Science 10
Unit 1-Chemistry Review

The Science 10 Chemistry Unit covers:

- Chapter 1-Elements and the Periodic Table
- Chapter 2-Chemical Formulas and Compounds
- Chapter 3-Chemical Reactions

1. When zinc metal is placed in a solution of hydrochloric acid, it fizzes producing hydrogen gas and zinc chloride.

   a) The reactants are zinc metal , hydrochloric acid

   b) The products are hydrogen gas , zinc chloride

   c) A word equation is:

   $Zn(s) + 2HCl(aq) \rightarrow H_2(g) + ZnCl_2(aq)$

2. In the following table, name the 3 major particles in the atom, state where they are located (in the nucleus or on the outside), state their relative mass compared to a proton (assume mass of a proton = 1) and their charge.

Particle	Location	Charge
Proton	nucleus	+
Neutron	nucleus	0
Electron	orbits/energy levels	−

3. List the four main points in John Dalton's **atomic theory**.

4. **Isotopes** of an element are two different forms which have the same number of protons and electrons, but with different numbers of neutrons.

5. The molar mass of an element is the average mass of the isotopes which occur in nature.

6. In a **neutral atom**, the number of **electrons** is always equal to the number of protons or the atomic number.

7. According to the model of the atom proposed by Neils Bohr, electrons move around the atom in levels When one orbit is filled, the electrons start filling the **next higher** orbit.

8. The first orbit holds 2 electrons.

   The second orbit holds 8 electrons.

   The third orbit holds 8 electrons.

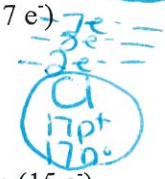
9. Give the total number of electrons and the number of electrons in each orbit for each of the following elements:

Element	Total # of electrons	Electrons in Level 1	Electrons in Level 2	Electrons in Level 3	Electrons in Level 4
Aluminum (Al)	13	2	8	3	0
Nitrogen (N)	7	2	5	0	0
Calcium (Ca)	20	2	8	8	2
Lithium (Li)	3	2	1	0	0
Argon (Ar)	18	2	8	8	

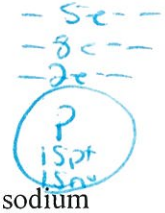
10. Draw the **Energy level** and **Lewis Dot Diagrams** for neutral atoms of each of the following elements.

   a) oxygen (8 e⁻)

   b) chlorine (17 e⁻)



   c) phosphorus (15 e⁻)



11. In order to have the same number of electrons as the noble gas neon, sodium would have to lose 1e⁻ electron.

12. Is potassium more or less reactive than sodium _____. Find rubidium on your periodic table. Do you think rubidium would be more or less reactive than potassium? _____.

13. Name iodine Symbol I Atomic number 53 # of electrons 53
    In order to have the same number of electrons as the noble gas xenon, iodine would have to gain 1e⁻ electron.

14. Classify each of the following elements as an **alkali metal, alkaline earth, halogen, noble gas** or **transition metal**:

Element	Family
Fe	transitional metal
Br	halogen
K	alkali
Kr	noble gas
Ba	alkaline earth
F	halogen
Pt	transitional
Li	alkali
Ne	noble
Ra	alkaline earth

15. What would alkali metal atoms need to do in order to end up with the same stable electron arrangements as the noble gases? lose e^-

16. What can be said about the chemical reactivity of the alkali metals? _____ **with O_2, H_2O, halogens and other elements**

17. Which family of elements has just enough electrons in their highest orbits to completely fill them up? noble gases

18. The outer orbits of halogen atoms each have 7 electrons. This is one less than the nearest noble gas atom.

19. In order to achieve the stable arrangement of noble gas atoms, each halogen atom would have to gain 1 electron.

20. Are the pH's of **Acid** Solutions (< 7, >7 or = 7? less than 7

Are the pH's of **Base** Solutions < 7, (>7 or = 7? greater than 7

21. The more **acidic** a solution is, the (*lower/higher*) the pH?

22. The more **basic** a solution is, the (*lower/higher*) the pH?

23. A solution with a pH = 7 is said to be neutral

24. List 4 properties (characteristics) **all acids** have in common:

25. List 4 properties (characteristics) **all bases** have in common:

26. When Fluorine has **gained** an electron, it now has 9 protons (*remember, it doesn't lose any protons*), and 10 electrons. Because protons are positive (+) and electrons are negative (-), the charge left over is 1 -. The Fluorine is no longer a neutral atom, but is a charged atom, which is called an ion.

