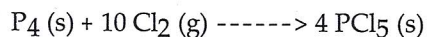


Please read all the questions VERY carefully before answering. Ask your instructor if you do not understand. No outside paper is allowed. The last page is a periodic table with constants. Total points = $50 + (20 * 3) = 60 = 110$

SHORT ANSWER. Please write the set-up equation first, then put the raw data with units before calculating. Write the word or phrase that best completes each statement or answers the question.

- 1) Phosphorus (P_4) reacts with chlorine gas, Cl_2 to produce PCl_5 according to the following reaction: 1) _____



- a) How many grams of PCl_5 is formed from 95.0 g of P_4 (3 pts.).

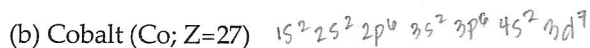
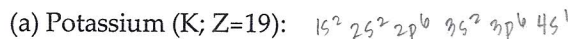
$$95.0 \text{ g } P_4 \times \frac{1 \text{ mol } P_4}{123.896 \text{ g } P_4} \times \frac{4 \text{ mol } PCl_5}{1 \text{ mol } P_4} \times \frac{205.239 \text{ g } PCl_5}{1 \text{ mol } PCl_5} = 639 \text{ g } PCl_5$$

- b) How many grams of PCl_5 is formed from 235.2 g of Cl_2 gas (3 pts.).

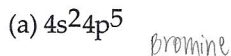
$$235.2 \text{ g } Cl_2 \times \frac{1 \text{ mol } Cl_2}{70.906 \text{ g } Cl_2} \times \frac{4 \text{ mol } PCl_5}{10 \text{ mol } Cl_2} \times \frac{205.239 \text{ g } PCl_5}{1 \text{ mol } PCl_5} = 270 \text{ g } PCl_5$$

- c) Which is the limiting agent if 95.0 g of P_4 and 235.2 g of Cl_2 gas was used in the rxn. (2 pts.) 235.2 g Cl_2 is the limiting agent because it gave a lower amount of PCl_5 .

- 2) Draw the **complete** ground state electron configuration for (4 pts./each; Total = 8pts.) 2) _____



- 3) Write the name of the element with the **valence** electron configuration given below (3 pts) 3) Bromine



- 4) Using only periodic table, 4) _____

- (a) List atomic numbers 15, 16, 33 in order of increasing atomic size (6 pts.)

$$16 < 15 < 33$$

- (b) List elements Cl, Br, I in order of increasing first ionic ionization energy (6 pts.)

$$I < Br < Cl$$

5) Calculate the energy (in joule) of one mole of blue light with wavelength = 434 nanometer. 5) _____

Given, $E = h\nu$; $c = \lambda\nu$; $N = 6.022 \times 10^{23}/\text{mol}$; $h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}/\text{photon}$, Vel of light $c = 2.89 \times 10^8 \text{ m/s}$; (8 pts.)

$$c = \lambda\nu \rightarrow 2.89 \times 10^8 \text{ m/s} = \left(434 \text{ nm} \times \frac{1 \text{ m}}{10^{-9} \text{ nm}} \right) \nu$$

$$\nu = \frac{2.89 \times 10^8 \text{ m/s}}{\left(434 \text{ nm} \times \frac{1 \text{ m}}{10^{-9} \text{ nm}} \right)} = 6.66 \times 10^{-4} \text{ Hz or } 1/\text{s}$$

$$E = h\nu = \frac{(6.626 \times 10^{-34} \text{ J}\cdot\text{s}) (6.66 \times 10^{-4} 1/\text{s})}{(6.022 \times 10^{23} \text{ mol})}$$

$$E = 7.33 \times 10^{-61} \text{ J/mol of blue light}$$

$$E = h\nu; \quad c = \lambda\nu \text{ or } \nu = \frac{c}{\lambda}$$

$$\therefore E = h \cdot \frac{c}{\lambda} \text{ for one photon.}$$

So for 1 mole

$$E = N h \cdot \frac{c}{\lambda} \quad N = \text{Avogadro\#}$$

$$= 6.022 \times 10^{23} \times 6.626 \times 10^{-34} \text{ J}\cdot\text{s} / \text{photon}$$

$$E = \frac{N \cdot h \cdot c}{\lambda}$$

$$= \frac{6.022 \times 10^{23} \text{ photons} \times 6.626 \times 10^{-34} \text{ J}\cdot\text{s} / \text{photon} \times 2.89 \times 10^8 \frac{\text{m}}{\text{s}} \times \frac{10^9 \text{ nm}}{1 \text{ m}}}{434 \text{ nm}}$$

$$= 2.66 \times 10^5 \text{ J/mol}$$

6) A monoatomic ion with a charge of 1- has an electronic configuration of $1s^2 2s^2 2p^6$. 6) _____

(a) Circle the correct answer: It is a CATION/ It is an ANION (3pts.)

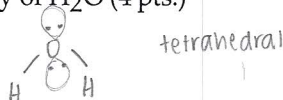
(b) Write the name and the symbol of the noble gas it is isoelectronic with (3 pts.) neon, [Ne]

(c) What is the symbol of the ion? (3 pts.) F^-

7) (a) Draw the Lewis structure of H_2O (2pts.) 7) _____



(b) Draw and name the electronic geometry of H_2O (4 pts.)



8) Magnesium reacts with Oxygen gas forming Magnesium oxide in the following balanced equation: $2 \text{Mg} (s) + \text{O}_2 (g) \rightarrow 2 \text{MgO} (s)$ 8) _____

What mass of $O_2 (g)$ is needed to completely react with 15.00 g of Mg? (6 pts.)

$$15.00 \text{ g Mg} \times \frac{1 \text{ mol Mg}}{24.305 \text{ g Mg}} \times \frac{1 \text{ mol O}_2}{2 \text{ mol Mg}} \times \frac{31.999 \text{ g O}_2}{1 \text{ mol O}_2} = 9.874 \text{ g O}_2 \text{ is needed.}$$

