Course: Chemistry 1B (1.10203)

- I am Mr. Belly Asong and I am your Lecturer for this course, and I have been in the teaching profession for the last 20 years.
- Office Room: Science 1 Building, S-157
- Consultancy Hour: 4:00 – 5:00 PM
- If you want to see me, *knock on my door gently and then push it slowly*. If the room is locked, that means I am out, otherwise, you may send your concern through my email.
- Email address: belly_asong@upng.ac .pg

- **Lab Manual – *where to pay*?**

  - pay K15 to Chemistry Account #525

  - bring your receipt & collect your lab manual at my office from 2:00 – 4:00 pm

- **Also it is a requirement for this course to have your *student.upng.ac.pg email account be activated*.**

- **You will need this email account to log in to our Moodle or Google classroom.**

- **For your assessment grade;**
  - **10% - Assignments**
  - **20% - Tests**
  - **20% - Practicals**
  - **50% - Final Exam**

- ***Textbook:*** **You can use any organic chemistry books**

- ***Appeals:***

Appeals are only for the final exam and not for internal marks.

So before you go on holiday at the end of the semester, kindly confirm your internal marks from your tutor.

Normally I am also publishing your internal marks on our google classroom every end of the semester for further vetting.

- ***Lecture Notes, Assignments, Notices:***

Lecture Notes, Assignments, Notices, and other stuff pertaining to our course are posted on our Moodle/Google classroom now and then.

- ***Taking Videos:***

When taking lecture videos, please do it discretely. Most of the time I am distracted by cameras pointing directly at my face. Kindly point your camera to the lecture board.

- ***On Personal Hygiene:***

Everyone is expected to observe *"proper personal hygiene"*.

Always see to it that you come to our class wearing clean clothes and shoes. If you are sweating, stay outside a bit and cool down.

Do not wear very strong perfume or come to class without taking a bath.

Taking care of yourself is a way of giving respect to others and to yourself also.

- ***On Laboratory time:***

During laboratory time, you are expected to wear a clean laboratory coat and shoes. It is also important that you have studied the practical procedure ahead of time so that you can finish the practical by 4:00 pm.

We are also maintaining the policy of no eating, drinking, or chewing betel nuts inside the lab.

- ***On Laboratory Marks:***

Your practical weighs 20% of your grade.

The marks included are the following;

- **Attendance and participation – 30 marks**
- **Scientific Report – 40 marks**
- **Post-lab questions – depending on the marks it carries**

**** Late submission will incur deductions***

- ***On Your Tests and Assignments:***

- **Normally, I am giving a test every fortnight. So expect that you will have a lot of things to study and to learn.**

- **Studying organic chemistry is a tough one because of too many concepts and reactions to learn. You will need a lot of time to digest this information, so spend your time well.**

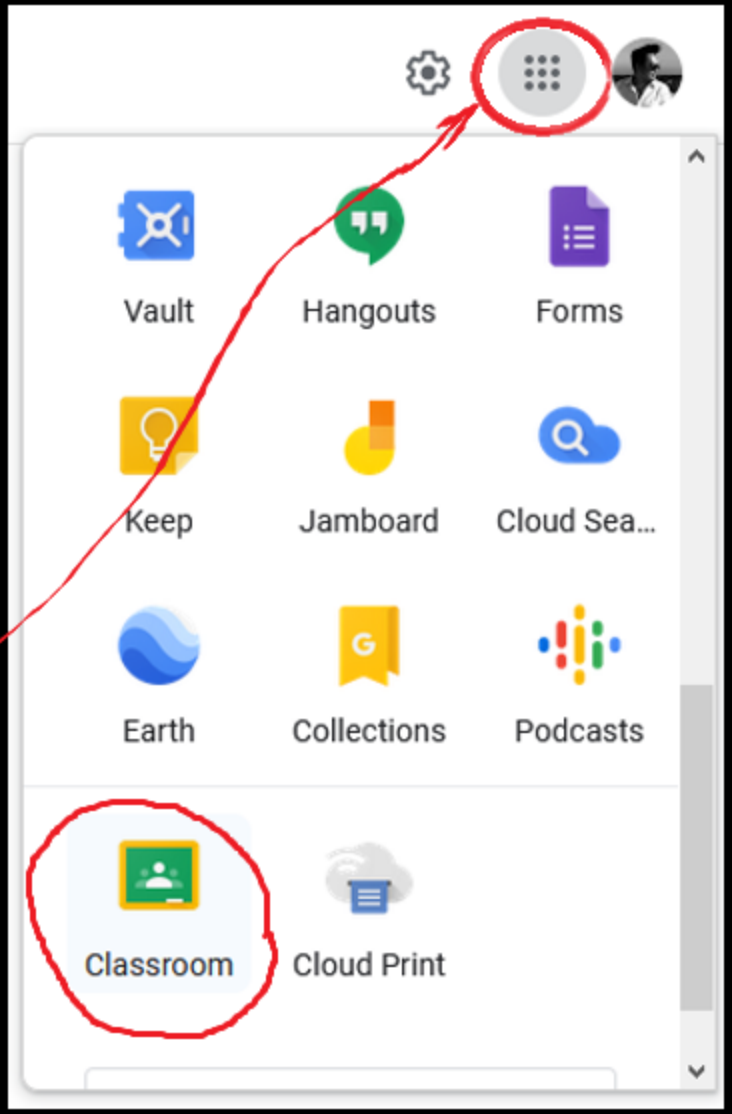
- **Your tests carry 20% of your grade and in a semester we may have 4-5 tests.**

