

Science Bowl Questions – Chemistry, Set 2

1. Multiple Choice: The triple bond between the carbon atoms causes acetylene, C₂H₂, to have which of the following shapes?

- w) trigonal planar (pron: try-gon-al)
- x) linear
- y) tetrahedral
- z) trigonal bipyramidal

ANSWER: X -- LINEAR

2. Short Answer: What is the EMPIRICAL formula for glucose?

ANSWER: CH₂O (read: C - H - 2 - O)

3. Multiple Choice: Which of the following four elements has the largest atomic radius? Is it:

- w) strontium
- x) francium
- y) calcium
- z) bromine

ANSWER: X -- FRANCIUM

4. Multiple Choice: Which of the following odors does the ester, methyl salicylate, produce? Is the odor that of:

- w) cinnamon
- x) avocado
- y) orange
- z) oil of wintergreen

ANSWER: D -- OIL OF WINTERGREEN

5. Short Answer: What two chemical elements are found in sphalerite?

ANSWER: ZINC AND SULFUR (ZnS)

6. Short Answer: Periclase is composed of what two elements?

ANSWER: MAGNESIUM AND OXYGEN (MgO)

7. Short Answer: Who patented the common dry cell?

ANSWER: GEORGES LECLANCHÉ

8. Multiple Choice: Ca(BrO₃)₂ (read: C - a, left parenthesis, B - r - O - subscript 3, right parenthesis, subscript 2) is called:

- w) calcium bromate
- x) calcium bromite
- y) calcium dibromite
- z) calcium bromide

ANSWER: W -- CALCIUM BROMATE

9. Short Answer: What is the common oxidation state of Radium?

ANSWER: +2 (read: Plus two)

10. Short Answer: What is the pH of a solution that is 1000 times more acidic than pure water?

ANSWER: 4

11. Multiple Choice: Which of the following are saturated aliphatic hydrocarbons?

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

ANSWER: W – ALKANES

12. Multiple Choice: Sucrose, ordinary table sugar, may be classified as a:

- w) Monosaccharide
- x) Disaccharide
- y) Polysaccharide
- z) Oligosaccharide

ANSWER: X -- DISACCHARIDE

13. Multiple Choice: Pure water is approximately what molar concentration:

- w) .55 Molar
- x) 5.5 Molar
- y) 55 Molar
- z) 550 Molar

ANSWER: Y -- 55 MOLAR

14. Multiple Choice: The rate at which dissolution occurs is LEAST dependent upon which one of the following factors:

- w) temperature
- x) pressure
- y) solution concentration
- z) solute surface area

ANSWER: X -- PRESSURE

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

ANSWER: DMITRI MENDELEEV

16. 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

17. Short Answer: What is the word that describes a substance that reacts with both strong acids and strong bases?

ANSWER: AMPHOTERIC

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

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

ANSWER: Y -- PRESSURE

19. Short Answer: What is the name of the point on a phase diagram which indicates the temperature above which a gas cannot be converted to a liquid?

ANSWER: THE CRITICAL TEMPERATURE

20. Short Answer: List the following atoms in order of increasing electron affinity: oxygen, boron, and fluorine.

ANSWER: (1) BORON, (2) OXYGEN, (3) FLUORINE

21. Short Answer: What name is given to the chemical elements with atom numbers 90 to 103, inclusively.

ANSWER: ACTINIDES or ACTINIDE SERIES

22. Short Answer: The removal of two hydrogen atoms from an alcohol yie what type of chemical substance?

ANSWER: ALDEHYDE

23. Short Answer: I will be describing a chemical element. Try to identify it with the fewest number of clues. This chemical element is a silver-white metal, with bluish tinge, capable of taking a high polish. T element occurs abundantly in all ordinary rocks, except limestone and sandstone; is third in abundance of the elements in the earth's crust and used to make drink cans. The atomic number of this element is 13. Name this element.

