

1. In the balanced equation for the reaction between dinitrogen pentoxide and water, forming nitric acid, the coefficient for nitric acid is:
 - (a) 4
 - (b) 1
 - (c) 2
 - (d) 3
2. What is the mass of one mole of silicon atoms?
 - (a) 6.022×10^{23} g
 - (b) 74.92 g
 - (c) 14.04 g
 - (d) 28.08 g
3. The formula mass of Iron(III) carbonate is given by:
 - (a) 291.72 g/mol
 - (b) 115.81 g/mol
 - (c) 139.85 g/mol
 - (d) 287.55 mol/g
4. The correct name for SF_6 is:
 - (a) Fluoride of sulfur
 - (b) Monosulfur hexafluoride
 - (c) Sulfur hexafluoride
 - (d) Hexafluorosulfur
5. The formula for sulfate ion is:
 - (a) H_2SO_4
 - (b) SO_4^{2-}
 - (c) HSO_4^{2-}
 - (d) HSO_4^-
6. Magnesium phosphate has the formula:
 - (a) $\text{Mg}_3(\text{PO}_4)_2$
 - (b) $\text{Mg}_2(\text{PO}_4)_3$
 - (c) Mg_3PO_4
 - (d) $\text{Mg}_3(\text{PO}_4)_3$
7. How many microliters are there in 265. L?
 - (a) 0.265 μL
 - (b) 26.5 μL
 - (c) 2.65×10^3 μL
 - (d) 2.65×10^8 μL

8. At a speed of 66.5 km per hour, how many seconds will it take to cover a distance of 1.00×10^3 m?
(a) 5.41×10 s
(b) 18.5 s
(c) 54,135 s
(d) 0.015 s
9. If the density of a substance is 1.680 g/mL, what is the mass of 9.200×10^{-3} L of this substance?
(a) 9.200 mL
(b) 1.546×10 g
(c) 1.55×10 g
(d) 1.68 g
10. A mass of 3.7 ng is also equal to:
(a) 3.70×10^{-9} g
(b) 3.7×10^9 g
(c) 3.7×10^{-9} g
(d) 3.70×10^{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:
(a) 10
(b) 3
(c) 7
(d) 13
12. A neutral atom contains 82 protons and has a mass number of 207. The number of neutrons in the atom is:
(a) 125
(b) 82
(c) 207
(d) 289
13. An atom with 80 protons, 80 electrons and 121 neutrons represents an atom of:
(a) Pb
(b) Sb
(c) Nb
(d) 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 km = 0.62 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:
- (a) 366.105 g
 - (b) $3.661 \times 10^2 \text{ g}$
 - (c) 366.1 g
 - (d) $3.7 \times 10^2 \text{ g}$
16. The largest volume is represented by:
- (a) 1.0 L
 - (b) 1000 mL
 - (c) $1.0 \times 10^5 \mu\text{L}$
 - (d) $1.0 \times 10^4 \text{ cm}^3$
17. After performing a calculation, Fred's calculator displayed the result as 5.35961. If the answer can have only three significant figures and must be expressed using scientific notation, it should be reported as:
- (a) 5.36×10^0
 - (b) 0.535×10
 - (c) 5.36
 - (d) 53.6/10
18. In the Periodic Table, the rare gases are in the same
- (a) Period
 - (b) Group
 - (c) Section
 - (d) Row
19. An element containing 33 electrons is a:
- (a) Metal
 - (b) Non-metal
 - (c) Metalloid
 - (d) None of the above

20. One mole of hydrogen atoms contains:
- (a) 1 atom of hydrogen
 - (b) 6.022×10^{23} atoms of hydrogen
 - (c) 6.022×10^{-23} atoms of H
 - (d) 1 g of hydrogen

The mass of an empty container is 15.096 g. 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?

