* chemistry 101 ملخص قوانين *

* chapter (1) :- foundation of chemistry

- → Density (d) = $\frac{mass\ (m)}{Volume\ (v)}$ → equation of density
- → $T_{(K)} = T_{°C} + 273.15\ K$ → converting °C to K
- → $T_{°C} = T_{(K)} - 273.15\ K$ → converting K to °C
- → $T_F = [T_{°C} \times \frac{9}{5}] + 32\ F°$ → converting °C to °F
- → $T_C = [T_F - 32] \times \frac{5}{9}$ → converting F° to °C

:)

Chapter (2) :- Atoms, Molecules and ions.

* Atomic number = number of protons or number of electrons

* mass number = number of protons + number of neutrons
  = atomic number + number of neutrons

* Number of neutrons = mass number — atomic number
  = A − Z

* charge of cation for an element in group 1, 2, 3 =
  + (group number).

* charge of anion for an element in group 5, 6, 7 =
  (group number − 8)

hapter (3) - stoichiometry

$$moles = \frac{mass}{molar\ mass}$$

* mass percent of certain element = $\frac{\text{mass of the element of interest}}{\text{mass of compound that containing that element}} \times 100\%$

* mass percent of element y = $\frac{\text{number of atoms of y element} \times \text{m.m of y}}{\text{molar mass of formula containing y}} \times 100\%$

* molecular formula = n x empirical formula

⇒ where $n = \frac{\text{m.m of molecular formula}}{\text{m.m of empirical formula}}$

percent yield of reaction = $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$

chapter (4):- types of chemical Reactions and solutions stoichiometry

* Molarity = $\frac{\text{moles of solute}}{\text{Liters of solution}}$ or $M = \frac{n\ (mol)}{V\ (L)}$

$M_i V_i = M_F V_F$ → Diluting equation

chapter (5):- Gases

* pressure = $\frac{Force}{Area}$ → calculating the pressure

* $P = gdh$ → " " "

* $P_{gas} = P_{atm} - h$ → " " " of gas when it is lower than the external pressure

* $P_{gas} = P_{atm} + h$ → calculating the pressure of gas when it is greater than the external pressure

$P_i V_i = P_F V_F$ → boyle's law

* $\frac{P_i V_i}{T_i} = \frac{P_F V_F}{T_F}$ → combined gas Law

* $\frac{V_i}{T_i (K)} = \frac{V_f}{T_f (K)}$ → charles's law

* $\frac{V_i}{n_i} = \frac{V_f}{n_f}$ → avogadro's law

* $PV = nRT$ → ideal gas law

** Remmember that → $n = \frac{mass}{molar\ mass}$

* molar mass $= \frac{dRT}{P}$ → calculating the molar mass using the ideal gas law in the presence of density

* $P_{total} = P_A + P_B + P_C$ ... → calculating the total pressure in presence of partial pressure

* $P_{total} = n_{total} \frac{RT}{V}$ → calculating the total pressure in presence of the total number of moles of gases

* $X_A = \frac{n_A}{n_t}$ → mole fraction

* $P_A = X_A P_t$ → calculating the partial pressure of certain gas using the mole fraction and the total pressure

* $(KE)_{Avg} = \frac{3}{2} RT$ → the relationship between temperature and average kinetic energy

* $U_{rsm} = \sqrt{\frac{3RT}{M}}$ → calculating the root mean square velocity.

* $\frac{\text{Rate of effusion for gas 1}}{\text{Rate of effusion for gas 2}} = \sqrt{\frac{M_2}{M_1}}$ → calculating the ratio of rates of two gases at constant pressure and temperature.

* $\underbrace{\left[P_{obs} + a\left(\frac{n}{V}\right)^2\right]}_{P\ ideal} \times (\underbrace{V - nb}_{V\ ideal}) = nRT$ → van der waals equation

chapter (6):- thermochemistry

$K.E = E_k = \frac{1}{2} mv^2$ → kinetic energy equation

$P.E = E_p = mgh$ → potential energy equation

$E_{tot} = E_k + E_p + U$ → total energy equation

* $\Delta U = w + q$ → Relationship between internal energy and (heat and work).

$w = -P\Delta V$ → work of gaseous sample.

$\Delta H = \Delta U + P\Delta V$ → Relationship among enthalpy, internal energy and work.