ANSWER: ALUMINUM

24. Multiple Choice: All alloys contain this element if they are amalga. The element is:

- w) iron
- x) mercury
- y) gold
- z) platinum

ANSWER: X -- MERCURY

25. Multiple Choice: Azo (pron: A-zo) Compounds characteristically are compounds containing the group:

- w) C2
- x) N2
- y) O2
- z) Cl2

ANSWER: X -- N2 (N = N)

26. Short Answer: I will be describing a chemical element. Try to identify it with the fewest number of clues. This element is a halogen which is a liquid at standard conditions. The element volatilizes readily at room temperature to form a reddish vapor which is very irritating to the eyes a flesh. The atomic number of this element is 35 and its chemical symbol is Br. Name this element.

ANSWER: BROMINE

27. Short Answer: Name the 5 elements of the periodic classification wh comprise the Carbon Group.

ANSWER: CARBON, SILICON, GERMANIUM, TIN AND LEAD

28. Multiple Choice: This noncombustible liquid in its dry form is noncorrosive to common metals except aluminum. About 90% of all of this material which is manufactured goes into the production of chlorofluorocarbons. Is this substance:

- w) carbon tetrachloride
- x) methylene chloride
- y) hydrogen chloride
- z) methyl fluoride

ANSWER: W -- CARBON TETRACHLORIDE

29. Multiple Choice: A compound which contains two ring structures having one common carbon atom is known as a:

- w) spiro-compound
- x) nonpolar compound
- y) interstitial compound
- z) inner compound

ANSWER: W -- SPIRO-COMPOUND

30. Multiple Choice: Which of the following elements would form an acid oxide with the formula XO_2 and an acidic compound with hydrogen with the formula XH_2 ?

- w) Sodium
- x) Magnesium
- y) Aluminum
- z) Sulfur

ANSWER: Z -- SULFUR

31. Multiple Choice: Which of the following would have the largest THIR ionization energy? Is it:

- w) Boron
- x) Carbon
- y) Nitrogen
- z) Magnesium

ANSWER: Z -- MAGNESIUM

32. Multiple Choice: How many atoms of oxygen are in a glucose molecule

- w) 2
- x) 6
- y) 10
- z) 12

ANSWER: X – 6

33. Multiple Choice: Which of the following compounds contains a double bond?

- w) butene
- x) acetylene
- y) butane
- z) propane

ANSWER: W -- BUTENE

34. Multiple Choice: An alcohol is related to an ester as a hydroxide compound is related to:

- w) an acid
- x) a ketone
- y) an ether
- z) a salt

ANSWER: Z -- A SALT

35. Multiple Choice: In any chemical reaction, a quantity that decrease to a minimum is:

- w) free energy
- x) entropy
- y) temperature
- z) enthalpy

ANSWER: W -- FREE ENERGY

36. Multiple Choice: It is believed that carbon-14 in nature is slowly generated by the action of:

- w) protons on carbon-12
- x) electrons on hydrogen
- y) cosmic rays on boron
- z) neutrons on nitrogen

ANSWER: Z -- NEUTRONS ON NITROGEN

37. Multiple Choice: When water at 10°C is heated to 20°C, its internal energy:

- w) changes by 10°C
- x) is doubled
- y) is less than doubled
- z) is more than doubled

ANSWER: Y -- IS LESS THAN DOUBLED

38. Multiple Choice: In the filling of electron orbitals for the element sulfur, which has 16 electrons, the number of electrons in the 3p orbitals is:

- w) 3
- x) 4

- y) 6
- z) 0

ANSWER: X -- 4

39. Short Answer: You have a solution of 5 molar Sodium Phosphate and n to prepare a solution of 500 millimolar Sodium Phosphate. How much water would you add to 100 milliliter of the original 5 molar solution to produce the 500 millimolar solution?