- (a) 5
- (b) 4
- (c) 3
- (d) 2

Workers have a right to:

- (a) Work in a safe and healthy environment
- (b) Know the processes and substances they are working with
- (c) Know the potential hazards from the substances and the processes
- (d) All of the above

23. The mere presence of a toxic agent constitutes a hazard. It is hazardous in all circumstances.
- (a) True
 - (b) False

24. A mountain climber at an altitude of 6000 meters may be subjected to pressure conditions described as:
- (a) Atmospheric
 - (b) Hyperbaric
 - (c) Hypobaric
 - (d) Hyperatmospheric

25. Hazard posed by exposure to radiation is classified as:
- (a) Chemical
 - (b) Biological
 - (c) Ergonomic
 - (d) Physical

Hazard posed by exposure to a virus is classified as:

- (a) Chemical
- (b) Biological
- (c) Ergonomic
- (d) Physical

27. Ergonomic stresses arise because of optimal adjustment between the worker and the work or workplace.
(a) True
(b) False
28. Which of the following statement is true for acute toxicity?
(a) Results from brief exposure to high concentrations of the contaminant
(b) Responses generally have latency periods
(c) Responses are difficult to observe and relate
(d) Results from low and repeated exposure over a long period of time
29. WHMIS was implemented with the goal to:
(a) Increase the incidence of illnesses and injuries caused by the hazardous materials in the workplace
(b) Catch those who pollute the environment
(c) Collect more taxes
(d) None of the above

Chemicals causing cancer are classified as:

- (a) Asphyxiants
(b) Carcinogens
(c) Teratogens
(d) Mutagens
31. Extremely fine particles of lead oxide formed during welding (a high temperature process) are an example of:
(a) Vapor
(b) Fume
(c) Smoke
(d) Mist
32. Commonly used units of concentration for gases and vapors in air are:
(a) ppm
(b) ppb
(c) %
(d) All of the above
33. Toxicity of air contaminants is determined by:
(a) Humans population studies
(b) Animals studies
(c) Bacterial studies
(d) All if the above

34. A concentration of 31.0 ppb for a gas in air is equal to:
(a) $3.1 \times 10^{-3}\%$
(b) $3.10 \times 10^{-6}\%$
(c) $3.1 \times 10^5\%$
(d) $3.10 \times 10^{-3}\%$
35. The concentration of SO_2 in air near a paper mill is 25. ppb, what will it be in ppm?
(a) 2.50×10^3 ppm
(b) 2.5×10^{-2} ppm
(c) 2.5×10^3 ppm
(d) 2.5×10^{-9} ppm
36. Based upon TLV-TWA values (given in parentheses), which of the following gas poses the most risk:
(a) Carbon monoxide (50 ppm)
(b) Ozone (100 ppb)
(c) Carbon dioxide (5.0×10^3 ppm)
(d) Nitrogen dioxide (3.0×10^3 ppb)
37. Hydrogen bonds in water are:
(a) Weaker than covalent bonds
(b) Stronger than covalent bonds
(c) Of the same bond strength
(d) None of the above
38. The formation of sulfuric acid in the atmosphere is due to the reactions of:
(a) NO_x
(b) SO_x
(c) CO
(d) SO_4^{2-}
39. A worker is repeatedly exposed to a concentration of 9.5×10^3 ppb of a substance. If the TLV-TWA for the substance is 12.5 ppm, it is a safe work environment for the worker.
(a) True
(b) False

40. The presence of hydrogen bonding in water accounts for its:
(a) Taste
(b) Exceptionally high heat of vaporization
(c) Odor
(d) None of the above
41. The burning of fossil fuels to generate energy is mainly responsible for the production of NO_x .
(a) True
(b) False
42. Which of the following factor(s) influence the intensity of toxic action?
(a) Age
(b) Environmental factors
(c) Host factors
(d) All of the above
43. On the basis of physiological action, gaseous carbon monoxide is classified as an:
(a) Irritant
(b) Asphyxiant
(c) Anaesthetic
(d) None of the above
44. Hepatotoxins are substances that affect the liver.
(a) False
(b) True
45. WHMIS was developed through the collective efforts of Labor, Industry, and Federal/Provincial/Territorial Governments.
(a) True
(b) False
46. The abbreviation WHMIS stands for:
(a) Workers House and Money Investment Society
(b) Workplace Hazardous Materials Information System
(c) Workplace Hazardous Machinery Indicator System
(d) Workers Hazardous Materials Inventory System

