Welcome to Chemistry 154!

Chemistry for Engineering

Contact Information

Instructor: Dr. Nigare Raheem
Lecture Hours: T/Th 3:30 – 4:50 pm (HEBB 100)

Office Location: CHEM E220
Email: nigarer@chem.ubc.ca
Office Hours: Mondays and Fridays (7:00– 8:00 pm) via Zoom, also available by appointment (in-person or Zoom)

Courses Taught:

Chem100 Foundations of Chemistry
Chem 121 Structure and Bonding in Chemistry
Chem 123/130 Thermodynamics, Kinetics and Organic Chemistry
Chem 123/135 Introductory Chemical Laboratory II
Chem 233 Organic Chemistry for the Biological Sciences
Chem 260 Organic Chemistry for Engineers

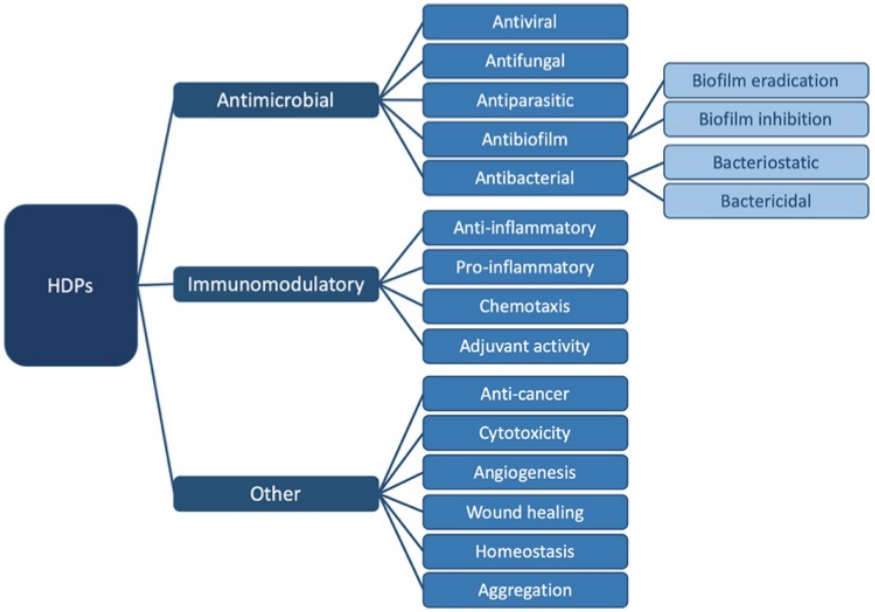
Education:

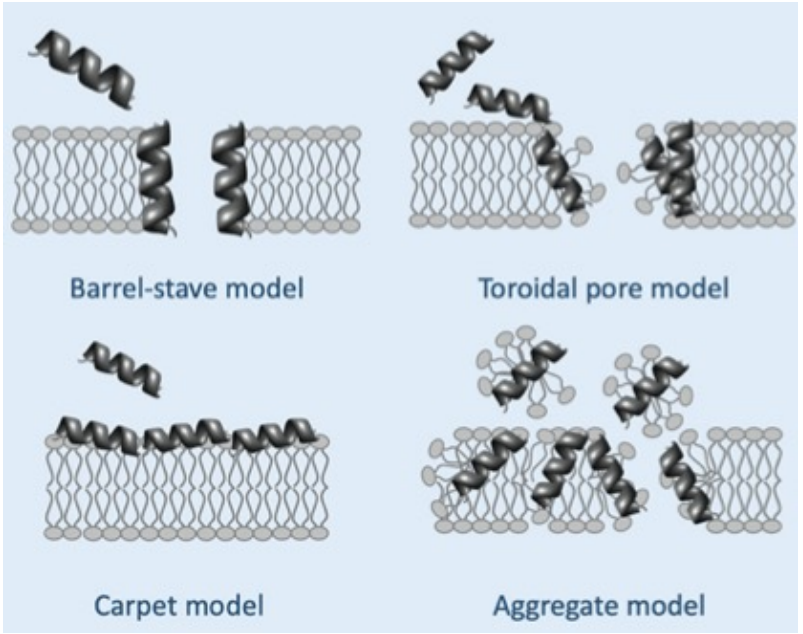
B.Sc. in chemistry (UBC); Ph.D. in chemistry (UBC)

