

Science Bowl Practice Questions - Chemistry

1. Multiple Choice: Which of the following scientists was awarded the Nobel Prize in 1911 for the discovery of the radioactive elements, radium and polonium?

- w) John Dalton
- x) Dmitri Mendeleev
- y) Emil Fischer
- z) Marie Curie

ANSWER: Z -- MARIE CURIE

2. Short Answer: Who was awarded a Nobel Prize in 1911 for the discovery of the radioactive elements, radium and polonium?

ANSWER: D -- MARIE CURIE

3. Multiple Choice: Which of the following pairs of German scientists discovered the atomic fission of uranium and set the stage for the nuclear age?

- w) Hahn and Strassman
- x) Nernst and Planck
- y) Ostwald and Heisenberg
- z) Bohr and Rutherford

ANSWER: W -- HAHN AND STRASSMAN

4. Multiple Choice: Name the person who developed a table of elements which revealed regularities in elemental properties in 1869?

- w) Theodore Richards
- x) Antoine Lavoisier
- y) Dmitri Mendeleev
- z) Svante Arrhenius

ANSWER: Y -- DMITRI MENDELEEV

5. Short Answer: Name the person who developed a table of elements which revealed regularities in elemental properties?

ANSWER: DMITRI MENDELEEV

6. Multiple Choice: Who was the first American chemist to receive a Nobel Prize? He was selected in 1914 for his precise determination of atomic weights.

- w) Edward Frankland
- x) Theodore Richards
- y) John Bardeen
- z) Paul Dirac

ANSWER: X -- THEODORE RICHARDS

7. Multiple Choice: How many electrons can occupy an s orbital?

- w) one
- x) two
- y) three
- z) four

ANSWER: X -- TWO

8. Short Answer: What is the maximum number of electrons that can occupy an s orbital?

ANSWER: TWO

9. Multiple Choice: Which of the following is a necessary characteristic for electrons that share an s orbital?

- w) coplanar spins
- x) parallel spins
- y) opposite spins
- z) none of these

ANSWER: Y -- OPPOSITE SPINS

10. Multiple Choice: Which of the following terms refers to the number of molecules or ions attached to a central metallic atom?

- w) coordination number
- x) connection number
- y) bonding number
- z) none of these

ANSWER: W -- COORDINATION NUMBER

11. Multiple Choice: Which of the following pairs do NOT show similar chemical properties?

- w) fluorine-argon
- x) beryllium-aluminum
- y) boron-silicon
- z) lithium-magnesium

ANSWER: W -- FLUORINE-ARGON

12. Short Answer: What is the common name for calcium oxide, CaO?

ANSWER: QUICKLIME (LIME)

13. Multiple Choice: Which of the following terms refers to a material which slows neutrons?

- w) retarder
- x) moderator
- y) buffer
- z) bottleneck

ANSWER: X -- MODERATOR

14. Multiple Choice: Which of the following refers to the scattering of light by colloidal particles?

- w) Rutherford effect
- x) Tyndall effect (pron: tin-dahl)
- y) Thompson effect
- z) none of these

ANSWER: X -- TYNDALL EFFECT

15. Short Answer: Who is accredited in the history of modern chemistry of proving that neutrons existed?

ANSWER: JAMES CHADWICK

16. Multiple Choice: Which of the following refers to an easily melted product of the reaction between the flux and the impurities of an ore?

- w) slag
- x) slurry
- y) slug
- z) none of the above

ANSWER: W – SLAG

17. Short Answer: Name the thermodynamic state function that is a measure of randomness.

ANSWER: ENTROPY

18. Short Answer: What term is used to describe silver which contains 7.5% copper?

ANSWER: STERLING

19. Short Answer: Name the state function that represents the heat content of a system.

ANSWER: ENTHALPY

20. Multiple Choice: Which of the following is NOT a physical property of crystalline boron?

- w) brown color
- x) diamond hardness
- y) brittleness
- z) high electrical resistance

ANSWER: W -- BROWN COLOR (Crystalline boron is transparent.)

