

일반생물학 및 실험 1

미래를 이끄는 전북대
Global TOP 100



2026년 1학기

고분자의 이해

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전북대학교

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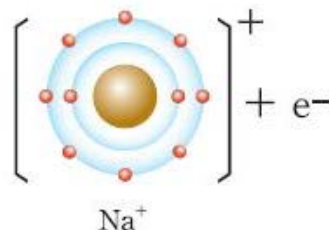
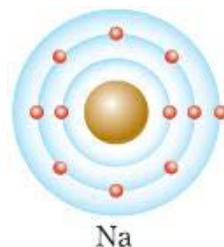
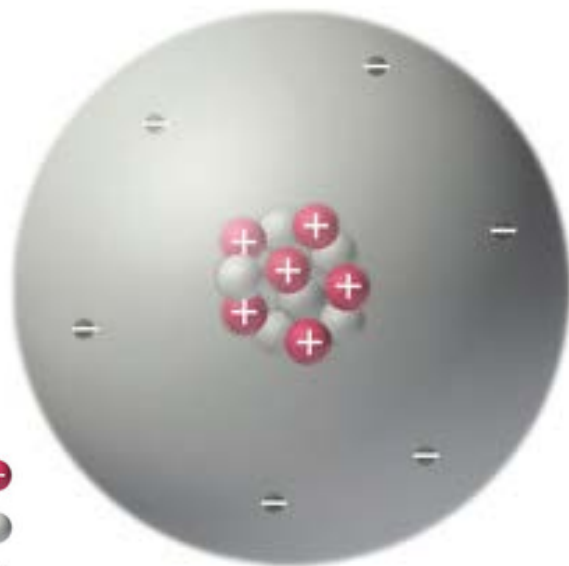
1 Atom & Molecule

원자와 분자

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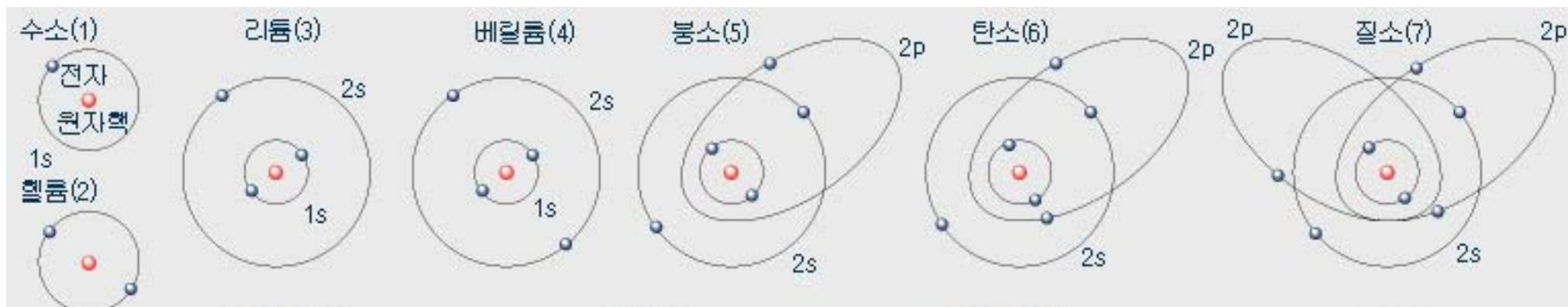
원자



원자 : 물질의 성질을 지닌 기본적인 최소 입자

- 원자 = 원자핵 + 전자
- 원자핵 = 양성자 + 중성자

이온 : 원자 또는 원자 덩치가 음 전하나 양 전하를 갖게 되면 이온이 된다



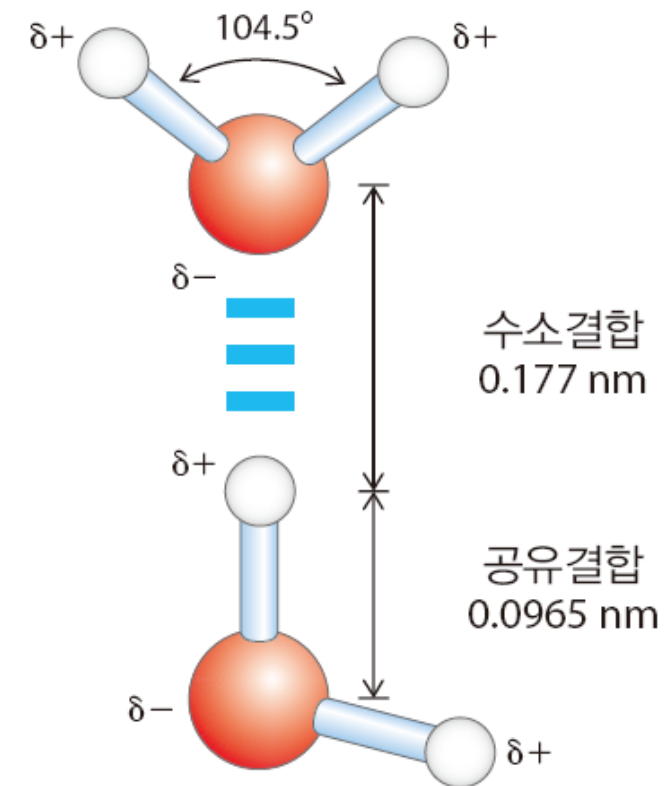
분자

분자 (Molecule) : 화학결합을 통해 이루어진 2개 이상의 원자들의 집합체

- 산소 : 산소원자가 2개 결합한 산소의 분자로 구성
- 물 : 수소원자 2개와 산소원자 1개가 결합한 물분자를 단위로 하여 구성.
- 분자의 분류 : 단원자분자 (He, Ne, Ar), 2원자분자 (H_2 , O_2 , HCl), 3원자분자 (H_2O , CO_2), 다원자분자 (H_2SO_4 , H_2CO_3), 고분자(녹말, 단백질, DNA)

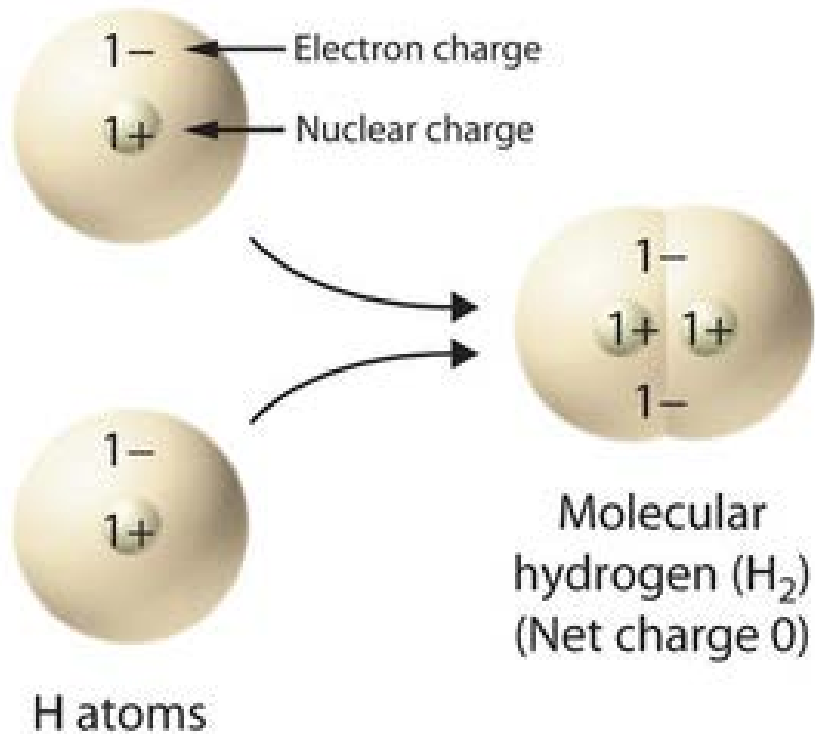
화학결합(Chemical Bonds)

