Chemical Supervisors

1. Which of the following statements about periodic properties is incorrect?
    a. Both electron affinity and ionization energy decrease down a group
    b. Atomic size increases to the right across a period $
    c. Ionization energy increases to the right across a period
    d. Atomic size increases down a group

2. Which one of the following is most likely to be an ionic compound?
    a. HNF_2
    b. H_2CO
    c. N_2H_4
    d. $CaCl_2$ $

3. The half-life of an isotope is 3 hours. After 6 hours, what fraction of the initial isotope will be left behind ?
    a. 1/6
    b. ¼ $
    c. 1/3
    d. 1/8

4. The lustre of metals is due to
    a. The high density of the metal
    b. The high polishing of the metal
    c. The presence of free electrons $
    d. The chemical inertness of the metal

5. Which one of the following elements does not exist as a diatomic molecule in nature?
    a. Hydrogen
    b. Nitrogen
    c. Fluorine
    d. Neon $

6. Which of the following is a strong acid?
    a. HNO_3 $
    b. NaOH
    c. $CaSO_4$
    d. NH_3

7. An unused flashbulb contains magnesium and oxygen. After use, the contents are changed to magnesium oxide but the total mass does not change. This observation can best be explained by the
    a. Law of Constant Composition
    b. Law of Multiple Proportions
    c. Avogadro's Law
    d. Law of Conservation of Mass $

8. Which response lists all of the following properties of sulfur that are physical properties and not other properties?
    I. It reacts with hydrogen when heated.
    II. It is a yellow solid at room temperature.
    III. It is soluble in carbon disulfide.
    IV. Its density is 2.97 g/cubic centimeter
    V. It melts at 112°C.

    a. II, III, IV, and V $
    b. II, IV, and V

c. I
d. II, III, and IV

9. According to the Lewis theory, a base
   a. Is a proton acceptor
   b. Is a proton donor
   c. Makes available a share in a pair of electrons $
   d. Accepts a share in a pair of electrons

10. How many atoms are in one mole of CH_3OH?
   a. 6
   b. 6.0×10^{23}
   c. 12.0×10^{23}
   d. 3.6×10^{24} $

11. A triple bond contains ___ sigma bond(s) and ___ pi bond(s).
   a. 0, 3
   b. 3, 0
   c. 2, 1
   d. 1, 2 $

12. Two isomeric forms of a saturated hydrocarbon
   a. Have the same structure
   b. Have different compositions of elements
   c. Have the same molecular formula $
   d. Have a different content of the isotopes of hydrogen

13. Hydrolysis (saponification) of a fat would yield
   a. Water and an alkene
   b. Ethanol and propanoic acid
   c. Glycerol and soap $
   d. Ethanol and a soap

14. The entropy will usually increase when
   I. a molecule is broken into two or more smaller molecules.
   II. a reaction occurs that results in an increase in the number of moles of gas.
   III. a solid changes to a liquid.
   IV. a liquid changes to a gas.

   a. II only
   b. III only
   c. IV only
   d. I, II, III, and IV $

15. Which of the following does **not** correctly describe ammonia?
   a. Pyramidal molecule
   b. Extremely soluble in water
   c. Forms basic aqueous solutions
   d. None of these $

16. A Geiger-Muller tube is a
   a. Gas ionization detector $
   b. Cloud chamber
   c. Fluorescence detector
   d. Spectrophotometer

17. How old is a bottle of wine if the tritium (^3H) content (called activity) is 25% that of a new wine? The half-life of tritium is 12.5 years.
    a. 1/4 year
    b. 3.1 years
    c. 25 years $
    d. 37.5 years

18. The valence electrons of representative elements are
    a. In s orbitals only
    b. Located in the outermost occupied major energy level $
    c. Located closest to the nucleus
    d. Located in d orbitals

19. Which is not a physical property of alcohols or phenols?
    a. Phenols are generally only slightly soluble in water
    b. The solubilities of normal primary alcohols in water decrease with increasing molecular weight
    c. The hydroxyl group of an alcohol is nonpolar $
    d. Due to hydrogen bonding, boiling points of alcohols are much higher than those of corresponding alkanes