- ***On Your Tests and Assignments:***
- **Your assignments carry 10% of your grade and we may have 3-4 assignments this semester.**
- **There are due dates also and when to submit your assignment. Your tutor will give you deductions if you submit your assignment late.**
- **Patience and commitment are the keys to success in life.**
- **Just always do your best, and God will do the rest.**

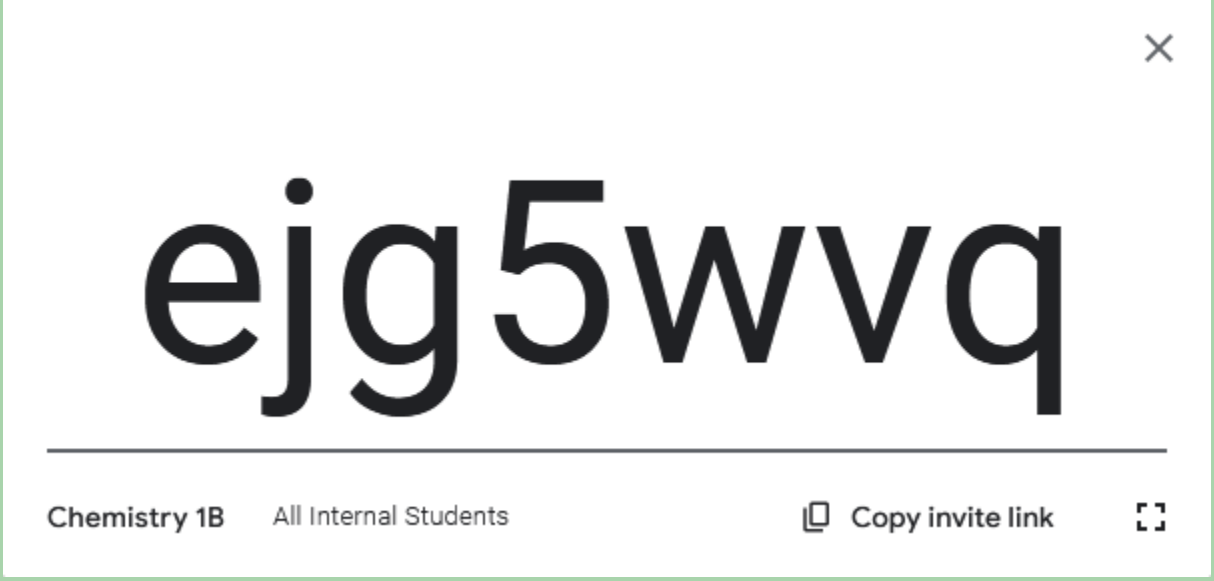
- ***On Your Tutorial Group:***
- **A (A1, A2, A3, A4) – Mr. Sosae SAMUEL**
- **B (B1, B2, B3, B4) – Mr. Isaac WALTER**
- **C (C1, C2, C3, C4) – Ms. Shirley KUNUMB**
- **D (D1, D2, D3, D4) – Miss Erin MAYA**