- 이온결합 : 양이온과 음이온이 정전기인력으로 결합하여 생기는 결합
- 공유결합 : 2개의 원자가 서로 전자를 방출하여 전자쌍을 형성하고, 이를 공유함으로써 생기는 결합
- 수소결합 : 수소 원자에 전기음성도가 강한 원자가 서로 이웃할 때 두 원자 사이에 생긴 정전기적 인력

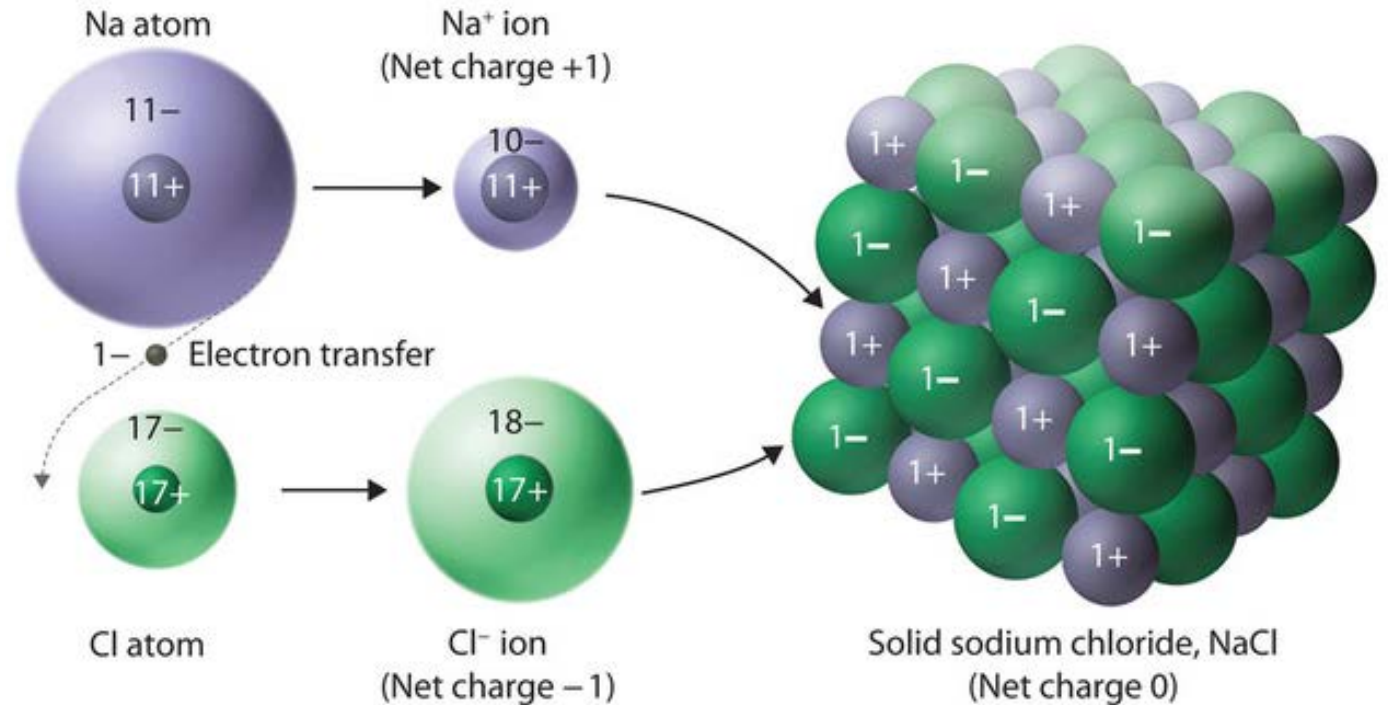


분자

화학결합(Chemical Bonds)



Covalent bonding



Ionic bonding

2 Structural Formula

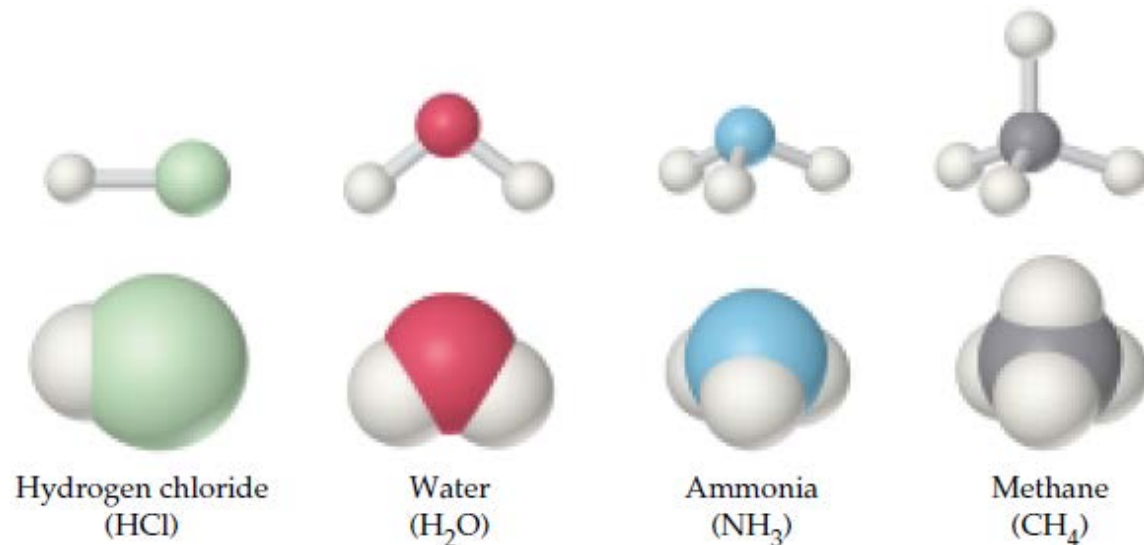
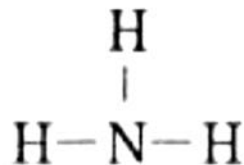
구조식

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구조식

- 화학식(Chemical Formula) : 분자 속에 포함되어 있는 각각의 원소들은 원소기호를 사용하여 나타내고, 탄소를 제외한 나머지 원자는 알파벳순으로 표기, 원자의 상대적 수는 아래 첨자로 나타낸다.
EX) 포도당 $C_6H_{12}O_6$, 산소 O_2 , 물 H_2O
- 구조식(Structural Formula) : 각각의 결합을 선으로 나타내고 분자의 실제 구조를 보여주기도 한다.
- 분자모형 : 공간채움 모형 (space filled model)과 공-막대 모형(ball and stick model)을 사용하여 분자 내에서 원자들의 상대적인 위치를 나타낸다. 공간채움 모형의 경우 원자들의 상대적 크기도 나타낼 수 있다.



분자모형



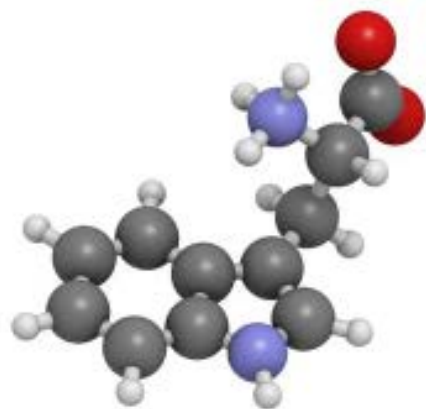
Isoleucine



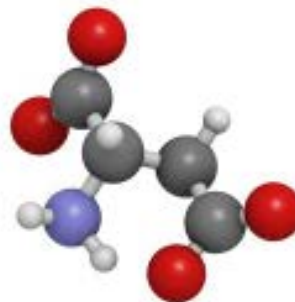
Alanine



Serine



Tryptophan



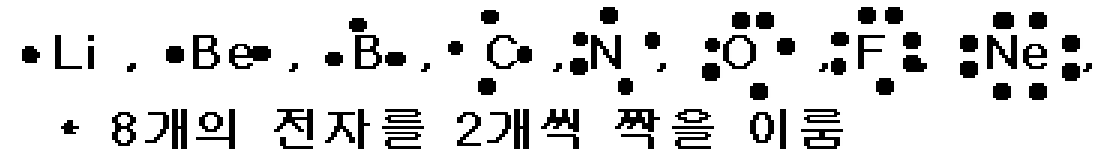
Aspartate



Glycine

구조식

- 루이스 구조식(Lewis structure) : 최외각 전자구조를 간단한 형태로 표시하는 것



- 케쿨레 구조 (Kekule structure) : 루이스 구조를 더 간단히 선으로 나타냄.



