

1. In the balanced equation for the reaction between dinitrogen pentoxide and water, forming nitric acid, the coefficient for nitric acid is:
- 4
  - 1
  - 2
  - 3
2. What is the mass of one mole of silicon atoms?
- $6.022 \times 10^{23}$  g
  - 74.92 g
  - 14.04 g
  - 28.08 g
3. The formula mass of iron(III) carbonate is given by:
- 291.72 g/mol
  - 115.81 g/mol
  - 139.85 g/mol
  - 287.55 mol/g
4. The correct name for  $\text{SF}_6$  is:
- Fluoride of sulfur
  - Monosulfur hexafluoride
  - Sulfur hexafluoride
  - Sulfur hexafluoride
- The formula for hydrogen sulfate ion is:
- $\text{H}_2\text{SO}_4$
  - $\text{SO}_4^{2-}$
  - $\text{HSO}_4^{2-}$
  - $\text{HSO}_4^-$
6. Magnesium phosphate has the formula:
- $\text{Mg}_3(\text{PO}_4)_2$
  - $\text{Mg}_2(\text{PO}_4)_3$
  - $\text{Mg}_3\text{PO}_4$
  - $\text{Mg}_3(\text{PO}_4)_3$
7. How many microliters are there in 363 L?
- 0.363  $\mu\text{L}$
  - 36.3  $\mu\text{L}$
  - $3.63 \times 10^3$   $\mu\text{L}$
  - $3.63 \times 10^5$   $\mu\text{L}$

8. At a speed of 66.5 km per hour, how many seconds will it take to cover a distance of  $1.00 \times 10^3$  m?
- $5.41 \times 10$  s
  - 18.5 s
  - 54,135 s
  - 0.015 s
- If the density of a substance is 1.680 g/mL, what is the mass of  $9.200 \times 10^{-3}$  L of this substance?
- 9.200 mL
  - $1.546 \times 10$  g
  - $1.55 \times 10$  g
  - 1.68 g
- A mass of 1.7 ng is also equal to:
- $1.70 \times 10^{-9}$  g
  - $1.7 \times 10^9$  g
  - $1.7 \times 10^{-9}$  g
  - $1.70 \times 10^{12}$  mg

11. An anion  $X^{3-}$  contains 10 electrons. The number of protons in the neutral atom (from which the anion is formed) is given by:
- 10
  - 3
  - 7
  - 13
12. A neutral atom contains 82 protons and has a mass number of 207. The number of neutrons in the atom is:
- 125
  - 82
  - 207
  - 289
13. An atom with 80 protons, 80 electrons and 121 neutrons represents an atom of:
- Pb
  - Sb
  - Nb
  - Hg

14. You are driving on a highway with a posted speed limit of 100 km/hr. Your speedometer indicates a speed of 95 miles/hr. If  $1 \text{ km} = 0.62 \text{ mile}$ , are you driving:
- (a) Below the speed limit
  - (b) Above the speed limit
  - (c) At the posted limit
  - (d) None of the above
15. The correct answer (expressed in scientific notation) for the calculation,  $229.56 \text{ g} + 123.345 \text{ g} + 13.2 \text{ g}$  is:
- 366.105 g
  - $3.661 \times 10^2 \text{ g}$
  - 366.1 g
  - $3.7 \times 10^2 \text{ g}$
16. The largest volume is represented by:
- 1.0 L
  - 1000 mL
  - $1.0 \times 10^5 \mu\text{L}$
  - $1.0 \times 10^4 \text{ cm}^3$
17. After performing a calculation, Martha's calculator displayed the result as 4.25961. If the answer can have only three significant figures and must be expressed using scientific notation, it should be reported as:
- $4.26 \times 10^0$
  - $0.426 \times 10$
  - 4.26
  - 42.6/10
18. In the Periodic Table, the halogens are in the same
- Period
  - Group
  - Section
  - Row
19. An element containing 54 electrons is a:
- Metal
  - Non-metal
  - Metalloid
  - None of the above