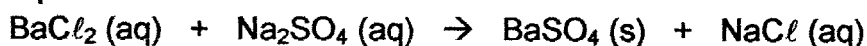
47. Toxic hazards posed by a substance depend upon:

- (a) Exposure dose
- (b) Individual susceptibility
- (c) Synergistic and other effects
- (d) All of the above

SO_x represents:

- (a) SO₃ only
- (b) Mixture of SO₂ and SO₃
- (c) Droplets of H₂SO₄
- (d) Particles of sulfate salts

49. What are the coefficients for the reactants and the products when the equation for the reaction:



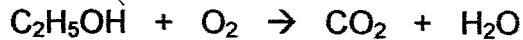
is balanced?

- (a) 1, 1, 1, 1
- (b) 1, 1, 1, 2
- (c) 2, 2, 2, 4
- (d) 2, 2, 2, 2

Susan saw three dogs in his backyard. The number has:

- (a) one significant figure
- (b) three significant figures
- (c) Infinite number of significant figures
- (d) Two significant figures

51. What is the coefficient for water when the equation for the reaction:



is balanced?

- (a) 2
- (b) 3
- (c) 1
- (d) 6

52. How many moles of ammonium ions are formed when one mole of ammonium sulfate (an ionic compound) is dissolved in water?

- (a) 1
- (b) 3
- (c) 2
- (d) 4

53. How many moles are there in 10.0 μg of nitrogen dioxide (molar mass = 45.98 g/mol)?
(a) 2.17×10^{-4}
(b) 2.17×10^{-2}
(c) 2.17×10^{-7}
(d) 4.59×10^2
54. The O–H bonds in water are:
(a) Covalent
(b) Ionic
(c) Nonbonding
(d) None of the above
55. The statistical estimate of dose that would cause death in 50% of the subjects is defined as LD_{50} .
(a) True
(b) False
56. Which of the following statement is true for acute toxicity?
(a) Much more difficult to study
(b) Results from brief exposure to high contaminant levels
(c) May have latency periods
(d) Results from low and repeated exposure over a long period of time

Hazard posed by HNO_3 is classified as:

- (a) Ergonomic
(b) Biological
(c) Physical
(d) Chemical
58. How many moles of sulfur are there in 64.12 g of sulfur?
(a) 1.000 mole
(b) 2.000 moles
(c) 5.000×10^{-1} mole
(d) 3.000 moles

Carbon-carbon double bond in organic compounds is formed by the sharing of:

- (a) One pair of electrons
(b) Two pairs of electrons
(c) Loss and gain of electrons
(d) Three pairs of electrons

60. Organic polymers containing long chain structures are common because carbon can form covalent bonds with other carbon atoms.

- (a) True
- (b) False

61. The functional group in an alcohol is:

- (a) -SH
- (b) -NH₂
- (c) -OH
- (d) None of the above

The compound with the formula CH₃(CH₂)₃NH₂ is an:

- (a) Amine
- (b) Ether
- (c) Ester
- (d) Alcohol

63. The compound with the formula CH₃CH₂OCH₂CH₃ is an:

- (a) Ether
- (b) Ester
- (c) Alcohol
- (d) None of the above

64. How many carbon atoms are there in a compound with the formula CH₃(CH₂)₄CH₃?

- (a) 8
- (b) 14
- (c) 6
- (d) 10

How many hydrogen atoms are there in a compound with the formula CH₃(CH₂)₅COOC₂H₅?

- (a) 9
- (b) 18
- (c) 2
- (d) 29

How many oxygen atoms are there in a compound with the formula HOCH₂(CH₂)₂COOC₃H₇?

