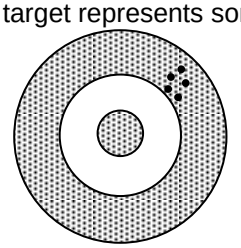
1. The following target represents someone who is:



   a) accurate, but not precise
   b) precise, but not accurate
   c) both precise and accurate
   d) neither precise, nor accurate

2. How close a measurement is to the true value is the _____ of the measurement and is communicated as _____
   a) accuracy, % error
   b) accuracy, ± notation
   c) precision, % error
   d) precision, ± notation

3. Consider the following data:

mass of slab	35.24 g
length of slab	35.14 cm
width of slab	15.85 cm
height of slab	0.68 cm

   What is the density of the slab? Show work.

4. Question was removed.

5. Which one of the following elements is diatomic?
   a) Cl
   b) S
   c) Mg
   d) C

6. Convert 0.00527 km into cm. Show work.

7. The accepted value for the density of aluminum is 2.70 g/cm^3. Your measurements indicate that the density is 2.80 g/cm^3. Is this an indication of the accuracy or precision of the measurement?

8. The measured density of aluminum is actually 2.80 ± 0.03 g/cm^3. Is the ± value an indication of the accuracy or precision of the measurement?

9. Write the following in scientific notation with correct sig figs:

   5000 g _____

   0.00350 L _____

   45.8 kg _____

   0.0000000262 km _____

   375 x 10^3 mL _____

10. What gas is formed when Zn metal is mixed with hydrochloric acid, HCl?

a) CO_2 c) O_2

b) He d) H_2

11. Which property is always conserved during a chemical reaction?

a) mass c) pressure

b) volume d) solubility

12. A cylinder is weighed empty and with a liquid.

Cylinder with liquid	51.85 g
Cylinder, empty	40.11 g
Volume of liquid in cylinder	7.0 mL

What is the density of the liquid?

a) 13 g/mL c) 5.7 g/mL

b) 7.4 g/mL d) 1.7 g/mL

CHEMICAL FORMULAS

13. Which one of the following is the correct formula for aluminum oxide?

a) AlO c) Al_2O_3

b) Al_6O_6 d) Al_3O_2

14. What is the name of the compound CF_4?

a) fluorocarbonate

b) carbon tetrafluoride

c) tricarbo fluoride

d) carbon difluorate

15. Sodium nitride has the formula Na_3N. What is the formula for magnesium nitride?

a) Mg_2N c) Mg_3N_2

b) Mg_3N d) Mg_2N_3

CHEMICAL EQUATIONS

16. Which set of coefficients balances the equation for the complete combustion of ethane, C_2H_6?

$\_\_C_2H_6 + \_\_O_2 \rightarrow \_\_CO_2 + \_\_H_2O$

a) 1,3,2,3 c) 2,6,4,5

b) 1,6,2,6 d) 2,7,4,6

17. When this expression is balanced,

$\_\_C_3H_6 + \_\_ O_2 \rightarrow \_\_\_ CO_2 + \_\_H_2O$

what is the coefficient of oxygen, O_2?

a) 6 c) 12

b) 9 d) 18

18. An acid was neutralized by the following reaction:

$NaOH + HCl \rightarrow NaCl + H_2O$

This reaction would be classified as…

a) synthesis

b) decomposition

c) double replacement

d) single replacement

19. Which reaction below would be classified as a decomposition reaction?

a) $NaHCO_3 \rightarrow NaOH + CO_2$

b) $2\ H_2 + O_2 \rightarrow 2\ H_2O$

c) $2\ AgNO_3 + Cu° \rightarrow Cu(NO_3)_2 + 2\ Ag°$

d) $Ba(OH)_2 + H_2SO_4 \rightarrow BaSO_4 + 2\ H_2O$

20. The complete combustion of ethane, C_2H_6, produces

a) C_2H_5OH c) CO_2 and H_2

b) CH_3COOH d) CO_2 and H_2O

21. Of the three particles; protons, neutrons, and electrons, which one(s) are responsible for most of the **mass** of an atom?
    a) the protons only
    b) the electrons only
    c) the neutrons only
    d) the protons and neutrons
    e) the protons and electrons

Questions 22 - 25 refer to the following terms. Each answer may be used once, more than once, or not at all.

a) proton
b) neutron
c) electron
d) proton and neutron

22. Moves very quickly around the nucleus.
23. Has a mass of 1 amu.
24. Has a charge of -1.
25. Defines the volume of the atom.