**** Never register your name to another group. This might cost your grade at the end of the semester.***

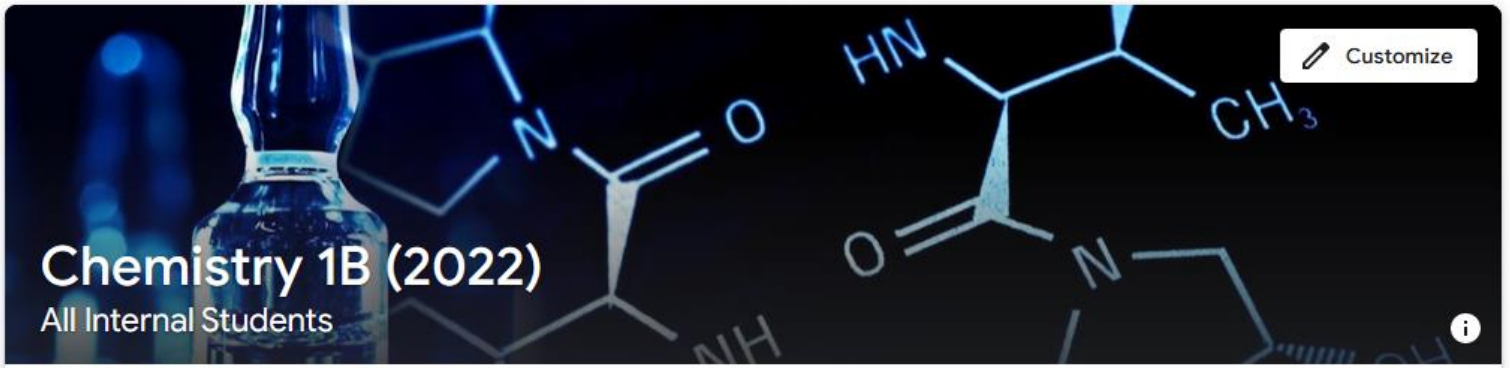
- I enjoined everyone to create a google classroom and use the class code below to join our class.
- To join the google classroom, open your Gmail and click the tab on the upper right portion.
- There will appear several apps and select classroom way below.



- **Select role [student] and use this class code to join our class. You must use your student.upng.ac.pg email address, otherwise you won't be accepted by the system.**



Stream Classwork People Grades



Class code ejg5wvq
Subject SFY Organic Chemistry Part
Room MLT

Meet

Generate link

Class code

ejg5wvq

Upcoming

No work due soon

View all

Announce something to your class

Mr. Belly Asong
3:23 PM (Edited 3:26 PM)

Welcome everyone to our google classroom. In this online platform, I will post your assignments, tutorials, lectures, and other learning materials. I am expecting that you will study hard on this course for you to get a good mark.

Your lecture time is as follows;

Monday:	11:00 - 12:00 (L) at MLT
Wednesday:	09:00 - 10:00 (L) at MLT
Friday:	01:00 - 02:00 (L) at MLT

*others are your timetable for practical and tutorial classes

*kindly see the attachment below for your guidance

Chemistry 1B Timetable (2...
PDF

- **The course will cover the following topics;**
  - **Hybridization and Molecular Geometry**
  - **Resonance, Organic Acids and Bases**
  - **Aliphatic and Aromatic Hydrocarbon Chemistry**
  - **Reactions of Aliphatic Hydrocarbons**
  - **Chemistry of Aromatic Hydrocarbons**
  - **Reactions of Organohalides**
  - **Alcohols, Ethers & Epoxides**
  - **Aldehydes and Ketones**
  - **Carboxylic acids and their Derivatives**

Introduction and Chemical Bonding

Introduction

- This second semester, you're going to learn the organic part (Chemistry 1B)
- You have already covered the inorganic chemistry component last semester 1
- In this semester 2, I expect that everyone will pay attention and do extra effort to understand this course
- Now let us take a look at what this course is about

Introduction

What is organic chemistry, and why should you study this?

- The answers to these questions are all around us since every living organism is made of organic chemicals
- Examples are proteins that make up our skin, hair, and muscles
- The DNA that controls our genetic heritage

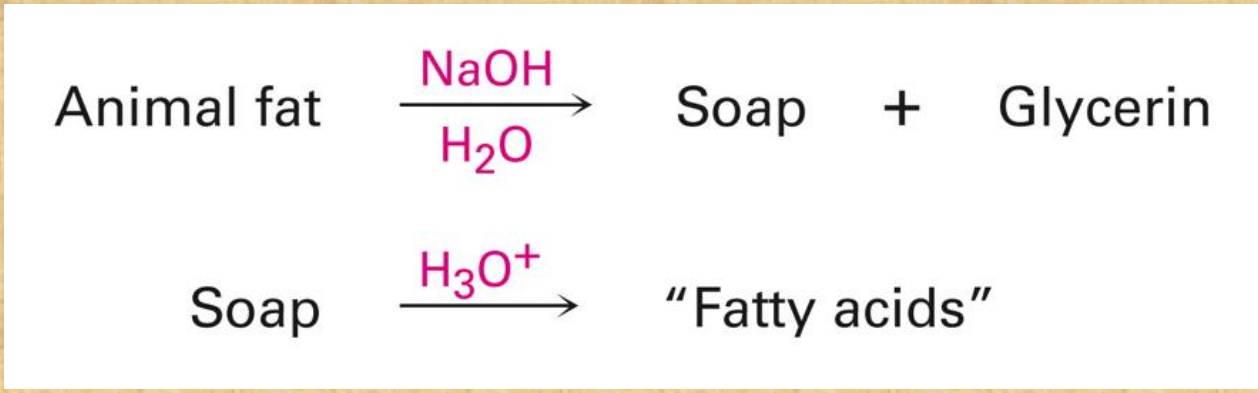
Introduction

What is organic chemistry, and why should you study this?