20. One mole of hydrogen atoms contains:  
1 atom of hydrogen  
 $6.022 \times 10^{23}$  atoms of hydrogen  
 $6.022 \times 10^{-23}$  atoms of H  
1 g of hydrogen
21. The mass of an empty container is 15.096g. A solid is then placed in the container. The combined mass of the solid and the container is 15.119 g. How many significant figures are there in the calculated mass of the solid?  
5  
4  
3  
2
22. Workers have a right to:  
Work in a safe and healthy environment  
Know the processes and substances they are working with  
Know the potential hazards from the substances and the processes  
All of the above
23. The mere presence of a toxic agent constitutes a hazard. It is hazardous in all circumstances.  
True  
False
24. A mountain climber at an altitude of 10,000 meters may be subjected to pressure conditions described as:  
Atmospheric  
Hyperbaric  
Hypobaric  
Hyperatmospheric
25. Hazard posed by exposure to radiation is classified as:  
Chemical  
Biological  
Ergonomic  
Physical
26. Hazard posed by exposure to a virus is classified as:  
Chemical  
Biological  
Ergonomic  
Physical

27. Ergonomic stresses arise as a result of optimal adjustment between the worker and the work or workplace.  
True  
False
28. Which of the following statement is false for chronic toxicity?  
Results from brief exposure to high concentrations of the contaminant  
Responses generally have latency periods  
Responses are difficult to observe and relate  
Results from low and repeated exposure over a long period of time
29. WHMIS was implemented with the goal to:  
Increase the incidence of illnesses and injuries caused by the hazardous materials in the workplace  
Catch those who pollute the environment  
Collect more taxes  
None of the above
30. Chemicals causing changes in DNA are classified as:  
Asphyxiants  
Carcinogens  
Teratogens  
Mutagens
31. Extremely fine particles of lead oxide formed during welding (a high temperature process) are an example of:  
Vapor  
Fume  
Smoke  
Mist
- Commonly used units of concentration for gases and vapors in air are:  
ppm  
ppb  
%  
All of the above
- Toxicity of air contaminants is determined by:  
Humans population studies  
Animals studies  
Bacterial studies  
All if the above

34. A concentration of 31.0 ppb for a gas in air is equal to:
- $3.1 \times 10^{-3}\%$
  - $3.10 \times 10^{-6}\%$
  - $3.1 \times 10^{-5}\%$
  - $3.10 \times 10^{-3}\%$
35. The concentration of  $\text{SO}_2$  in air near a paper mill is 25. ppb, what will it be in ppm?
- $2.50 \times 10^3$  ppm
  - $2.5 \times 10^{-2}$  ppm
  - $2.5 \times 10^3$  ppm
  - $2.5 \times 10^{-9}$  ppm
36. Based upon TLV-TWA values (given in parentheses), which of the following gas poses the most risk:
- Carbon monoxide (50 ppm)
  - Ozone (100 ppb)  $\approx 1 \text{ ppm}$
  - Carbon dioxide ( $5.0 \times 10^3$  ppm)
  - Nitrogen dioxide ( $3.0 \times 10^3$  ppb) 3
37. Hydrogen bonds in water are:
- Weaker than covalent bonds
  - Stronger than covalent bonds
  - Of the same bond strength
  - None of the above
38. The formation of sulfuric acid in the atmosphere is due to the reactions of:
- $\text{NO}_x$
  - $\text{SO}_x$
  - CO
  - $\text{SO}_4^{2-}$
39. A worker is repeatedly exposed to a concentration of  $9.5 \times 10^3$  ppt of a substance. If the TLV-TWA for the substance is 12.5 ppm, it is a safe work environment for the worker.
- True
  - False

40. The presence of hydrogen bonding in water accounts for its:  
Taste  
Exceptionally high heat of vaporization  
Odor  
None of the above
41. The burning of fossil fuels to generate energy is mainly responsible for the production of  $\text{NO}_x$ .  
True  
False
42. Which of the following factor(s) influence the intensity of toxic action?  
Age  
Environmental factors  
Host factors  
All of the above
43. On the basis of physiological action, gaseous carbon monoxide is classified as an:  
Irritant  
Asphyxiant  
Anaesthetic  
None of the above
44. Hepatotoxins are substances that affect the liver.  
False  
True
45. WHMIS was developed through the collective efforts of Labor, Industry, and Federal/Provincial/Territorial Governments.  
True  
False
46. The abbreviation WHMIS stands for:  
Workers House and Money Investment Society  
Workplace Hazardous Materials Information System  
Workplace Hazardous Machinery Indicator System  
Workers Hazardous Materials Inventory System