27. Because the lithium ion (Li^+) and the fluoride ion (F^-) have opposite charges, they **attract** each other. This attraction forms an ionic bond

28. Write the correct formulas for the following ionic compounds.

a) magnesium iodide ..... $MgI_2(s)$

b) aluminum fluoride ..... $AlF_3(s)$

c) calcium sulphide ..... $CaS(s)$

d) rubidium oxide ..... $Rb_2O(s)$

e) sodium phosphide ..... $Na_3P(s)$

f) iron (III) sulphate ..... $Fe_2(SO_4)_3(s)$

g) manganese (IV) oxide ..... $MnO_2(s)$

h) copper (II) phosphate ..... $Cu_3(PO_4)_2(s)$

i) calcium nitrate ..... $Ca(NO_3)_2(s)$

j) ammonium chloride ..... $NH_4Cl(s)$

k) lithium oxalate ..... $Li_2OOCCOO(s)$

l) nickel (III) carbonate ..... $Ni_2(CO_3)_3(s)$

m) copper (I) permanganate ..... $CuMnO_4(s)$

n) ammonium sulphate ..... $(NH_4)_2SO_4(s)$

Compounds with only **two** elements are called **binary** compounds.

In a **binary** compound, the non-metal changes it's name so it ends in the letters **IDE**

In a compound containing a ***polyatomic ion,*** the name of the polyatomic ion **never** changes.

29. Write the correct names for the following ionic compounds Spelling counts!

a) Na_3PO_4 ..... Sodium phosphate

b) K_2S ..... potassium sulfide

c) Rb_2SO_3 ..... rubidium sulfite

d) $(NH_4)_2CO_3$ ..... ammonium carbonate

e) $Ba(OH)_2$ ..... barium hydroxide

f) $MgSO_4$ ..... magnesium sulfate

g) Cs_2HPO_4 ..... cesium hydrogenphosphate

h) $NaHCO_3$ ..... sodium hydrogencarbonate

i) $AgNO_3$ ..... silver(I) nitrate

j) Na_3As ..... Sodium arsenide

k) NH_4NO_3 ..... ammonium nitrate

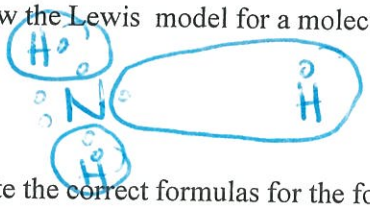
l) $Ag_2Cr_2O_7$ ..... silver(I) dichromate.

In a ***covalent*** compound, one atom **shares** electrons with another atom.

30. Give the formulas for molecules of the 10 molecular elements. The first one is H_2.

N_2 O_2 F_2 Cl_2 Br_2 I_2 (At_2) H_2 P_4 S_8

31. Draw the Lewis model for a molecule of ammonia (NH_3).



32. Write the correct formulas for the following **covalent** compounds:

a) nitrogen trioxide NO_3

b) silicon tetrafluoride SiF_4

c) nitrogen monoxide ~~NO_2~~ NO

d) selenium hexafluoride SeF_6

e) phosphorus pentachloride PCl_5

f) sulphur dioxide SO_2

g) dinitrogen tetroxide N_2O_4

33. Write the correct names for the following **molecular** (covalent) compounds:

a) PF_5 ..... phosphorus pentafluoride

b) SO_3 ..... sulfur trioxide

c) ClF_6 ..... chlorine hexafluoride

d) SeO_2..... selenium dioxide

e) N_2O ..... dinitrogen monoxide

f) N_2Cl_4 ..... dinitrogen tetrachloride

34. What is meant by a *physical* change?

↳ no new products formed.

