Chemistry 11
Atomic Theory Practice Test

Name: Key
Date:
Block:

__B__ 1. If two atoms of Ca have a different number of electrons, which property (or properties) would be significantly different?

ions

a) Mass
b) Charge
c) Both A & B
d) Neither A nor B

Ca vs Ca^{2+}

__A__ 2. If two atoms of Na have a different number of neutrons which property (or properties) would be significantly different?
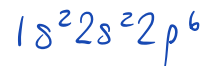
Isotope

a) Mass
b) Charge
c) Both A & B
d) Neither A nor B

Sodium-11   vs   Sodium-12

__C__ 3. Which of the following ions will NOT have the same electron configuration as Ne?

a) Na^+ $(11e^- - 1e^-) = 10e^-$
b) Al^{3+} $(13e^- - 3e^-) = 10e^-$
c) Ar $18e^-$
d) O^{2-} $(8e^- + 2e^-) = 10e^-$

$10e^-$
$1s^2 2s^2 2p^6$

__A__ 4. Which of the following easily loses one outermost electron?

a) Potassium period 4 → fewer protons
b) Beryllium period 2
c) Iron period 4
d) Bromine period 4

low ionization energy
(largest atomic radius)

__B__ 5. Which of the following would have the largest atomic radius?

a) Seaborgium ⎰ period 7
b) Einsteinium ⎱ → fewer protons
c) Indium period 5
d) Thallium period 6

__A__ 6. Which trend in the halogen family occurs with increasing atomic number?

a) Ionization energies decrease
b) Atomic radii decrease
c) Electronegativities increase
d) Tendency to gain electrons increases
(electronegativity)

Halogens
atomic radius ↑
Ionization energy ↓
electronegativity ↓

__D__ 7. Which of the following species would have 2 valence electrons?

a) Boron 3
b) Fluorine 7
c) Oxygen ion $6 + 2 = 8$
d) Vanadium (III) ion $5 - 3 = 2$

__C__ 8. What sub-shell is especially stable when it is half-filled?

a) s-subshell
b) p-subshell
c) d-subshell
d) f-subshell

_**D**___ 9. A molecule has the VSEPR shape of AX_4E_2. What shape would it have?

2 lone pairs

6 ligands

a) tetrahedral
b) T-shaped
c) trigonal planar
(d)) square planar

_**C**___ 10. A molecule is T-shaped. What VSEPR notation would it have?

a) AX_4E
b) AX_5
(c)) AX_3E_2
d) AX_2E_3

AX_3E_2

or

AX_3E_3

11. The following mixtures of isotopes are found in nature. Calculate the average atomic mass of a sample given that ^{107}Ag = 51.8% and ^{109}Ag = 48.2%. Round your answer to one decimal place. Include units.

$(0.518 \times 107) + (0.482 \times 109)$

$= 107.964 \approx$ $\boxed{108.0 \text{ amu}}$

atomic
Mass
Unit

12. Complete the following table:

Element Name	Element Symbol	Atomic Number	Atomic Mass	# of protons	# of neutrons	# of electrons
Titanium	Ti^{4+}	22	48	22	26	18
Bromine	Br^{-}	35	80	35	45	36
Gold	Au	79	197	79	118	79

13. Fill in the following table by writing the **_full electron configuration_** for:

Element	Full Electron Configuration
N	$1s^2 2s^2 2p^3$
Mo	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^1 4d^5$
Ge^{+2}	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} \cancel{4p^2}$

14. Show the <u>core notation</u> orbital diagram and determine the number of valence electrons.

Element	Core Notation Orbital Diagram	# Valence Electrons
Ru³⁺	$[Kr] 5s^{\cancel{2}} 4d^{\cancel{5}}$ $[Kr]$ ⥮̶ 1 1 1 1 1 4d	5
S	$[Ne] 3s^2 3p^4$ $[Ne]$ ⥮ ⥮ 1 1 3s 3p	6
Ti²⁺	$[Ar] 4s^{\cancel{2}} 3d^2$ $[Ar]$ 1 1 _ _ _ 3d	2
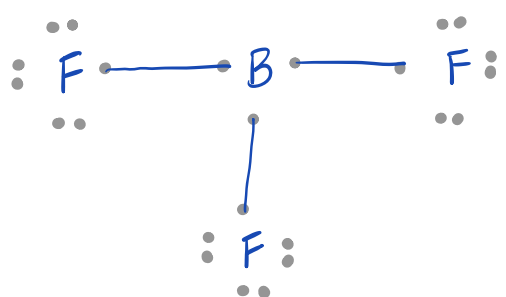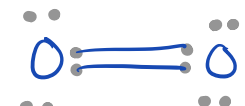
15. Identify the **atoms** that has the following electron configuration:

a) $1s^2 2s^2 2p^2$ ___C___   b) $1s^2 2s^2 2p^4$ ___O___   c) $1s^2 2s^2 2p^6 3s^2 3p^2$ ___Si___

d) $[Ne]3s^2 3p^4$ ___S___   e) $[Ar]4s^1$ ___K___   f) $[Ar]3d^{10}$ ___Ni___

16. Consider two neutral atoms: Al and Cl
    period 3   Period 3

    a) Which atom has a larger atomic radius?

      Al   fewer protons to "pull" in the electrons

    b) Which atom has the larger ionization energy?

      Cl   smaller atomic radius

    c) Which atom has a greater electron affinity?