21. Multiple Choice: Which noble gas has the highest melting point ?

- w) argon
- x) krypton
- y) xenon
- z) radon

ANSWER: Z – RADON

22. Multiple Choice: The noble gases have low boiling points because:

- w) their ionization potentials are very low
- x) only weak Van der Waals forces hold the atoms together
- y) they are produced by the fractional distillation of liquid air
- z) they have eight electrons in the outer shell

ANSWER: X -- ONLY WEAK VAN DER WAALS FORCES HOLD THE ATOMS TOGETHER

23. Multiple Choice: For which of the following classes of salts are all of its compounds soluble in water?

- w) sulfates
- x) nitrates
- y) hydroxides
- z) chlorides

ANSWER: X -- NITRATES

24. Multiple Choice: Which of the following is NOT a general property of hydroxide bases in aqueous solution?

- w) High solubility
- x) Bitter taste
- y) Ability to neutralize aqueous acid solutions
- z) Ability to change phenolphthalein from colorless to red

ANSWER: W -- HIGH SOLUBILITY (The hydroxides of the alkali metals are soluble in water but all the other metal hydroxides are only moderately or sparingly soluble.)

25. Multiple Choice: Aqua regia is:

- w) concentrated nitric acid
- x) a mixture of three parts of concentrated hydrochloric acid and one part concentrated nitric acid
- y) concentrated hydrochloric acid
- z) a mixture of sulfuric acid and hydrochloric acid

ANSWER: X -- A MIXTURE OF THREE PARTS OF CONCENTRATED HYDROCHLORIC ACID AND ONE PART CONCENTRATED NITRIC ACID

26. Short Answer: What is the common name given to a mixture of three parts of concentrated hydrochloric acid and one part concentrated nitric acid?

ANSWER: AQUA REGIA

27. Multiple Choice: A solution with a pH of 12 is:

- w) weakly acidic
- x) strongly acidic
- y) weakly basic
- z) strongly basic

ANSWER: Z -- STRONGLY BASIC

28. Multiple Choice: The halogen with the largest atomic radius is:

- w) Cl
- x) I
- y) Br
- z) At

ANSWER: Z -- At

29. Short Answer: Which halogen has the largest atomic radius:

ANSWER: ASTATINE

30. Multiple Choice: Compounds of iodine are NOT used for which of the following?

- w) as a refrigerant
- x) in photographic film
- y) as an essential part of diet
- z) as an antiseptic

ANSWER: W -- AS A REFRIGERANT

31. Multiple Choice: Allotropic modifications of phosphorus include each of the following EXCEPT:

- w) red phosphorus
- x) black phosphorus
- y) white phosphorus
- z) green phosphorus

ANSWER: Z -- GREEN PHOSPHORUS

32. Short Answer: How many milligrams are in one metric carat?

ANSWER: 200 MILLIGRAMS

33. Short Answer: What class of organic compounds is characterized by an -OH group bonded to an alkyl group?

ANSWER: ALCOHOL

34. Multiple Choice: Which of the following contain sp^2 hybridized carbon atoms?

- w) alkanes
- x) alkenes
- y) alkynes
- z) cycloalkanes

ANSWER: X -- ALKENES

35. Multiple Choice: Which of the following phrases is NOT appropriate for a description of benzene?

- w) characteristic reactivity of an alkene
- x) volatile liquid
- y) aromatic hydrocarbon
- z) resonance hybridization

ANSWER: W -- CHARACTERISTIC REACTIVITY OF AN ALKENE

36. Multiple Choice: Which of the following is NOT an aromatic hydrocarbon?

- w) naphthalene
- x) hexane
- y) styrene
- z) xylene

ANSWER: X -- HEXANE

37. Multiple Choice: Which of the following is NOT an aliphatic hydrocarbon?

- w) n-octane
- x) propylene
- y) n-tridecane
- z) benzene

ANSWER: Z -- BENZENE

38. Multiple Choice: Which of the following is NOT a means of preparing carbon dioxide?

- w) burning coke in the absence of air
- x) combustion of methane
- y) heating certain normal carbonates
- z) action of acids on carbonates

ANSWER: W -- BURNING COKE IN THE ABSENCE OF AIR

39. Short Answer: After carbon, hydrogen, and oxygen, the next most abundant element in proteins is:

ANSWER: NITROGEN

40. Multiple Choice: One of the following is NOT a lipid. Is it:

- w) fats and oils
- x) starches
- y) steroids
- z) waxes

ANSWER: X – STARCHES

41. Multiple Choice: Which one of the following is NOT a vitamin?

- w) ascorbic acid
- x) niacin (pron: nI-eh-sen)
- y) trypsin (pron: trip-sen)
- z) riboflavin (pron: rye-bow-fla-vin)