ANSWER: 900 MILLILITERS (or 0.9 LITERS)

40. Multiple Choice: Which of the following is the weakest acid?

- w) hydrochloric acid
- x) hydrofluoric acid
- y) sulfuric acid
- z) nitric acid

ANSWER: X -- HYDROFLUORIC ACID

41. Short Answer: Marie Curie shared the 1911 Nobel Prize in chemistry with two fellow chemists. Name them.

ANSWER: PIERRE CURIE and (A. HENRI) BECQUEREL

42. Multiple Choice: A mystical substance supposedly released during combustion was called:

- w) thermal flax
- x) ether
- y) caloric
- z) phlogiston (pron: flow-gis-ton)

ANSWER: Z – PHLOGISTON

43. Multiple Choice: Of the following liquids, which is most dense?

- w) water
- x) gasoline
- y) acetone
- z) chloroform

ANSWER: Z -- CHLOROFORM

44. Short Answer: What is the most abundant element in the human body, WEIGHT?

ANSWER: OXYGEN

45. Multiple Choice: Solids may be considered to be either crystalline noncrystalline. The basic difference between them is that a crystal, in contrast to a noncrystal:

- w) has a sharp melting point
- x) has an irregular array of atoms
- y) exhibits double refraction
- z) has a completely regular atomic or molecular structure

ANSWER: Z -- HAS A COMPLETELY REGULAR ATOMIC OR MOLECULAR STRUCTURE

46. Multiple Choice: The Rate Law expresses the rate of a reaction in terms of the concentrations of the:

- w) reactants
- x) products
- y) by-products
- z) catalysts

ANSWER: W -- REACTANTS

47. Multiple Choice: Hydrocarbons that contain a triple bond between carbon atoms are known as:

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

ANSWER: Y – ALKYNES

48. Multiple Choice: Which of the following metals melts in your hand?

- w) gallium
- x) cesium
- y) sodium
- z) magnesium

ANSWER: W -- GALLIUM

49. Multiple Choice: When vinegar and baking soda are mixed together, w gas is formed?

- w) oxygen
- x) nitrogen
- y) carbon dioxide
- z) hydrogen

ANSWER: Y -- CARBON DIOXIDE

50. Short Answer: How many carbons are found in a propane molecule?

ANSWER: 3

51. Multiple Choice: The atoms in sugar are bound by what type of bond?

- w) ionic
- x) hydrogen
- y) covalent
- z) van der Waals

ANSWER: Y -- COVALENT

52. Multiple Choice: Which is an example of a polymer?

- w) salt
- x) oil
- y) plastic
- z) glucose

ANSWER: Y – PLASTIC

53. Multiple Choice: Vegetable oil is made into margarine through:

- w) halogenation

- x) partial hydrogenation
- y) methylation
- z) oxidation

ANSWER: X -- PARTIAL HYDROGENATION

54. Multiple Choice: What is the name given to the equation $PV=nRT$?

- w) law of partial pressure
- x) ideal gas equation
- y) quadratic equation
- z) Raoult's equation

ANSWER: X -- IDEAL GAS EQUATION

55. Short Answer: What term describes the process when a solid phase changes directly to the gas phase?

ANSWER: SUBLIMATION

56. Multiple Choice: Which of the following elements can form the great number of covalent bonds?

- w) carbon
- x) nitrogen
- y) oxygen
- z) sulfur

ANSWER: Z -- SULFUR

57. Multiple Choice: Which of the following elements forms a tetrahedra structure?

- w) carbon
- x) beryllium
- y) boron
- z) fluorine

ANSWER: W – CARBON

58. Multiple Choice: Which of the following metals is a solid at room temperature, yet melts in your hand?

- w) gallium
- x) cesium
- y) sodium
- z) magnesium

ANSWER: W -- GALLIUM

59. Short Answer: When water and an active metal react, what are the two products that result?

ANSWER: HYDROGEN AND A BASE (HYDROXIDE)

60. Multiple Choice: 2.5 liters of a sodium chloride (NaCl) solution contain 5 moles of the solute. What is the molarity?