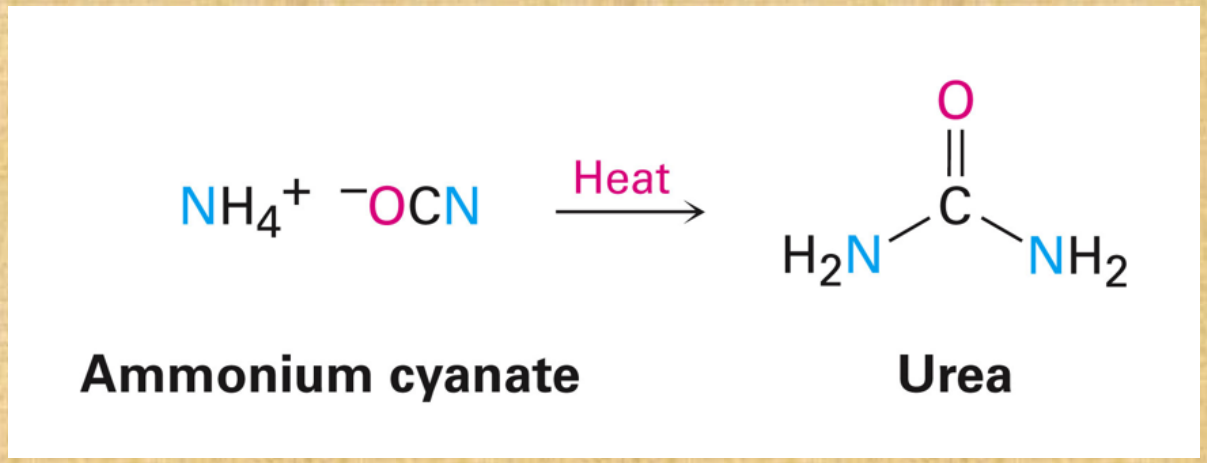
- **The foods that nourish us**
- **The medicines we take when we are sick**
- **The polymers that we used in vehicles, aircraft, boats, and many infrastructures**
- **The fuel that we are using to run our cars SUVs, airplanes, yachts, and many others**
- **The perfume we like, these are all organic**

Introduction

- **Historically and originally, organic chemistry was known as *the study of chemical compounds found in living things***
- **Over time, this concept has had to be modified as many other compounds were synthesized by chemists in laboratories**

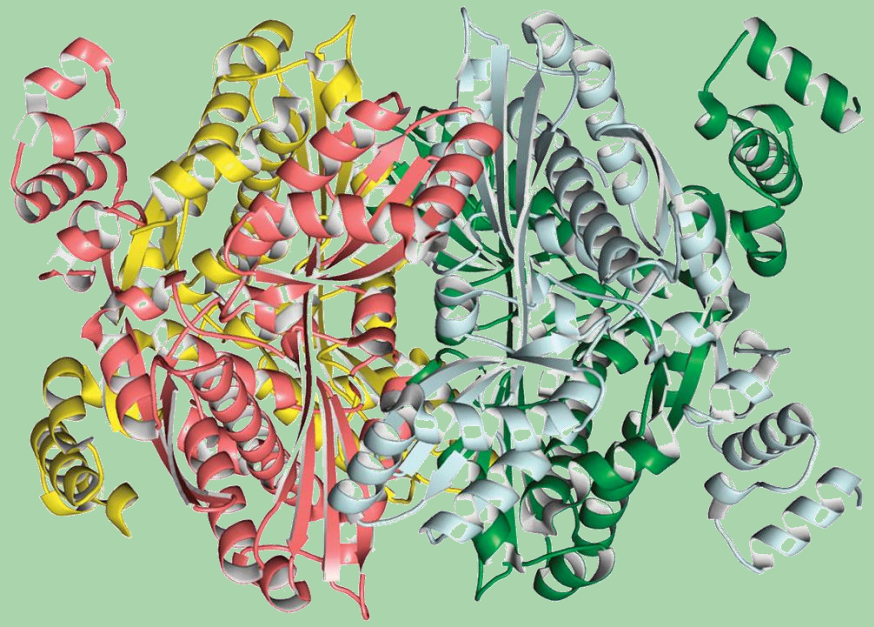


Introduction



- The modern definition of organic chemistry is the study of ***carbon-containing*** compounds of which 10-20% of known organic compounds are found in living things