Give 3 examples of physical changes:
- boiling
- evaporating
- melting

35. What is meant by a *chemical* change?

↳ new products

Give 3 examples of chemical changes:
- flamability
- color change
- odor change

There are 5 type of reactions that you can predict – plus an 'other' category.

simple decomposition

element + element → compound

simple decomposition

compound → element + element

single replacement

element + compound → element + compound

double replacement

compound + compound → compound + compound

combustion (hydrocarbon)

$C_xH_y + O_2(g) \rightarrow CO_2(g) + H_2O(g)$

36. Balance the following equations and state what type of reaction they are

a) $2Sr(s) + O_2(g) \rightarrow 2SrO(s)$

b) $2Al(s) + 6 HOH \rightarrow 2Al(OH)_3(aq) + 3H_2(g)$

c) $4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$

d) $C_5H_{12}(l) + 13O_2(g) \rightarrow 5CO_2(g) + 6H_2O(g)$

e) $Na(s) + 2H_2O(l) \rightarrow H_2(g) + NaOH$

f) $2NaClO_3(s) \rightarrow 2NaCl(s) + 3O_2(g)$

g) $Ca(NO_3)_2(aq) + (NH_4)_2SO_4(aq) \rightarrow CaSO_4(aq) + 2NH_4NO_3(aq)$

h) $2C_2H_5OH(l) + O_2(g) \rightarrow 4CO_2(g) + 3H_2O(g)$

i) $2Al(NO_3)_3(aq) + 3K_2CrO_4(aq) \rightarrow Al_2(CrO_4)_3(aq) + 6KNO_3(aq)$

j) $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$

k) $2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(g)$

l) $S_8(s) + 8O_2(g) \rightarrow 8SO_2(g)$

m) $3HNO_3(aq) + Fe(OH)_3(aq) \rightarrow 3H_2O(l) + Fe(NO_3)_3$

n) $2Br(l) + CaCl_2(aq) \rightarrow CaBr_2(aq) + Cl_2(g)$

o) $3Mg(s) + 2AlCl_3(aq) \rightarrow 3MgCl_2(aq) + 2Al(s)$

37. Write balanced chemical equations for the following reactions. Indicate the reaction type – be sure to include states of matter.

a) solid iron plus oxygen gas yield iron (III) oxide

$Fe(s) + O_2(g) \rightarrow Fe_2O_3(\ )$ formation

b) solid mercury (II) oxide decomposes into liquid mercury and oxygen gas

$2HgO(s) \rightarrow 2Hg(l) + O_2(g)$ decomposition

c) hydrogen sulfide gas plus oxygen gas yields sulfur dioxide gas plus water

$2H_2S(g) + 3O_2(g) \rightarrow 2SO_2(g) + 2H_2O(g)$

Single replacement

d) copper (II) sulfate reacts with nickel solid to produce nickel(III) sulfate and copper solid.

$3CuSO_{4(aq)} + 2Ni(s) \rightarrow Ni_2(SO_4)_3(aq) + 3Cu(s)$

Single replacement

e) magnesium oxide reacts with carbon dioxide to produce magnesium carbonate.

$MgO(s) + CO_2(g) \rightarrow MgCO_3(s)$

Formation

f) aqueous sodium chloride reacts with silver nitrate

Double replacement $NaCl(aq) + AgNO_3 \rightarrow NaNO_3(aq) + AgCl(s)$

g) nitric acid reacts with sodium hydroxide

Double replacement $HNO_3(aq) + NaOH(aq) \rightarrow H_2O(aq) + NaNO_3(aq)$

h) a solution of lead (II) nitrate reacts with potassium iodide

$2Pb(NO_3)_2 + 2KI_{(aq)} \rightarrow PbI_2(s) + 2KNO_3(aq)$

i) combustion of ethane (C_2H_6)

