As you go through these questions, I have picked them because I think you already should be able to handle them. All the answers are in your head or on the Reference Tables. Sometimes there will be one word that you have NOT heard of. That happens right below in question #1. Never choose something that you don't know, it's probably not right. The answer to number one here is not a beta particle. You'll learn of them later in the year. If the question is in the packet, then you should be able to do the question correctly. If an answer is crazy (to you) then it's not correct. I know that, so don't choose crazy answers. Good luck.

NYS Chemistry Regents Exam from June 2015

1   Compared to an electron, which particle has a charge that is equal in magnitude but opposite in sign?
   A. an alpha particle   B. a beta particle   C. a neutron   D. a proton

2   The mass of a proton is approximately equal to
   A. 1 atomic mass unit   B. 12 atomic mass units
   C. the mass of 1 mole of carbon atoms   D. the mass of 12 moles of electrons

3   Which property increases when the elements in Group 17 are considered in order of increasing atomic number?
   A. 1st Ionization Energy   B. atomic radius   C. melting point   D. electronegativity

8   Which atom in the ground state has a stable valence electron configuration?   A. Ar   B. Al   C. Si   D. Na

9   What occurs when two fluorine atoms react to produce a fluorine molecule?
   A. Energy is absorbed as a bond is broken.   B. Energy is absorbed as a bond is formed.
   C. Energy is released as a bond is broken.   D. Energy is released as a bond is formed.

12 The concentration of a solution can be expressed in
   A. Kelvins   B. milliliters   C. Joules per kilogram   D. moles per liter

14 According to the kinetic molecular theory, which statement describes an ideal gas?
   A. The gas particles are diatomic.
   B. Energy is created when the gas particles collide.
   C. There are no attractive forces between the gas particles.
   D. The distance between the gas particles is small, compared to their size.

15 Which physical change is endothermic?
   A. $CO_{2(S)} \rightarrow CO_{2(G)}$ B. $CO_{2(\ell)} \rightarrow CO_{2(S)}$ C. $CO_{2(G)} \rightarrow CO_{2(\ell)}$ D. $CO_{2(G)} \rightarrow CO_{2(S)}$

17 Hydrocarbons are composed of the elements
   A. carbon and hydrogen, only   B. carbon and oxygen, only
   C. carbon, hydrogen, and oxygen   D. carbon, nitrogen, and oxygen

22 What is the oxidation state for a Mn atom?   A. 0   B. 7   C. 3   D. 4

23 Which compounds are classified as electrolytes?
   A. KNO_3 and H_2SO_4 B. KNO_3 and CH_3OH C. CH_3OCH_3 and H_2SO_4 D. CH_3OCH_3 and CH_3OH

31 Which electron shell contains the valence electrons of a radium atom in the ground state?
   A. the sixth shell   B. the second shell   C. the seventh shell   D. the eighteenth shell

32 Each diagram here represents the nucleus of an atom.   How many different elements are represented by the diagrams?
A. 1   B. 2   C. 3   D. 4

$$\begin{array}{cccc} \binom{1p}{0n} & \binom{1p}{1n} & \binom{2p}{1n} & \binom{2p}{2n} \end{array}$$
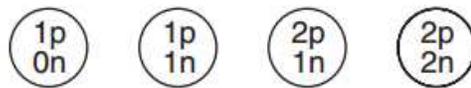
33 Chlorine and element X have similar chemical properties.
An atom of element X could have an electron configuration of   A. 2-2   B. 2-8-1   C. 2-8-8   D. 2-8-18-7

34 Which group of elements contains a metalloid?   A. Group 8   B. Group 2   C. Group 16   D. Group 18

35 Which Lewis electron-dot diagram represents a fluoride ion?

(1)   (2)   (3)   (4)
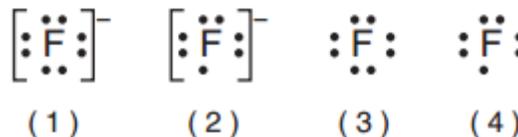
36 In the formula for the compound XCl_4, the X could represent   A. Ga   B. Mg   C. Zr   D. Al