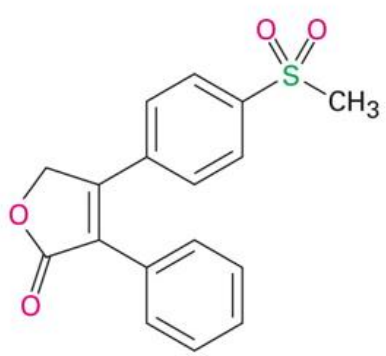
In enzymatic reactions…



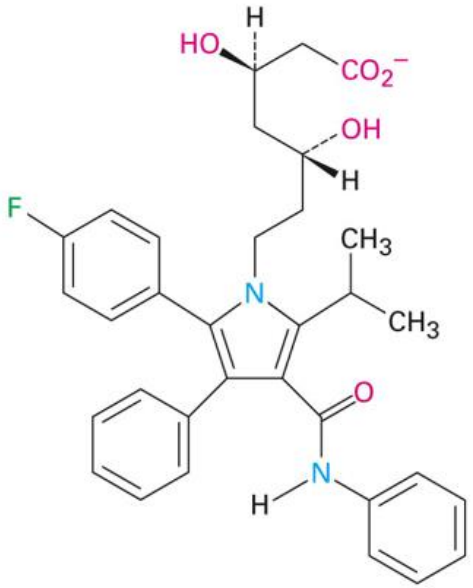
The enzyme (3-hydroxy-3-methyl-glutaryl-CoA reductase or HMGR or HMG-CoA reductase) shown here in the ribbon model, is the rate-controlling enzyme of the mevalonate pathway that catalyzes a crucial step in the body's synthesis of cholesterol.

Understanding how this enzyme function has led to the development of drugs credited with saving millions of lives.

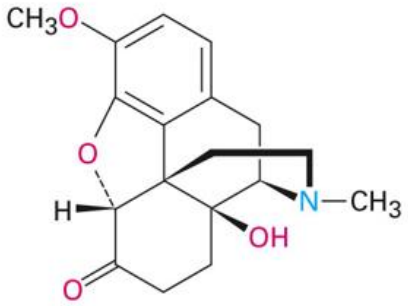
In Medicines



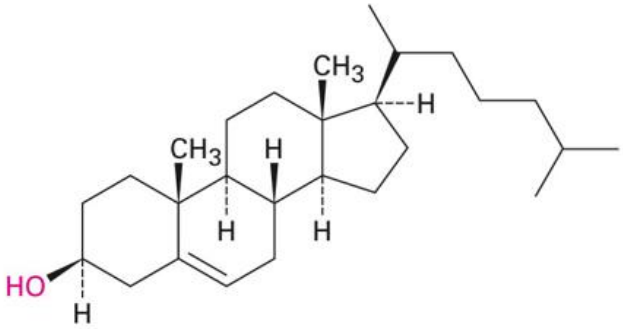
Rofecoxib
(Vioxx)



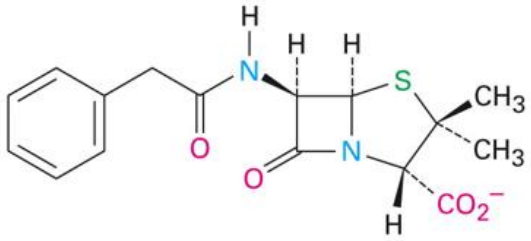
Atorvastatin
(Lipitor)



Oxycodone
(OxyContin)



Cholesterol



Benzylpenicillin

Why is carbon special?