ANSWER: Y -- TRYPSIN

42. Multiple Choice: Of the following, which has units of "Pascal".

- w) force
- x) volume
- y) pressure
- z) viscosity

ANSWER: Y -- PRESSURE

43. Multiple Choice: A Poise is the unit of measure of which of the following?

- w) pressure
- x) viscosity
- y) force
- z) mass

ANSWER: X – VISCOSITY

44. Multiple Choice: Which of the following is the element represented by the symbol B?

- w) Barium
- x) Bismuth
- y) Boron
- z) Beryllium

ANSWER: Y -- BORON

45. Short Answer: Which element is represented by the symbol B?

ANSWER: BORON

46. Short Answer: What is the element represented by the symbol Rb?

ANSWER: RUBIDIUM

47. Short Answer: What is the element represented by the symbol Sn?

ANSWER: TIN

48. Short Answer: What is the element represented by the symbol Sr?

ANSWER: STRONTIUM

49. Multiple Choice: In the periodic table, which of the following identifies a horizontal row?

- w) period
- x) group
- y) family
- z) series

ANSWER: W -- PERIOD

50. Multiple Choice: Which of the following describes the orientation of bonds in an sp^3 hybridized atom?

- w) triangular
- x) linear
- y) tetrahedral
- z) planar

ANSWER: Y – TETRAHEDRAL

51. Multiple Choice: Forces in ionic crystalline solids are primarily which of the following?

- w) covalent
- x) electrostatic
- y) Van der Waals
- z) magnetic

ANSWER: X – ELECTROSTATIC

52. Multiple Choice: In which of the following is the "octet rule" violated?

- w) CO₂
- +
x) NH₄ (read: N - H - 4 - plus)
- 2-
y) SO₄ (read: S - O - 4 - 2 minus)
- z) NO₂

ANSWER: Z -- NO₂

53. Multiple Choice: Normality is defined as the number of:

- w) moles of solute per 1000 grams of solvent
- x) equivalent weights of solute per liter of solution
- y) kilograms of solute per liter of solution
- z) moles of solute per 1000 grams of solution

ANSWER: X -- EQUIVALENT WEIGHTS OF SOLUTE PER LITER OF SOLUTION

54. Multiple Choice: The oxidation number of N in NaNO₂ is:

- w) +5
- x) +2
- y) +3
- z) -3

ANSWER: Y -- +3 (Accept 3)

55. Short Answer: What is the oxidation number of nitrogen in NaNO₂:

ANSWER: +3 (Accept 3)

56. Multiple Choice: Which one of the following atoms has two unpaired electrons in its ground state:

- w) Sodium
- x) Calcium
- y) Oxygen
- z) Aluminum

ANSWER: Y – OXYGEN

57. Multiple Choice: In which of the following compounds is the bonding most covalent?

- w) NaCl
- x) F₂
- y) MgS
- z) Fe₃C

ANSWER: X -- F₂

58. Multiple Choice: The elements in group 1A of the periodic table are called:

- w) halogens
- x) alkaline earths
- y) alkali metals
- z) rare earths

ANSWER: Y -- ALKALI METALS

59. Short Answer: What is the family name given to the elements in group 1A of the periodic table?

ANSWER: ALKALI METALS

60. Short Answer: What is the name of the organic compound whose chemical name is amygdalin (pron: a-MIG-da-lin) and is found in the pits of apricots and peaches?

ANSWER: LAETRILE

61. Multiple Choice: Name the element discovered upon its extraction from pitchblende?

- w) platinum
- x) uranium
- y) iridium
- z) plutonium

ANSWER: X -- URANIUM

62. Short Answer: All proteins contain at least 5 specific elements. Four of them are carbon, oxygen, hydrogen, and nitrogen. What is the fifth element?

