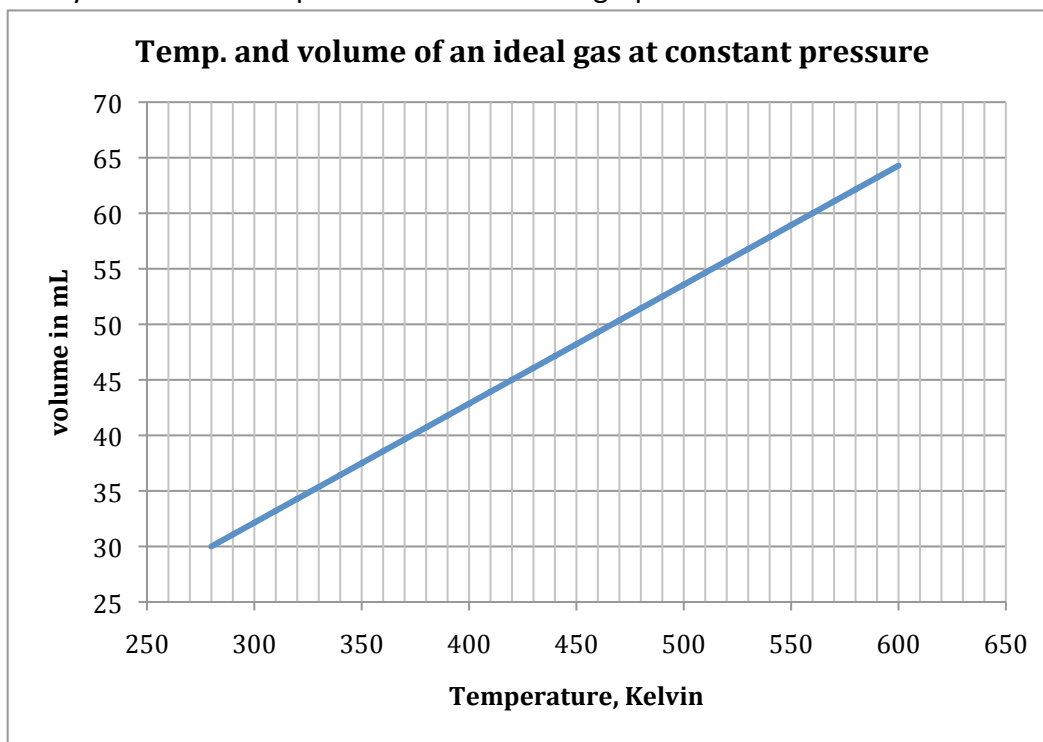Yeshivah of Flatbush High School
Science Department. Dr. Joyce Fruchter, Chair
Final Examination in Chemistry 1.
January 2011

Questions 1 to 55 must be answered on the Scantron sheet. (1.20 pts each)
Questions I to VII are in the test booklet. Write your name NOW on both the Scantron sheet and the test booklet.

Base your answers to questions 1 to 4 on the graph below:

1. The gas has a volume of 40. mL at a temperature of
    A) 350 K   B) 370 K   C)   430 K   D)   480 K

2. The lowest temperature shown on the graph is 250 K. In degrees Celsius this would be A) 23° B. −23°   C) 523°   D) −523°

3. The Y axis on this graph shows the volume. A graph with the **most** similar shape would result if the Kelvin temperature were plotted versus   A) vapor pressure of a liquid   B) pressure of a gas at constant volume   C) density of a gas at constant pressure

4. This graph illustrates that the volume of a gas varies
    A) directly with Kelvin temperature   B) inversely with Kelvin temperature   C) directly with pressure   D) inversely with pressure

5. Which measurement has three significant figures?
    A) 45.00 mm   B) 0.0560 g   C) 0.050 m   D)   11.08 mL

6. How many liters are there in 542 mL?   A) 54200   B) 542000
    C) 0.542   D) 5.42

7. Which is a unit of mass?   A) mL   B) cm^3 C) kg   D) m

8.   A substance that contains at least two different elements must be
    A) a compound   B) a mixture   C) a solution   D) an alloy

9. An example of an **exothermic, physical** change is
    A) ice melts   B)   liquid mercury freezes
    C) water boils   D) magnesium burns

10. All chemical changes **must** result in
    A) release of heat   B) formation of a new substance
    C) production of a gas   D) decreased temperature

11. Which set of changes MUST increase the volume of a gas? (assume that
    the number of gas particles is constant)
    A) increased temperature and increased pressure
    B) increased temperature and decreased pressure
    C) decreased temperature and increased pressure
    D) decreased temperature and decreased pressure

12.   A mixture of neon, argon, and helium gas is contained in a 10.0 liter
    container at 300. K. The total pressure of the gases is 2.00 atm.
    If the neon and argon each have a partial pressure of 0.600 atm., what
    is the partial prssure of the helium?
    A) 0.600 atm   B) 0.800 atm.   C)   1.40 atm   D) 2.20 atm