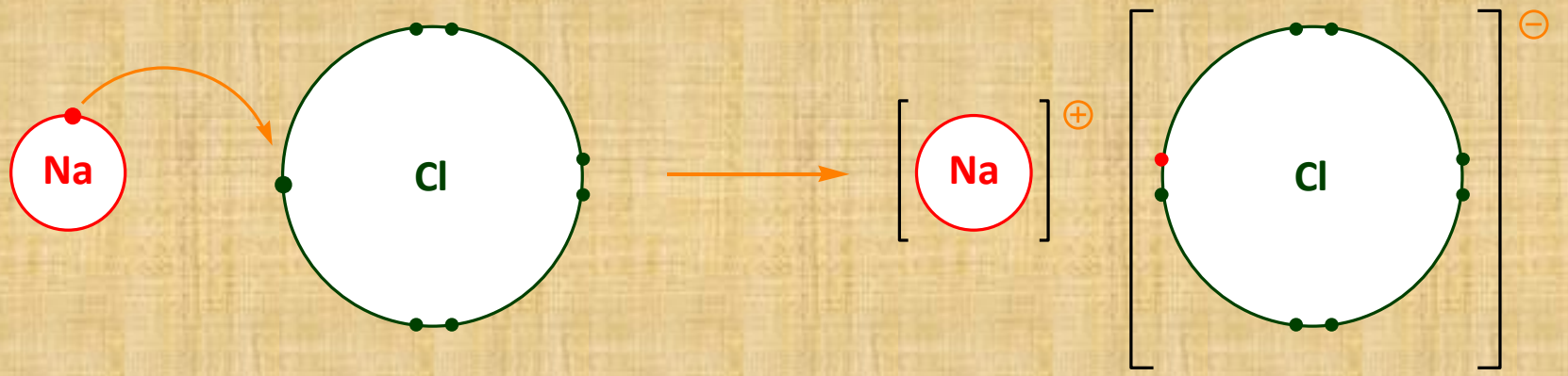
- More than 50 million presently known chemical compounds, most of them contain carbon
- It is element number 6 and is in Period 2 and Group 4 in the Periodic Table
- It has 4 valence shell electrons and has an electronic configuration of 2,4 or $1s^2$, $2s^2$, $2p^2$
- In forming a bond, it does not lose or gain electrons, it shares electrons – i.e. it forms covalent bonds

Chemical bonding

- To talk about a bond in a chemical sense is simply saying a linkage between two atoms
- A representation of this link is when one atom is ‘attached’ to another in a chemical compound
- In the simplest sense, this linkage comes in two ways:
  - Ionic bond, and
  - covalent bond

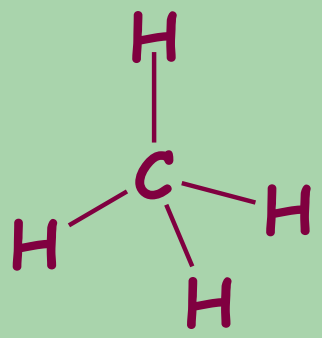
Ionic bond

- **When there is a complete electron(s) transfer from one atom's valance shell to another atom's valance shell**
  - ***E.g. sodium chloride***

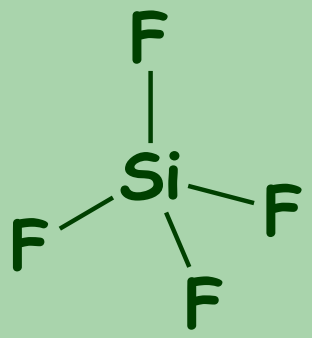


Covalent bond

- **But when two atoms equally share their valence shell electrons, the linkage is called the *covalent bond***
- ***E.g. methane and tetrafluorosilane***



methane



tetrafluorosilane

General rule

- As a general rule, when two non-metals bond, the bond is a covalent bond
- When a metal and non-metal bond, it is a ionic bond
- But what about the covalent bond – how do they form and what brings it about

A short review of orbital

- Remember from your Chem 1A that, according to the quantum mechanical model, the behavior of a specific electron in an atom can be described by a mathematical expression called "*wave equation*"
- This is the same type of expression used to describe the motion of waves in a fluid.

A short review of orbital

- The solution to wave equation is called a "*wave function*", or "orbital", and is denoted by the Greek letter psi (ψ).
- By plotting the square of the wave function, (ψ^2), in three-dimensional space, an orbital describes the volume of space around a nucleus that an electron is most likely to occupy.

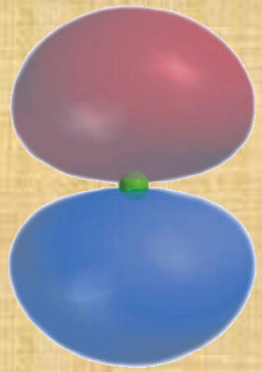
A short review of orbital

- You might therefore think of an orbital as looking like a photograph of the electron taken at a slow shutter speed.
- In such a photo, the orbital would appear as blurry cloud, indicating the region of space where the electron has been.

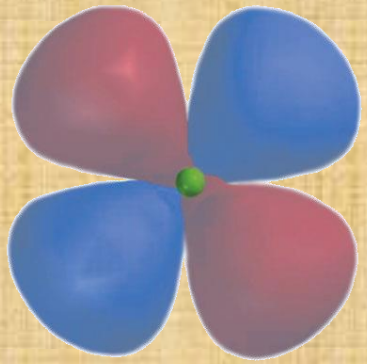
A short review of orbital

- This electron cloud doesn't have a sharp boundary, but for practical purposes we can set the limit by saying that an orbital represents the space where an electron spends 90% to 95% of its time.