- (a) 7
- (b) 14
- (c) 10
- (d) 3

67. Benzene has a ring structure containing three carbon-carbon double bonds.
(a) True
(b) False

Interaction of high energy with atmospheric oxygen leads to the formation of ozone.

- (a) True
(b) False

Using non-fossil energy sources is a suggested way to control global warming.

- (a) True
(b) False

70. The abbreviation VOCs stands for:
(a) Volume of Contaminants
(b) Victory over Contaminants
(c) Volatile Organic Complexes
(d) Volatile Organic Compounds

71. Iron is a:
(a) Transition metal
(b) Metalloid
(c) Halogen
(d) Non-metal

72. The corrosion product of iron has the formula:
(a) Fe
(b) Fe_2O_3
(c) O_2
(d) CaCO_3

Acid precipitation plays no role in the damage to forests.

- (a) True
(b) False

74. Weakly acidic nature of rain is due to the formation of:
(a) O_2 (g)
(b) N_2 (g)
(c) H_2CO_3 (aq)
(d) O_3 (g)

75. The pH of a wastewater sample is measured to be 11.9. The sample is:
(a) Acidic
(b) Neutral
(c) Basic
(d) None of the above
76. The pH value for an aqueous solution of nitric acid should be:
(a) Higher than 7.0
(b) Lower than 7.0
(c) Equal to 7.0
(d) Equal to 11.5
77. A water sample shows a pH of 7.0. The sample is:
(a) Acidic
(b) Neutral
(c) Colorless
(d) Basic

The solubility of aluminum at a pH of 7.0 is lower than at a pH of 3.2.

- (a) True
(b) False
79. Which compound reacts with an acid to generate carbon dioxide gas?
(a) H_2O (l)
(b) CaCO_3 (s)
(c) NaBr (aq)
(d) SO_2 (g)

Solar energy is an example of a:

- (a) Fossil energy source
(b) Non-fossil energy source
(c) No energy source
(d) Nuclear energy source
81. One of the gases responsible for global warming is:
(a) CO
(b) N_2O
(c) N_2
(d) O_2

82. One of the suggested ways to control global warming is to:
- (a) Increase CO₂ emissions
 - (b) Use more fossil fuels
 - (c) Destroy CO₂ sinks
 - (d) Conserve energy

Oxygen/Ozone screen in the stratosphere blocks much of the solar UV radiation.

- (a) True
- (b) False

84. The agreement to reduce and ultimately ban the manufacture and use of chlorofluorocarbons goes by the name of:
- (a) Kyoto Protocol
 - (b) Glen Eagle Agreement
 - (c) Montreal Protocol
 - (d) Geneva Convention

The depletion of stratospheric ozone is caused by:

- (a) Natural sources only
- (b) Human-made sources only
- (c) Both natural and human-made sources
- (d) None of the above

86. The major causes of ozone destruction include:
- (a) Water vapor
 - (b) Nitric oxide
 - (c) CFCs
 - (d) All of the above

87. Adverse effects of acid rain on the aquatic life are due to:
- (a) Increase in pH
 - (b) Decrease in pH
 - (c) Decrease in aqueous concentrations of Al
 - (d) 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?
- (a) 15.0 moles
 - (b) 45.0 moles
 - (c) 30.0 moles
 - (d) 22.5 moles

89. The reaction of limestone with H_2SO_4 (aq) generates gaseous:
- (a) Carbon dioxide
 - (b) Sulfur dioxide
 - (c) Carbon monoxide
 - (d) Sulfur trioxide
90. Benzene contains:
- (a) Single bonds only
 - (b) Double bonds only
 - (c) Triple bonds only
 - (d) 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:
- (a) Deafness
 - (b) Depression
 - (c) Cataracts
 - (d) AIDS
92. Hazard posed by exposure to an oxidizing agent is classified as:
- (a) Chemical
 - (b) Biological
 - (c) Ergonomic
 - (d) Physical