13.   In the container described in question 12, the neon and argon must
    A) have the same number of molecules
    B) move at the same speed
    C) have the same mass
    D) have the same density

14.   A gas at a pressure of 3.00 atm has a volume of 12.0 mL.   What would
    the volume of the same gas be at a pressure of 2.00 atm if the
    temperature remains constant?
    A) 8.00 mL   B) 12.0 mL   C)   18.0 mL   D) 24.0 mL

15. How much heat is needed to raise the temperature of 20.0 grams of
    water from 25.0°C to 55.0°C ?
    A) 2090 joules   B) 2510 joules   C) 4600 joules   D) 600. joules

16. The quantity of heat required to melt one gram of ice is called
    A) specific heat   B) heat of fusion   C) heat of vaporization
    D) heat of reaction

17. The normal boiling point is the temperature at which the vapor pressure
    of the liquid is 1.00 atmosphere. Based on table H, what is the normal
    boiling point of propanone? A) 26°C   B) 56°C   C) 62°C   D) 79°

18. Which of the liquids on table H has the **strongest** intermolecular
    attractions? A) propanone   B) ethanol   C) water   D) ethanoic acid

19. At a temperature of 75° which liquid has the lowest vapor pressure?
    A) propanone   B) ethanol   C) water   D) ethanoic acid

20. How many grams of water can be boiled at 100.°C using 1130 joules of
    heat?   A) 0.500 g   B) 2.00 g   C) 11.3 g   D) 16.8 g

21-24   A. solids only   B. liquids only   C. gases only   D. all three states
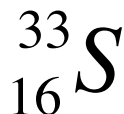
21. The molecules are constantly in motion

22.   Take the volume of their container

23.   The volume varies inversely with the pressure

24.   Formed when dry ice and iodine sublime

25 - 27. Base your answers on the atom represented by the symbol

$$^{33}_{16}S$$

25. The nuclear charge of this atom is
     A) + 16   B) + 17   C)   +33   D) 0

26. How many neutrons are there in this atom?
     A) 16   B) 17   C)   33   D) 49

27. How many **valence** electrons are there on this atom?
     A) 1   B) 6   C) 8   D) 16

28. The average atomic mass of a chlorine atom is 35.5 . Assume that chlorine consists entirely of two isotopes, one that has a mass of 35.0, and the other with a mass of 37.0. What percentage of chlorine atoms have a mass of 35.0? A) 25 %   B) 50 %   C) 75 %   D) 100 %

29. How many electrons will completely fill the third principal energy level?
    A) 3   B) 6   C) 8   D) 18

30. It requires the greatest amount of energy to remove one electron from an atom of A) O   B) F   C) Cl   D) Ar

31. In each period of the periodic table, the element with the largest atomic radius is A) a noble gas   B) an alkali metal   C) a halogen
    D) an alkaline earth metal

32. Which is the most active metal of the following?
    A) K   B) Ca   C) Na   D) Mg

33. On the modern periodic table, the elements are placed in order of their
    A) mass numbers   B) atomic masses   C) atomic numbers
    D) states

34. Which element often loses electrons from two principal energy levels?
    A) K   B) Fe   C) O   D) F

35. Which is an ionic compound? A) BrCl   B) KCl   C) CO_2 D) Cu

36. Which substance is a good conductor of electricity in the solid state?
    A) Ni   B) S   C) CS_2 D) KCl

37. A soft solid with a low melting point and poor electrical conductivity might have the formula
    A) $BaCl_2$ B) $C_6H_4Cl_2$ C) Ag   D) K_2O

38. Which is a polar molecule? A) CBr_4 B) NH_3 C) H_2 D) CO_2

39. Which molecule shows an attraction called hydrogen bonding?
    A) H_2 B) CH_4 C) H_2O D) HI

40. Based on the information on the periodic table, barium atoms generally react by A) losing one electron   B) losing two electrons
    C) gaining one electron   D) gaining two electrons

41. Most molecules contain bonds in which electrons are shared **unequally**. These bonds are called A) ionic bonds   B) metallic bonds C) nonpolar covalent bonds   D) polar covalent bonds

42. Which bond has the greatest amount of ionic character?
     A) As–Cl   B) Bi–Cl   C) P–Cl   D) N–Cl

43. All atoms of a given element must have the same
     A) mass number   B) number of protons   C) number of neutrons
     D) number of electrons plus neutrons

44. An atom of which element has the same electron configuration as an oxide ion? (O^{2-})   A) Li   B) Na   C) S   D) Ne

45. Most elements are A) metals   B) metalloids   C) nonmetals
     D) gases

46. Which solid contains positively charged kernals surrounded a sea of mobile electrons? A) Fe   B) I_2 C) NaCl   D) H_2O

47.   When the element with the configuration 2-8-8-2 bonds with the element with the configuration 2-8-7, we would expect the bonds that form to be A) metallic   B) polar covalent   C) nonpolar covalent   D) ionic

48. The bright line spectrum of an element is a series of colored lines, produced when A) electrons fall to lower energy levels B) electrons jump to higher energy levels   C) protons move to lower energy levels   D) neutrons move to higher energy levels

