Practice Chemistry Final Fall 2022

Monday, November 7, 2022 9:25 AM

Practice Fall22…

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PRACTICE MA: Chemistry Final Exam

EPS Chemistry – Fall Trimester 2022

Name Ava Section A

Instructions: You may use the provided periodic table and a calculator. Use complete sentences for your explanations, show all work, and label with proper units where applicable. At the end of each question, take a few seconds to assess how well you think you answered. Your assessment of your answers has no impact on your score.

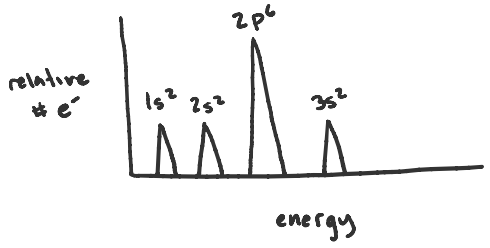
1) Complete the following table.

Name	Symbol	Mass Number	Protons	Neutrons	Electrons	Family/Group
Osmium	$^{191}Os^{4+}$	191	76	115	72	transition metals
Uranium	^{235}U	235	92	143	92	actinides
Iodide	$^{131}I^{-}$	131	53	78	54	group 17/ halogens

2) Boron has two stable isotopes, ^{10}B and ^{11}B. If you were randomly given a single atom of boron, what is the probability that it has a mass of 10.81 amu? Please explain your reasoning.

0%: 10.81 is the average atomic mass of all stable boron isotopes. However, it is impossible to have a decimal for amu, as half a proton or 0.81 of a neutron do not exist.

3) Sketch the photoelectron spectrum for magnesium. You do not need to have correct numerical values for the ionization energies. Make sure your axes are labelled correctly, peaks are the correct height, and all peaks are labelled with subshell and number of electrons in that subshell.



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4) Use the ionization energy equation to explain why ionization energy decreases for each alkali metal as you go down the group.

$IE = \frac{-kq_1q_2}{d}$

$IE_{Li} = \frac{-k(-1)(1)}{d_2} = \frac{k}{d_2}$

$IE_{Na} = \frac{-k(-1)(1)}{d_3} = \frac{k}{d_3}$

$IE_{K} = \frac{-k(-1)(1)}{d_4} = \frac{k}{d_4}$

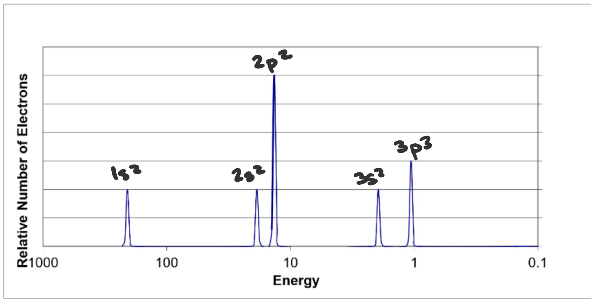
$d_2 < d_3 < d_4 \ldots$

the denominator is the only variable that changes as we go down the alkali metals since all neutral alkali metal atoms have a core charge of -1. since $d_2 < d_3 < d_4$ etc., $\frac{k}{d_2} < \frac{k}{d_3} < \frac{k}{d_4}$ etc.

5) Complete the table below: $3p^2$

	Core Charge	Valence Shell	# Valence Electrons
Si (14)	+4	3p	4
Ca (20)	+2	4s	2

6) Identify the neutral element from the following PES.



phosphorous

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7) Give the full electron configurations for the following species.

	Electron Configuration
Br	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^5$
P^{3-}	$1s^2 2s^2 2p^6 3s^2 3p^6$

8) Give three atoms or ions that have the electron configuration ~~$1s^2 2s^2 3s^2 3p^6$~~.

Ar, S^{2-}, K^+ $1s^2 2s^2 2p^6 3s^2 3p^6$

9) What is the mass of 3.25 moles of $Pb(NO_3)_2$?