47. Toxic hazards posed by a substance depend upon:  
 Exposure dose  
 Individual susceptibility  
 Synergistic and other effects  
 All of the above
48.  $\text{SO}_2$  represents:  
 $\text{SO}_3$  only  
 Mixture of  $\text{SO}_2$  and  $\text{SO}_3$   
 Droplets of  $\text{H}_2\text{SO}_4$   
 Particles of sulfate salts
49. What are the coefficients for the reactants and the products when the equation for the reaction:  
 $\text{BaCl}_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + \text{NaCl}(\text{aq})$   
 is balanced?  
 1, 1, 1, 1  
 1, 1, 1, 2  
 2, 2, 2, 4  
 2, 2, 2, 2
50. Patrick saw three cats in his backyard. The number has:  
 one significant figure  
 three significant figures  
 Infinite number of significant figures  
 Two significant figures
51. What is the coefficient for water when the equation for the reaction:  
 $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$   
 is balanced?  
 2  
 3  
 1  
 6
52. How many moles of ammonium ions are formed when one mole of ammonium sulfate (an ionic compound) is dissolved in water?  
 1  
 3  
 2  
 4

53. How many moles are there in 10.0  $\mu\text{g}$  of nitrogen dioxide (molar mass = 45.98 g/mol)?
- $2.17 \times 10^{-4}$
  - $2.17 \times 10^{-2}$
  - $2.17 \times 10^{-7}$
  - $4.59 \times 10^2$
54. The O-H bonds in water are:
- Covalent
  - Ionic
  - Nonbonding
  - None of the above
55. The statistical estimate of dose that would cause death in 50% of the subjects is defined as LD<sub>50</sub>.
- True
  - False
56. Which of the following statement is true for acute toxicity?
- Much more difficult to study
  - Results from brief exposure to high contaminant levels
  - May have latency periods
  - Results from low and repeated exposures over a long period of time
57. Hazard posed by HNO<sub>3</sub> is classified as:
- Ergonomic
  - Biological
  - Physical
  - Chemical
58. How many moles of sulfur are there in 64.12 g of sulfur?
- 1.000 mole
  - 2.000 moles
  - $5.000 \times 10^{-1}$  mole
  - 3.000 moles
59. Carbon-carbon double bond in organic compounds is formed by the sharing of:
- One pair of electrons
  - Two pairs of electrons
  - Loss and gain of electrons
  - Three pairs of electrons

60. Organic polymers containing long chain structures are common because carbon can form covalent bonds with other carbon atoms.  
 True  
 False
61. The functional group in an alcohol is:  
 -SH  
 -NH<sub>2</sub>  
 -OH  
 None of the above
62. The compound with the formula CH<sub>3</sub>(CH<sub>2</sub>)<sub>3</sub>NH<sub>2</sub> is an:  
 Amine R-NH<sub>2</sub>  
 Ether R-O-R  
 Ester  
 Alcohol R-OH
63. The compound with the formula CH<sub>3</sub>CH<sub>2</sub>OCH<sub>2</sub>CH<sub>3</sub> is an:  
 Ether  
 Ester  
 Alcohol  
 None of the above
64. How many carbon atoms are there in a compound with the formula CH<sub>3</sub>(CH<sub>2</sub>)<sub>4</sub>CH<sub>3</sub>?  
 8  
 14  
 6  
 10
65. How many hydrogen atoms are there in a compound with the formula CH<sub>3</sub>(CH<sub>2</sub>)<sub>3</sub>COOC<sub>2</sub>H<sub>5</sub>?  
 9  
 18  
 2  
 29
66. How many oxygen atoms are there in a compound with the formula HOCH<sub>2</sub>(CH<sub>2</sub>)<sub>2</sub>COOC<sub>2</sub>H<sub>5</sub>?  
 7  
 14  
 10  
 3

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67. Benzene has a ring structure containing three carbon-carbon double bonds.  
True  
False
68. Interaction of high energy with atmospheric oxygen leads to the formation of ozone.  
True  
False
69. Using non-fossil energy sources is a suggested way to control global warming.  
True  
False
70. The abbreviation VOCs stands for:  
Volume of Contaminants  
Victory over Contaminants  
Volatile Organic Complexes  
Volatile Organic Compounds
71. Iron is a:  
Transition metal  
Metalloid  
Halogen  
Non-metal
72. The corrosion product of iron has the formula:  
Fe  
Fe<sub>2</sub>O<sub>3</sub>  
O<sub>2</sub>  
CaCO<sub>3</sub>
73. Acid precipitation plays no role in the damage to forests.  
True  
False
74. Weakly acidic nature of rain is due to the formation of:  
O<sub>2</sub> (g)  
N<sub>2</sub> (g)  
H<sub>2</sub>CO<sub>3</sub> (aq)  
O<sub>3</sub> (g)