3 Carbohydrate

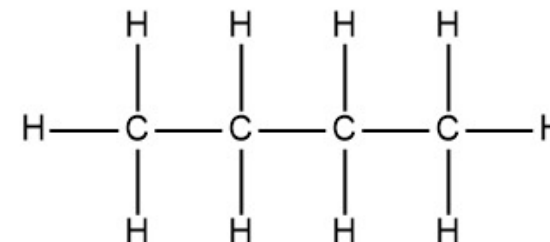
탄소 화합물

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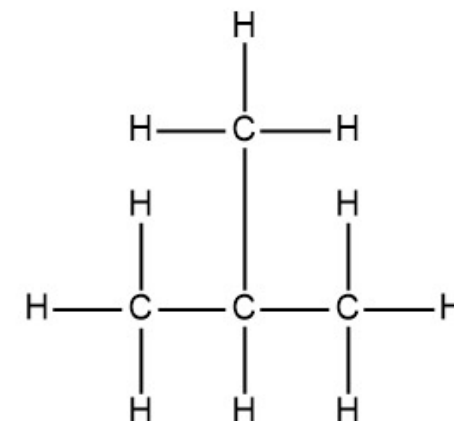
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탄소화합물

- 생물체의 주요 성분을 구성하는 탄소 화합물은 19세기 초 까지만 하더라도 생물체 속에서 생명력에 의해서만 만들어진다고 생각하였으므로, 무생물계에서 얻어지는 무기 화합물과 구별하여 유기 화합물이라고 불렀다.
- 그러나 1828년 독일의 화학자 빌러가 무기물인 시안산암모늄(NH_4CNO)에서 유기 화합물인 요소를 합성한 이후부터 무기 화합물과 유기 화합물의 구별이 무의미 하게 되어, 지금은 유기 화합물을 탄소 화합물이라고 부른다.
- 탄소결합개수에 따라서 Alkane, Alkene, Alkyne으로 나눌 수 있다.
- 이성질체 : 분자식은 같으나 구조식이 다른 물질. 따라서 성질도 다르다.
EX) 부탄의 끓는점은 0도이나 이소부탄의 끓는점은 -12도이다.



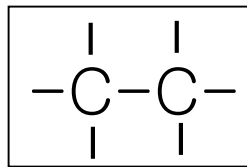
butane



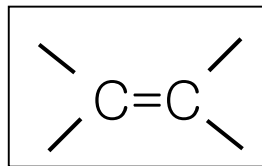
isobutane

Alkane, Alkene, Alkyne

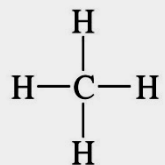
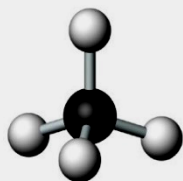
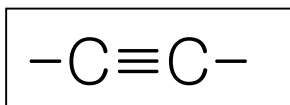
■ Alkane (알케인) : 일반식 C_nH_{2n+2}



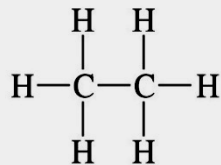
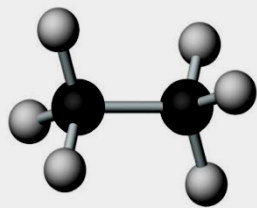
■ Alkene (알켄) : 일반식 C_nH_{2n}



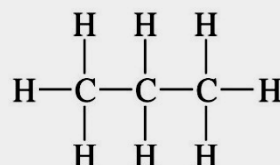
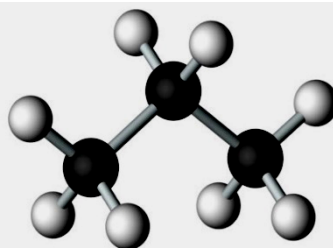
■ Alkyne (알카인) : 일반식 C_nH_{2n-2}



Methane, CH_4

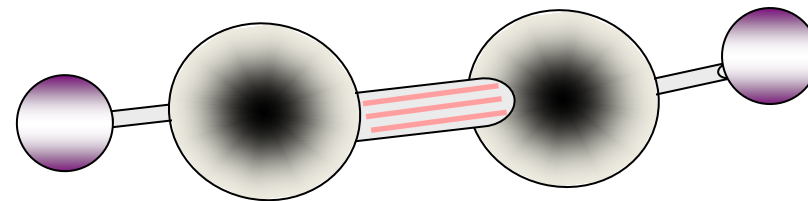


Ethane, C_2H_6

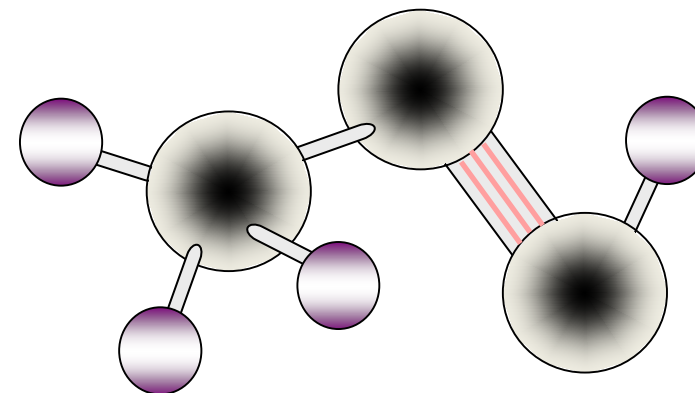


Propane, C_3H_8

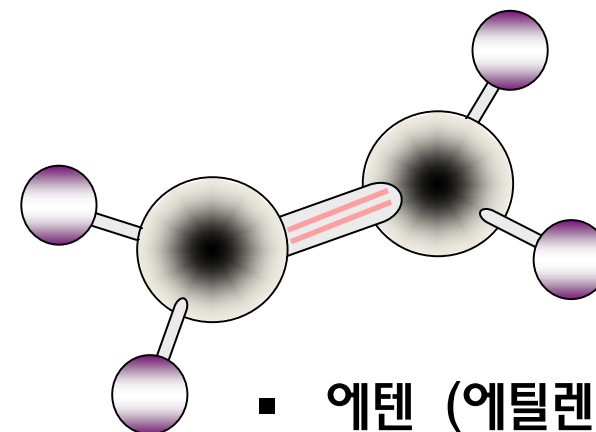
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■ 에타인 (아세틸렌 C_2H_2)



■ 프로파인 (C_3H_4)



■ 에텐 (에틸렌 C_2H_4)