An *s* orbital



A *p* orbital



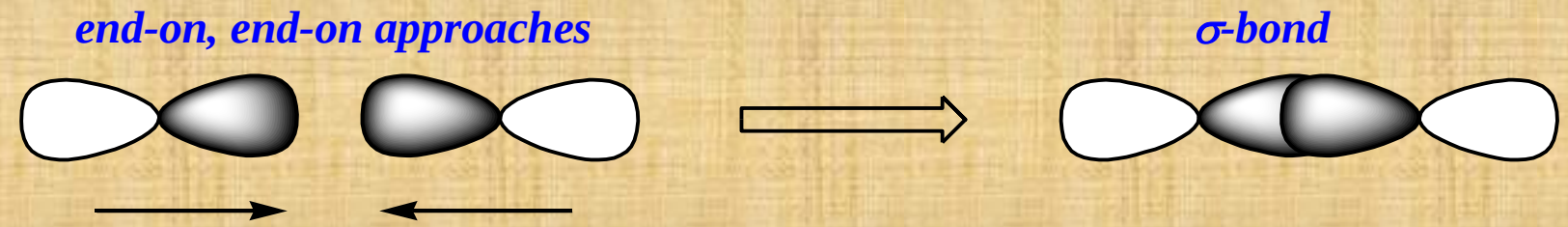
A *d* orbital

Back to Covalent bond

- **It is classified into two major types:**
  - **Sigma (σ) bonds and pi (π) bonds**
- **The main difference between the two is the manner in which they are formed**
- **Sigma bonds are formed when atomic orbitals overlap along the line joining the two bonded atoms (i.e. end-on/end-on overlap)**
- **Here the electron distribution has an axial symmetry around the axis joining the two bonded nuclei**

Covalent bond

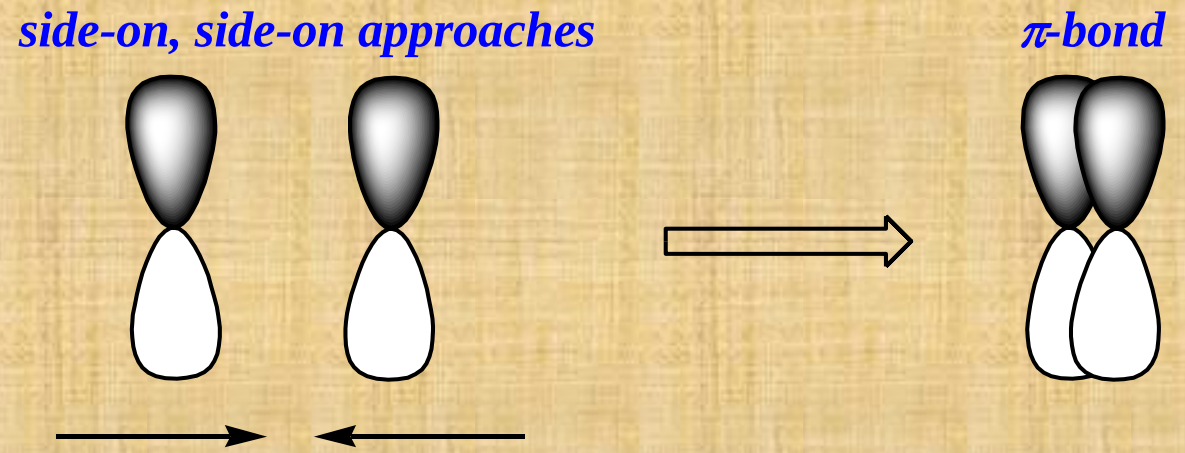
- The σ bond is much, much stronger than the π bond because of the nature of the overlap



- π bonds are formed by a side-on/side-on overlap of the unhybridized ***p***-orbitals.
- This overlap can only occur if the orbitals are parallel to each other as shown next

Covalent bond

- A π-bond



- In order for a bond to form between two atoms, atomic orbitals have to overlap
- This is only possible when the overlapping orbitals are of similar energy

Electronic configuration

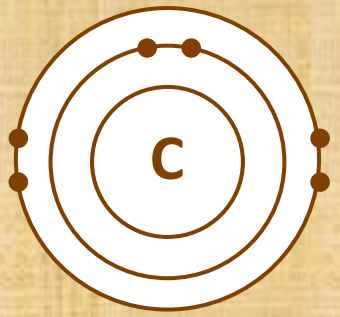
- **All atoms on the periodic table have a certain electronic arrangement known as the *electronic configuration***
- **The electron in each shell are placed in orbitals of differing energy levels**
- **Before overlapping happens, the valence shell orbitals of differing energy levels undergo a process called *hybridization***