Antibiotic Resistance and Antimicrobial Peptides

- Increasing antibiotic resistance
- Search for antimicrobial alternatives, such as antimicrobial peptides

- **Mechanism of action of two active antimicrobial peptides derived from aurein 2.2**





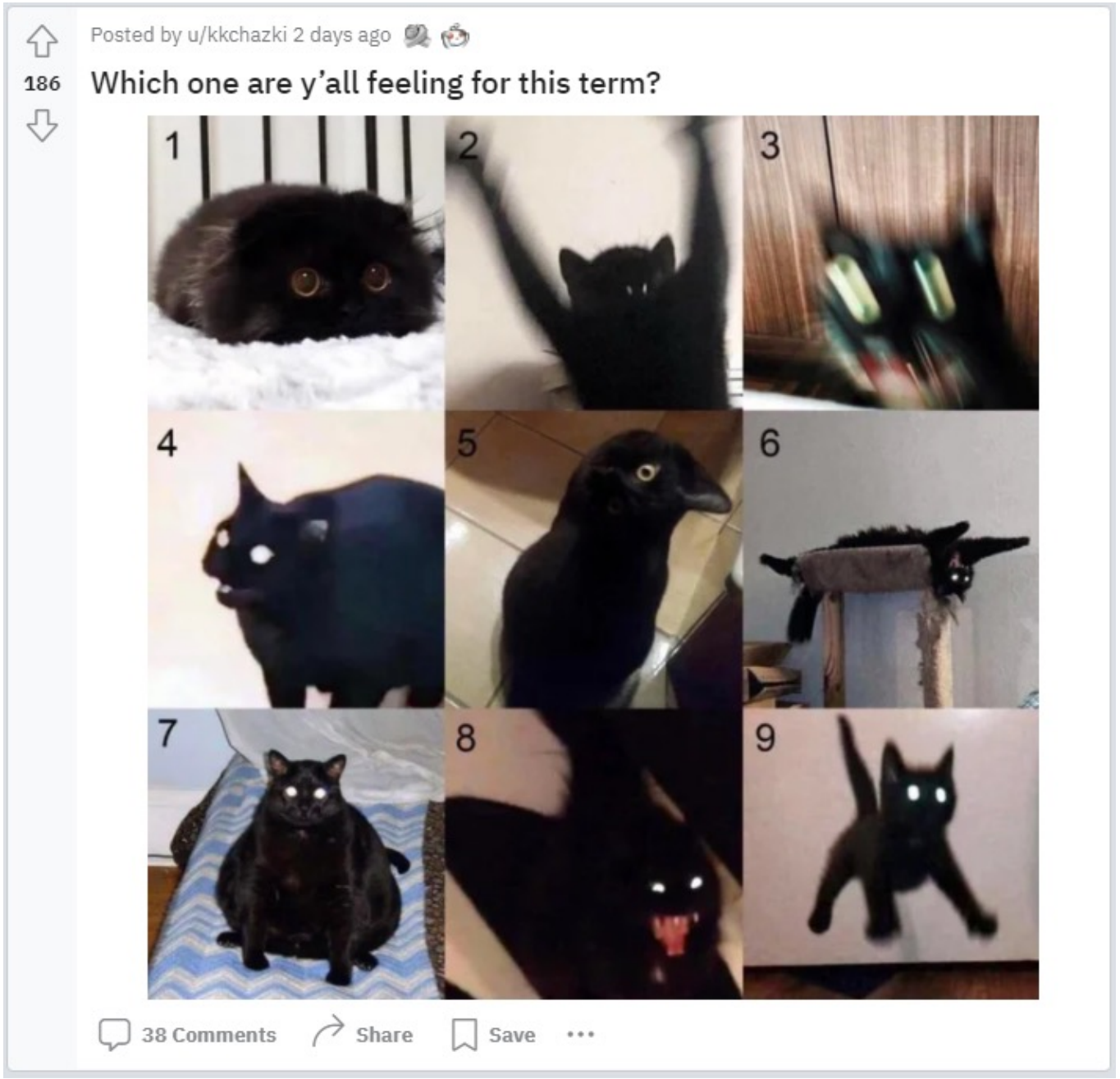
Raheem, N.; Straus, S. K. Mechanisms of Action for Antimicrobial Peptides with Antibacterial and Antibiofilm Functions. *Frontiers in Microbiology.* **2019**, 10, 1 – 14. doi: 10.3389/fmicb.2019.02866.