■ 알칸의 동족체

이름		분자식	녹는점 ℃	끓는점 ℃	이성 질체수	알킬기 (R-)	알킬기 이름
메테인	methane	CH ₄	-182.1	-164.0	0	CH ₃ -	메틸
에테인	ethane	C ₂ H ₆	-183.8	-88.6	0	C ₂ H ₅ -	에틸
프로페인	propane	C ₃ H ₈	-189.7	-42.1	0	C ₃ H ₇ -	프로필
뷰테인	butane	C ₄ H ₁₀	-138.4	-0.5	2	C ₄ H ₉ -	부틸
펜테인	pentane	C ₅ H ₁₂	-130.0	36.1	3	C ₅ H ₁₁ -	페틸
헥세인	hexane	C ₆ H ₁₄	-95.0	69.0	5	C ₆ H ₁₃ -	헥실
헵테인	heptane	C ₇ H ₁₆	-90.6	98.4	9	C ₇ H ₁₅ -	헵틸
옥테인	octane	C ₈ H ₁₈	-56.8	125.7	18	C ₈ H ₁₇ -	옥틸
노네인	nonane	C ₉ H ₂₀	-51.0	150.8	36	C ₉ H ₁₉ -	노닐
데케인	decane	C ₁₀ H ₂₂	-29.7	174.1	75	C ₁₀ H ₂₁ -	데실

✓서로 CH₂ 씩 차이
가 나는 한 무리

■ 물질명에 쓰인 수의 표시

	1	2	3	4	5	6	7	8	9	10
수	mono	di(bi)	tri	tetra	penta	hexa	hepta	octa	nona	deca
물질이름	metha	etha	proa	buta	penta	hexa	hepta	octa	nona	deca

4 Functional group 기능기

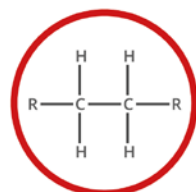
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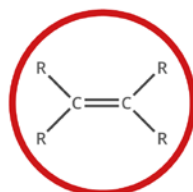
기능기에 따른 분류

■ 기능기 : 공통된 화학적 특성을 지니는 원자단
기화합물에서 그 특성이 나타나는 원자단

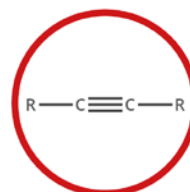
● HYDROCARBONS ● SIMPLE OXYGEN HETEROATOMICS ● HALOGEN HETEROATOMICS ● CARBONYL COMPOUNDS ● NITROGEN BASED ● SULFUR BASED ● AROMATIC



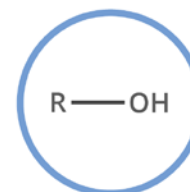
ALKANE
Naming: -ane
e.g. ethane



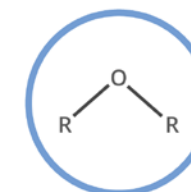
ALKENE
Naming: -ene
e.g. ethene



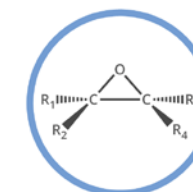
ALKYNE
Naming: -yne
e.g. ethyne



ALCOHOL
Naming: -ol
e.g. ethanol



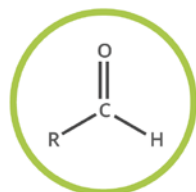
ETHER
Naming: -oxy -ane
e.g. methoxyethane



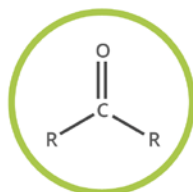
EPOXIDE
Naming: -ene oxide
e.g. ethene oxide



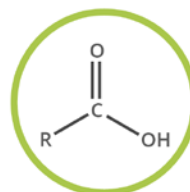
HALOALKANE
Naming: halo-
e.g. chloroethane



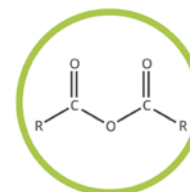
ALDEHYDE
Naming: -al
e.g. ethanal



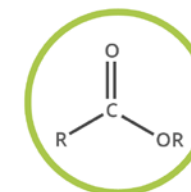
KETONE
Naming: -one
e.g. propanone



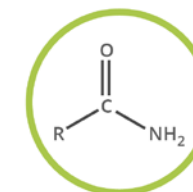
CARBOXYLIC ACID
Naming: -oic acid
e.g. ethanoic acid



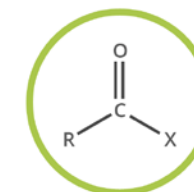
ACID ANHYDRIDE
Naming: -oic anhydride
e.g. ethanoic anhydride



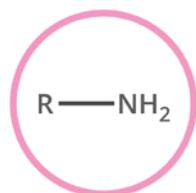
ESTER
Naming: -yl -oate
e.g. ethyl ethanoate



AMIDE
Naming: -amide
e.g. ethanamide



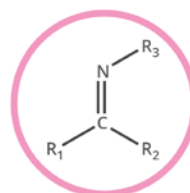
ACYL HALIDE
Naming: -oyl halide
e.g. ethanoyl chloride



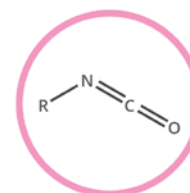
AMINE
Naming: -amine
e.g. ethanamine



NITRILE
Naming: -nitrile
e.g. ethanenitrile



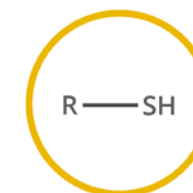
IMINE
Naming: -imine
e.g. ethanimine



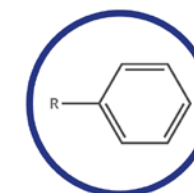
ISOCYANATE
Naming: -yl isocyanate
e.g. ethyl isocyanate