ANSWER: SULFUR

63. Multiple Choice: Cinnabar, pyrite and galena are minerals which consist of one or more metals combined with the same element. Which one of the following is the element that is common to all three of these minerals? Is it:

- w) iron
- x) copper
- y) sulfur
- z) sodium

ANSWER: C-- SULFUR

64. Multiple-choice: In a flame test, the presence of copper in a solution is evident by what color flame? Is the flame

- w) red
- x) orange
- y) indigo
- z) blue-green

ANSWER: Z -- BLUE-GREEN

65. Multiple Choice: Alpha rays are different from beta rays in one of the following ways. Are they different since:

- w) alpha rays are deflected in a magnetic field and beta rays are not
- x) alpha rays are identical to the electron in mass, and beta rays are not
- y) alpha rays have a positive charge and beta rays have a negative charge
- z) alpha rays are produced within the nucleus and beta rays are produced outside the nucleus

ANSWER: Y -- ALPHA RAYS HAVE A POSITIVE CHARGE AND BETA RAYS HAVE A NEGATIVE CHARGE

66. Multiple Choice: Which one of the following statements is TRUE regarding the molar heat capacity for the noble gases?

- w) heat capacity decreases from Helium to Xenon
- x) heat capacity increases from helium to argon
- y) heat capacity increases from Helium to Argon, then decreases to Xenon
- z) heat capacity is the same for all noble gases

ANSWER: Z -- HEAT CAPACITY IS THE SAME FOR ALL NOBLE GASES

67. Multiple Choice: Of the following types of material, which is the one that is heterogeneous? Is it:

- w) quartz
- x) feldspar
- y) granite
- z) mica

ANSWER: Y -- GRANITE

68. Multiple Choice: Which of the following halogens does NOT replace the other halogens from their compounds?

- w) fluorine
- x) iodine
- y) bromine
- z) chlorine

ANSWER: X – IODINE

69. Short Answer: Excluding Astatine, which halogen does NOT replace the other halogens from their compounds?

ANSWER: IODINE

70. Multiple Choice: The bond in hydrogen chloride is which of the following types? Is it

- w) ionic
- x) nonpolar covalent
- y) polar covalent
- z) covalent network

ANSWER: Y -- POLAR COVALENT

71. Multiple Choice: The bond in Fluorine is which of the following types? Is it

- w) ionic
- x) nonpolar covalent
- y) polar covalent
- z) covalent network

ANSWER: X -- NONPOLAR COVALENT

72. Multiple Choice: Which of the following concentration expressions is defined as the number of moles of solute per kilogram of solvent:

- w) molarity
- x) molality
- y) normality
- z) equivalents

ANSWER: X – MOLALITY

73. Multiple Choice: Among the following, the substance that is considered to be the earliest stage in coal formation is:

- w) sub-bituminous
- x) bituminous
- y) anthracite
- z) lignite

ANSWER: Z – LIGNITE

74. Multiple Choice: When an aldehyde is heated with Fehling's solution, the aldehyde undergoes one of the following processes. Does it undergo:

- w) neutralization
- x) oxidation
- y) reduction
- z) esterification

ANSWER: X -- OXIDATION

75. Multiple Choice: The hydrolysis of a fat using a solution of a strong hydroxide is called:

- w) neutralization
- x) esterification
- y) saponification
- z) condensation

ANSWER: Y -- SAPONIFICATION

76. Multiple Choice: In the common dry cell, the zinc atoms are:

- w) reduced at the cathode
- x) oxidized at the cathode
- y) oxidized at the anode
- z) reduced at the anode

ANSWER: Y -- OXIDIZED AT THE ANODE

77. Multiple Choice: As one goes across a period in the periodic table, the ionization energy generally increases for one of the following reasons. Is it because of the increasing

- w) atomic radius
- x) melting point
- y) nuclear charge
- z) density

ANSWER: Y -- NUCLEAR CHARGE

78. Multiple Choice: Which of the following reactions involve NEITHER oxidation nor reduction?

- w) burning antimony in chlorine
- x) decomposition of potassium chlorate
- y) reaction of sodium with water
- z) reaction of potassium hydroxide with nitric acid

ANSWER: Z -- REACTION OF POTASSIUM HYDROXIDE WITH NITRIC ACID

79. Short Answer: In a flame test both lithium and strontium produce various shades of this color. What is this color?

ANSWER: RED

80. Multiple Choice: Who hypothesized that it would be impossible to know the exact location and exact momentum of a particle at the same time? Was it:

- w) Heisenberg
- x) De Broglie
- y) Planck
- z) Schrodinger

ANSWER: A -- HEISENBERG

81. Short Answer: Who hypothesized that it would be impossible to know the exact location and exact momentum of a particle at the same time?