Traditional and non-traditional Careers in chemistry

- Academic Research
- Industry Research and Development
- Instrument Technician
- Sales/Marketing
- Engineering
- Medicine
- Pharmacology
- Toxicology
- Nursing
- Clinical chemist
- Environmental Scientist
- Astrochemistry

- Science outreach
- Communications (journalism, youtube star, podcaster, museum curator)
- Policy/Regulation specialist
- Forensics
- Project management
- Consulting
- Teaching (K-12, higher education)
- Healthcare, diagnostics
- Waste management
- Environmental Law / Chemical patents
- Food / Agriculture
- Cosmetics
- City planning / Logistics
- Pyrotechnics / Firefighting / Hazardous Materials expert
- Entrepreneur
- Chancellor of Germany / Pope!

How are you all feeling for this term?



Course Resources

Course Canvas Sites (All lectures, section specific, lab)

- All Lectures Canvas site: information relevant to all Chem154 students
- Section specific website: information such as annotated lecture notes, worksheet submission module and section specific announcements
- Lab Canvas site: laboratory information of Chem154. Any laboratory questions should be directed to freshman154@chem.ubc.ca.

Dr. Vishakha Monga

- Lab Instructor for Chem154

Raksha Kandel

- Teaching Assistant for section 113

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Achieve (Required)

- Access from All Lectures Canvas site
- Achieve access codes are required for this course (purchase from UBC bookstore)

Calculators (Required)

- Any calculator with basic functionality if acceptable provided it does not have wireless communication capabilities

Online Textbooks (Optional)

- links provided in course syllabus

Grading Scheme for Chem154

Section specific activities *(iClicker, worksheets)*	5%
Achieve assignments	10%
Quizzes	10%
Midterm exam	15%
Final exam	45%
Laboratory	15%
Total	100%

*You must pass both the **lecture** and **laboratory** components of Chemistry 154 **individually** to pass the course.*

Section specific activities

- **iClicker Questions (1%)**
- There will be several iClicker questions during each class (specific numbers will vary). Each question is worth 1 mark and will be graded for completion only.
- As an accommodation, 3 lowest Clicker grades will be dropped for all students to account for missed classes or technical difficulties. Please follow this link for more information on how to sign up for iClicker Cloud (https://lthub.ubc.ca/guides/iclicker-cloud-student-guide/).

- **Worksheet Questions (4%)**
- Worksheet questions are marked for effort and completion. Each worksheet is graded out of 0/1/2 depending on the amount of effort you put in to answer the questions.
- Three lowest worksheet grades will be dropped to account for absences
- Available on section specific Canvas site
- Worksheet: Unit 1 is due by **September 11th** at 23:59

Assignments and Quizzes

- **Achieve Assignments**
- Periodic assignments for each content module will be posted on Achieve on Tuesdays (generally) and be due the following Monday by 23:59 (Vancouver time)
- First Achieve Assignment is high-school review on stoichiometry, due on **September 13th**
- For students who complete the "Relevance of this course to engineering" Bonus assignment, the lowest Achieve assignment grade will be removed before calculating the final average.

- **Quizzes**
- One lowest quiz score will be dropped
- Missing more than one quiz? Please complete the self-declaration form on All Lectures Canvas site and submit to your course instructor within one week of the scheduled quiz

Midterm and Final Exams (in person)

- **Midterm Exam**
- November 17th (17:30 – 18:30)

- **Final Exam**
- December 11th – 22nd, 2023
- Will be announced when the exam date is set by the university


On October 12, 2023:
• Your THURSDAY class will be canceled
• Your MONDAY class will take place at its regularly scheduled time and location on Thursday October 12*
*Programs will vary, please confirm the time and location changes with your instructor
UBC-wide course schedule changes are in effect WT1 to balance out instructional hours affected by Statutory Holiday (the majority falling on Mondays).