38 Given the balanced equation representing a reaction: $4Al_{(S)} + 3O_{2(G)} \rightarrow 2Al_2O_{3(S)}$
How many moles of $Al_{(S)}$ react completely with 4.50 moles of $O_{2(G)}$ to produce 3.00 moles of $Al_2O_{3(S)}$?
A. 1.50 mol   B. 2.00 mol   C. 6.00 mol   D. 4.00 mol

39 What is the percent composition by mass of oxygen in $Ca(NO_3)_2$ (gram-formula mass = 164 g/mol)?
A. 9.8%   B. 29%   C. 48%   D. 59%

40 Given the balanced equation representing a reaction: $6Li + N_2 \rightarrow 2Li_3N$
Which type of chemical reaction is represented by this equation?
A. synthesis   B. decomposition   C. single replacement   D. double replacement

41 Which elements can react to produce a molecular compound?
A. calcium and chlorine   B. hydrogen and sulfur   C. lithium and fluorine   D. magnesium and oxygen

42 Compared to a 1.0-mole sample of $NaCl_{(S)}$, a 1.0-mole sample of $NaCl_{(l)}$ has a different
A. number of ions   B. empirical formula   C. gram-formula mass   D. electrical conductivity

44 Which ion combines with Ba^{+2} to form a compound that is most soluble in water?
A. S^{-1} B. OH^{-1} C. CO_3^{-2} D. SO_4^{-2}

45 When a sample of gas is cooled in a sealed, rigid container, the pressure the gas exerts on the walls of the
container will decrease because the gas particles hit the walls of the container
A. less often and with less force   B. less often and with more force
C. more often and with less force   D. more often and with more force

1 Compared to the charge of a proton, the charge of an electron has
   A. a greater magnitude and the same sign   B. a greater magnitude and the opposite sign
   C. the same magnitude and the same sign   D. the same magnitude and the opposite sign

2 Which atom has the largest atomic radius?   A. potassium   B. rubidium   C. francium   D. cesium

3 In the wave-mechanical model of the atom, an orbital is defined as
   A. a region of the most probable proton location   B. a region of the most probable electron location
   C. a circular path traveled by a proton around the nucleus   D. a circular path traveled by an electron around the nucleus

4 When an excited electron in an atom moves to the ground state, the electron
   A. absorbs energy as it moves to a higher energy state   B. absorbs energy as it moves to a lower energy state
   C. emits energy as it moves to a higher energy state   D. emits energy as it moves to a lower energy state

5   Which polyatomic ion is found in the compound represented by the formula $NaHCO_3$?
     A. acetate   B. hydrogen carbonate   C. hydrogen sulfate   D. oxalate

6 The atomic mass of magnesium is the weighted average of the atomic masses of
   A. all of the artificially produced isotopes of Mg   B. all of the naturally occurring isotopes of Mg
   C. the 2 most abundant artificially produced isotopes of Mg   D. the 2 most abundant naturally occurring isotopes of Mg

7 Which element has atoms that can form halide ions?   A. iodine   B. silver   C. strontium   D. xenon

9 Which quantity can be calculated for a solid compound, given only the formula of the compound and the
   Periodic Table of the Elements?
   A. the density of the compound   B. the % composition by mass of each element in the compound
   C. the heat of fusion of the compound   D. the melting point of each element in the compound

10 Which terms identify types of chemical reactions?
   A. decomposition + sublimation   B. decomposition + synthesis
   C. deposition + sublimation   D. deposition + synthesis

11. What is the gram-formula mass of $Fe(NO_3)_3$?   A. 146 g/mol   B. 194 g/mol   C. 214 g/mol   D. 242 g/mol

12. Which element is a liquid at STP?   A. bromine   B. cesium   C. francium   D. iodine

13 Compared to the physical and chemical properties of the compound NO_2, the compound N_2O has
   A. different physical properties and different chemical properties
   B. different physical properties and the same chemical properties
   C. the same physical properties and different chemical properties
   D. the same physical properties and the same chemical properties

15 Which sample of copper has atoms with the lowest average kinetic energy?
   A. 10. g at 45°C   B. 20. g at 35°C   C. 30. g at 25°C   D. 40. g at 15°C

