C101 Chapters 1 and 2 — 90 representative questions from old exams

The questions are grouped by topic. Do these problems as homework to prepare for Exam 1.

1. Carbon is a metal/nonmetal that has the symbol _____.
   a. metal, C
   b. metal, Ca
   c. nonmetal, C
   d. nonmetal, Ca
   e. nonmetal, Cl

2. The elements tin, titanium, tantalum and thallium are represented respectively by the symbols:
   a. Ti, Tm, Ta, Th
   b. Sb, Ti, Tl, Tm
   c. Sn, Ti, Tl, Th
   d. Sn, Ti, Ta, Tl
   e. W, Tc, Tl, Hg

3. Barium and beryllium are examples of
   a. alkaline earth metals.
   b. rare earth metals.
   c. transition metals.
   d. alkali metals.
   e. halogens.

4. Which is a transition metal?
   a. indium
   b. cadmium
   c. rubidium
   d. selenium
   e. antimony

5. Which of the following elements is misspelled?
   a. scandium
   b. vanadium
   c. tellerium
   d. iridium
   e. lanthanum

6. How many nonmetal atoms are there in the formula: NaH_2PO_4?
   a. 1
   b. 2
   c. 4
   d. 6
   e. 7

7. Alkali metals

   a. react violently with water.
   b. have one valence electron.
   c. form 1:1 compounds with halogens.
   d. **all of the above**
   e. **none of the above**

8. Which of the following would you expect to be chemically similar to chlorine?

   a. Ar
   b. F and Br
   c. Se and Ne
   d. O and Kr
   e. P and S

9. Which element is likely to have chemical properties similar to elemental potassium?

   a. Ar
   b. Ca
   c. Sc
   d. Rb
   e. Sr

10. Which of the following is equivalent to 0.002100?

   a. 2.1×10^{3}
   b. 2.10×10^{4}
   c. 2.10×10^{-3}
   d. 2.100×10^{-3}
   e. 2.100×10^{-4}

11. Express 23400 in scientific notation.

   a. 2.34×10^{3}
   b. 2.34×10^{4}
   c. 2.34×10^{5}
   d. 2.34×10^{-2}
   e. 2.34×10^{-4}

12. Which digit is uncertain in the following mass? 54.3210 g

   a. 0
   b. 1
   c. 2
   d. 3
   e. 4

13. Which of the following has exactly 4 significant figures?

a. 5.050×10^7
b. 9.7001
c. 0.0020
d. 0.15510
e. 3510

14. The number 78.6543 should be rounded to what value in order to have exactly 3 significant figures?

a. 80.0
b. 78.6
c. 78.7
d. 78.654
e. 7.86×10^{-3}

15. Evaluate the following expression to the correct number of significant figures:

$$2.34 \times 10^{-2}\ \text{mL} \quad + \quad 1.002 \times 10^{-2}\ \text{mL} \quad + \quad 0.02\ \text{mL}$$

a. $5. \times 10^{-2}$ mL
b. 5.0×10^{-2} mL
c. 5.3×10^{-2} mL
d. 5.34×10^{-2} mL
e. 5.342×10^{-2} mL

16. What temperature is 75.0°F on the Kelvin scale?

a. 24.0 K
b. 43.0 K
c. 215 K
d. 297 K
e. 348 K

17. Which of the following describes a chemical change?

a. new materials are formed
b. the change is reversible
c. the change is not reversible
d. **a and b**
e. **a and c**

18. Identify the physical change (or changes) in the following list.

a. diluting bleach with water
b. explosion of gasoline in an automobile engine
c. making rock candy by evaporating water from a sugar solution
d. **a and b**
e. **a and c**

19. When a substance undergoes a *physical* change
   a. it always undergoes a change of state.
   b. the process cannot be reversed.
   c. a new substance is produced.
   d. its chemical composition remains unchanged.
   e. heat is always given off.