:)

$\Delta H = q_p$ → Relationship between enthalpy and heat at constant pressure

$\Delta H = H_{products} - H_{reactant}$ → the meaning of ΔH

* $q = C\Delta T$ → relationship among heat, molar heat capacity and charge in temperature.

$q = ms\Delta T$ → relationship among heat, mass, specific heat capacity and charge in temperature

$\Delta H = \Delta U + P\Delta V = q_v$, $w = q_v$ → relationship between enthalpy and heat at constant volume.

:)

* $\Delta H = \Delta U + RT\Delta n$ → Relationship between enthalpy and heat for gaseous sample at constant volume.

* $\Delta H^\circ_{reaction} = \sum n_p \Delta H^\circ_f (\text{products}) - \sum n_r \Delta H^\circ_f (\text{Reactants})$ → the standard enthalpy of reaction in terms of standard enthalpy of formation.

* chapter (7):- Quantum theory of the atom

- $c = \nu\lambda$ → relation of the light wave speed, frequency and wavelength.

- $E = h\nu$ → the amount of energy in the light wave at a given frequency

- $E = \frac{hc}{\lambda}$ → the amount of energy in the light wave at a given wavelength

- $E_n = \frac{-R_H}{n^2}$, $n = 1, 2, 3$ → the energy of hydrogen atom orbits.

- $\Delta E = R_H \left(\frac{1}{n_i^2} - \frac{1}{n_f^2} \right)$ → the energy difference between two orbits.
  * when $n_i < n_f$

- $\lambda = \frac{h}{mv}$ → De Broglie's equation

- $(\Delta x)(\Delta p_x) \geq \frac{h}{4\pi}$ → heisenberg uncertainty principle

chapter (8):- the periodic table and the periodicity

total number of orbitals in certain main shell = n^2

" " " electrons " " " " = $2n^2$

number of nodes of ns orbital = $(n-1)$

" " " " np " = $(n-2)$

" " " " nd " = $(n-3)$

" " " " nf " = $(n-4)$

* $Z_{eff} = Z - S$ where Z_{eff} = effective nuclear charge.

  S = screening or shielding electrons

  Z = nuclear charge.

* chapter (7):- Quantum theory of the atom

$c = \nu\lambda$ → relation of the light wave speed, frequency and wavelength.

* $E = h\nu$ → the amount of energy in the light wave at a given frequency

* $E = \frac{hc}{\lambda}$ → the amount of energy in the light wave at a given wavelength

* $E_n = \frac{-R_H}{n^2}$, $n = 1, 2, 3$ → the energy of hydrogen atom orbits.

* $\Delta E = R_H \left(\frac{1}{n_i^2} - \frac{1}{n_f^2}\right)$ → the energy difference between two orbits.
  * when $n_i < n_f$

$\lambda = \frac{h}{m\nu}$ → De Broglie's equation

* $(\Delta x)(\Delta P_x) \geq \frac{h}{4\pi}$ → heisenberg uncertainty principle

chapter (8):- the periodic table and the periodicity

* total number of orbitals in certain main shell $= n^2$
* " " " electrons " " " " $= 2n^2$

number of nodes of ns orbital $= (n-1)$

" " " " np " $= (n-2)$

* " " " " nd " $= (n-3)$

" " " " nf " $= (n-4)$

* $Z_{eff} = Z - S$ where Z_{eff} = effective nuclear charge.
  S = screening or shielding electrons
  Z = nuclear charge

chapter (9):- Ionic and covalent bonding

* $E = \frac{kq_1q_2}{r}$

Formal charge = [valence electrons in free atom] − ½ [total number of electrons in bond] − [total number of non bonding electrons]

* Formal charge = group number − (bonds + dot)

* bond length (A−B) = ½ bond Length (A−A) + ½ bond Length (B−B)
  = covalent Radius of A + covalent Radius of B

* $\Delta H = \sum B.E$ (broken bonds) − $\sum B.E$ (formed bonds)
  - $\sum B.E$ (broken bonds) → energy required
  - $\sum B.E$ (formed bonds) → energy released

chapter (10):- molecular geometry and chemical bonding theory

* bond order = ½ (number of electrons in bonding MO)
  (number of electrons in antibonding MO)

→ I hope all have (A) in this course --- :)
→ the most best wishes from me to you all --- ^_*
→ your colleague :-
Ghaidaa AL-Gallab ^_^