20. When the concentration of reactant molecules is increased, the rate of reaction increases. The best explanation is: As the reactant concentration increases,
    a. The average kinetic energy of molecules increase
    b. The frequency of molecular collisions increases $
    c. The rate constant increases
    d. The activation energy increases

21. The speed of a chemical reaction
    a. Is constant no matter what the temperature is
    b. Is independent of the amount of contact surface of a solid involved
    c. Between gases should in all cases be extremely rapid because the average kinetic energy of the molecules is great
    d. Between ions in aqueous solution is extremely rapid because there are no bonds that need to be broken $

22. Consider the titration of 30.0 mL of 0.20 M nitrous acid by adding 0.0500 M aqueous ammonia to it. The pH at the equivalence point is _____. (Note: This is the titration of a weak acid with a weak base.)
    a. Greater than 7
    b. Equal to 7
    c. Less than 7 $
    d. Cannot be determined without more data

23. What is the pH at the equivalence point in the titration of 100.0 mL of 0.20 M ammonia with 0.10 M hydrochloric acid?
    a. 4.6
    b. 5.2 $
    c. 7.0
    d. 5.5

24. The precipitate formed when barium chloride is treated with sulfuric acid is _____ .
    a. BaS_2O_4
    b. $BaSO_3$
    c. $BaSO_2$
    d. $BaSO_4$ $

25. The vapor pressure of a solution containing a nonvolatile solute is directly proportional to the
    a. Molality of the solvent
    b. Osmotic pressure of the solute.
    c. Molarity of the solvent
    d. Mole fraction of solvent $

26. Which of the following elements has the greatest attraction for electrons in a covalent bond?
    a. Ge
    b. As
    c. Se
    d. Br $

27. Which of the following changes would increase the vapor pressure of a liquid?
    I. An increase in temperature
    II. An increase in the intermolecular forces in the liquid
    III. An increase in the size of the open vessel containing the liquid

    a. I and II only
    b. I and III only
    c. I only $
    d. II only

28. The Heisenberg Principle states that
    a. No two electrons in the same atom can have the same set of four quantum numbers
    b. Two atoms of the same element must have the same number of protons
    c. It is impossible to determine accurately both the position and momentum of an electron simultaneously $
    d. Electrons of atoms in their ground states enter energetically equivalent sets of orbitals singly before they pair up in any orbital of the set

29. Carbon monoxide has ten bonding electrons and four antibonding electrons. Therefore it has a bond order of
    a. 3 $
    b. 7
    c. 1
    d. 5/2

30. Soluble metal compounds tend to be found in the _____, whereas insoluble metal compounds tend to be found in the _____
    a. Oceans; earth's crust $
    b. Earth's crust; oceans
    c. Salt beds; oceans
    d. Oceans; salt beds

31. If reaction A has an activation energy of 250 kJ and reaction B has activation energy of 100 kJ, which of the following statements is true?
    a. If reaction A is exothermic and reaction B is endothermic then reaction A is favored kinetically
    b. At the same temperature the rate of reaction B is greater than the rate of reaction A $
    c. The energy of reaction A must be greater than the energy of reaction B
    d. The energy of reaction B must be greater than the energy of reaction A

32. The mass number of an atom is the number of _____ in the atom.
    a. Protons
    b. Neutrons
    c. Protons plus the number of electrons
    d. Protons plus the number of neutrons $

33. What is the name of the process used to make steel from iron?
    a. The Basic Carbon Process
    b. The Basic Oxygen Process $
    c. The Acidic Oxygen Process
    d. The Casting Process

34. Which of the elements is an alkali metal?
    a. Sodium $
    b. Calcium
    c. Carbon
    d. Zinc

35. The atom formed by the beta decay of Carbon – 14 is
    a. Oxygen – 18
    b. Beryllium – 10
    c. Boron – 14
    d. Nitrogen – 14 $