75. The pH of a wastewater sample is measured to be 11.9. The sample is:  
Acidic  
Neutral  
Basic  
None of the above
76. The pH value for an aqueous solution of nitric acid should be:  
Higher than 7.0  
Lower than 7.0  
Equal to 7.0  
Equal to 11.5
77. A water sample shows a pH of 7.0. The sample is:  
Acidic  
Neutral  
Colorless  
Basic
78. The solubility of lead at a pH of 7.0 is lower than at a pH of 3.2.  
True  
False
79. Which compound reacts with an acid to generate carbon dioxide gas?  
 $H_2O (l)$   
 $CaCO_3 (s)$   
 $NaBr (aq)$   
 $SO_2 (g)$
80. Solar energy is an example of a:  
Fossil energy source  
Non-fossil energy source  
No energy source  
Nuclear energy source
81. One of the gases responsible for global warming is:  
CO  
 $N_2O$   
 $N_2$   
 $O_2$

82. One of the suggested ways to control global warming is to:
- Increase CO<sub>2</sub> emissions
  - Use more fossil fuels
  - Destroy CO<sub>2</sub> sinks
  - Conserve energy
83. Oxygen/Ozone screen in the stratosphere blocks much of the solar UV radiation.
- True
  - False
84. The agreement to reduce and ultimately ban the manufacture and use of chlorofluorocarbons goes by the name of:
- Kyoto Protocol *greenhouse*
  - Glen Eagle Agreement
  - Montreal Protocol → *ozone*
  - Geneva Convention
85. The depletion of stratospheric ozone is caused by:
- Natural sources only
  - Human-made sources only
  - Both natural and human-made sources
  - None of the above
86. The major causes of ozone destruction include:
- Water vapor
  - Nitric oxide
  - CFCs
  - All of the above
87. Adverse effects of acid rain on the aquatic life are due to:
- Increase in pH
  - Decrease in pH
  - Decrease in aqueous concentrations of Al
  - Decrease in aqueous concentrations of Pb
88. If under a set of optimum conditions, 2.00 moles of gaseous ozone are produced from 3.00 moles of oxygen gas, how many moles of oxygen gas will be required (under similar conditions) to produce 15.0 moles of gaseous ozone?
- 15.0 moles
  - 45.0 moles
  - 30.0 moles
  - 22.5 moles

89. The reaction of limestone with  $\text{H}_2\text{SO}_4$  (aq) generates gaseous:  
Carbon dioxide  
Sulfur dioxide  
Carbon monoxide  
Sulfur trioxide
90. Benzene contains:  
Single bonds only  
Double bonds only  
Triple bonds only  
Single and double bonds
91. The increased intensity of ground-level UV due to ozone depletion may lead to higher probability (in case of humans) of:  
Deafness  
Depression  
Cataracts  
AIDS
92. Hazard posed by exposure to an oxidizing agent is classified as:  
Chemical  
Biological  
Ergonomic  
Physical
93. The combined interaction of  $\text{O}_3/\text{O}_2$  in the stratosphere with solar radiation protects us from the harmful effects of:  
IR radiation  
UV radiation  
Visible radiation  
Microwave radiation
94. The symbol for the rare gas in the same period as sodium is:  
Mg  
S  
Ar  
Cl
95. The oxide ion contains:  
8 protons and 8 electrons  
8 protons and 10 electrons  
8 protons and 5 electrons  
8 protons and 6 electrons

CHEM/CHEZ 208 XX (Final Exam, Winter 2006)

96. In the implementation of WHMIS, suppliers must provide hazard information through:
- Telephone calls
  - e-Mails
  - MSDSs only
  - Labels and MSDSs
97. Serious damage to lungs may occur on exposure to:
- $O_2(g)$
  - $NO_2(g)$
  - $N_2(g)$
  - $CO_2(g)$
98. Risk characterization integrates the exposure and effects components to estimate the risk.
- True
  - False
99. The organization responsible for developing TLVs is abbreviated as:
- AGCIH
  - ACGIH
  - AICIC
  - ACGHI
100. Which of the following is a greenhouse gas?
- Nitrogen
  - Oxygen
  - ~~Methane~~
  - None of the above