- w) 5 molar
- x) 2 molar
- y) 2.5 molar
- z) 12.5 molar

ANSWER: X -- 2 MOLAR

61. Short Answer: What is the active ingredient in many common laxative that is also an acid-base indicator?

ANSWER: PHENOLPHTHALEIN (pron: fEn-el-thal-E-en)

62. Multiple Choice: The structure of an ammonia molecule can best be described as:

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

ANSWER: Y – PYRAMIDAL

63. Short Answer: What naturally occurring radioactive element is so common in homes that testing for its presence is often advisable?

ANSWER: RADON

64. Multiple Choice: How many moles of carbon are in 48 grams of carbon?

- w) 4
- x) 3
- y) 2
- z) 1

ANSWER: W -- 4

65. Short Answer: What is the molality of a salt solution prepared by dissolving two moles of salt in 500 grams of water?

ANSWER: 4

Short Answer: During electrolysis of water, what gas is evolved from the cathode?

ANSWER: HYDROGEN

66. Multiple Choice: Crude oil is separated into its components by:

- w) chemical reaction
- x) simple distillation
- y) fractional distillation
- z) settling

ANSWER: Y -- FRACTIONAL DISTILLATION

67. Short Answer: What compound occurs when ammonia and hydrogen chloride are mixed together?

ANSWER: AMMONIUM CHLORIDE FORMS

68. Short Answer: The acid present in vinegar is:

ANSWER: ACETIC ACID

69. Multiple Choice: What force between molecules tends to cause most common gases to behave as non-ideal gases?

- w) Van der Waals' force
- x) ionic bonding force
- y) gravitational force
- z) covalent bonding force

ANSWER: W -- VAN DER WAALS' FORCE

70. Short Answer: What UNUSUAL type of bonding occurs in diborane, B₂H₆?

ANSWER: THREE CENTER BONDING

71. Multiple Choice: What is the name given to the non-superimposable mirror image forms of chiral compounds?

- w) cis-trans
- x) enantiomers
- y) functional isomers
- z) diastereomers

ANSWER: X -- ENANTIOMERS

72. Multiple Choice: Which of the following is the EMPIRICAL formula of dodecane?

- w) C₅H₁₁
- x) C₆H₁₃
- y) C₁₀H₂₂
- z) C₁₂H₂₆

ANSWER: X -- C₆H₁₃

73. Short Answer: What is the chemical formula for baking soda?

ANSWER: NaHCO₃

74. Multiple Choice: Copper is refined commercially by a process of:

- w) smelting
- x) electrolysis
- y) sublimation
- z) roasting

ANSWER: X -- ELECTROLYSIS

75. Multiple Choice: The action of concentrated sulfuric acid on sugar best described as:

- w) catalysis
- x) oxidation
- y) reduction
- z) dehydration

ANSWER: Z -- DEHYDRATION

76. Multiple Choice: A metal that does NOT occur native in the earth is

- w) copper
- x) gold
- y) sodium
- z) silver

ANSWER: Y -- SODIUM

77. Short Answer: What metal is used as a reducing agent to obtain iron from iron oxide in the Thermite process?

ANSWER: ALUMINUM

78. Short Answer: Glycerine and what other substance are made by heating animal fats or vegetable oils with sodium hydroxide?

ANSWER: SOAP

79. Short Answer: What is the formula for the anhydride of sulfuric acid?

ANSWER: SO₃

80. Multiple Choice: Under similar conditions, which of the following is the best reducing agent?

- w) fluoride ion
- x) chloride ion
- y) bromide ion
- z) iodide ion

ANSWER: Z -- IODIDE ION

81. Multiple Choice: How many carbon atoms are there in one naphthalene molecule?

- w) 6
- x) 8
- y) 10
- z) 15

ANSWER: Y -- 10

82. Multiple Choice: A process in which substances are separated through differences in the rates at which the components migrate is called:

- w) filtration
- x) chromatography
- y) elution
- z) titration

ANSWER: X -- CHROMATOGRAPHY

83. Short Answer: What is the name of the bond that joins amino acids together in a protein?

ANSWER: PEPTIDE BOND or AMIDE

84. Multiple Choice: Which bond has the LEAST ionic character?

- w) H - F

- x) Li - F
- y) Li - Br
- z) F - F

ANSWER: Z -- F - F

85. Multiple Choice: The lanthanide series elements are also known as:

- w) rare earth elements
- x) non-metals
- y) fifth period elements
- z) sixth period elements