Centre for Accessibility

For students registered with (or will become registered with) the Centre for Accessibility (CFA)

1. Register your letter (if you choose to) for CHEM 154. We will read and acknowledge its receipt on the CFA website.

2. Send letters to your section professor as soon as you can.

3. Please register for the exams now! If you don't register for the midterm exams, your accommodation(s) may not be met.

4. Once the final exam is announced, you should immediately register this exam through the CFA.

Academic Integrity

Students are expected to follow the University of British Columbia academic integrity guidelines. See https://academicintegrity.ubc.ca.

In CHEM 154, the worksheets and Achieve assignments are formative assessments, meant to help students identify strengths and weaknesses in their understanding of course content.

- As such, using educational or internet resources, study groups, or other such aids to complete these assignments is not considered academic misconduct, provided the work a student submits is ultimately their own.

The quizzes and exams, however, are summative assessments, meant to grade the understanding of course content.

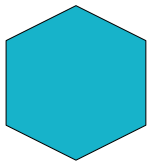
- These must be done by you alone and without the aid of any other resources, except those provided during the assessment by the invigilators. Any attempt to use any other resources, either organic or inorganic, is considered a serious breach of academic integrity and can result in academic discipline.

How to do well in Chem154

- Be curious, ask why
- Be deliberate
- Come to lectures and be engaged while you're here
- Be focused when you are studying/doing homework, remove distractions and take actual breaks
- Make note of your questions, ask questions and get help (Piazza, office hours, etc.) We want you to succeed!
- Do practice problems (without looking at the answer key), this helps you understand and apply the knowledge learned in class
- Consistent and regular practice over time (spaced practice) helps you develop a deeper understanding of course material. Do not binge study (very stressful!)
- Form study groups, explaining concepts to others helps solidify your own understanding as well
- Take Care of Yourself!

Housekeeping

- Please be respectful and courteous to your fellow students.
- Participate in class. You are here to learn. Please do not hesitate to ask questions.
- If you have a question, please raise your hand.
- Cell phones off (or to silent)
- Laptop users — please try not to be distracting



Course Etiquette

- We *all* have the responsibility to create and maintain a respectful learning environment.
- Hostile interactions will not be tolerated.
- Be scholarly, professional, and polite.
- Be kind – we are all in this together!

Please avoid misinforming others when/if an answer is unknown. If you are guessing, clearly state that you don't have all the information.

From an adaptation (by U of M) of the Arizona State University resource:
https://teachonline.asu.edu/2016/04/teaching-good-netiquette/

How do you feel about Chem154 this term?

A: Hyped! Let's do it!

B: Nervous, but ready.

C. Very neutral

D: Unsure, worried.

E: Sigh… The worst.

Unit 2

Atomic Structure and Properties
&
Chemical Bonding

Learning Objectives

After mastering this unit you will be able to:

- Define the terms valence and core electrons
- Determine the number of valence electrons and core electrons based on electron configuration for atoms and ions
- Define, in words or using equations, effective nuclear charge (Z_{eff}), atomic and ionic radius, ionization energy, and electron affinity.
- Rank elements and ions according to their Z_{eff}, atomic size, ionization energy, and electron affinity.
- Rationalize the periodic trends of radii, relative ionization energies and electron affinities of atoms and ions based on nuclear charge and/or electron configurations.