      Cl   smaller atomic radius

    d) How many valence electrons does each atom have?

      Al : 3 electrons   Cl : 7 electrons

17. Draw the **Lewis structures** (electron dot diagrams) for the following. *Include the VSEPR names as well.*

Boron trifluoride	Oxygen gas (O_2)
VSEPR name: trigonal planar	VSEPR name: linear

SI₆

VSEPR name: octahedral

BrH₃
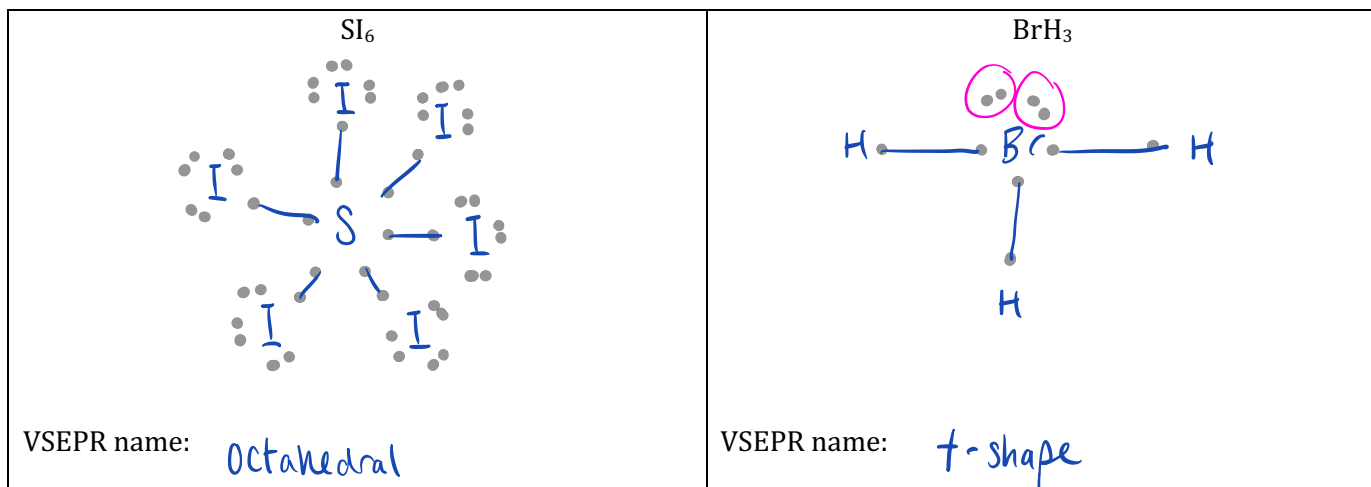
VSEPR name: t-shape

18. Draw the **VSEPR shapes** for the following. *Include the VSEPR names as well.*

CO₂

$O = C = O$

$X - A - X$

VSEPR name: linear

BrCl₄⁻

VSEPR name: Square planar
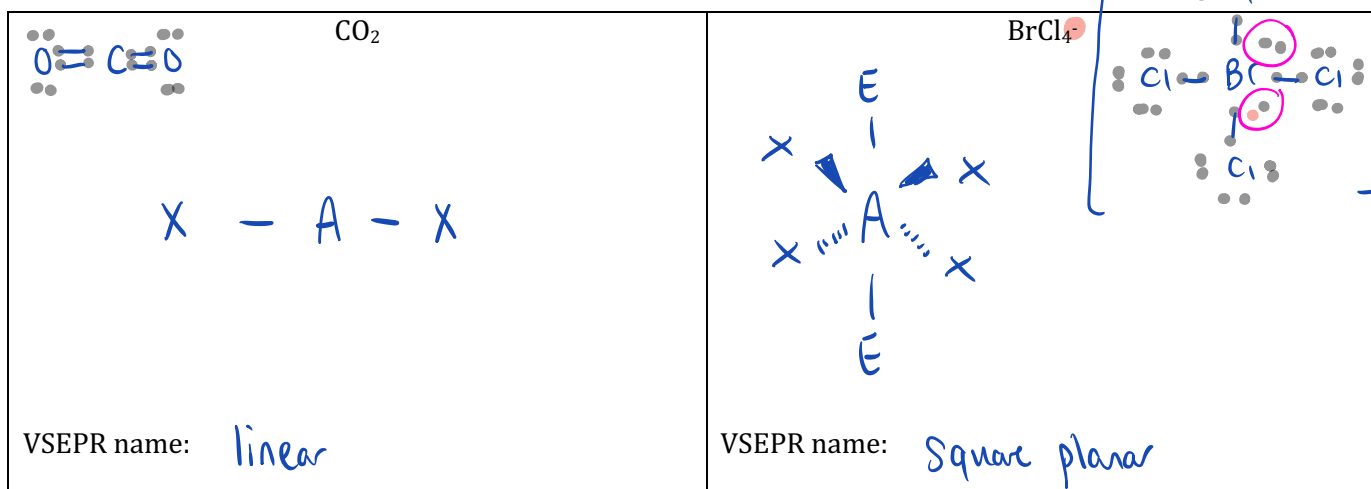
19. Determine the type of bond that forms between the following atoms:

a) O and O   3.5 - 3.5 = 0   nonpolar covalent

b) P and O   3.5 - 2.1 = 1.4   polar covalent

c) CaBr₂   2.8 - 1.0 = 1.8   ionic

d) NaF   4.0 - 0.9 = 3.1   ionic