AZO COMPOUND
Naming: -azo-
e.g. azoethane



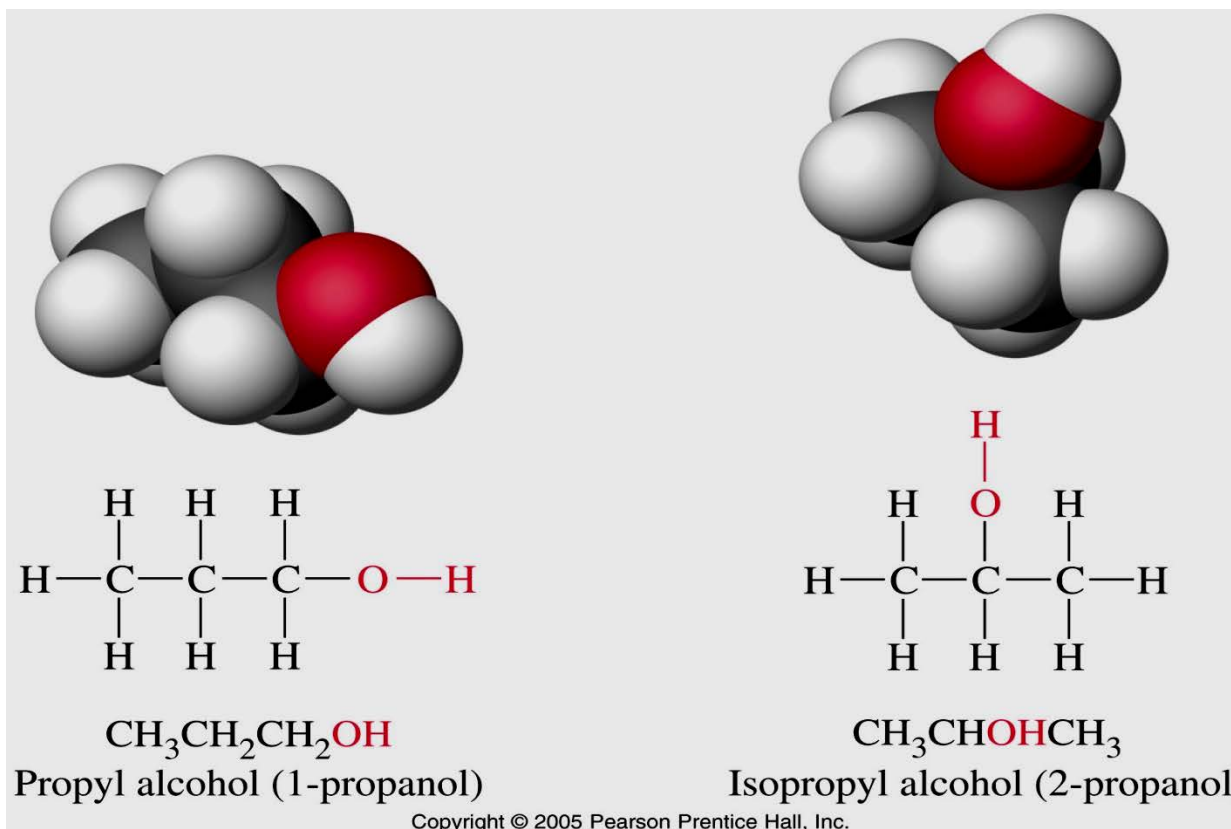
THIOL
Naming: -thiol
e.g. methanethiol



ARENE
Naming: -yl benzene
e.g. ethyl benzene

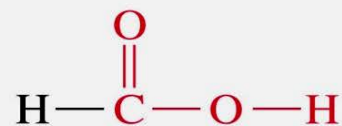
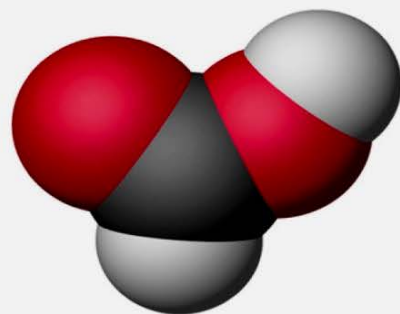
알코올

- 알코올에 공통적인 기능 원자단 : -OH hydroxyl group
- CH_3OH (methanol), $\text{C}_2\text{H}_5\text{OH}$ (ethanol)

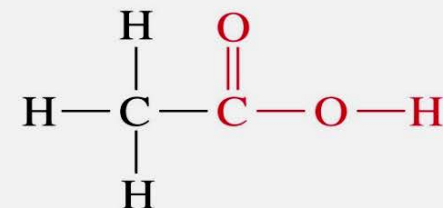
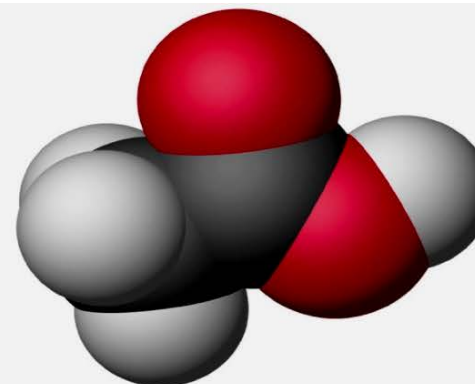


카르복실산 (carboxylic acid)

- 유기 분자에 산성을 가지게 하는 기능 원자단: -COOH carboxyl group



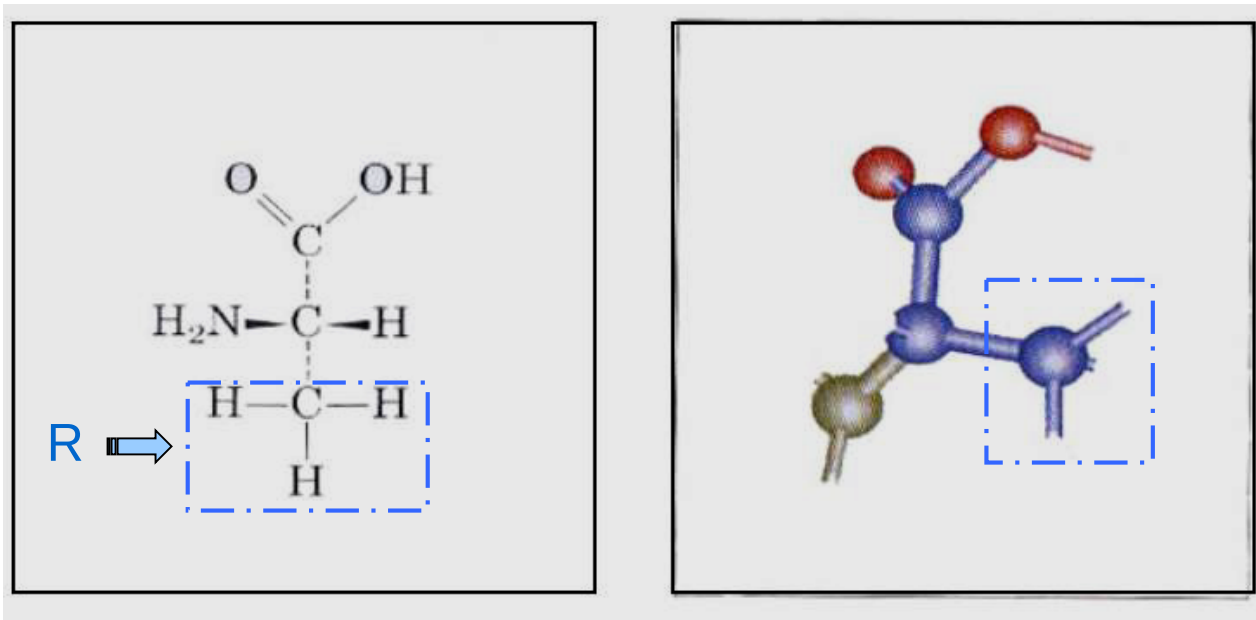
Formic acid (methanoic acid)



Acetic acid (ethanoic acid)

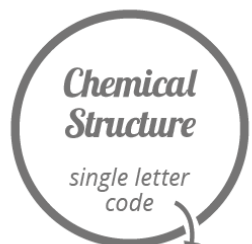
아미노산

- 한 분자 안에 아미노기 (NH_2)와 카르복실기 (COOH)를 가지는 유기화합물
- 모든 생명현상을 관장하고 있는 단백질의 기본 구성단위
- 일반식 : $\text{R-CHNH}_2\text{-COOH}$

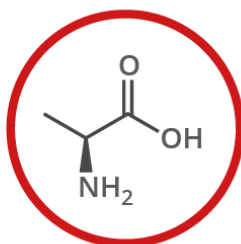


알라닌

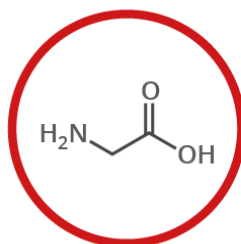
Chart Key: ● ALIPHATIC ● AROMATIC ● ACIDIC ● BASIC ● HYDROXYLIC ● SULFUR-CONTAINING ● AMIDIC ○ NON-ESSENTIAL ○ ESSENTIAL



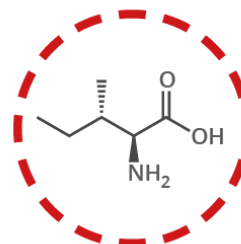
NAME **A**
three letter code
DNA codons



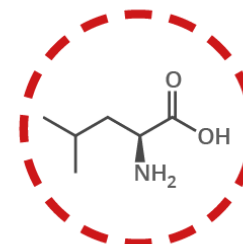
ALANINE **A**
Ala
GCT, GCC, GCA, GCG



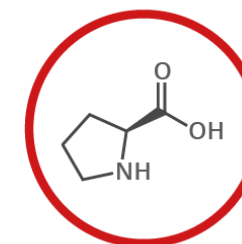
GLYCINE **G**
Gly
GGT, GGC, GGA, GGG



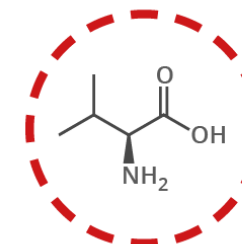
ISOLEUCINE **I**
Ile
ATT, ATC, ATA



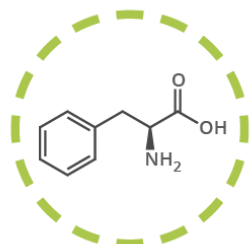
LEUCINE **L**
Leu
CTT, CTC, CTA, CTG, TTA, TTG