26. If you constructed an atomic model the size of the classroom, the nucleus might be formed from
    a) several softballs
    b) several ping pong balls
    c) several pieces of sand

27. The ***modern*** periodic table has the elements arranged in order of increasing
    a) electron energy
    b) atomic number
    c) atomic size
    d) molar mass

28. Which element would be the best conductor?
    a) Sn
    b) S
    c) As
    d) P

Questions 29 – 32 refer to the following families. Each answer may be used once, more than once, or not at all.

a) halogen family
b) alkaline earth metal family
c) alkali metal family
d) noble gas family

29. Very unreactive
30. Form 2+ ions
31. React with water
32. Includes Ca, Mg, and Ba

33. The fact that hydrogen forms diatomic molecules makes it similar to the _____ family.
    a) halogen
    b) alkali metal
    c) noble gas
    d) alkaline earth metal

34. The fact that hydrogen has one valence electron makes it similar to the _____ family.
    a) halogen
    b) alkali metal
    c) noble gas
    d) alkaline earth metal

35. Properties of metals include:
    a) brittleness
    b) poor conductivity
    c) dull surface
    d) can be pounded into sheets

36. Which family contains examples of metals, semi-metals, and non-metals?
    a) H/Li
    b) C/Si
    c) F/Cl
    d) He/Ne

37. List the elements, P, As, S in order of largest to smallest atomic radius.

a) P > As > S
c) S > P > As
b) As > P > S
d) P > S > As

38. When a neutral Cl atom becomes a Cl^- ion how and why does the size change?

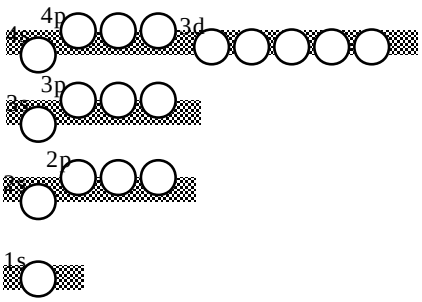
a) bigger / more electron-electron repulsion
b) smaller / more electron-proton attraction
c) bigger / more electron-proton repulsion
d) smaller / more electron-electron attraction

39. Where are the largest atoms located on the periodic table?

a) upper right
c) upper left
b) lower right
d) lower left

Questions 40 – 42 refer to the iron, Fe, atom:

40. Fill in the orbital diagram for **Fe** (Z=26).



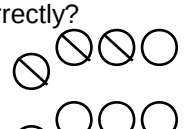
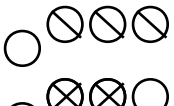
41. Iron's electrons that are farthest from the nucleus occupy the ___ orbital.

a) 4s
c) 3p
b) 4p
d) 3d

42. Iron's electrons that have the highest energy occupy the ___ orbital.

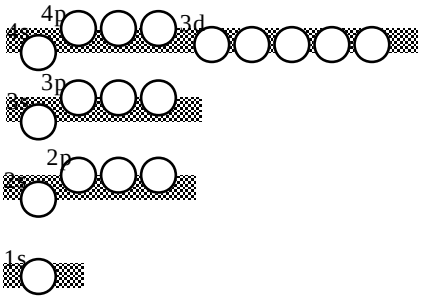
a) 4s
c) 3p
b) 4p
d) 3d

43. Which electrons are being placed into orbitals correctly?

a) 
c) 
b) 
d) 

Questions 44 – 46 refer to the sulfur, S, atom:

44. Fill in the orbital diagram for **S** (Z=16).



45. How many orbitals in sulfur have only one electron?

a) zero
c) 2
b) 1
d) 3

46. How many electrons in sulfur are available for bonding (valence electrons)?

a) 2
c) 6
b) 4
d) 8

47. Which element below has the greatest ionization energy?

a) Na
c) Mg
b) K
d) Ca

Questions 48 – 51 refer to an isotope with a mass number of 31, 16 protons, and a charge of 2-.