1076.47 g

$(1 \cdot 3.25 \text{ mol Pb} \cdot \frac{207.2 \text{ g Pb}}{\text{mol Pb}}) + (2 \cdot 3.25 \text{ mol N} \cdot \frac{14.01 \text{ g N}}{\text{mol N}}) + (6 \cdot 3.25 \text{ mol O} \cdot \frac{16.00 \text{ g O}}{\text{mol O}})$

673.4 g Pb = 91.065 = 312

10) How many moles of Co^{2+} would be found in 45.0 mL of a 0.250 M Co^{2+} solution?

$$45.0 \text{ mL} \cdot \frac{0.250 \text{ mol } Co^{2+}}{1000 \text{ mL}} = 0.011 \text{ mol } Co^{2+}$$

11) How many milliliters do you need of a 2.0 M Co^{2+} stock solution if you want to make 45 mL of a 0.250 M Co^{2+} solution?

$M_1 \cdot V_1 = M_2 \cdot V_2$

$2.0 \text{ M } Co^{2+} \cdot V_1 = 0.250 \text{ M } Co^{2+} \cdot 45 \text{ mL}$

$V_1 = \frac{0.250 \text{ M } Co^{2+}}{2.0 \text{ M } Co^{2+}} \cdot 45 \text{ mL}$

$= 0.125 \cdot 45 \text{ mL}$

$= 5.625 \text{ mL}$

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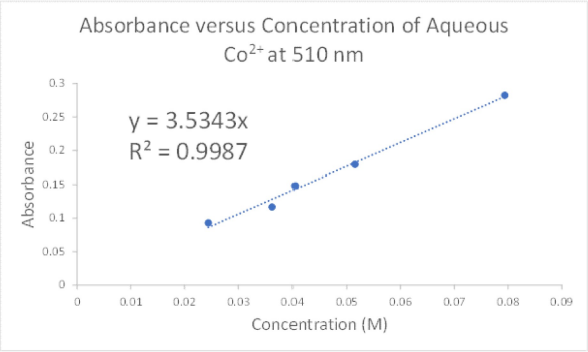
12) Based on the Beer's Law plot below, determine the concentration of a solution that has an absorbance of 0.340.



$y = 3.5343x$

$0.340 = 3.5343x$

$x = \frac{0.340}{3.5343}$

$x = 0.096\ M$

13) In chemistry, what is a mole and why do we use it?

A mole is a unit of measurement that describes approximately $6.022 \cdot 10^{23}$ units. We use it in chemistry to refer to groups of atoms, since individual atoms are so small and have such little relative mass. $6.022 \cdot 10^{23}$ is also called Avogadro's number, named after the scientist who came up with the number. It describes the exact number of atoms in 12 grams of carbon-12.

14) List all the parts that must be present in a scientific graph.

- a clear an informative title
- clear, visible data points
- labels on each axis, including units
- a trend line or best fit line if appropriate
- what else is there?

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15) A classmate asks you to check through their homework problems. For each student response, briefly explain how you know if it is correct or incorrect. If it is incorrect, give the correct answer.

Student Incorrect Name or Formula	Correction with explanation
$FeCN_3$ for iron(III) cyanide Fe^{3+}, CN^-	incorrect: • no parentheses around $(CN)_3$ correct: $Fe_3(CN)_3$
Cesium(III) nitride for Cs_3N	incorrect: • cesium (III) implies that Cs_3 has a charge of +9 • nitride only has a charge of -3 • ionic bond → charge = 0 correct: cesium (I) nitride
Trisulfide septoxide for S_3O_7	incorrect: • wrong numerical prefix • -ide ending on first component correct: trisulfur heptoxide
$N_2(OH)_4$ for dinitrogen tetrahydride	incorrect: • incorrectly identifies OH • hydroxide, not hydride correct: dinitrogen tetrahydroxide

16) Lab skills tested:
   a. Identify a piece of lab equipment
   b. Identify an unknown compound
      i. Flame test for cation, includes lighting a Bunsen burner
      ii. Qualitative analysis flow chart for anion, includes adequate clean up
   c. Measure a volume of liquid accurately, includes using the appropriate glassware