

Chapter 1 Problems - Introduction to Chemistry

The first part of this exercise has been designed to familiarize you with the names and symbols of some of the elements. Fill in the name, symbol and multiple choice answer for each problem.

	<u>Element</u>	<u>Symbol</u>	<u>Multiple Choice</u>
Choices for 1-4: a. Br b. Bi c. B d. Ba e. Be			
1. Compounds of this group IIIA (or 13) element are important in cleaners (<i>also what one termite might say to another</i>).	_____	_____	_____
2. A heavy alkaline earth element. Despite the toxicity of its salts, one of the salts (sulfate) is used in the "milk shakes" taken by a patient for a gastrointestinal series of X-rays (<i>also what happens to patients when the doctor fails</i>).	_____	_____	_____
3. The heaviest nonradioactive element.	_____	_____	_____
4. This halogen is the only liquid non-metal.	_____	_____	_____
Choices for 5-7: a. Ge b. Hg c. He d. H			
5. The only liquid metal. Used for thermometers and to make amalgams for items such as tooth fillings (<i>also a Greek stalker who wore shoes with wings</i>).	_____	_____	_____
6. The lightest gas. By far the most common element in the sun and universe.	_____	_____	_____
7. An inert gas used in balloons (<i>also what a doctor tries to do to patients</i>).	_____	_____	_____
Choices for 8-11: a. Na b. Ni c. Ne d. N e. Zn			
8. Transition metal used in many alloys such as brass and to galvanize steel (<i>also where you pour stale milk</i>).	_____	_____	_____
9. Alkali metal whose ion is blamed for high blood pressure.	_____	_____	_____
10. Inert gas used in colored display lights.	_____	_____	_____
11. Nonmetal which is 78% of air (<i>also what one trogen says to another on the way to bed</i>).	_____	_____	_____

	<u>Element</u>	<u>Symbol</u>	<u>Choice</u>
Choices for 12-15: a. C b. Ce c. Ca d. Co e. Cu			
12. Compounds of this alkaline earth metal make up limestone, chalk, teeth and bones.	_____	_____	_____
13. This transition metal is used for electrical wiring.	_____	_____	_____
14. This is the transition metal present in Vitamin B ₁₂ (<i>also what happens to men as they grow old</i>).	_____	_____	_____
15. Organic chemistry is the chemistry of compounds of this element. It occurs as diamond and graphite.	_____	_____	_____
Choices for 16-17: a. I b. K c. Kr d. Mg e. Mn			
16. This inert gas is also the name for Superman's planet.	_____	_____	_____
17. This halogen is used as an antiseptic.	_____	_____	_____
Choices for 18-20: a. Si b. S c. Se d. Sn e. Ra			
18. The second most abundant element in the earth's crust is used in semiconductors (<i>also a joker in jail</i>).	_____	_____	_____
19. This alkaline earth metal is radioactive and has been used on watch and clock hands (<i>also what police do to wild parties</i>).	_____	_____	_____
20. This nonmetal is used in the vulcanization of natural rubber and as a fungicide.	_____	_____	_____
Choices for 21-25: a. P b. Pt c. Pb d. Pu e. U			
21. This transuranium element is used in nuclear weapons and reactors and is extremely toxic.	_____	_____	_____
22. This silvery white, rare transition metal is used in jewelry and for electrical contacts (<i>also what you might like to do to a big meanie</i>).	_____	_____	_____
23. This nonmetal is used in the manufacture of match heads, pesticides and detergent additives.	_____	_____	_____
24. This radioactive element is used in nuclear reactors and weapons.	_____	_____	_____
25. This metal is used in the manufacture of storage batteries and X-ray shields.	_____	_____	_____