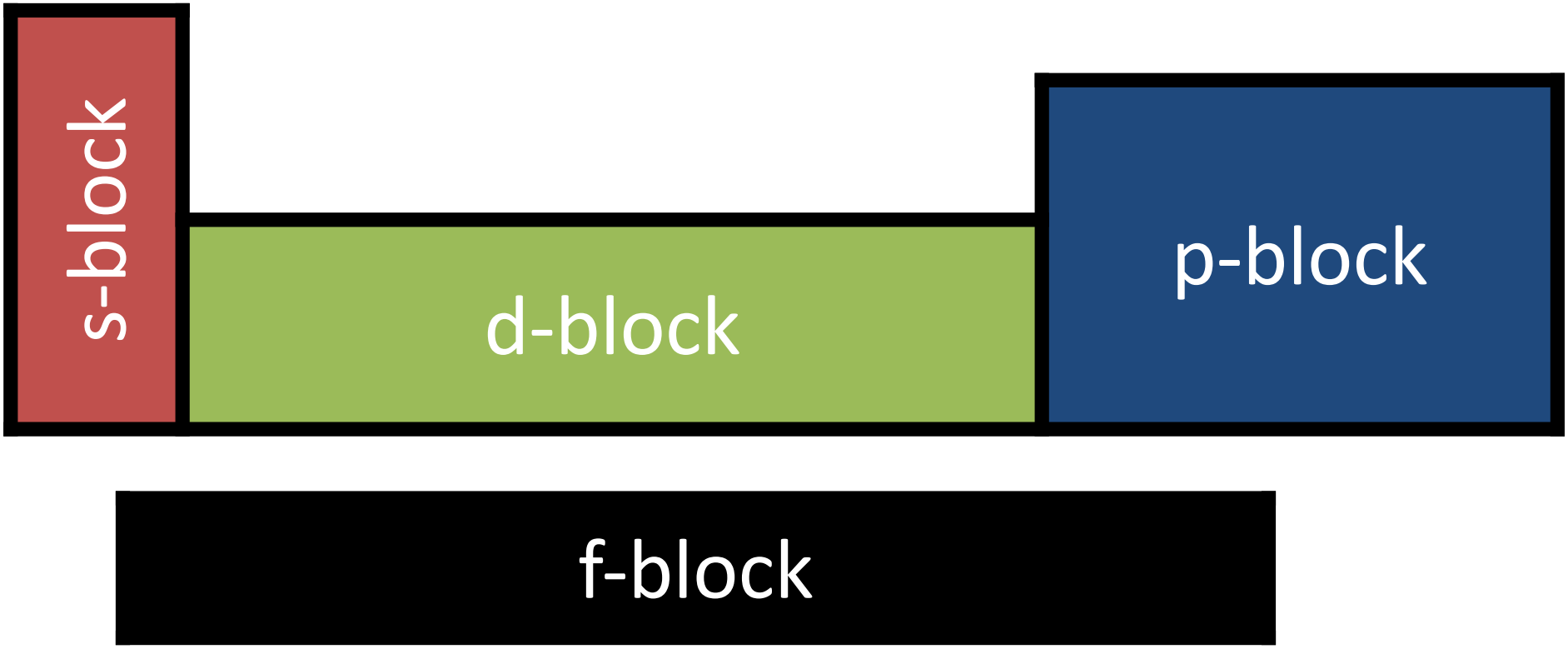
Learning Objectives (continued)

- Describe the nature of ionic and covalent bonds.
- Define electronegativity and describe how electro-negativity varies with position in the periodic table.
- Predict the nature of a chemical bond (ionic/covalent, polar/nonpolar) and justify your prediction by comparing the relative electronegativities of the atoms involved.
- Predict lattice energy trends in ionic solids & justify your predictions.