48. The atomic number is ___.

a) 14 b) 15 c) 16 d) 18

49. The isotope contains ___ electrons.

a) 14 b) 15 c) 16 d) 18

50. The nucleus contains ___ neutrons.

a) 14 b) 15 c) 16 d) 18

51. The element is ___.

a) Si b) P c) S d) Ar

52. Give the 4 quantum numbers for sulfur.

a) 3, 1, -1, ½ c) 3, 2, -1, -1/2

b) 3, 1, -1, -1/2 d) 3, 2, -1, 1/2

53. Give the 4 quantum numbers for Iron.

a) 3, 2, -2, -1/2 c) 3, 3, -2, -1/2

b) 3, 2, 2, -1/2 d) 3, 3, 2, -1/2

54. How many electrons can fit into a d sublevel?

a) 2 b) 6 c) 10 d) 14

55. How many electrons can fit on n=5?

a) 18 b) 25 c) 36 d) 50

56. A photon has 4.67×10^{-21}J of energy what is the wavelength in meters?

a) 4.25×10^{-5} c) 1.98×10^{-25}

b) 9.27×10^{-46} d) 23500

57. Predict the type of bonding formed by the following pairs of atoms from their position on the periodic table.

a) LiI metallic / ionic / covalent

b) NO metallic / ionic / covalent

c) ICl metallic / ionic / covalent

d) SnPb metallic / ionic / covalent

e) CuO metallic / ionic / covalent

58. State whether each bond is ionic, nonpolar covalent, or polar covalent.

a) Rb – N _____

b) As – Cl _____

c) Na – At _____

d) Cl – Br _____

Ionic Bonding

59. Draw Lewis electron dot symbols for:

N		N^{3-}	
O		O^{2-}	
F		F^{-}	
Ne			
Na		Na^{+}	
Mg		Mg^{2+}	
Al		Al^{3+}	

60. When K reacts with F_2, the compound ____ is formed.

K, _____ (gains/loses) ___ electron(s) while
F, _____ (gains/loses) ___ electron(s).

74. Cl will be isoelectronic with the noble gas, ____, when it _____ (gains / loses) 1 e^-.

75. Add dots to the element symbols below to show the Lewis electron dot symbols for the following and state the bonding capacity.

Li	Be	B	C	N	O	F	Ne

76. Draw Lewis structures for the following molecules:
a) H_2O _____
b) CH_4 _____
c) PCl_3 _____
d) LiH _____
e) H_2S _____
f) BF_3 _____
g) C_2H_4 _____
h) CO_2 _____

77. Give the molecular geometry
a) H_2O _____
b) CH_4 _____
c) PCl_3 _____
d) LiH _____
e) H_2S _____
f) BF_3 _____
g) C_2H_4 _____
h) CO_2 _____

78. Are the following polar or non polar molecules
a) H_2O _____
b) CH_4 _____
c) PCl_3 _____
d) LiH _____
e) H_2S _____
f) BF_3 _____
g) C_2H_4 _____
h) CO_2 _____

79. Draw the Lewis structure for hydrogen peroxide, H_2O_2, H–O–O–H. The molecule contains:

___ # shared (bonding) pairs of electrons and

___ # unshared (lone) pairs of electrons.

80. Given the following Lewis structures, state the shape of the molecules.

Molecule:	AlH_3	SiF_4	NH_3	H_2Te	HCl
Lewis Structure:					
Areas of electron density					
Molecular Geometry:					
Polar / Nonpolar?:					