16 Which change results in the formation of different substances?
   A. burning of propane   B. melting of $NaCl_{(S)}$ C. deposition of $CO_{2(G)}$ D. solidification of water

17 Which substance cannot be broken down by chemical change?
   A. ammonia   B. ethanol   C. carbon monoxide   D. zirconium

21 Given the balanced equation representing a reaction: $O_2 \rightarrow O + O$ What occurs during this reaction?
   A. Energy is absorbed as bonds are broken.   B. Energy is absorbed as bonds are formed.
   C. Energy is released as bonds are broken.   D. Energy is released as bonds are formed.

32 Which electron configuration represents the electrons in an atom of Ga in an excited state?
   A. 2-8-17-3   B. 2-8-17-4   C. 2-8-18-3   D. 2-8-18-4

35 Given the balanced equation representing a reaction: $Al_2(SO_4)_3 + 6NaOH \rightarrow 2Al(OH)_3 + 3Na_2SO_4$
   The mole ratio of NaOH to $Al(OH)_3$ is   A. 1:1   B. 1:3   C. 3:1   D. 3:7

36 Which equation represents a single replacement reaction?
   A. $2H_2O_2 \rightarrow 2H_2O + O_2$ B. $2H_2 + O_2 \rightarrow 2H_2O$
   C. $H_2SO_4 + Mg \rightarrow H_2 + MgSO_4$ D. $HCl + KOH \rightarrow KCl + H_2O$

37 The accepted value for the percent by mass of water in a hydrate is 36.0%. In a laboratory activity, a student determined the percent by mass of water in the hydrate to be 37.8%. What is the percent error for the student's measured value?
   A. 5.0%   B. 4.8%   C. 1.8%   D. 0.05%

40 The graph below represents the uniform heating of a substance from the solid to the gas phase.
   Which line segment of the graph represents boiling?   A. AB   B. BC   C. CD   D. DE
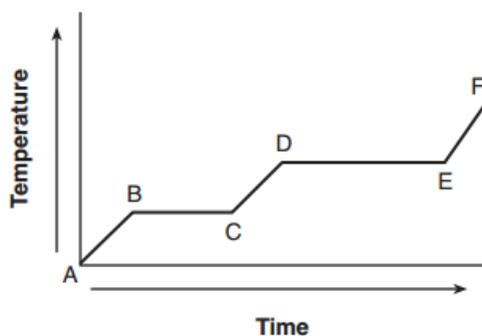
41 A 1-gram sample of a compound is added to 100 grams of $H_2O_{(l)}$ and the resulting mixture is then thoroughly stirred. Some of the compound is then separated from the mixture by filtration. Based on Table F, the compound could be
   A. AgCl   B. $CaCl_2$ C. NaCl   D. $NiCl_2$

46 What is the oxidation number of manganese in $KMnO_4$?   A. 7   B. 2   C. 3   D. 4

Answers.

1. D. Electrons are –1 charge, so a +1 charge would equal that in magnitude but have opposite sign. Magnitude means "size"

2. A. Protons (and neutrons) have mass of 1 amu each (approx). In high school electrons have no mass, but that's not really true.

3. B. Look at table S, or just count orbitals. Going down a group means adding orbitals each step, atoms get bigger going ↓ a group

8. A. Argon has a noble gas/full outer orbital or full VALENCE orbital.

9. D. When bonds form, energy is released (memorize this line) when bonds break, it requires energy input (the opposite)

12. D. Moles/Liter in on table T. Kelvin = temp, mL = volume, and J/kg is wacky to you.

14. C. The KMT says that there is no attraction or repulsion of particles.

15. A. To change from solid to gas requires energy input (endo). The other 3 are all going in a colder direction.

17. A. Hydrocarbons have only H + C in them. Oxygenated hydrocarbons have oxygen too, but the are not hydrocarbons, are they!

22. A. Atoms all have an oxidation number of zero (no charge, no oxidation numbers needed unless bonding) (this was harder)

23. A. Electrolytes mean they form loose ions in water: they are AQ on table F, or they are acids or bases on table K + table L

31. C. Radium is atom #88, but you knew that. It's in the 7th period, which means it has 7 orbitals. Valence means OUTERMOST orbital.