20. When an electrical current is used to make hydrogen gas and oxygen gas from water,
   a. a chemical change has occurred.
   b. a simple change of state (physical change) has occurred.
   c. water is a reactant and hydrogen and oxygen are products.
   d. **a and c**
   e. **b and c**

21. A compound is a liquid at 250°F. Which of the following could be the correct melting point and boiling point for this material?
   a. 0°C and 100°C
   b. 390°C and 840°C
   c. 100°C and 212°C
   d. –20°C and 120°C
   e. 130°C and 180°C

22. Benzyl salicylate, a sunscreen, melts at 75°F and boils at 608°F. At which temperature would benzyl salicylate be a gas?
   a. 0°F
   b. 0°C
   c. 100°C
   d. 300°C
   e. **none of the above**

23. Which of the following would be described as a heterogeneous mixture?
   a. air, a mixture of O_2, N_2, CO_2 and other gases
   b. propane gas, C_3H_8
   c. 95% ethyl alcohol (C_2H_6O dissolved in water)
   d. elemental sulfur, S_8
   e. **none of the above**

24. Which of the following pairs consists of an example of a mixture and an example of a pure substance?
   a. concrete, air
   b. rubbing alcohol, liquid hand soap
   c. salt water, helium gas
   d. anhydrous ammonia, aluminum foil
   e. air, motor oil

25. Which of the following can be classified as a pure compound?

a. glucose, $C_6H_{12}O_6$
b. mercury metal, Hg
c. chlorine gas, Cl_2
d. rubbing alcohol, C_3H_8O in H_2O
e. **all of the above**

26. Which should be classified as a heterogeneous mixture?

a. salsa
b. salt water
c. table salt, NaCl
d. **a and b**
e. **all of the above**

27. A piece of lead floats when it is dropped into a pool of mercury. This means that

a. the density of lead is less than one.
b. the density of Pb is less than the specific gravity of Pb.
c. the density of mercury is greater than the density of lead.
d. the atomic weight of lead is less than the atomic weight of mercury.
e. the specific gravity of lead is greater than the specific gravity of mercury.

28. A liquid sample has a density of 1.3 g/mL. What is the volume occupied by 10. g of this liquid?

a. 7.7 mL
b. 10. mL
c. 13 mL
d. 0.077 mL
e. 1.3×10^{-2} mL

29. The density of a solution is 1.293 g/mL. What is the mass of 3.0 mL of this solution (with proper attention to correct significant digits)?

a. 0.43 g
b. 4.0 g
c. 3.9 g
d. 3.879 g
e. 2.3 g

30. What is the density if 58.41 g of a metal occupies a volume of 9.0 cubic centimeters?
Make sure your answer has the correct number of significant figures.

a. 6.49 g/mL
b. 6.5 g/mL
c. 7 g/mL
d. 0.154 g/mL
e. 0.15 g/mL

31. The densities of ethylene glycol, water and wood alcohol are 1.11 g/mL, 1.00 g/mL and 0.79 g/mL respectively. Suppose an object floats in water and ethylene glycol but sinks when placed in wood alcohol. Which of the following could be the density of the object?

a. 1.22 g/mL
b. 1.11 g/mL
c. 1.05 g/mL
d. 0.92 g/mL
e. 0.75 g/mL

32. What is the mass of 2.00 in^3 of mercury? Note: The density of mercury is 13.6 g/cm^3.

a. 2.67 g
b. 27.2 g
c. 69.1 g
d. 223 g
e. 446 g

33. The density of air is 1.185×10^5 cg/kL. Express this density in mg/L.

a. 1.185×10^{-5} mg/L
b. 1.185×10^{-3} mg/L
c. 1.185×10^{-2} mg/L
d. 1.185 mg/L
e. 1185 mg/L

34. What temperature change results if 10.0 g of iron absorbs 50.0 calories? Note: $C_{Fe} = 0.106$ cal/g·°C.

a. 47.2°C
b. 0.530°C
c. 0.0212°C
d. 1.89°C
e. 53.0°C

35. How much heat (in kcal) is released when 125 g of water cools from 90.0ºC to 9.5ºC? (Note: the specific heat value for water is 1.00 cal/g·°C.)

a. 0.644 kcal
b. 1.55 kcal
c. 12.5 kcal
d. 2.44 kcal
e. 10.1 kcal

36. Suppose an equal amount of heat is absorbed by different masses of each of the following metals and you discover that the temperature of the magnesium sample changes the most. Which of the following could be a correct statement of the relative masses of the metal samples studied?