36. If both the volume and pressure of a gas are doubled, how will the absolute temperature change?
    a. It will increase by two times its original value
    b. It will decrease to one fourth of its original value
    c. It will stay the same as the original value
    d. It will increase by four times its original value $

37. Which of the gasses is most soluble in water?
    a. N_2
    b. NH_3 $
    c. CH_4
    d. CO_2

38. If a system loses 250 kJ of heat at the same time that it is doing 500 kJ of work, what is the change in the internal energy of the system?
    a. + 250 kJ
    b. – 250 kJ
    c. + 750 kJ
    d. – 750 kJ $

39. What would be the volume in litres of 640 g of oil if the density of the oil is 0.8 g/mL?
    a. 800 Litres
    b. 0.8 Litres $
    c. 512 Litres
    d. 0.5 Litres

40. What is the molecular geometry for ammonia (NH_3)?
    a. Saw Horse
    b. Trigonal Planar
    c. Tetrahedral
    d. Pyramidal $

41. Which one of the following substances can be melted without breaking chemical bonds?
    a. Sodium sulfate
    b. Zinc chloride
    c. Sulfur dioxide $
    d. Silicon dioxide

42. The density of hot and cold water are different mainly because
    a. The molecules in hot water move slower and are slightly closer together
    b. The molecules in hot water are larger
    c. The molecules in hot water move faster and are slightly further apart $
    d. The molecules in cold water move faster and are further apart

43. Which of the following statements is true?
    a. A submerged object displaces a volume of liquid equal to the volume of the object $
    b. A submerged object displaces a volume of liquid more than the volume of the object
    c. A submerged object displaces a volume of liquid less than the volume of the object
    d. None of the above

44. When will different volumes of water always have the same density?
    a. When the pressure in the same
    b. When the temperature is the same $
    c. When temperature is different
    d. None of the above

45. A candle made of wax floats in water. Wax comprises of Hydrogen and Carbon while water comprises of Hydrogen and Oxygen. This implies
    a. Oxygen is lighter than carbon
    b. Oxygen is heavier than carbon $
    c. Oxygen is as heavy as carbon
    d. Cannot comment on the relative weights if carbon ad oxygen

46. A metal that is usually extracted from sea water is
    a. Calcium
    b. Potassium
    c. Magnesium $
    d. Sodium

47. Which of the following has an octane number of zero?
    a. 2 – methyl octane
    b. N - heptane $
    c. Iso - octane
    d. 3 – methyl octane

48. The hardest from of carbon is
    a. Charcoal
    b. Coke
    c. Graphite
    d. Diamond $

49. The Avogadro's number is
    a. $6.02214129 \times 10^{23}$ $
    b. 6.02214129
    c. 10^{23}
    d. None of the above

50. Which of the following methods will not be useful to remove permanent hardness of water?
    a. Boiling $
    b. Adding Sodium Carbonate
    c. Adding Caustic Soda
    d. Distillation

51. The most commonly available rare gas in the atmosphere is
    a. Argon $
    b. Helium
    c. Neon
    d. Xenon

52. Thermal capacity is defined as
    a. The heat required to raise the temperature of a body by 1° K $
    b. The heat required to raise the temperature of a body by 1° C
    c. The heat required to raise the temperature of a body by 1° F
    d. None of the above

53. The first metal known to be used by humans was
    a. Iron
    b. Copper $
    c. Gold
    d. Silver

54. The "conjugate acid" in the reaction of H_2SO_4 and NaOH is
    a. H_2SO_4
    b. NaOH
    c. Na_2SO_4
    d. H_2O $

55. Alcohol is less dense than water. If you measured the mass of the same volume of alcohol and water
    a. The water would have a greater mass $
    b. The water would have a lower mass
    c. The mass of the alcohol and water would be the same
    d. The mass of the alcohol and water would cancel each other out

56. The element common to all acids is
    a. Oxygen
    b. Sulphur
    c. Hydrogen $
    d. Carbon

57. Different structural modifications of the same element are called
    a. Allotropes $
    b. Isotopes
    c. Isomers
    d. Isomorphs