32. B. The number of protons matters only. Here we have 2 kinds of Hydrogen (1 proton) and 2 kinds of Helium (2 protons)

33. D. Chlorine is in group 17. To be similar they have the SAME number of valence electrons (7). Must be Br with 2-8-18-7

34. C. Metalloids all touch the staircase on the periodic table, except for AlPo. Look to see that only Te works in this list

35. A. Hard question, but an F^{-1} ion has 8 valence electrons and an –1 charge. Therefore it has to be the first diagram.

36. C. The answer must have a +4 cation to make this XCl_4 compound. There are no unknown atoms, the only real one with +4 is #40.

38. C. Do the mole ratio (2 different ways if you like, $Al:O_2$ or Al: Al_2O_3. Both work out to x = 6.00 with 3 SF

39. D. Divide the part by the whole x 100%. Here it's 96g/164g X 100% = 59%

40. A. Two or more smaller substances combine to one larger one is synthesis. SOMETIMES this is called a COMBINATION reaction

41. B. Molecular compounds have NO METALS ever.

42. D. Solid salt cannot conduct electricity because it has no loose ions. Aqueous salt has loose ions, BUT SO DOES MELTED salt.

44. B. When you use table F correctly, you see that the Ba^{+2} cation only becomes soluble with the hydroxide as an exception.

45. A. As the temperature decreases so does kinetic energy. Less (or weaker) collisions makes for less pressure

1. D. Protons are +1 charge. Equal but opposite to that is –1, which is the charge of an electron.

2. C. Count the number of orbitals, more orbitals = bigger atom

3. B. The modern model (wave-mechanical) has zones or clouds which are where the electrons are most of the time.

4. D. It also emits spectra here. Excited electrons have extra energy, which is released in order to allow them back to the ground state.

5. B. Look at table E (polyatomic ions). You might have picked carbonate but that is WRONG too.

6. B. Average weighted atomic mass combines the masses of all naturally occurring isotopes with the proportion found in nature.

7. A. Halides are the group 17 elements, also called halogens

9. B. Percent comp by mass (and molar mass, but that was not a choice)

10. B. Deposition and sublimation are both physical changes. They make 3/4 of the answers unacceptable for chemical reactions.

11. D. Another (dumb) vocabulary word that means MOLAR MASS.

12. A. Memorize that only bromine and mercury are liquids, or use table S melting/boiling points. Only Br has 273 K between these points

13. A. Different formulas means different compounds. New stuff with new properties (physical and chemical properties)

15. D. Average kinetic energy means the mass is not important here. Low temp = low Kinetic energy

16. A. Burning = combustion. The other choices are all physical changes/phase changes.

17. D. Cannot be broken down is the definition of element

21. A. To break the bond between the two oxygens in O_2 it requires energy to be added.

32. B. Gallium has a 2-8-18-3 ground state (look at that) with 31 electrons. Only B has 31 electrons, in an excited state

35. C. The ration here of NaOH: $Al(OH)_3$ is 6:2. No choice for that, so do a John Dalton and reduce it to 3:1

36. C. In this the Mg replaces the H in solution (Mg is the lunk-head on the beach!)

37. A. Best answer would be 5.00% with 3 SF but sometimes the state likes to toy with your mind. You're smart enough to see thru them!

40. D. The boiling point is the HOT phase change, so the flat part of the heating curve happens at the higher (hotter) temp.

41. A. Great question. When you put an ionic compound into water it dissolves into loose ions, unless it doesn't! Some compounds are insoluble and the mixture is water with a solid ionic compound at the bottom of the beaker. You can filter out solids.

46. A. All compounds are electrically neutral, or at least their oxidation numbers sum to zero. Here we have a +1 charge for the K. Each oxygen is a –2 ion, with 4 oxygens that is –8 total charge. To stay neutral the (+1) plus (-8) plus (? For Mn) = 0 to work out, it has to be a +7 charge for the manganese, which it can make: manganese VII or Mn^{+7} cation