49. Which ion has the smallest ionic radius?
     A) Cl^- B) O^{2-} C) Mg^{2+} D) K^+

50. The shape of an ammonia molecule, NH_3, is best described as
     A) linear   B) equilateral triangle   C) triangular pyramid
     D) square

Questions 51 to 55   A) decreases   B) increases   C) remains the same

51. As the atomic number increases in group 2, the number of valence
      electrons...

52. As the external pressure decreases, the boiling temperature of a
      liquid....

53. As the temperature increases, the vapor pressure of a liquid.....

54.   As water boils, at constant pressure, the average kinetic energy of the
      molecules.....

55. As the temperature increases, the speed of molecular motion....

Name_____ Class _____

Time (minutes)	Temperature (Celsius)
0	80
0.5	71
1	63
1.5	55
2	53
2.5	53
3	53
3.5	53
4	53
4.5	53
5	53
5.5	48
6	42
6.5	34
7	25

A student heated a sample of paradichlorobenzene, $C_6H_4Cl_2$, to 80°, and then allowed the liquid to cool to room temperature. The temperature of the sample was recorded every half minute.

I. Plot the data from the table on the grid below.
 A. Choose an appropriate title for your graph.
 B. Label the two axis, choosing appropriate values for each axis.
 C. Circle all of your points, and connect them.

 (hint: you may want to BEGIN your Y axis at a temperature of 25 degrees) (4 pts)
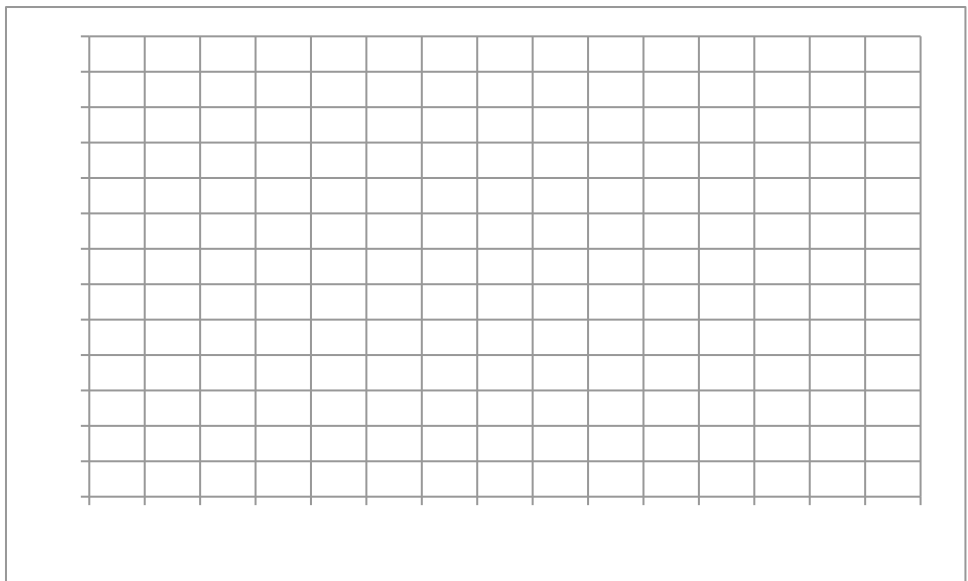
II. What phase change occurred during this experiment? (2pts)

III. At what temperature does this phase change occur? (2 pts)

IV. Draw dot structures for each of the following molecules (2 pts each)

A. PH_3 B. CO_2 C. H_2O D. N_2

V. 24.0 mL of neon gas is collected at standard temperature and pressure.

A. Express standard temperature and pressure in Kelvin, and kilopascals. (2 pts)

B. The gas is heated to a temperature of 400. K, and it expands to a new volume of 48.0 mL.

1. Set up the equation that should be used to find the new pressure of the gas in kilopascals. (2 pts)

2. Solve your equation, and find the new pressure of the gas. (2 pts)

VI. Provide the correct formulas for each of the following compounds: (2 pts each)

A. Barium nitrate _____

B. Sodium oxide _____

C. Nickel (II) phosphate_____

D. Provide the correct name of the substance with the formula NI_3

VII. Balance the following chemical equation: (2 pts)

$AlBr_3$ + $AgNO_3$ ➜ $Al (NO_3)_3$ + $AgBr$

What type of reaction is this? (2 pts)

Extra Credits

I. Draw the dot structure for the compound   Barium sulfate

II. Calculate the quantity of ice, in grams that can be converted from ice at
0°C to water at 50.0°C   using   3400. joules of heat.

III. A gas tank contains 50.0 grams of oxygen gas at a pressure of 5.00 atm, and a temperature of 350 K.   The tank springs a leak, and before it can be fixed, most of the oxygen leaks out, leaving only 10.0 grams in the tank. The temperature also changes, dropping to 300 K. What is the pressure of the oxygen gas remaining in the tank?

IV. For the gas graphed on page 1 of the exam, what would the volume be at a temperature of 800 K? (show work)