Chem15, Fall 2016, SJCC, Test3 Name KEY

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 periodeic 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) _____

$$P_4\ (s) + 10\ Cl_2\ (g) \text{------>} 4\ PCl_5\ (s)$$

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

$95.0\ g\ P_4 \times \frac{1\ mol\ P_4}{123.896\ g\ P_4} \times \frac{4\ mol\ PCl_5}{1\ mol\ P_4} \times \frac{208.239\ g\ PCl_5}{1\ mol\ PCl_5} = 639\ g\ PCl_5$

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

$235.2\ g\ Cl_2 \times \frac{1\ mol\ Cl_2}{70.906\ g\ Cl_2} \times \frac{4\ mol\ PCl_5}{10\ mol\ Cl_2} \times \frac{208.239\ g\ PCl_5}{1\ mol\ PCl_5} = 276\ g\ PCl_5$

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) _____

(a) Potassium (K; Z=19): $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

(b) Cobalt (Co; Z=27) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^7$

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

(a) $4s^2 4p^5$ 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 = hγ; c = λγ; N= 6.022×10^{23}/mol; h = 6.626×10^{-34} j.s/photon, Vel of light c = 2.89×10^{8}m/s.; (8 pts.)

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

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

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

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

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

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

So for 1 mole

$E = Nh \cdot \frac{c}{\lambda}$ N = Avogadro #

$= \frac{6.022 \times 10^{23} \times 6.626 \times 10^{-34}\ j.s}{\text{photon}}$

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

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

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

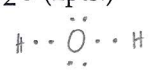
6) A monoatomic ion with a charge of 1- has an electronic configuration of $1S^2 2S^2 2p^6$. 6) _____

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

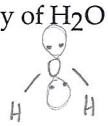
(b) Write the name and the symbol of the noble gas it is isoelectronic with(3 pts.) Neon, [Ne]

(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.)



tetrahedral

8) Magnesium reacts with Oxygen gas forming Magnesium oxidein the following balanced equation: 2 Mg (s) + O_2 (g) -> 2 MgO (s) 8) _____

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

$15.00\ g\ Mg \times \frac{1\ mol\ Mg}{24.305\ g\ Mg} \times \frac{1\ mol\ O_2}{2\ mol\ Mg} \times \frac{31.999\ g\ O_2}{1\ mol\ O_2} = 9.874\ g\ O_2$ is needed.