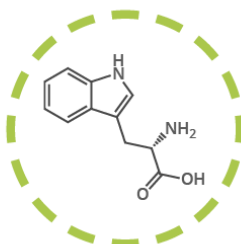
PROLINE **P**
Pro
CCT, CCC, CCA, CCG



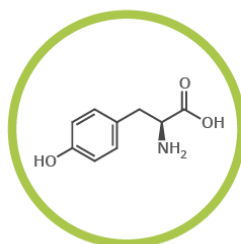
VALINE **V**
Val
GTT, GTC, GTA, GTG



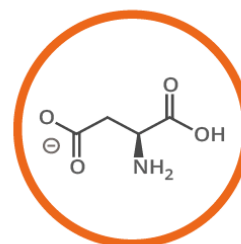
PHENYLALANINE **F**
Phe
TTT, TTC



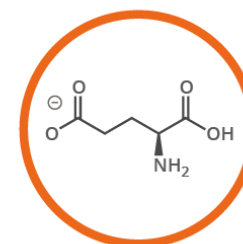
TRYPTOPHAN **W**
Trp
TGG



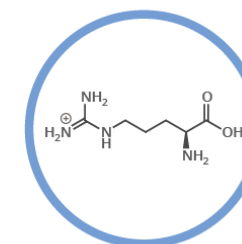
TYROSINE **Y**
Tyr
TAT, TAC



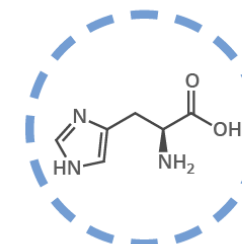
ASPARTIC ACID **D**
Asp
GAT, GAC



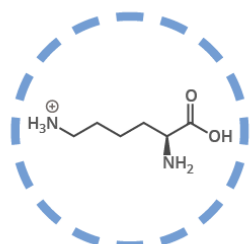
GLUTAMIC ACID **E**
Glu
GAA, GAG



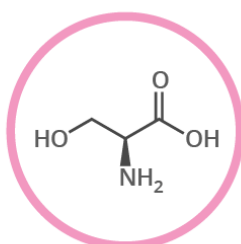
ARGININE **R**
Arg
CGT, CGC, CGA, CGG, AGA, AGG



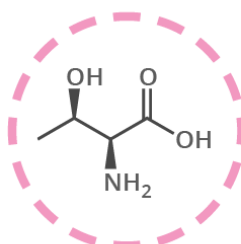
HISTIDINE **H**
His
CAT, CAC



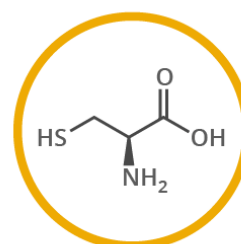
LYSINE **K**
Lys
AAA, AAG



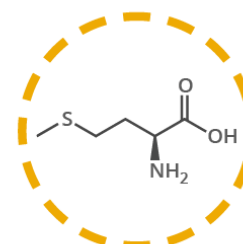
SERINE **S**
Ser
TCT, TCC, TCA, TCG, AGT, AGC



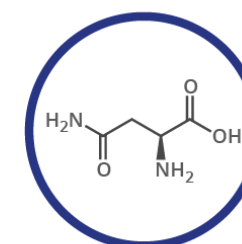
THREONINE **T**
Thr
ACT, ACC, ACA, ACG



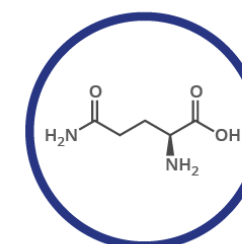
CYSTEINE **C**
Cys
TGT, TGC



METHIONINE **M**
Met
ATG



ASPARAGINE **N**
Asn
AAT, AAC

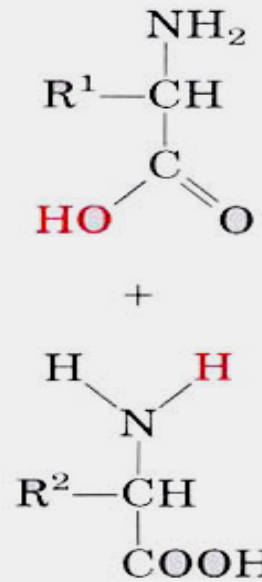


GLUTAMINE **Q**
Gln
CAA, CAG

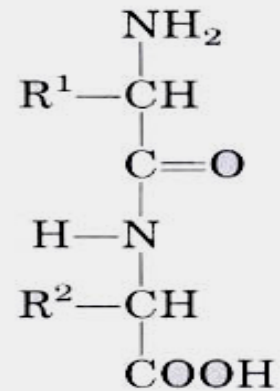
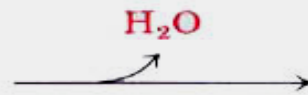
폴리펩타이드