ANSWER: HEISENBERG

82. Multiple Choice: Ammonia can be considered a Lewis base because it can donate:

- w) electrons
- x) protons
- y) hydronium ions
- z) hydroxide ions

ANSWER: A – ELECTRONS

83. Multiple Choice: Acids react with bases to form which of the following? Do they form:

- w) salt and acidic anhydride
- x) water and basic anhydride
- y) basic anhydride and salt
- z) salt and water

ANSWER: D -- SALT AND WATER

84. Multiple Choice: Which of the following is a metallic salt of a fatty acid? Is it:

- w) soap
- x) plastic
- y) rubber
- z) petroleum

ANSWER: A -- SOAP

85. Multiple Choice: Which of the following choices are considered to be polymers of amino acids? Are they:

- w) nucleotides
- x) carbohydrates

- y) lipids
- z) proteins

ANSWER: Z – PROTEINS

86. Multiple Choice: Which of the following pairs of compounds could NOT be used to create a buffer solution? Would it be:

- w) HCL and NaCl (read: H - C - L and N - A - C - L)
- x) HCN and NaCN (read: H - C - N and N - A - C - N)
- y) NH₃ and NH₄Cl (read: N - H - 3 and N - H - 4 - C - L)
- z) HNO₂ and NaNO₂ (read: H - N - O - 2 and N - A - N - O - 2)

ANSWER: W -- HCL AND NaCl (read: H - C - L and N - A - C - L)

87. Short Answer: In a body-centered structure for cesium chloride how many nearest neighbor chloride ions surround a cesium ion?

ANSWER: 8

88. Short Answer: Metallic elements are often obtained from ores. Name the metallic element which is produced from the ore Bauxite.

ANSWER: ALUMINUM

89. Short Answer: Name any five of the six noble gases.

ANSWER: HELIUM, NEON, ARGON, KRYPTON, XENON, OR RADON

90. Short Answer: Name any four alkali metals.

ANSWER: LITHIUM, SODIUM, POTASSIUM, RUBIDIUM, CESIUM, AND FRANCIUM

91. Short Answer: The element I am thinking about has several interesting characteristics. It occupies the same column in the periodic table as lead. Resistors which are commonly found in electronic circuits are often made out of this element. In addition, in one of its forms, this element is one of the hardest substances on earth. What element am I thinking about?

ANSWER: CARBON

92. Short Answer: Give me the names, in order of increasing mass, of the four lightest members the halogen family.

ANSWER: FLUORINE, CHLORINE, BROMINE, AND IODINE

93. Short Answer: Ketones are organic compounds. Name the functional group that all ketone molecules contain.

ANSWER: CARBONYL GROUP or C DOUBLE BOND O

94. Short Answer: Four of the lightest ten elements in the periodic table are solids at standard temperature and pressure. Name these four elements.

ANSWER: LITHIUM, BERYLLIUM, BORON, CARBON

95. Multiple Choice: Which of the following scientists first stated the law of conservation of mass? Was it:

- w) Lavoisier
- x) Dalton
- y) Proust
- z) Boyle

ANSWER: W -- LAVOISIER

96. Multiple Choice: Which of the following scientists explained the photoelectric effect? Was it:

- w) Einstein
- x) Planck
- y) Bohr
- z) Chadwick

ANSWER: W -- EINSTEIN

97. Multiple Choice: Which of the following scientists hypothesized that it would be possible for particles to have wave-like properties? Was it:

- w) Planck
- x) Heisenberg
- y) Einstein
- z) de Broglie

ANSWER: Z -- DE BROGLIE

98. Short Answer: Who developed the equation that is used to determine the PROBABILITY of finding the electron in any given place?

ANSWER: SCHRODINGER

99. Short Answer: How many hydrogen atoms are there in the organic compound 1,1,2,2-tetrabromoethane (read: tetra - bromo - ethane)?

ANSWER: 2

100. Short Answer: Give the empirical formula for the organic compound naphthalene?

ANSWER: C₁₀H₈