	<u>Element</u>	<u>Symbol</u>	<u>Multiple Choice</u>
Choices for 26-30: a. Ar b. Al c. Au d. Ag e. As			
26. This inert gas is the third most abundant gas in the atmosphere.	_____	_____	_____
27. This member of Group IIIA (or 13) is used extensively in foil, kitchen utensils and wiring.	_____	_____	_____
28. This member of the nitrogen family is used in the manufacture of pesticides.	_____	_____	_____
29. This transition metal has often been used as the base for monetary systems and is used in jewelry.	_____	_____	_____
30. This brilliant white metal is an excellent electrical conductor and used in jewelry and tooth fillings.	_____	_____	_____
Choices for 31-34: a. O b. W c. Ti d. Li			
31. Compounds of this member of the alkali metals are used to treat some types of mental disorders.	_____	_____	_____
32. This nonmetal is the second most abundant element in the atmosphere and the most abundant in the earth's crust.	_____	_____	_____
33. This transition metal is used for light bulb filaments.	_____	_____	_____
34. This transition metal is as strong as steel but 45% less dense.	_____	_____	_____
Choices for 35-38: a. F b. Fe c. Cl d. Cr			
35. Compounds of this halogen are used as additives in toothpastes (<i>also the opposite of roofing</i>).	_____	_____	_____
36. This halogen is used in bleaches and pools.	_____	_____	_____
37. This transition metal is used as a coating on water taps and bumpers because of its luster.	_____	_____	_____
38. This transition metal is the main element in steel (<i>also a really pressing thing</i>).	_____	_____	_____

Choose the correct number of protons, electrons and neutrons (for the examples given, there is only one abundant natural isotope).

element or ion	a	b	c	d	answer
39. H	1, 1, 0	1, 1, 1	1, 0, 0	none	_____
40. He	4, 4, 4	2, 2, 2	2, 2, 4	none	_____
41. F	10, 10, 9	9, 9, 10	9, 9, 9	none	_____
42. F ⁻	10, 9, 10	9, 10, 10	9, 10, 9	none	_____
43. Na	11, 12, 12	11, 10, 12	12, 12, 11	none	_____
44. Na ⁺	11, 10, 12	11, 13, 12	12, 11, 11	none	_____
45. Mn	55, 55, 25	25, 25, 30	30, 30, 25	none	_____
46. Mn ²⁺	25, 27, 30	30, 28, 25	25, 23, 30	none	_____
47. I	74, 74, 53	53, 54, 74	53, 53, 74	none	_____
48. I ⁻	74, 73, 53	53, 54, 74	53, 53, 74	none	_____
49. Bi	83, 83, 126	126, 126, 83	83, 80, 126	none	_____
50. Bi ³⁺	83, 83, 126	83, 80, 126	120, 123, 83	none	_____

51. $^{235}_{92}\text{U}$ undergoes nuclear fission when impacted by neutrons and is therefore utilized as a fuel in nuclear reactors. $^{238}_{92}\text{U}$ does not undergo nuclear fission when impacted by neutrons (although it can be converted to fissionable $^{239}_{94}\text{Pu}$ in "breeder reactors"). Because of the natural abundances of the uranium isotopes (234 - 0.0057%, 235 - 0.72%, 238 - 99.27%), fuel for nuclear reactors is expensive (uranium is a relatively rare element and it is difficult to separate isotopes). How many neutrons are in $^{235}_{92}\text{U}$ and $^{238}_{92}\text{U}$ respectively?

a. 235, 238 b. 143, 146 c. 92, 92 d. none of the previous answers _____

52. An alternative to nuclear fission reactors that is still in the development stage involves the use of nuclear fusion reactions that utilize one of the isotopes of hydrogen, ^2_1H (often called deuterium). There are three known isotopes of hydrogen, two of which are naturally occurring (99.985% ^1_1H , 0.015% ^2_1H). The third isotope is radioactive (^3_1H - tritium) and has a half-life of 12.26 years. Although the percentage of deuterium in nature is very low, there is sufficient hydrogen around to supply fuel for deuterium fusion reactors for millions of years. How many neutrons are in the three isotopes of hydrogen (^1_1H , ^2_1H , ^3_1H) respectively?

