

CHEM105 Test 1 Please show all formulas, all equations, and all work to receive any credit

1. Today is the 24th day of the month. In celebration of today, please answer the following concerning Cr.
- a. Complete the following table showing, in the order that they are filled, the quantum numbers for each of the 24 electrons in a chromium atom that is in the ground electronic state.

<i>Electron number</i>	<i>n</i>	<i>l</i>	<i>m_l</i>	<i>m_s</i>
<i>1</i>				
<i>2</i>				
<i>3</i>				
<i>4</i>				
<i>5</i>				
<i>6</i>				
<i>7</i>				
<i>8</i>				
<i>9</i>				
<i>10</i>				
<i>11</i>				
<i>12</i>				
<i>13</i>				
<i>14</i>				
<i>15</i>				
<i>16</i>				
<i>17</i>				
<i>18</i>				
<i>19</i>				
<i>20</i>				
<i>21</i>				
<i>22</i>				
<i>23</i>				
<i>24</i>				

- b. Calculate the binding energy per nucleon, in units of J/nucleus, for the chromium-51 isotope. Its mass is 50.9447 amu; the masses of a proton and neutron are 1.0078 amu and 1.0087 amu.
- c. ⁵¹Cr has a half-life of 27.7 days. Predict how many grams of an initial 2.45 g quantity of chromium-51 would remain after 200.0 days.

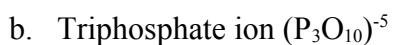
2. Quantify the relative strengths of Coulombic interactions for these pairs of charges
 - +2 charge separated by 200 pm from a -1 charge
 - +3 charge separated by 100 pm from a -2 charge
 - +1 charge separated by 50 pm from a -3 charge

3. The Sun emits its highest intensity electromagnetic radiation at a wavelength of 480 nm. Calculate the surface temperature of the sun.

4. Compare the chemical reactivity of potassium atoms with the reactivity of sodium atoms. Clearly explain and justify your rationale using fundamental chemical principles.

5. Define electronegativity and compare the electronegativity of carbon atoms with the electronegativity of oxygen atoms. Use fundamental physical principles and Coulomb's Law to clearly explain your predicted difference.

6. Draw the complete Lewis structures for:



7. Complete the following table

Molecule	HSO_4^-	COCl_2	ClF_5	O_2NCl	SF_5^+
Number of Valence Electrons					
Lewis Structure (include all nonzero formal charges & resonance structures)					
Electron Arrangement					
Molecular Geometry					
Bond Angle(s)					
Hybridization					
Polar or Nonpolar Molecule					
Number of sigma (σ) bonds					
Number of pi (π) bonds					
Bond Order (specify atoms)					