

Complete in pencil; show your work; erase mistakes completely. If you need more space, use the back of this sheet or attach further sheets as is necessary. For problems involving calculations, no credit will be given if work is not shown. Use the atomic masses on the laminated Periodic Table provided. Use the values of the constants listed below for calculations. Write your answers in the blanks provided.

$\Delta E = h\nu$ $c = \lambda\nu$ $E_n = \frac{-2.178 \times 10^{-18} \text{ joule}}{n^2}$ $h = 6.63 \times 10^{-34} \text{ J s}$ $c = 3.0 \times 10^8 \text{ m s}^{-1}$

1. (5 pts) A certain photographic film requires minimum radiation energy of 94 kJ/mol to cause exposure. What is the longest wavelength (in nm) of radiation that possesses the energy to expose the film?

$$\frac{1 \text{ atom}}{6.02 \times 10^{23} \text{ mol}} \times \frac{94 \text{ kJ}}{1 \text{ mol}} = 1.6 \times 10^{-19} \text{ J}$$

$$E = \frac{hc}{\lambda}$$

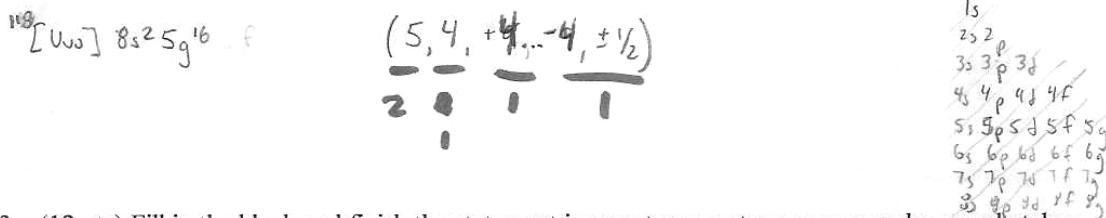
$$1.6 \times 10^{-19} = \frac{(6.63 \times 10^{-34})(3.0 \times 10^8)}{\lambda}$$

$$\lambda = 1.27 \times 10^{-6} \text{ m}$$

 Wavelength = 1300 nm

1 ans
1 SF

2. (5 pts) A new element is synthesized, and it is determined that the atomic number is 136. What is one of the correct quantum number sets of the highest energy electron of Element 136?



3. (12 pts) Fill in the blank and finish the statement in a sentence or two; you may also use sketches to help. (The answer because "that's the trend." will receive no credit; you must explain, briefly but thoroughly, why the trend is the way it is.)

a. Of the period 3 elements, Ar has the smallest radius because...

- highest NC / ENC - same shielding
- all valence e⁻ same distance from nucleus

b. Of the alkali metal elements, Cs has the lowest 2nd ionization energy because...

Fr - e⁻ furthest from nucleus
- equal equivalent ENC

c. Of the period 3 elements, Cl has the highest electron affinity because...

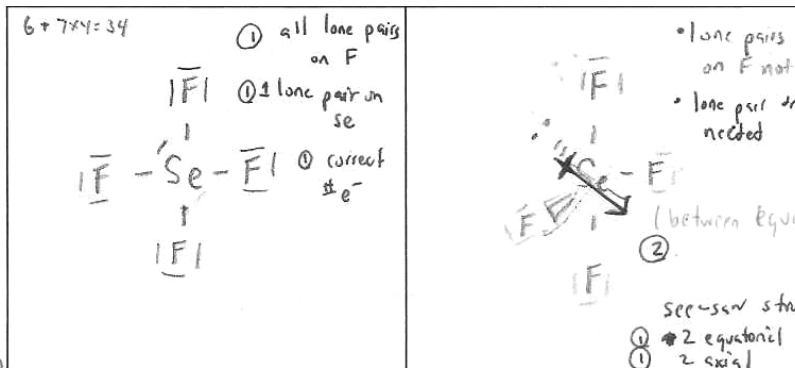
Ar, Mg (most e⁻) - gains noble gas config

d. Of the period 3 elements' most common ions (excluding Si), P has the largest radius because...

- anions are larger than cations b/c of e⁻/e⁺ repulsion
- more e⁻, more e⁻/e⁺ repulsion

4. (9 pts) For the molecule SeF_4 ,
- In the left box, draw the most likely Lewis structure.
 - In the right box, draw the molecular geometry, showing 3-dimensional structure if appropriate. Also, using a different color, draw the overall dipole moment of the molecule.
 - Name the hybridization of the central atom and estimate one of the F-Se-F bond angles as accurately as you can:

Se: sp^3d
 bond angle: $\sim 118^\circ$ ($119^\circ - 116^\circ$)
 $\sim 88^\circ$ ($89^\circ - 86^\circ$)



5. (9 pts) Draw and name all of the isomers of C_5H_{10} . Draw and name one isomer in each box below. All boxes need not be used, attach more paper if necessary.

12 or 14 = 9 pts
 10 or 9 = 8 pts
 8 or 7 = 7 pts
 6 or 5 = 6 pts
 4 or 3 = 5

| | | | |
|-----------------------------------|-------------------------------------|---|---|
| <p>1</p> <p>1-pentene</p> | <p>2</p> <p>cis-2-pentene</p> | <p>4</p> <p>2-methyl-1-butene</p> | <p>5</p> <p>2-methyl-2-butene</p> |
| <p>6</p> <p>3-methyl-1-butene</p> | <p>3</p> <p>trans-2-pentene</p> | <p>9</p> <p>1-methyl-cyclopropane</p> | <p>10</p> <p>1,1-dimethylcyclopropane</p> |
| <p>7</p> <p>cyclopentane</p> | <p>8</p> <p>1-methylcyclobutane</p> | <p>11</p> <p>cis-1,2-dimethylcyclopropane</p> | <p>12</p> <p>trans-1,2-dimethylcyclopropane</p> |

OK