IB Chemistry 1

Name: Key
Date: _____ Period: _____

Power Standard #2—Atomic Structure Unit Review

2.1 Students understand that the mass of an atom is concentrated in its minute, positively charged nucleus.
2.2 Students can deduce the electron configuration of an atom from its atomic number.

BIG IDEA #1—The Atom

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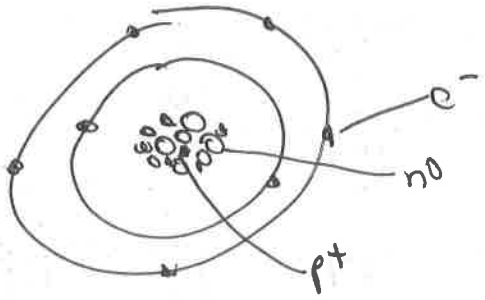
1. Where are protons, neutrons, and electrons found in atoms? Draw and label a sketch of a nitrogen atom.

p+ - nucleus
n⁰ - nucleus
e⁻ — e⁻ cloud



2. Define the following terms:
   a) Mass Number (A) = $p^+ + n^0$

   b) Atomic Number (Z) = p^+

   c) Isotope = atoms of the same element with different #s of neutrons

3. Complete the table below.

Subatomic Particle	Relative Mass	Relative Charge
Proton	1	+
Electron	0.0005	−
Neutron	1	Ø

4. Write symbols for the following elements in ${}^{A}_{Z}X$ notation.

a) neon-20 ${}^{20}_{10}Ne$

b) oxygen-17 ${}^{17}_{8}O$

c) carbon-13 ${}^{13}_{6}C$

5. All atomic masses are expressed relative to the mass of which atom?

Carbon-12 ${}^{12}_{6}C$

6. Complete the table for the following elements.

Element	Number of Protons	Number of electrons	Number of neutrons	Atomic number	Mass number
Potassium	19	19	20	19	39
Silicon	14	14	14	14	28
Chlorine	17	17	18	17	35
Iridium	77	77	115	77	192
Iodine	53	53	74	53	127
Lanthanum	57	57	82	57	139

BIG IDEA #2—The Mass Spectrometer & Atomic Mass

7. A mass spectrometer can be used to determine _____.

8. Circle the combination of properties that would lead to the greatest deflection in a mass spectrometer.

High Charge High Mass

Low Charge Low Mass

9. Oxygen exists as 3 stable isotopes, ^{16}O, ^{17}O, ^{18}O. The average atomic mass of oxygen is 16.00. Which isotope is most abundant? How do you know?

^{16}O -- this is closest to the average mass.

10. The two most abundant isotopes of carbon are carbon-12 (mass=12.00 amu) and carbon-13 (mass=13.00 amu). Their relative abundances are 98.9% and 1.10%, respectively. Calculate the atomic mass of carbon. Show your work.

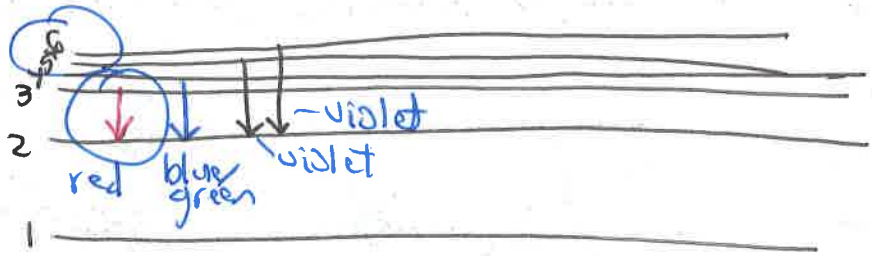
$(0.989)(12)$

$+ (0.0110)(13)$

12.011

BIG IDEA #3—Electron Arrangement

11. Draw an energy level diagram in the space below.



12. Where are energy levels farthest apart? Closest together?

close to the nucleus
1 & 2

5 & 6
farther from the nucleus

13. What is a quantum leap? What is produced as a result of a quantum leap?

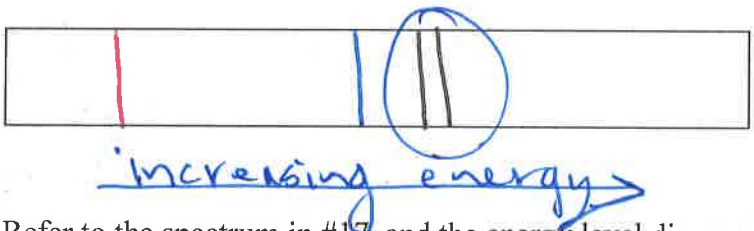
An e⁻ moving from a higher to a lower energy level. Light (photons) are released.