- 2개 이상의 아미노산이 사슬 모양의 펩티드 결합으로 길게 연결된 것

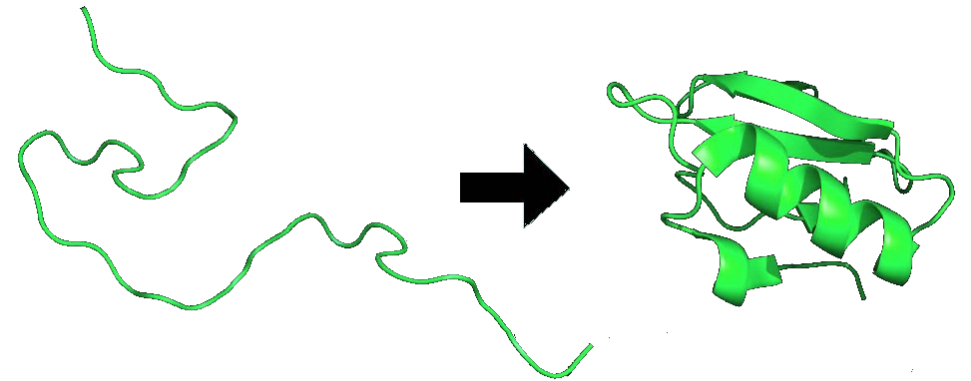
Condensation



Two amino acids



Dipeptide



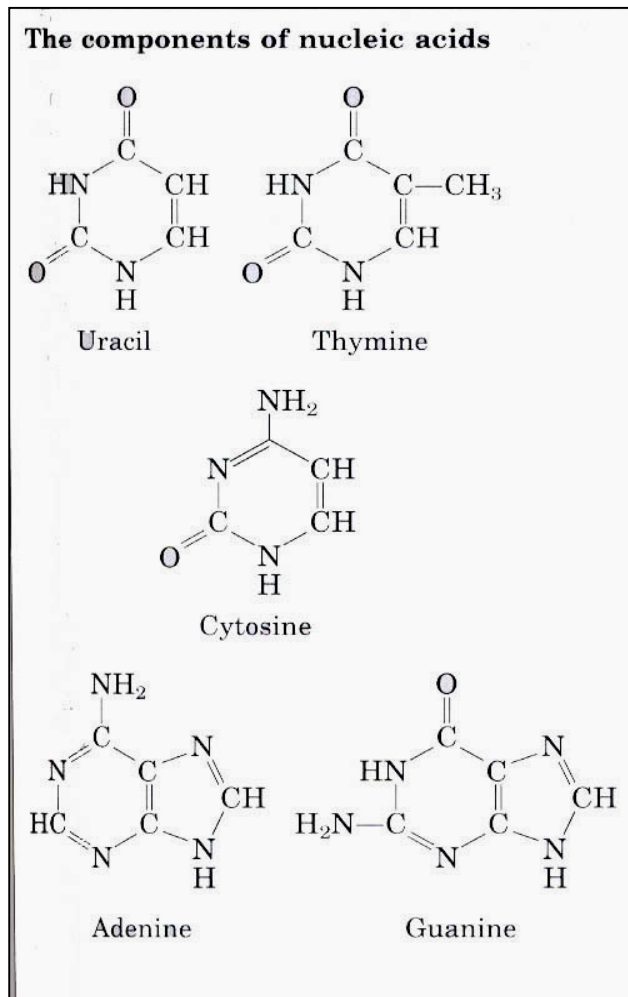
5 Nucleic acid

핵산

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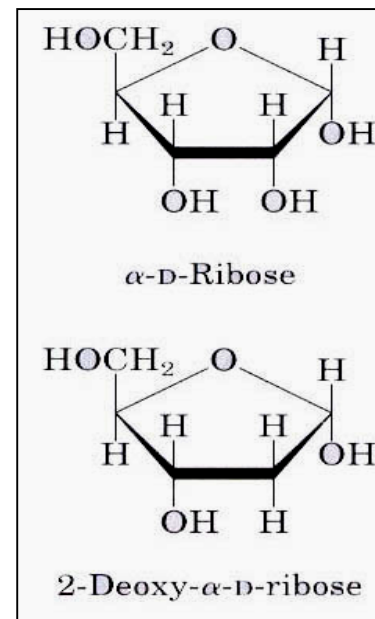
전북대학교

핵산의 구조



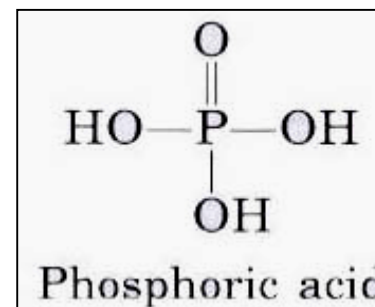
+

염기



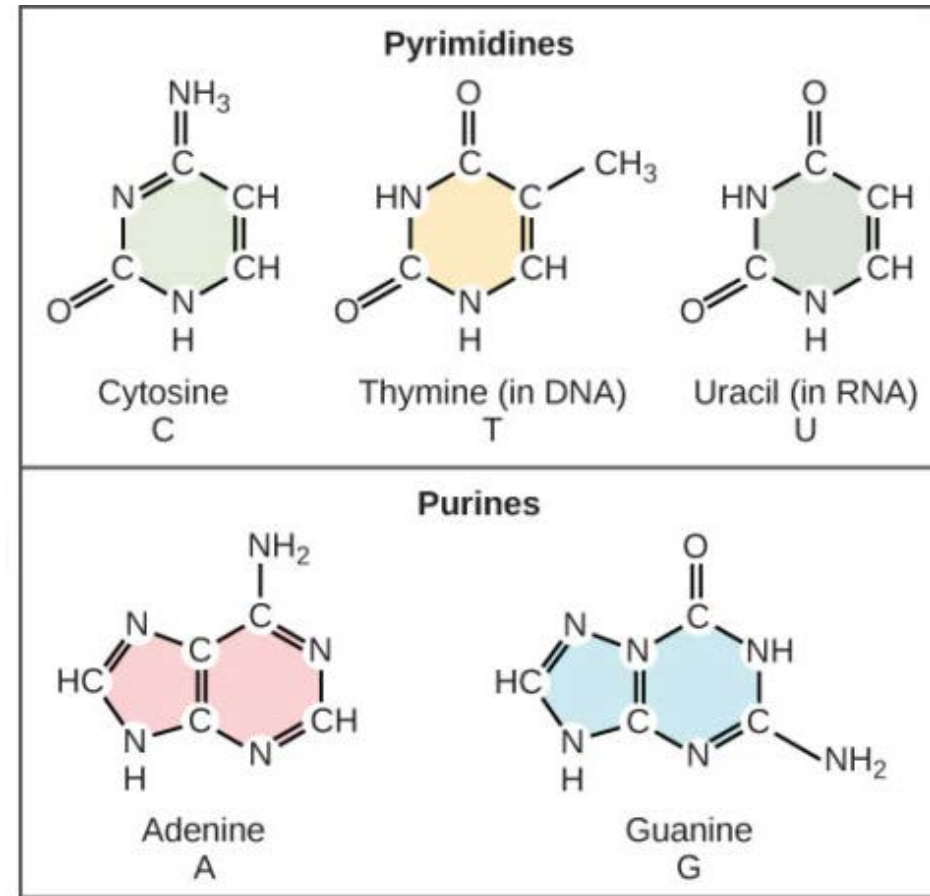
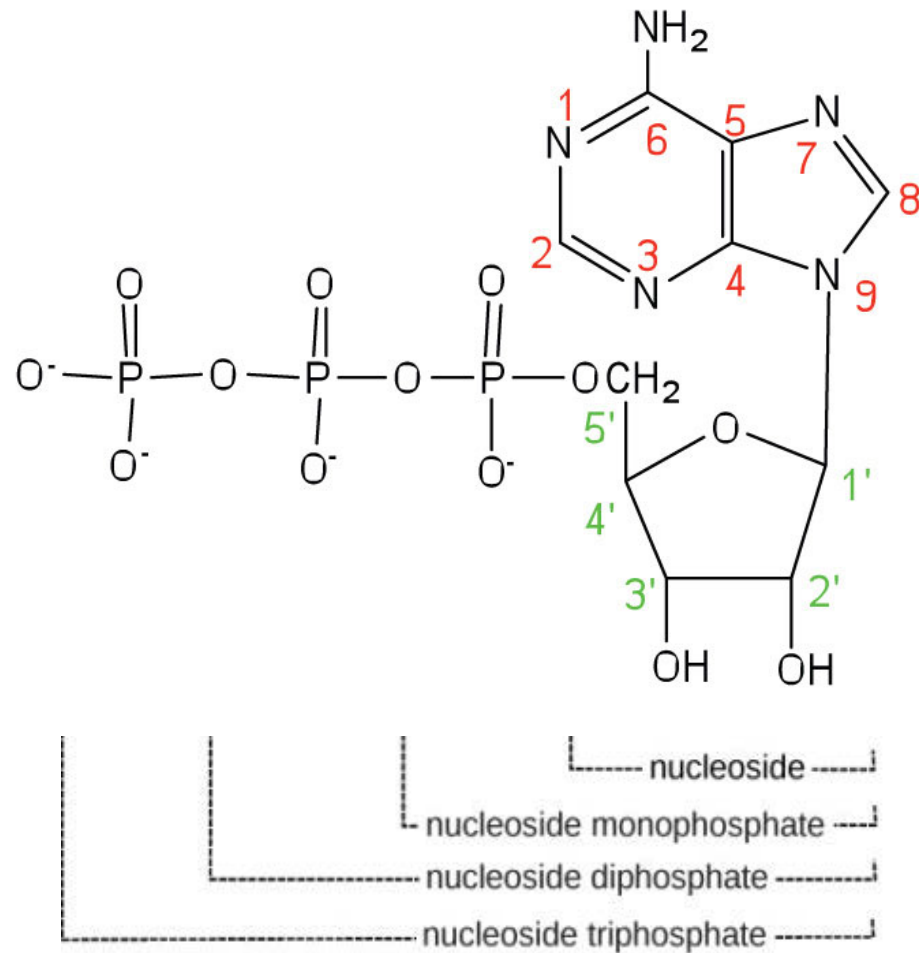
당