$2C_2H_6(g) + 7O_2(g) \rightarrow 6H_2O(g) + 4CO_2(g)$

j) butane undergoes combustion

1 6 4 4

$2C_4H_8 + 6O_{2(g)} \rightarrow 4H_2O(g) + 4CO_2(g)$

38. Find the molar masses of the following compounds:

16 8 24 4 12

a) NaBr (102.9 g/mol)

b) $PbSO_4$ (303.3 g/mol)

c) $Ca(OH)_2$ (74.1 g/mol)

d) Na_3PO_4 (164.0 g/mol)

e) $(NH_4)_2CO_3$ (96.0 g/mol)

f) $C_6H_{12}O_6$ (180.0 g/mol)

g) $Fe_3(PO_4)_2$ (357.4 g/mol)

h) $(NH_4)_2S$ (68.1 g/mol)

i) $Zn(C_2H_3O_2)_2$ (183.4 g/mol)

j) AgF (126.9 g/mol)

39. How many moles are in 25 grams of water?

40. How many grams are in 4.5 moles of Li_2O?

41. How many moles are in 142 g of H_2SO_4?

42. How many grams are in 3.25 grams of NH_3?

43. How many moles are in 15 grams of lithium?

44. How many grams are in 2.4 moles of sulfur?

45. How many moles are in 22 grams of argon?

46. How many moles are in 98.3 grams of aluminum hydroxide, $Al(OH)_3$?

47. How many moles are in 68 grams of copper (II) hydroxide, $Cu(OH)_2$?

48. How many moles are in 1.2×10^3 grams of ammonia, NH_3?

49. How many grams are in 2.3×10^{-4} moles of calcium phosphate, $Ca_3(PO_3)_2$?

50. How many grams are in 1.11 moles of manganese sulfate, $Mn_3(SO_4)_7$?

Rules for Naming Acids

When the name of the anion ends in -ide, the acid name begins with the prefix hydro-, the stem(root word) of the anion has the suffix -ic and it is followed by the word acid.

-ide becomes hydro _____ic Acid

Cl- is the Chloride ion so HCl = hydrochloric acid

When the anion name ends in -ite, the acid name is the stem (root word) of the anion with the suffix -ous, followed by the word acid.

-ite becomes _____ous Acid

ClO_2^- is the Chlorite ion so $HClO_2$ = Chlorous acid.

When the anion name ends in -ate, the acid name is the stem (root word) of the anion with the suffix -ic, followed by the word acid.

-ate becomes _____ic Acid

ClO_3^- is the Chlorate ion so $HClO_3$ = Chloric acid.

Write the formula for each of the acids listed below:

Nitric acid $HNO_3(aq)$

Perbromic acid _____

Hydrocyanic acid $HCN(aq)$

Hydrobromic acid $HBr(aq)$

Chloric acid $HClO_3(aq)$

Sulfurous acid $H_2SO_3(aq)$

Chlorous acid $HClO_2(aq)$

Hydrochloric acid $HCl(aq)$

Phosphoric acid $H_3PO_4(aq)$

Nitrous acid $H_2NO_2(aq)$

Hydrofluoric acid $HF(aq)$

~~Perchloric acid~~

Hydroiodic acid $HI(aq)$

~~Phosphorous acid~~ $H_3PO_3(aq)$

Carbonic acid $H_2CO_3(aq)$

Sulfuric acid $H_2SO_4(aq)$

Name each of the following acids:

$HClO_4$ perchloric acid

H_3PO_4 ~~H_3PO_4~~ phosphoric acid

$HCl_{(aq)}$ hydrochloric acid

H_2SO_4 sulfuric acid

HNO_2 nitrous acid

$HI_{(aq)}$ hydroiodic acid

$HF_{(aq)}$ hydrofluoric acid

~~H_3PO_3~~ phosphorous acid

$HCN_{(aq)}$ cyanic acid

$HClO_3$ chloric acid

H_2CO_3 ~~chlorous acid~~ ~~chloric acid~~ carbonic acid.

H_2SO_3 sulfurous acid

$HClO_2$ ~~chloric acid~~ chlorous acid.

HNO_3 nitric acid.

$HBr_{(aq)}$ hydrobromic acid