Practice questions for Ch. 2

1. The first chemist to perform truly quantitative experiments was
   A) Paracelsus
   B) Boyle
   C) Priestly
   D) Bauer
   E) Lavoisier

2. Which of the following pairs of compounds can be used to illustrate the law of multiple proportions?
   A) NH_4 and NH_4Cl
   B) ZnO_2 and $ZnCl_2$
   C) H_2O and HCl
   D) NO and NO_2
   E) CH_4 and CO_2

3. Which of the following statements from Dalton's atomic theory is no longer true, according to modern atomic theory?
   A) Elements are made up of tiny particles called atoms.
   B) Atoms are not created or destroyed in chemical reactions.
   C) All atoms of a given element are identical.
   D) Atoms are indivisible in chemical reactions.
   E) All of these statements are true according to modern atomic theory.

4. Avogadro's hypothesis states that:
   A) Each atom of oxygen is 16 times more massive than an atom of hydrogen.
   B) A given compound always contains exactly the same proportion of elements by mass.
   C) When two elements form a series of compounds, the ratios of masses that combine with 1 gram of the first element can always be reduced to small whole numbers.
   D) At the same temperature and pressure, equal volumes of different gases contain an equal number of particles.
   E) Mass is neither created nor destroyed in a chemical reaction.

5. The first scientist to show that atoms emit any negative particles was
   A) J. J. Thomson
   B) Lord Kelvin
   C) Ernest Rutherford
   D) William Thomson
   E) John Dalton

6. The scientist whose alpha-particle scattering experiment led him to conclude that the nucleus of an atom contains a dense center of positive charge is
   A) J. J. Thomson
   B) Lord Kelvin
   C) Ernest Rutherford
   D) William Thomson
   E) John Dalton

7. Bromine exists naturally as a mixture of bromine-79 and bromine-81 isotopes. An atom of bromine-79 contains
   A) 35 protons, 44 neutrons, 35 electrons
   B) 34 protons and 35 electrons, only
   C) 44 protons, 44 electrons, and 35 neutrons
   D) 35 protons, 79 neutrons, and 35 electrons
   E) 79 protons, 79 electrons, and 35 neutrons

8. Which of the following atomic symbols is incorrect?
   A) $^{14}_{6}C$
   B) $^{37}_{17}Cl$
   C) $^{32}_{15}P$
   D) $^{39}_{19}K$
   E) $^{14}_{8}N$

9. Which among the following represent a set of isotopes? Atomic nuclei containing:

   I. 20 protons and 20 neutrons
   II. 21 protons and 19 neutrons
   III. 22 neutrons and 18 protons
   IV. 20 protons and 22 neutrons
   V. 21 protons and 20 neutrons

   A) I, II, III
   B) III, IV
   C) I, V
   D) I, IV and II, V
   E) No isotopes are indicated.

10. By knowing the number of protons a neutral atom has, you should be able to determine
    A) the number of neutrons in the neutral atom
    B) the number of electrons in the neutral atom
    C) the name of the atom
    D) two of the above
    E) none of the above

11. Which of the following statements is (are) true?
    A) $^{18}_{8}O$ and $^{19}_{9}F$ have the same number of neutrons.
    B) $^{14}_{6}C$ and $^{14}_{7}N$ are isotopes of each other because their mass numbers are the same.
    C) $^{18}_{8}O^{2-}$ has the same number of electrons as $^{20}_{10}Ne$.
    D) A and B
    E) A and C

12. Which of the following are incorrectly paired?
    A) K, alkali metal
    B) Ba, alkaline earth metal
    C) O, halogen
    D) Ne, noble gas
    E) Ni, transition metal

13. All of the following are characteristics of metals *except*:
    A) good conductors of heat
    B) malleable
    C) ductile
    D) often lustrous
    E) tend to gain electrons in chemical reactions

14. You are given a compound with the formula MCl_2, in which M is a metal. You are told that the metal ion has 26 electrons. What is the identity of the metal?
    A) Fe
    B) Al
    C) Zn
    D) Co
    E) Ni

15. How many oxygen atoms are there in one formula unit of $Ca_3(PO_4)_2$?
    A) 2
    B) 4
    C) 6
    D) 8
    E) none of these