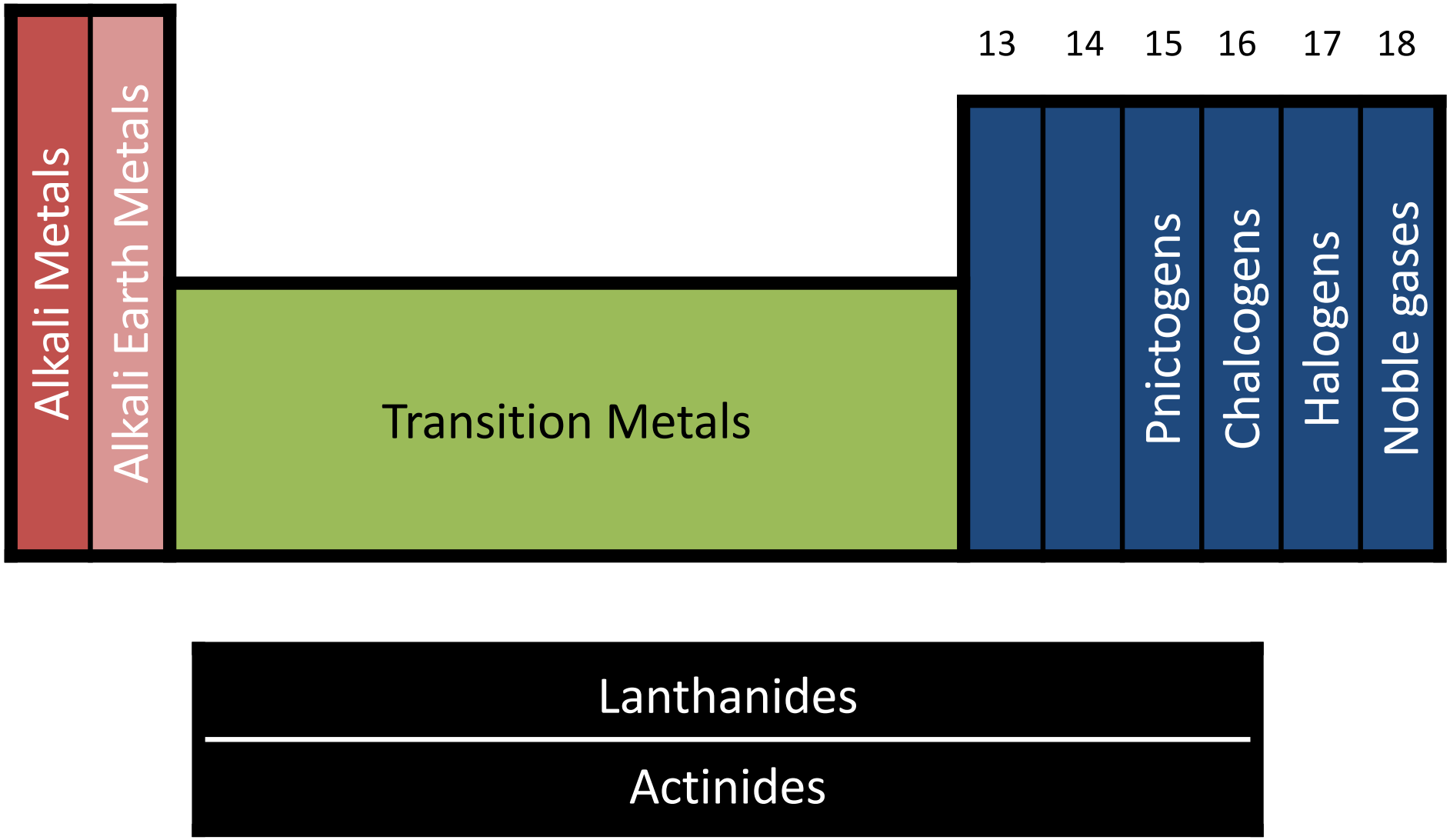
The Periodic Table

Columns in the periodic table are called groups.

Rows in the periodic table are called periods.



The Periodic Table



The Xe + PtF_6 Experiment

Until 1962 the gases helium, neon, argon, krypton, xenon and radon were known as the inert gases because it was believed that they were incapable of forming chemical compounds. The Bartlett Experiment was the decisive discovery that led to the oxidation of xenon, and the initiation of noble gas chemistry.