14. Each line in a line spectrum is the result of a particular quantum leap.

15. Hydrogen has four lines in the visible spectrum. Draw arrows on your energy level diagram above, representing quantum leaps that would produce visible light. Circle the arrow that would result in the lowest energy light.

16. Label each arrow with the color of light produced, red, blue-green, violet.

17. Sketch the line spectrum of hydrogen.



18. Refer to the spectrum in #17, and the energy level diagram in #11, to explain the concept of convergence.

Convergence refers to the fact that the energy levels are closer together farther from the nucleus.

The lines in the emission spectrum are closer together at higher energy.

19. Complete the following table:

Prinicipal Energy Level (n)	Number of sublevels	Types of Sublevels	Number of orbitals (n^2)	Number of electrons ($2n^2$)
1	1	s	1	2
2	2	s p	4	8
3	3	s p d	9	18
4	4	s p d f	16	32
5	5	s p d f g	25	50

20. Complete the following table:

Type of Sublevel	Number of orbitals	Max. Number of Electrons	Shape
s	1	2	sphere
p	3	6	peanut ∞
d	5	10	X
f	7	14	X

22. How is the quantum view of energy different from the traditional view of energy?

BIG IDEA: I can write electron configurations.

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23. Define each of the following:

a. Aufbau principle

e⁻ fill orbitals of lowest energy first.

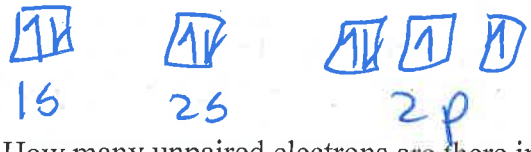
b. Pauli exclusion principle

No more than 2 e⁻ per orbital

c. Hund's rule

e⁻ enter orbitals of ~~equal~~ equal energy, 1 per orbital before pairing up

24. Write the electron configuration for oxygen in orbital box notation.



a. How many unpaired electrons are there in an oxygen atom?

2

b. What rule or principle is being followed?

Hund's rule

25. Write the electron configuration for neon in spdf notation.

$1s^2 2s^2 2p^6$

a. Give the formulas (symbols and charges) of two oppositely charged ions which have the same electron configuration as neon.

F^-, Na^+

26. Write the noble gas electron configuration for Tungsten (W).

$[Xe]\ 6s^2 5d^5$

27. What are the symbols for all the elements that have the following outer configurations?

a. s^2 He, Be, Mg, Ca, Sr, Ba, Ra

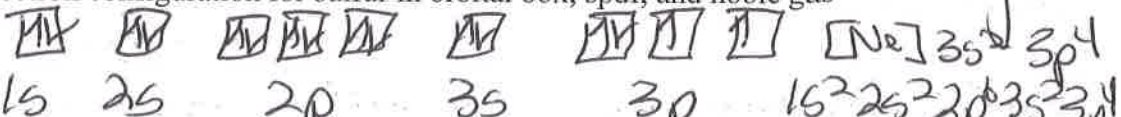
b. s^2p^5 F, Cl, Br, I, At

c. s^2d^2 Ti, Zr, Hf

28. Why do the elements potassium and sodium have similar chemical and physical properties?

They are in the same group / have the same outer e⁻ arrangement

29. Write the electron configuration for sulfur in orbital box, spdf, and noble gas notation.



[Ne] $3s^2 3p^4$

$1s^2 2s^2 2p^6 3s^2 3p^4$

30. The outermost electrons are called valence electrons. How many of these electrons does sulfur have?

6

($3s^2 3p^4$)

31. Copper has an "exceptional" electron configuration.

A. Why is it considered "exceptional"?

It doesn't follow the Aufbau principle

B. Write copper's electron configuration in spdf notation.

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$

C. Name 1 other element with an exceptional electron configuration.

Cr, Ag, Au, Mn