Au: 0.031 cal/g·°C **Fe**: 0.106 cal/g·°C **Mg**: 0.245 cal/g·°C

a. mass Mg > mass Au > mass Fe
b. mass Mg > mass Fe > mass Au
c. mass Au > mass Fe > mass Mg
d. mass Au > mass Mg > mass Fe
e. mass Fe > mass Mg > mass Au

37. How many micrograms are in a kilogram?

a. 10^9

b. 10^{-9}

c. 10^{-6}

d. 10^6

e. 10^3

38. Which of the following is equivalent to 75.0 grams?

a. 7500 mg

b. 0.0750 mg

c. 7.50×10^{-4} mg

d. 7.50×10^4 mg

e. 7.50×10^7 mg

39. Convert 3.5 liters to milliliters.

a. 3.5×10^{-3} mL

b. 3.5×10^3 mL

c. 3.5×10^6 mL

d. 350000 mL

e. 0.00350 mL

40. Convert 6.0 pints to nanoliters. (Note: 1 pint = 0.473 L)

a. 2.8×10^{-9} nL

b. 2.8×10^9 nL

c. 7.1×10^8 nL

d. 1.3×10^8 nL

e. 1.3×10^{-8} nL

41. Which of the following is equivalent to the volume of a cube that is 100 cm on each side? Note: The volume of a cube is length × width × height.

a. 1 kiloliter

b. 1 megaliter

c. 10^2 centiliters

d. 10^6 microliters

e. 10^9 milliliters

42. Convert 5.0×10^{-8} cm to units of Å. Note that 1 Å is exactly 10^{-10} m.

a. 0.50 Å

b. 5.0 Å

c. 50 Å

d. 5.0×10^{-2} Å

e. 5.0×10^1 Å

43. An extra-strength aspirin tablet contains 0.500 grams of aspirin. How many grains is this?
Note: 1 grain = 64.8 mg

a. 3.24×10^4 grains
b. 65.3 grains
c. 32.4 grains
d. 13.0 grains
e. 7.72 grains

44. Which of the following types of electromagnetic radiation has the highest energy?

a. red light
b. blue light
c. yellow light
d. infrared radiation
e. ultraviolet radiation

45. Put the following types of electromagnetic radiation in order of increasing energy.

I: orange light **II**: UV radiation **III**: red light **IV**: microwaves

a. IV < I < II < III
b. IV < III < I < II
c. I < IV < III < II
d. III < IV < I < II
e. II < I < III < IV

46. What is the subatomic particle that has a positive charge and a mass of approximately 1 amu?

a. electron
b. proton
c. neutron
d. protium
e. deuterium

47. The nucleus is held together by

a. electromagnetic radiation.
b. nuclear strong force.
c. electrostatic attraction.
d. gravitational force.
e. **all of the above**

48. An atom that contains 47 protons, 47 electrons and 60 neutrons is an isotope of:

a. Ag
b. Al
c. Nd
d. Bh
e. **cannot be determined from the information given**

49. How many protons are in an isotope of strontium that has 50 neutrons?

a. 50

b. 87

c. 36

d. 38

e. 12

50. A certain isotope has 17 protons, 18 neutrons, and 18 electrons. The correct symbol for this is:

a. ^{35}Ar

b. $^{35}Cl^{-}$

c. $^{17}Cl^{+}$

d. $^{36}K^{2-}$

e. $^{53}I^{-}$

51. Which has more neutrons than electrons?

a. $^{32}_{16}S^{2-}$

b. $^{38}_{19}K$

c. $^{31}_{15}P^{3-}$

d. $^{24}Mg^{2+}$

e. ^{9}B

52. An atom with mass number (A) 69 and atomic number (Z) 31 contains:

a. 31 protons and 69 neutrons

b. 69 protons and 31 neutrons

c. 31 protons and 38 neutrons

d. 38 protons and 31 neutrons

e. 31 protons and 100 neutrons

53. Consider $^{54}Co^{2+}$. The atomic number, mass number, number of protons, number of neutrons and number of electrons are (in order):

a. 27, 54, 27, 27, 29

b. 27, 54, 27, 27, 25

c. 54, 59, 27, 27, 25

d. 54, 59, 29, 27, 27

e. **none of the above**

54. A charged atom (-1) has 76 electrons and has a mass number (A) of 190. How many protons and neutrons are in the nucleus of this atom?

a. 114 p 190 n

b. 115 p 75 n

c. 75 p 190 n

d. 75 p 115 n

e. 76 p 114 n

55. Which of the following contains exactly 44 neutrons?

a. I-131
b. Ti-22
c. Se-78
d. Sc-44
e. Ru-101

56. The atomic weight listed for an element in the periodic table is

a. the same as the mass number (A) for the element.
b. a weighted average of the weights of naturally-occurring isotopes of the element.
c. the average of the mass number (A) and the atomic number (Z).
d. the mass of an atom with the weight adjusted to reflect loss or gain of electrons.
e. the weight of the predominant isotope found on earth.