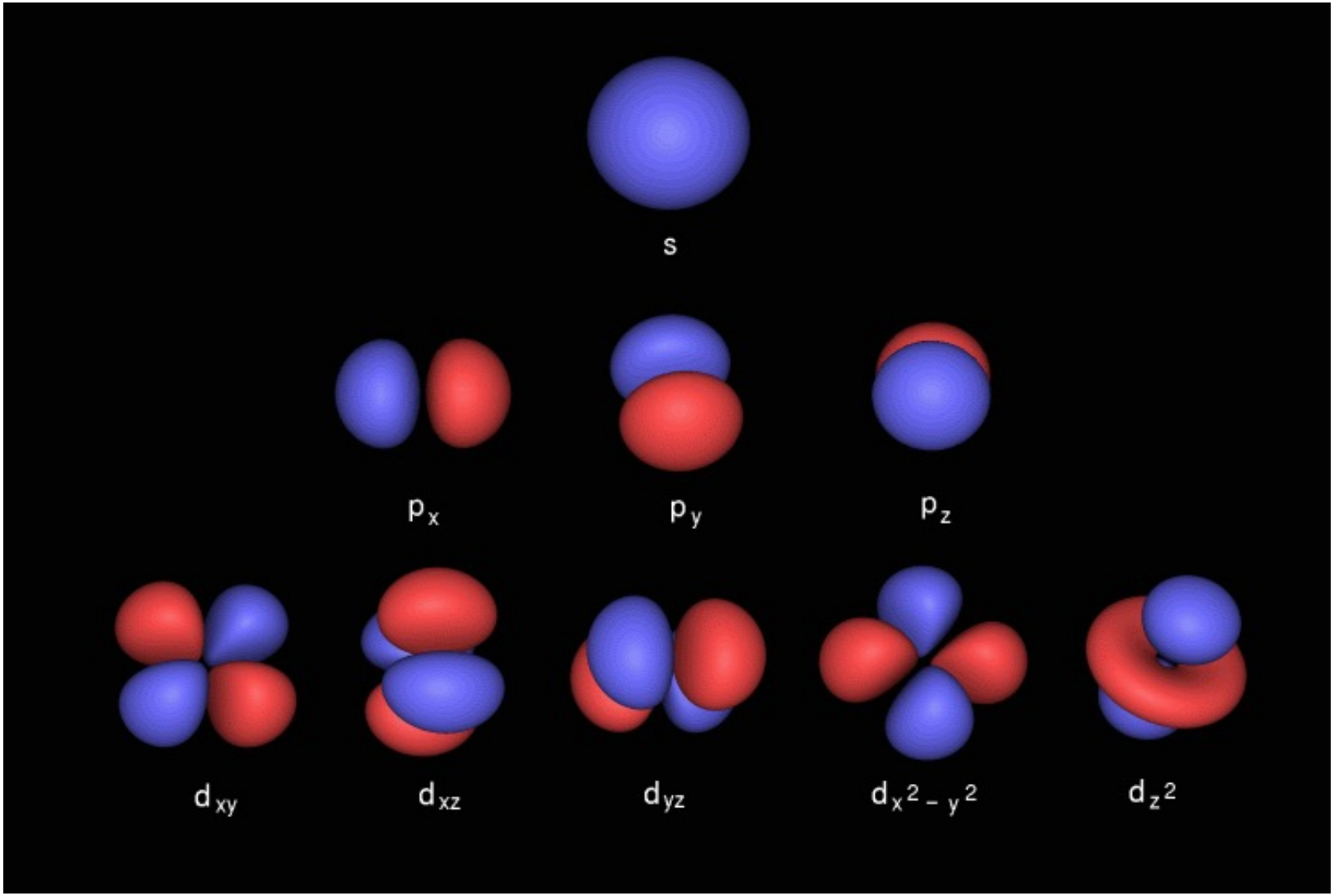
https://www.chem.ubc.ca/neil-bartlett

Salient Features of Quantum Mechanics

Small objects, like electrons, behave as both particles and waves which means they can interfere, diffract and spread. Orbitals give the probability for finding electrons at particular points in space.

Image source: https://www.nature.com/articles/natrevmats201690

Hydrogenic Orbitals



Salient Features of Quantum Mechanics

Quantum mechanics is the theory explaining why energies and angular momenta of atoms and molecules are quantized, that is only have certain discrete values.

Quantum Numbers

Quantum Number		Values	Example
n	*Principal Quantum Number*	Positive integer values	1, 2, 3, …
ℓ	*Angular Momentum Quantum Number*	Integer values $0 \le \ell \le n\text{-}1$	0, 1 (if n=2)
m_ℓ	*Magnetic Quantum Number*	Integer values $-\ell \le m_\ell \le \ell$	-1, 0, 1 (if $\ell = 1$)

ℓ=0, indicates s subshell
ℓ=1, indicates p subshell
ℓ=2, indicates d subshell
ℓ=3, indicates f subshell

Note: This slide is Additional information. It is meant to help you understand "max. # of electrons in subshells" determination.

Shells and subshells

Sub-shell	# of orbitals	# of electrons
s	1	2
p	3	6
d	5	10
f	7	14

Shells and subshells

Shell (n)	Sub-shells	Max. # e^- in subshells	
1	s	2	$2(1)^2 = 2$
2	s, p	2 + 6 = 8	$2(2)^2 = 8$
3	s, p, d	2 + 6 + 10 = 18	$2(3)^2 = 18$
4	s, p, d, f	2 + 6 + 10 + 14 = 32	$2(4)^2 = 32$