# Periodic Table of the Elements

1A 2A 3A 4A 5A 6A 7A 8A

|          |          |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |          |         |          |         |          |         |           |        |          |         |  |  |  |  |
|----------|----------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----------|---------|----------|---------|----------|---------|-----------|--------|----------|---------|--|--|--|--|
| 1        | 2        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 3        | 4       | 5        | 6       | 7        | 8       | 9         | 10     | 11       | 12      |  |  |  |  |
| H        | He       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Li       | Be      | B        | C       | N        | O       | F         | Ne     | Na       | Mg      |  |  |  |  |
| 1.0079   | 4.0026   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 6.941    | 9.01218 | 10.811   | 12.011  | 14.0067  | 15.9994 | 18.998403 | 20.179 | 22.98977 | 24.305  |  |  |  |  |
| 3        | 4        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 11       | 12      | 13       | 14      | 15       | 16      | 17        | 18     | 19       | 20      |  |  |  |  |
| 3        | 4        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Na       | Mg      | Al       | Si      | P        | S       | Cl        | Ar     | K        | Ca      |  |  |  |  |
| 22.98977 | 24.305   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 22.98977 | 24.305  | 26.98154 | 28.0855 | 30.97376 | 32.06   | 35.453    | 39.948 | 40.08    | 44.9559 |  |  |  |  |
| 21       | 22       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 23       | 24      | 25       | 26      | 27       | 28      | 29        | 30     | 31       | 32      |  |  |  |  |
| Sc       | Ti       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | V        | Cr      | Mn       | Fe      | Co       | Ni      | Cu        | Zn     | Ga       | Ge      |  |  |  |  |
| 44.9559  | 47.88    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 50.9415  | 51.996  | 54.9380  | 55.847  | 58.9332  | 58.71   | 63.546    | 65.38  | 69.72    | 72.63   |  |  |  |  |
| 37       | 38       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 39       | 40      | 41       | 42      | 43       | 44      | 45        | 46     | 47       | 48      |  |  |  |  |
| Rb       | Sr       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Y        | Zr      | Nb       | Mo      | Tc       | Ru      | Rh        | Pd     | Ag       | Cd      |  |  |  |  |
| 85.4678  | 87.62    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 88.9059  | 91.22   | 92.9064  | 95.94   | (98)     | 101.07  | 102.9055  | 106.4  | 107.868  | 112.41  |  |  |  |  |
| 55       | 56       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 57       | 72      | 73       | 74      | 75       | 76      | 77        | 78     | 79       | 80      |  |  |  |  |
| Cs       | Ba       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | La       | Hf      | Ta       | W       | Re       | Os      | Ir        | Pt     | Au       | Hg      |  |  |  |  |
| 132.9054 | 137.33   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 138.9055 | 178.49  | 180.9479 | 183.85  | 186.207  | 190.2   | 192.22    | 195.09 | 196.9665 | 200.59  |  |  |  |  |
| 87       | 88       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 89       | 104     | 105      | 106     |          |         |           |        |          |         |  |  |  |  |
| Fr       | Ra       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ac       | Unq     | Ump      | Unh     |          |         |           |        |          |         |  |  |  |  |
| (223)    | 226.0254 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 227.0278 | (261)   | (262)    | (263)   |          |         |           |        |          |         |  |  |  |  |

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|        |          |        |       |       |        |        |          |        |          |        |          |        |         |
|--------|----------|--------|-------|-------|--------|--------|----------|--------|----------|--------|----------|--------|---------|
| 58     | 59       | 60     | 61    | 62    | 63     | 64     | 65       | 66     | 67       | 68     | 69       | 70     | 71      |
| Ce     | Pr       | Nd     | Pm    | Sm    | Eu     | Gd     | Tb       | Dy     | Ho       | Er     | Tm       | Yb     | Lu      |
| 140.12 | 140.9077 | 144.24 | (145) | 150.4 | 151.96 | 157.25 | 158.9254 | 162.50 | 164.9304 | 167.26 | 168.9342 | 173.04 | 174.967 |

α

|          |          |         |          |       |       |       |       |       |       |       |       |       |       |
|----------|----------|---------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 90       | 91       | 92      | 93       | 94    | 95    | 96    | 97    | 98    | 99    | 100   | 101   | 102   | 103   |
| Th       | Pa       | U       | Np       | Pu    | Am    | Cm    | Bk    | Cf    | Es    | Fm    | Md    | No    | Lr    |
| 232.0381 | 231.0369 | 238.029 | 237.0482 | (244) | (243) | (247) | (247) | (251) | (252) | (257) | (259) | (259) | (260) |