57. Put the following in order of increasing mass.

I: beryllium ion, Be^{2+} **II**: electron **III**: neutron **IV**: tritium, ${}^{3}_{1}H$

a. II < III < IV < I
b. II < III < I < IV
c. I < IV < III < II
d. III < IV < I < II
e. IV < III < II < I

58. What is the approximate mass of 10 chromium atoms?

a. 10 amu
b. 24 amu
c. 52 amu
d. 240 amu
e. 520 amu

59. What is the approximate mass in amu of 33 atoms of gold-203?

a. 5200 amu
b. 6700 amu
c. 1.1×10^{-19} amu
d. 1.1×10^{-20} amu
e. 1.0×10^{-23} amu

60. What is the mass in grams of 135 atoms of bromine? Note: 1 amu = 1.6606×10^{-24} grams

a. 1.5394×10^{-28} g
b. 9.8288×10^{-25} g
c. 2.8056×10^{-24} g
d. 7.8463×10^{-21} g
e. 1.7913×10^{-20} g

61. How many atoms are there in a 10.0 g sample of aluminum? Note: 1 amu = 1.6606×10^{-24} grams

a. 2.23×10^{23} atoms

b. 6.15×10^{-25} atoms

c. 1.62×10^{26} atoms

d. 4.48×10^{-22} atoms

e. 2.23×10^{21} atoms

62. The atomic weight of hydrogen from the periodic table is 1.0079 amu. From this information, what is the likely *approximate* isotopic composition of naturally occurring hydrogen on earth?

a. mostly protium (no neutrons)

b. mostly deuterium (1 neutron)

c. mostly tritium (2 neutrons)

d. equal amounts of protium, deuterium and tritium

e. equal amounts of protium and deuterium, with a lesser amount of tritium

63. Which of the following sets of isotopic abundance data does NOT make sense based on the atomic weights listed in the periodic table for these elements?

a. vanadium-50, 0.25% and vanadium-51, 99.75%

b. bromine-79, 50.7% and bromine-81, 49.3%

c. lithium-6, 72.3% and lithium-7, 27.7%

d. neon-20, 90.5% and neon-22, 9.5%

e. boron-10, 19.8% and boron-11, 80.2%

64. There are 4 naturally occurring isotopes of strontium. The mass numbers of these isotopes are 84, 86, 87 and 88. One isotope makes up about 82% of a typical sample of strontium. Based on the atomic weight listed in the periodic table, which isotope is the most abundant?

a. strontium-84

b. strontium-86

c. strontium-87

d. strontium-88

e. It is impossible to answer this question from the available information.

65. A single orbital (for example: a *d* orbital in the 3rd shell or a 2*p* orbital) has a maximum capacity of

a. 2 protons.

b. 2 neutrons.

c. 2 electrons.

d. 6 electrons.

e. 10 electrons.