The combined interaction of O_3/O_2 in the stratosphere with solar radiation protects us from the harmful effects of:

- (a) IR radiation
- (b) UV radiation
- (c) Visible radiation
- (d) Microwave radiation

The symbol for the rare gas in the same period as sodium is:

- (a) Mg
- (b) S
- (c) Ar
- (d) Cl

95. The oxide ion contains:
- (a) 8 protons and 8 electrons
 - (b) 8 protons and 10 electrons
 - (c) 8 protons and 5 electrons
 - (d) 8 protons and 6 electrons

96. In the implementation of WHMIS, suppliers must provide hazard information through:
- (a) Telephone calls
 - (b) e-Mails
 - (c) MSDSs only
 - (d) Labels and MSDSs
97. Serious damage to lungs may occur on exposure to:
- (a) O₂ (g)
 - (b) NO₂ (g)
 - (c) N₂ (g)
 - (d) CO₂ (g)
98. Risk characterization integrates the exposure and effects components to estimate the risk.
- (a) True
 - (b) False

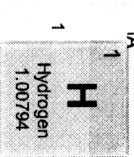
The organization responsible for developing TLVs is abbreviated as:

- (a) AGCIH
- (b) ACGIH
- (c) AHGIC
- (d) ACGHI

Which of the following is a greenhouse gas?

