compounds which are used in dry cells, storage batteries, and in high-temperature lubricants. It has two naturally occurring isotopes, 6Li (isotopic mass = 6.015123 amu) and 7Li (isotopic mass = 7.016005 amu). Lithium has an atomic mass of 6.9412 amu. What is the percent abundance of lithium-6?

A. 92.53%

B. 86.65%

C. 49.47%

**D.** 7.47%

E. 6.015%

*Accessibility: Keyboard Navigation*

*Bloom's Level: 3. Apply*

*Difficulty: Hard*

*Gradable: automatic*

*Subtopic: Atomic Number, Mass Number, Atomic Symbol, and Isotopes*

*Subtopic: Elements and the Periodic Table*

*Topic: Components of Matter*

|  |  |
| --- | --- |
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