66. Which of these orbitals has the highest energy?

a. 1*s*

b. 2*s*

c. 3*s*

d. 4*s*

e. 5*s*

67. Which is a spherically-shaped region of electron density?

a. any orbital in an *s* subshell

b. any orbital in a *p* subshell

c. 3*d* orbital

d. 4*f* orbital

e. **none of the above**

68. How many distinct d-orbitals exist? Remember, the d-block is ten elements wide.

a. 3

b. 5

c. 6

d. 10

e. 18

69. How many electrons can occupy the shell having n = 2?

a. 2

b. 6

c. 8

d. 18

e. 32

70. How many electrons are in an atom with electron configuration: $1s^2 2s^2 2p^6 3s^2 3p^6$?

a. 5

b. 8

c. 10

d. 11

e. 18

71. What is the electron configuration for an uncharged (neutral) cadmium atom?

a. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10}$

b. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2$

c. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$

d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$

e. $1s^4 2s^4 2p^{12} 3s^4 3p^{12} 4s^4 3d^8$

72. The neutral element with electron configuration $1s^2 2s^2 2p^4$ is:

a. Be

b. C

c. O

d. Si

e. S

73. Which have the following electron configuration? $1s^2 2s^2 2p^6 3s^2 3p^6$

a. S and Cl

b. K^+ and P^{3-}

c. Ar and Ca^{2+}

d. **a and b**

e. **b and c**

74. Which is the correct electron configuration for an uncharged selenium atom in the ground state?

a. $[Ar]3s^2 3d^{10} 3p^4$

b. $[Ar]4s^2 4d^{10} 4p^4$

c. $[Ar]4s^2 3d^{10} 4p^4$

d. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$

e. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^{10} 4p^6$

75. Which is the correct ground state electron configuration for a neutral scandium atom?

a. $[Ar]4d^3$

b. $[Ar]4s^2 3d^1$

c. $[Ar]3s^2 3p^1$

d. $1s^2 1p^6 2s^2 2p^6 3s^2 3p^3$

e. $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4d^1$

76. Which is the correct ground state electron configuration for aluminum ion, Al^{3+}?

a. $1s^2 2s^2 2p^2$

b. $1s^2 2s^2 2p^6$

c. $1s^2 2s^2 2p^2 3s^2$

d. $1s^2 2s^2 2p^6 3s^2 3p^1$

e. $1s^2 2s^2 2p^2 3s^2 3p^2$

77. Which of the following represents a ground state electron configuration?

a.	1s ↑↓	2s ↑↓	2p ↑ ↑ ↑	3s ↑
b.	1s ↑↓	2s ↑↓	2p ↑↓ ↑↓ ↑	3s __
c.	1s ↑↓	2s ↑	2p ↑ ↑ ↑	3s __
d.	1s ↑	2s ↑	2p ↑ ↑ ↑	3s ↑
e.	1s ↑↓	2s ↑↓	2p ↑↓ ↑ ↑	3s ↑

78. Which could be represented by the following electron configuration?

1s ↑↓ 2s ↑↓ 2p ↑ ↑ ↑ 3s __

a. an oxygen ion in an excited state

b. a carbon atom in an excited state

c. a nitrogen atom in the ground state

d. a phosphorus atom in the ground state

e. a fluorine atom that has gained two electrons

79. Which represents the electron configuration of a neutral sodium atom in an excited state?

a. $[He]2s^2 2p^6 3s^1 3p^1$

b. $1s^2 2s^2 2p^6$

c. $1s^2 2s^2 2p^5 3s^1$

d. $[Ne]3p^1$

e. $[Ne]3s^2$

80. The valence shell for a neutral atom of rubidium is n = _____.

a. 2

b. 3

c. 4

d. 5

e. 6

81. Elements that have one, two or three valence electrons are likely

a. metals.

b. nonmetals.

c. nearly inert.

d. liquids at room temperature.

e. gases at room temperature.

82. Antimony is a _____ that has _____ valence electrons.

a. metal, 3

b. nonmetal, 3

c. metalloid, 4

d. nonmetal, 5

e. metalloid, 5

83. The valence electrons in a neutral atom of gallium are:

a. $3p^1$

b. $4p^1$

c. $3s^2 3p^1$

d. $4s^2 4p^1$

e. $4s^2 4p^6$

84. Sodium and lithium have similar chemical properties because

a. they have the same number of valence electrons.

b. sodium ion and lithium ion are isoelectronic.

c. they are both alkaline earth metals

d. **a and b**

e. **a and c**

85. The neutral element that has exactly four valence electrons is:
   a. H
   b. Na
   c. Mg
   d. Si
   e. S

86. In terms of atomic structure, the common characteristic of elements in the same group is:
   a. number of electrons
   b. number of valence electrons
   c. number of neutrons
   d. number of protons
   e. mass number

87. A polonium atom that has gained 2 electrons has the same number of electrons as:
   a. a neutral atom of lead
   b. a neutral atom of radium
   c. an atom of astatine that has lost 1 electron
   d. an atom of barium that has lost 2 electrons
   e. an atom of radium that has lost 2 electrons

88. The term "isoelectronic" refers to species that
   a. have the same charge.
   b. have identical mass numbers, A.
   c. have identical electron configurations.
   d. reside in the same period in the periodic table.
   e. have the same number of protons, but different numbers of neutrons.

89. A sulfur atom that has gained two electrons has the same number of electrons as a neutral atom of:
   a. C
   b. Ne
   c. Mg
   d. Si
   e. Ar

90. Rb^+ is isoelectronic with:
   a. K^+
   b. Cs^+
   c. Kr
   d. **a and b**
   e. **all of the above**