58. Marsh gas is a hydrocarbon gas largely composed of
    a. Nitrogen
    b. Ethane
    c. Oxygen
    d. Methane $

59. Under which of the following categories can air be classified?
    a. Compound
    b. Element
    c. Mixture $
    d. None of the above

60. Iron, Cobalt and Nickel, as a group of metals, is generally referred to
    a. Main group metals
    b. Transition metals $
    c. Rare metals
    d. Alkali metals

61. DDT is the short form of
    a. Diethyl – diphenyl – trichloromethane
    b. Dichloro – diphenyl – trichloromethane
    c. Diphenyl – dichloro – trichloromethane
    d. Dichloro – diphenyl – trichloroethane $

62. Alcohol is produced by
    a. Oxidation of an aldehyde
    b. Esterification of a fat
    c. Hydrolysis of ether $
    d. None of the above

63. The formal chemical name of Oil of Vitriol is
    a. Hydrochloric Acid
    b. Sulphuric Acid $
    c. Nitric Acid
    d. None of the above

64. The calorific value of which of the following forms of coal is the highest?
    a. Lignite
    b. Anthracite $
    c. Peat
    d. Sub – bituminous

65. After water, the next major constituent of vinegar is
    a. Citric Acid
    b. Acetic Acid $
    c. Tartaric Acid
    d. Sulphuric Acid

66. The boiling point of oxygen is approximately
    a. – 183 ° C $
    b. – 196 ° C
    c. – 276 ° C
    d. None of the above

67. In multistage equilibrium conversion of SO_2 to SO_3 ($2SO_2 + O_2 \rightleftharpoons 2SO_3$), the reverse reaction becomes appreciable at a temperature of 550° C. The percentage equilibrium conversion of SO_2 to SO_3 can be increased by
    a. Increasing the oxygen concentration
    b. Putting more quantity of V_2O_5 catalyst in the converter
    c. Maintaining low temperature and pressure in the converter
    d. Removing some quantity of SO_3 during intermediate stage $

68. The boiling point of nitrogen is approximately
    a. – 183 ° C
    b. – 196 ° C $
    c. – 276 ° C
    d. None of the above

69. The addition of steel scrap in the LD convertor during the steel making process
    a. Increases the temperature of the molten hot metal
    b. Decreases the temperature of the molten hot metal $
    c. Does not affect the temperature of the molten hot metal
    d. None of the above

70. Which of the following forms of sugar is the sweetest?
    a. Glucose
    b. Lactose
    c. Sucrose
    d. Fructose $

71. The chemical compound with the formula $C_6H_2(NO_2)_3CH_3$ is more commonly known as
    a. RDX
    b. Methane
    c. TNT $
    d. None of the above

72. The chemical name of bakelite is
    a. Polyvinyl Chloride
    b. Polybutadiene
    c. Phenol formaldehyde $
    d. Polyurathane

73. Which is the purest form of iron?
    a. Cast iron
    b. Pig iron
    c. Wrought iron $
    d. High silicon iron

74. The process by which very fine and colloidal particles / impurities are removed from water is called
    a. Coagulation $
    b. Sedimentation
    c. Softening
    d. None of the above

75. DDT (dichlorodiphenyltrichloroethane) is
    a. Colourless
    b. Tasteless
    c. Odourless
    d. All of the above $

76. Which of the following contain Bromine?
    a. Fire extinguishing compounds
    b. Fire proofing agents
    c. Dyes
    d. All of the above $

77. Vacuum crystallization of Hydrogen Peroxide leads to
    e. Increase in the concentration of Hydrogen Peroxide $
    f. Decrease in the concentration of Hydrogen Peroxide
    g. No change in the concentration of Hydrogen Peroxide
    h. None of the above

78. During the manufacture of glass, the addition of which compound reduces the coefficient of thermal expansion of glass?
    a. Zinc Oxide $
    b. Calcium Oxide
    c. Manganese Dioxide
    d. None of the above

79. Addition of sulphur in to soap ensures
    a. Improved soap texture
    b. Faster lather formation
    c. Increased cleansing action
    d. None of the above $