- (a) Nitrogen
- (b) Oxygen
- (c) Methane
- (d) None of the above

1A
IIA



Periodic Table of Elements

1	Li Lithium 6.941	4	Be Beryllium 9.01218	12	Mg Magnesium 24.3050	20	Ca Calcium 40.078	28	Ni Nickel 58.6934	36	Kr Krypton 83.798	54	Xe Xenon 131.29	86	Rn Radon 222
2	Na Sodium 22.98977	10	Ne Neon 20.1797	18	Ar Argon 39.948	26	Fe Iron 55.845	34	Se Selenium 78.96	42	Zn Zinc 65.38	50	Sn Tin 118.710	68	Ba Barium 137.327
3	K Potassium 39.0983	19	Ar Argon 39.948	27	Co Cobalt 58.93320	35	Br Bromine 79.904	45	Rh Rhodium 102.90550	53	I Iodine 126.90447	61	Pm Promethium (145)	87	Fr Francium (223)
4	Rb Rubidium 85.4678	28	Kr Krypton 83.798	36	Kr Krypton 83.798	63	Eu Europium 151.964	71	Lu Lutetium 174.967	79	Au Gold 196.96655	87	Lr Lawrencium (260)	103	La Lanthanum 138.9055
5	Cs Cesium 132.90545	37	Rb Rubidium 85.4678	45	Rh Rhodium 102.90550	71	Lu Lutetium 174.967	79	Au Gold 196.96655	87	Lr Lawrencium (260)	103	La Lanthanum 138.9055	104	Rf Rutherfordium (261)
6	Fr Francium (223)	46	Sr Strontium 87.62	54	Xe Xenon 131.29	80	Hg Mercury 200.59	88	Ra Radium (226)	96	Cm Curium (247)	104	Rf Rutherfordium (261)	105	Db Dubnium (262)
7	Fr Francium (223)	55	Ba Barium 137.327	63	Eu Europium 151.964	80	Hg Mercury 200.59	96	Cm Curium (247)	104	Rf Rutherfordium (261)	105	Db Dubnium (262)	106	Sg Seaborgium (263)
8	Fr Francium (223)	64	La Lanthanum 138.9055	71	Lu Lutetium 174.967	87	Lr Lawrencium (260)	103	La Lanthanum 138.9055	104	Rf Rutherfordium (261)	105	Db Dubnium (262)	106	Sg Seaborgium (263)
9	Fr Francium (223)	71	Ce Cerium 140.116	78	Pt Platinum 195.078	86	Rn Radon 222	100	Fm Fermium (257)	107	Bh Bohrium (264)	108	Hs Hassium (265)	109	Mt Meitnerium (268)
10	Fr Francium (223)	80	Pr Praseodymium 140.90765	86	Rn Radon 222	100	Fm Fermium (257)	107	Bh Bohrium (264)	108	Hs Hassium (265)	109	Mt Meitnerium (268)	110	Uun Ununium (269)
11	Fr Francium (223)	87	Nd Neodymium 144.24	93	Np Neptunium (237)	103	La Lanthanum 138.9055	104	Rf Rutherfordium (261)	105	Db Dubnium (262)	106	Sg Seaborgium (263)	107	Bh Bohrium (264)
12	Fr Francium (223)	94	Pm Promethium (145)	100	Fm Fermium (257)	107	Bh Bohrium (264)	108	Hs Hassium (265)	109	Mt Meitnerium (268)	110	Uun Ununium (269)	111	Uuu Ununium (272)
13	Fr Francium (223)	101	Sm Samarium 150.35	107	Bh Bohrium (264)	108	Hs Hassium (265)	109	Mt Meitnerium (268)	110	Uun Ununium (269)	111	Uuu Ununium (272)	112	Uub Unubium (277)
14	Fr Francium (223)	108	Eu Europium 151.964	114	Uuq Ununquadium (294)	120	Uuh Ununhexium (286)	126	Uuq Ununquadium (294)	132	Uuh Ununhexium (286)	138	Uuq Ununquadium (294)	144	Uuh Ununhexium (286)
15	Fr Francium (223)	115	Gd Gadolinium 157.25	121	Uuq Ununquadium (294)	127	Uuh Ununhexium (286)	133	Uuh Ununhexium (286)	139	Uuh Ununhexium (286)	145	Uuh Ununhexium (286)	151	Uuh Ununhexium (286)
16	Fr Francium (223)	122	Tb Terbium 158.92534	128	Uuq Ununquadium (294)	134	Uuh Ununhexium (286)	140	Uuh Ununhexium (286)	146	Uuh Ununhexium (286)	152	Uuh Ununhexium (286)	158	Uuh Ununhexium (286)
17	Fr Francium (223)	129	Dy Dysprosium 162.50	135	Uuq Ununquadium (294)	141	Uuh Ununhexium (286)	147	Uuh Ununhexium (286)	153	Uuh Ununhexium (286)	159	Uuh Ununhexium (286)	165	Uuh Ununhexium (286)
18	Fr Francium (223)	136	Ho Holmium 164.93032	142	Uuq Ununquadium (294)	148	Uuh Ununhexium (286)	154	Uuh Ununhexium (286)	160	Uuh Ununhexium (286)	166	Uuh Ununhexium (286)	172	Uuh Ununhexium (286)
19	Fr Francium (223)	143	Er Erbium 167.26	149	Uuq Ununquadium (294)	155	Uuh Ununhexium (286)	161	Uuh Ununhexium (286)	167	Uuh Ununhexium (286)	173	Uuh Ununhexium (286)	179	Uuh Ununhexium (286)
20	Fr Francium (223)	150	Tm Thulium 168.93421	156	Uuq Ununquadium (294)	162	Uuh Ununhexium (286)	168	Uuh Ununhexium (286)	174	Uuh Ununhexium (286)	180	Uuh Ununhexium (286)	186	Uuh Ununhexium (286)
21	Fr Francium (223)	157	Yb Ytterbium 173.04	163	Uuq Ununquadium (294)	169	Uuh Ununhexium (286)	175	Uuh Ununhexium (286)	181	Uuh Ununhexium (286)	187	Uuh Ununhexium (286)	193	Uuh Ununhexium (286)
22	Fr Francium (223)	164	No Nobelium (259)	170	Uuq Ununquadium (294)	176	Uuh Ununhexium (286)	182	Uuh Ununhexium (286)	188	Uuh Ununhexium (286)	194	Uuh Ununhexium (286)	200	Uuh Ununhexium (286)