+



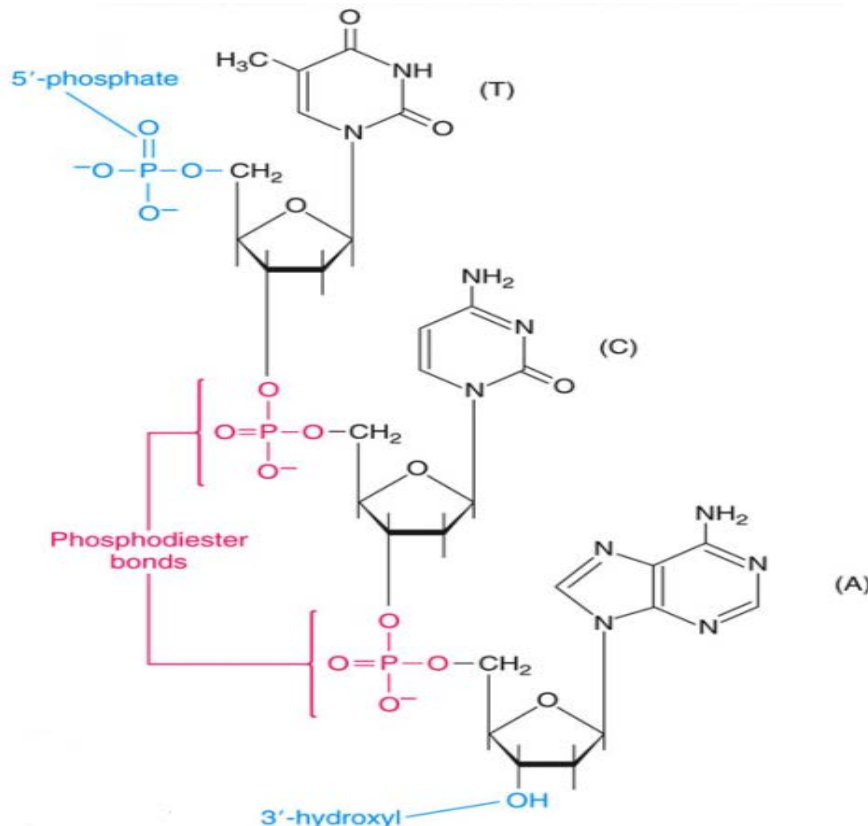
인산

핵산의 구조



DNA (Deoxyribonucleic acid)

- 핵산의 일종으로 세포의 핵 안에서 생물의 유전 정보를 저장하는 물질. 네 종류의 뉴클레오티드가 중합되어 이중나선 구조를 이룬다.
- 구성 : Sugar(deoxyribose), phosphate, base



Polynucleotide의 기본 구조

1. 당과 염기의 결합

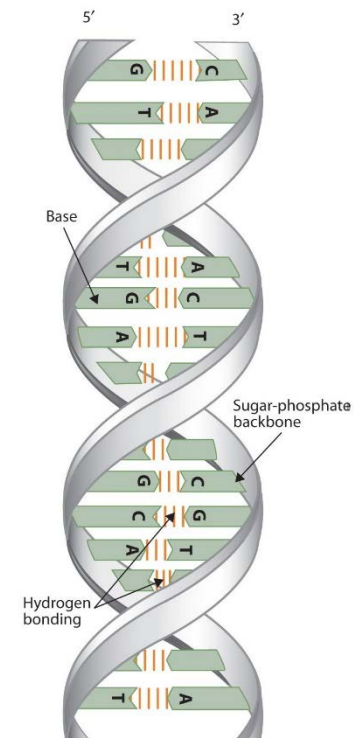
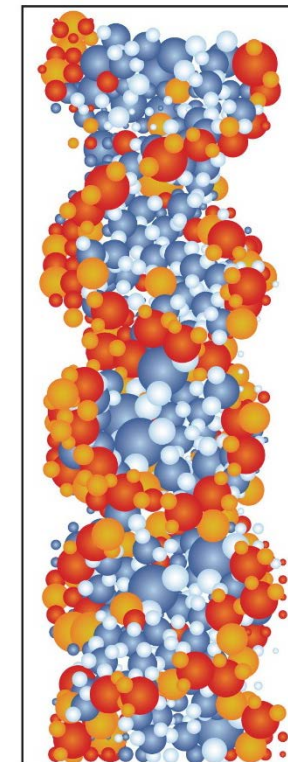
: 당 1번과 퓨린 염기 9번,
피리미딘 1번 위치가 결합

2. 당 사이의 결합

: 당 3번 -OH기와 인접
당 5번 -H가 탈락하여
phosphodiester 결합

3. Polarity (방향성)

: 5번 말단에는 항상 인산
3번 말단에는 항상 OH기



1 분자모형 만들기

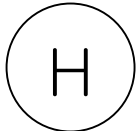
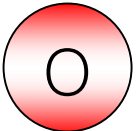
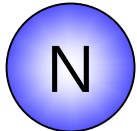
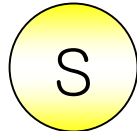
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■ 실험 목적

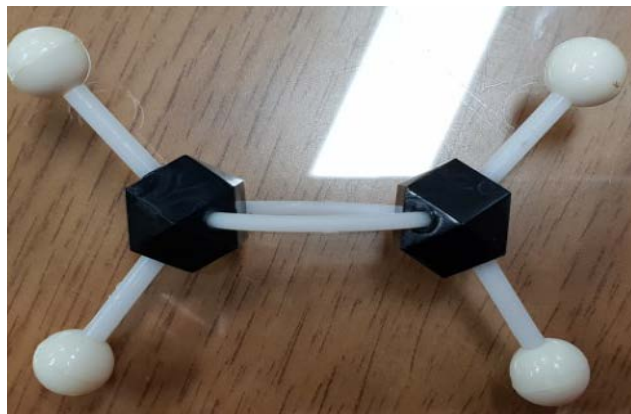
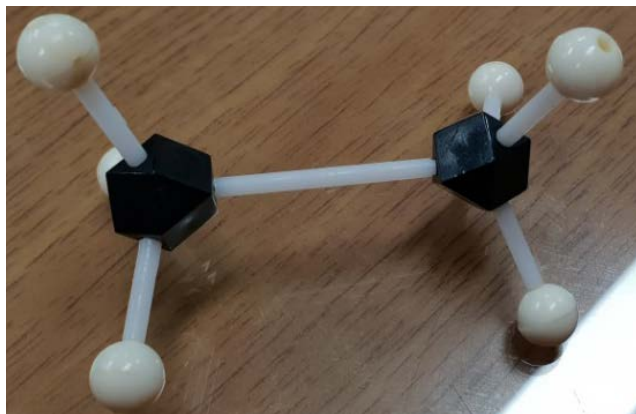
- 분자구조모형을 가지고 그 분자를 구성하고 있는 원자의 입체 배치와 원자 간의 결합상태를 이해한다. 이를 통해 핵산과 아미노산의 구조, 펩타이드 결합상태를 이해한다.

■ 재료

- 분자모형키트 : 원자구     
- 연결고리(막대) : 짧은 고리, 중간고리, 긴 고리, 휘어진 고리(공유결합)

■ 방법

- 앞서 설명한 슬라이드를 참고하여 다음과 같이 제작하여 사진을 찍는다.
 1. 알칸, 알켄 기본형태의 분자모형을 제작한다. (탄소 두 개)
 2. 기능기를 가진 화합물을 제작한다.
 3. 조별로 1개의 아미노산을 제작한다. (글라이신 제외)
 4. 핵산의 염기 (A,C,G,T) 중 한 개 를 제작한다.



■ 결과

1. 방법에서 찍은 사진을 첨부해 작성한다.
2. DNA 구조를 그리고 구성성분에 대해 간단히 설명하시오.
3. 2개의 아미노산의 구조식과 이들이 펩타이드 결합을 이룬 구조를 그려 비교해본다.
4. O, X 중 고르고, X면 틀린 부분을 알맞게 고치세요.
 1. DNA는 염기(base), 인산(phosphate), 그리고 ribose로 된 당으로 구성되어 있다. (O, X)
 2. 펩타이드 결합을 이룰 때 물 분자가 방출된다. (O, X)
 3. DNA 가닥은 방향성이 있어서 5' end 는 phosphoryl group이 3' end 는 hydroxyl group이 있다. (O, X)
 4. 아미노산은 amino group과 carboxyl group을 가지고 있다. (O, X)