ANSWER: W -- RARE EARTH ELEMENTS

86. Multiple Choice: If the first ionization energy of magnesium is 176 kilocalories per mole, one would expect the second ionization energy to be approximately:

- w) 350 kilocalories per mole
- x) 1,760 kilocalories per mole
- y) 200 kilocalories per mole
- z) 20 kilocalories per mole

ANSWER: W -- 350 KILOCALORIES PER MOLE

87. Short Answer: When considering electron orbitals, which orbital is generally considered spherical?

ANSWER: S ORBITAL

88. Short Answer: The angle between any two carbon-hydrogen bonds in a methane molecule is how many degrees?

ANSWER: 109.5 DEGREES

89. Short Answer: Jaroslav Heyrovsky (Czechoslovakia) received the 1959 Nobel Prize in chemistry for developing what technique used in chemical analysis?

ANSWER: POLAROGRAPHY

90. Multiple Choice: Ferrous is an equivalent name for which of the following?

- w) Iron (IV) (pron: iron-4)
- x) Iron (III) (pron: iron-3)
- y) Iron (II) (pron: iron-2)
- z) Iron (I) (pron: iron-1)

ANSWER: Y -- IRON (II)

91. Multiple Choice: Mass percentage of carbon in CO₂ is approximately:

- w) 37.5%
- x) 27.3%
- y) 75%
- z) 45%

ANSWER: X -- 27.3%

92. Multiple Choice: Harold Clayton Urey, an American, received the 1934 Nobel Prize in chemistry for his discovery of:

- w) Francium
- x) Americium
- y) deuterium
- z) protium

ANSWER: Y -- DEUTERIUM

93. Multiple Choice: The most abundant element in the universe is thought to be:

- w) carbon
- x) oxygen
- y) hydrogen
- z) nitrogen

ANSWER: Y – HYDROGEN

94. Multiple Choice: The 1936 Nobel Prize in chemistry was awarded to Peter J.W. Debye for his studies of:

- w) kinetic energy of colliding particles
- x) electron configuration
- y) dipole moments
- z) conformations of cyclohexane

ANSWER: Y -- DIPOLE MOMENTS

95. Multiple Choice: The inventor of the Kelvin temperature scale was:

- w) K. Cavendish II
- x) Lord William H. Harrison
- y) Sir William Thomson
- z) none of the above

ANSWER: Y -- SIR WILLIAM THOMSON (Lord Kelvin)

96. Multiple Choice: "Under the same conditions of temperature and pressure, the volumes of reacting gases and of their gaseous products are expressed in ratios of small whole numbers." This law is attributed to:

- w) Dalton
- x) Gay-Lussac
- y) Ramsay
- z) Avogadro

ANSWER: X -- GAY-LUSSAC

97. Multiple Choice: The type of crystal lattice exemplified in a diamond is:

- w) ionic crystal
- x) covalent network crystal
- y) metallic crystal
- z) covalent molecular crystal

ANSWER: X -- COVALENT NETWORK CRYSTAL

98. Multiple Choice: A crystallized substance containing water of crystallization is most appropriately termed:

- w) a hydrate
- x) an oxide
- y) a hydroxide
- z) a condensation crystal

ANSWER: W -- A HYDRATE

99. Multiple Choice: The loss of water of crystallization from a hydrate when exposed to air is termed:

- w) efflorescence (pron: eh-floor-es-ence)
- x) deliquescence (pron: del-i-kwes-ence)
- y) quiescence (pron: kwi-es-ence)
- z) anhydrogenation

ANSWER: W -- EFFLORESCENCE

100. Multiple Choice: Mayonnaise is:

- w) a coalescent solution
- x) a hydrogenated oil
- y) a covalent solution
- z) an emulsion

ANSWER: Z -- AN EMULSION