Hybridization

- This process is essentially a mixing of electrons and the atomic orbitals to produce degenerate one (having same energy levels) called *hybrid* orbitals
- Now let's take a closer look at carbon:
- Carbon is in Period 2 and Group 4 of the Periodic Table
- It has an atomic number of 6, which means that it has 6 electrons in total

Hybridization

- **In the electron shell diagram, the arrangement is as follows: the first 2 electrons are placed in the first shell while next 4 are placed in the second shell**



Electron configuration

C: 2,4

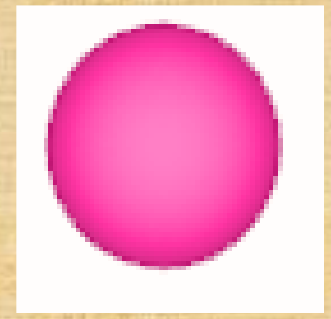
Hybridization

- In each of these shells, there are atomic orbitals where these electrons are stored
- Each of these orbitals is capable of only storing 2 electrons
- The first shell has only one orbital (i.e. an *s*-orbital) and thus there are only 2 electrons found in there
- The second shell has four atomic orbitals, an *s*-orbitals and three *p*-orbitals

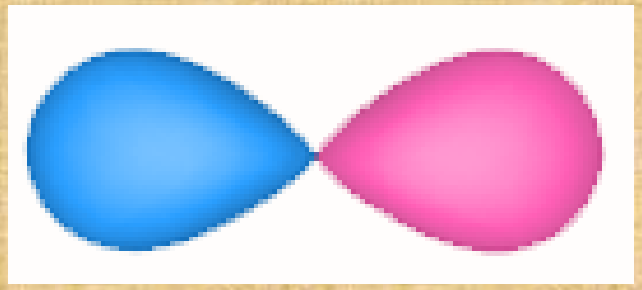
Hybridization

- **The *s*- and *p*-orbitals have different energy levels with the *s* having a lower level than the *p* ones**
- **The shape of these orbitals are given below:**

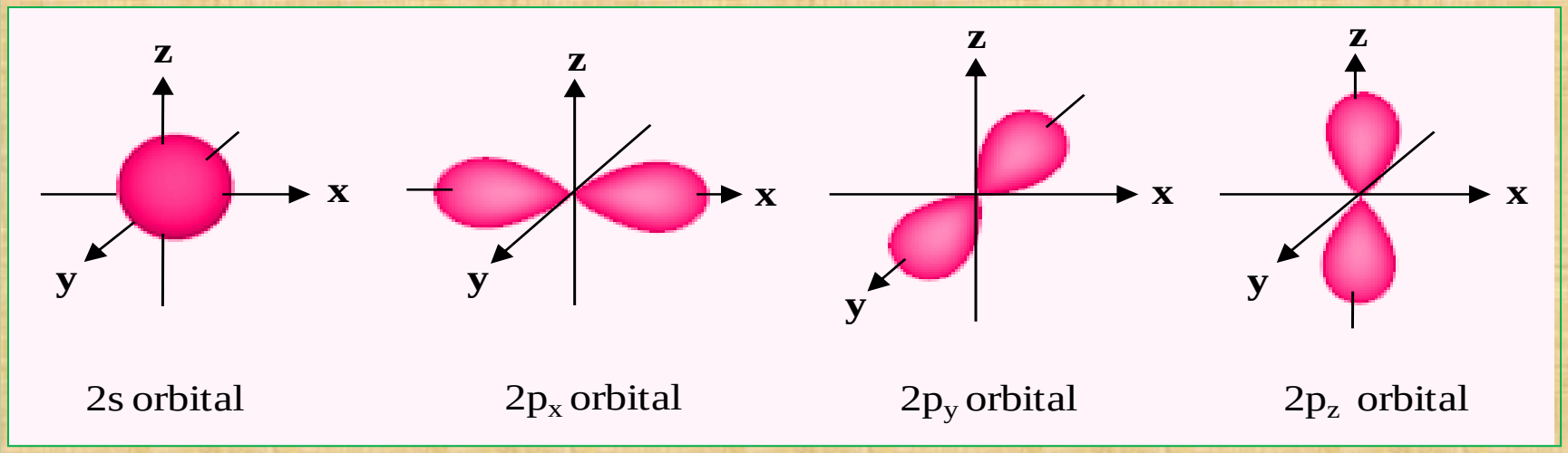
Spherical *s* orbital



Dumb-bell shape of *p* orbital



Hybridization



- **Notice that the three p orbitals are perpendicular to one another and occupy the three axes (p_x, p_y, and P_z)**