16. The correct name for FeO is
    A) iron oxide
    B) iron(II) oxide
    C) iron(III) oxide
    D) iron monoxide
    E) iron(I) oxide

17. Which of the following is *incorrectly* named?
    A) SO_3^{2-}, sulfite ion
    B) $S_2O_3^{2-}$, thiosulfate ion
    C) PO_4^{3-}, phosphate ion
    D) ClO_3^-, chlorite ion
    E) CN^-, cyanide ion

18. All of the following are in aqueous solution. Which is *incorrectly* named?
    A) $HC_2H_3O_2$, acetic acid
    B) HBr, bromic acid
    C) H_2SO_3, sulfurous acid
    D) HNO_2, nitrous acid
    E) $HClO_3$, chloric acid

19. Which metals form cations with varying positive charges?
    A) transition metals
    B) Group 1 metals
    C) Group 2 metals
    D) Group 3 metals
    E) metalloids

20. Complete the following table.

Symbol	# Protons	# Neutrons	# Electrons	Net Charge
^{206}Pb				
	31	38		3_+
	52	75	54	
Mn^{2+}		30		2_+

21. Write the names of the following compounds:
    a) $FeSO_4$ _____
    b) $NaC_2H_3O_2$ _____
    c) KNO_2 _____
    d) $Ca(OH)_2$ _____
    e) $NiCO_3$ _____

22. Which of these statements is a consequence (follows from) the Law of Definite Proportion?
    A) All samples of chlorine contain ^{35}Cl and ^{37}Cl in the same (definite) ratio.
    B) The mass of oxygen that is combined with a fixed mass of nitrogen in each of the binary nitrogen oxides can be expressed as a ratio of small whole numbers.
    C) The atomic masses of all of the elements in the periodic table have fixed values.
    D) The % lead by mass in the compound galena is the same for all pure samples obtained from any source.
    E) None of these is correct

23. How many protons, neutrons and electrons, in that order are present in the anion formed by one atom of ^{79}Se?
    A) 34, 34, 45
    B) 34, 45, 34
    C) 32, 45, 34
    D) 34, 45, 36
    E) 36, 45, 36

24. Which of the following compounds is incorrectly named?
    A) $Mg(OH)_2$ is magnesium dihydroxide
    B) CaO is calcium oxide
    C) NH_4NO_3 is ammonium nitrate
    D) K_3PO_4 is potassium phosphate
    E) $MgSO_3$ is magnesium sulfite

Answer key to practice questions for Ch. 2

1. B
2. D
3. C
4. D
5. A
6. C
7. A
8. E
9. D
10. D
11. E
12. C
13. E
14. E
15. D
16. B
17. D
18. B
19. A
20.

Symbol	# Protons	# Neutrons	# Electrons	Net Charge
^{206}Pb	82	124	82	0
Ga^{3+}	31	38	28	3+
Te^{2-}	52	75	54	2-
Mn^{2+}	25	29	23	2+

21.

iron(II) sulfate
sodium acetate
potassium nitrite
calcium hydroxide
nickel(II) carbonate

22. D
23. D
24. A

Solutions to selected practice questions for Ch. 2

(8.) First we need to make sure that the element symbol is consistent with the atomic number

Nitrogen (N) has an atomic number of 7, not 8

so $^{14}_{8}N$ is wrong.

(9.) We are looking for atoms that have the same no. of protons and different no. of neutrons.

I. 20 p, 20 n ←
II. 21 p, 19 p ←
III. 22 n, 18 p
IV. 20 p, 22 n ←
V. 21 p, 20 n ←

I, IV and II, V

(14.) MCl_2 implies that M has a charge of +2

If the ion (with a charge of +2) has 26 electrons, the neutral atom would have 28 electrons (and an atomic no. of 28)

→ the metal is Ni

(23.) ^{79}Se has an atomic no. of 34 (i.e. 34 protons)

no. of neutrons = mass no. − no. of protons

= 79 − 34 = 45

Se is a nonmetal in Group 6A (2 positions away from the noble gases), so it forms a divalent anion (charge = −2)

no. of electrons of the anion = 34 + 2 = 36

⇒ 34 p, 45 n, 36 e