80. Which of the followings statements is correct
    a. The shorter the half-life of an isotope, the more dangerous it is $
    b. The longer the half-life of an isotope, the more dangerous it is
    c. The half-life of the isotope does not matter – it is equally difficult to handle
    d. None of the above

81. Henry's law states
    a. The amount of gas dissolved in a liquid is proportional to its partial pressure $
    b. The amount of gas dissolved in a liquid is proportional to its pressure
    c. The amount of gas is proportional to its partial pressure
    d. The amount of gas is proportional to its pressure

82. The material which can be deformed permanently by heat and pressure is called a
    a. Chemical compound
    b. Polymer
    c. Thermoplastic
    d. Thermoset $

83. To manufacture Vanaspati (Dalda) from vegetable oil, one needs to use
    a. Oxygen
    b. Nitrogen
    c. Hydrogen $
    d. Carbon Dioxide

84. Epoxy resins are common ingredient of
    a. Adhesives $
    b. Detergents
    c. Insect repellants
    d. Water purifiers

85. If a glass is found to be deep blue is colour, it is due to the presence of
    a. Iron oxide
    b. Nickel oxide
    c. Cupric oxide
    d. Cobalt oxide $

86. The chemical representation of laughing gas is
    a. NO
    b. NO_2
    c. N_2O $
    d. None of the above

87. Graphite is an allotropic form of
    a. Carbon $
    b. Sulphur
    c. Silicon
    d. Germanium

88. Which of the following processes will separate isotopes?
    a. Filtration
    b. Sublimation
    c. Crystallization
    d. Distillation $

89. An object with a density of 0.86 g/cm3 sink is dropped in to a bucket of water and allowed to settle down. The object will, eventually,
    a. Float in water $
    b. Sink in water
    c. Whether it will float of sink will depend on the force with which it is dropped in to the bucket
    d. Cannot comment based on the given information

90. Which of the following metal will help us obtain copper from a copper sulphate solution?
    a. Sodium
    b. Silver
    c. Iron $
    d. Mercury

91. In general, if the temperature of a reaction is increased by 20°, the reaction rate will be
    a. Two times as fast
    b. Four times as fast $
    c. Twenty times as fast
    d. Unchanged, as the reaction rate is not dependent on the temperature

92. Which of the following elements is expected to be most similar to tin?
    a. Calcium
    b. Copper
    c. Bromine
    d. Lead $

93. A(An) _____ is a region of space in which there is a high probability of finding an electron in an atom.
    a. Shell
    b. Atomic orbital $
    c. Core
    d. Nucleus

94. Rutherford carried out experiments in which a beam of alpha particles was directed at a thin piece of metal foil. From these experiments he concluded that:
    a. Electrons are massive particles
    b. The positively charged parts of atoms are moving about with a velocity approaching the speed of light
    c. (c) the positively charged parts of atoms are extremely small and extremely heavy particles $
    d. The diameter of an electron is approximately equal to that of the nucleus

95. What type of interparticle forces holds liquid N_2 together?
    a. Ionic bonding
    b. London forces $
    c. Hydrogen bonding
    d. Dipole-dipole interaction

96. A molecule that cannot be superimposed on its mirror image is said to exhibit which of the following?
    a. Geometrical isomerism
    b. Optical isomerism $
    c. Linkage isomerism
    d. Reactive isomerism

97. In the standard notation for a voltaic cell, the double vertical line "||" represents:
    a. A phase boundary
    b. Gas electrode
    c. A wire (metal) connection
    d. A salt bridge $

98. The most abundant metal in the earth's crust is:
    a. Cu
    b. Fe
    c. Na
    d. Al $

99. The boiling point of hydrogen is approximately
    a. – 183 ° C
    b. – 196 ° C
    c. – 253 ° C $
    d. None of the above

100. For a gas, which pair of variables are inversely proportional to each other (if all other conditions remain constant)?
    a. P, T
    b. P, V $
    c. V, T
    d. n, V