a. 1, 2, 3 b. 1, 1, 1 c. 0, 0, 0 d. 0, 1, 2 e. none

53. Which statement below is incorrect?
- a. Up to an atomic number of 20, the numbers of protons and neutrons are about equal.
 - b. Chlorine atoms have 18.453 neutrons.
 - c. The element with atomic number 50 has more than one stable isotope.
 - d. Zinc has 5 stable isotopes.
 - e. Technetium does not have any stable isotopes. _____
54. Which statement below is always incorrect?
- a. Elements with atomic masses close to whole numbers (within 0.05) probably have a predominance of one isotope.
 - b. Elements with even atomic numbers have many more isotopes than elements with odd atomic numbers.
 - c. Elements with atomic masses that deviate from whole numbers by more than 0.1 probably have more than one naturally occurring isotope.
 - d. The atomic mass of copper indicates that there are at least two stable isotopes of copper.
 - e. Elements with odd atomic numbers often have only one stable isotope. _____
55. Considering only the atomic mass of sodium, which conclusion below is not necessarily correct?
- a. Sodium has one and only one stable isotope.
 - b. The isotopes of sodium have an average of 12 neutrons.
 - c. The isotope of sodium with 12 neutrons is probably by far the most abundant isotope of sodium and may be the only stable isotope of sodium.
 - d. Because sodium has an odd atomic number, it can have only one stable isotope.
 - e. None of the above. _____
56. Except for small but very important differences in rates of chemical reactions, isotopes (of the same element) behave identically in chemical reactions (in sharp contrast, nuclear stability is very dependent on the neutron to proton ratio). The very significant exception to this observation is that replacement of hydrogen-1 by hydrogen-2 (deuterium) can result in rate changes of as much as a factor of seven in chemical reactions. Why is it that hydrogen isotopes have such a large rate difference when intimately involved in a chemical reaction?
- a. Hydrogen is diatomic.
 - b. Hydrogen is a gas.
 - c. The isotopes of hydrogen differ in mass by a factor of 2 whereas most isotopes differ in mass by a small percentage.
 - d. None of the above. _____

57. Shortly after the Chernobyl nuclear reactor accident, some people took potassium iodide tablets to dilute the radioactive iodide in their bodies and diminish its retention in the thyroid gland. Although many experts questioned this practice, little harm was probably caused because of the relatively low toxicity of KI. However, on May 12, 1986, *Newsweek* incorrectly captioned a photo that showed a child apparently receiving KI with "On Alert: Administering iodine to Polish children." Which statement is incorrect?
- The caption was fine.
 - The caption is incorrect because iodine is toxic.
 - The caption should have read "On Alert: Administering potassium iodide to Polish children."
58. What color is water? a. clear b. transparent c. white d. colorless e. none
59. Hg means: a. hydrogen b. hydragyrum (water silver) c. halogen d. none

Dalton's original atomic theory consisted of 5 rules:

- Elements are made of extremely small particles called atoms*
 - Atoms of a given element are identical in size, mass, and other properties atoms of different elements differ in size, mass, and other properties.*
 - Atoms cannot be subdivided, created, or destroyed.*
 - Atoms of different elements combine in simple whole-number ratios to form chemical compounds.*
 - In chemical reactions, atoms are combined, separated, or rearranged.*
60. Since the time of Dalton, much more information about the atom has become available. Which of the following statements is true:
- All of Dalton's rules were wrong.
 - Only item 2 needed modification due to the discovery of isotopes.
 - Items 2 and 3 needed modification due to the discovery of isotopes and the experiments demonstrating that atoms can be broken down.
 - None of Dalton's rules needed modification.
 - None of the above.

Label the following as: a. element b. compound c. mixture d. none of the previous

- water
- salt water
- air
- neon
- wine
- carbon dioxide
- mercury