CHEMISTRY 0110   Exam 2, Practice
Make sure to only use a calculator and the infosheet when working these practice exam problems. You should be able to complete this entire practice within 75 minutes.

MULTIPLE CHOICE:

1. Choose the name-formula pair that does NOT match.
   a) sodium sulfite, Na\(_2\)SO\(_3\)
   b) calcium fluoride, CaF\(_2\)
   c) potassium permanganate, K\(_2\)MnO\(_4\)
   d) aluminum oxide, Al\(_2\)O\(_3\)
   e) iron(III) oxide, Fe\(_2\)O\(_3\)

2. Energy from the following chemical reaction provided the lift for the moon lander:
   \[ (\text{CH}_3)_2\text{N}_2\text{H}_2 + \text{N}_2\text{O}_4 \rightarrow \text{N}_2 + \text{H}_2\text{O} + \text{CO}_2 \]
   When this equation is balanced, the coefficient of nitrogen is
   a) 1
   b) 2
   c) 3
   d) 4
   e) 5

3. A sample of 124 g of white phosphorus, P\(_4\), contains the same number of atoms as
   a) 23.0 g of sodium
   b) 32.0 g of oxygen (O\(_2\))
   c) 48.0 g of ozone (O\(_3\))
   d) 30.0 g of formaldehyde (CH\(_2\)O)
   e) 14.0 g of nitrogen

4. Which of the following reactions is an oxidation-reduction reaction?
   a) CaCO\(_3\) + 2HCl → CaCl\(_2\) + H\(_2\)O + CO\(_2\)
   b) NH\(_4\)NO\(_3\) → N\(_2\)O + 2H\(_2\)O
   c) AgNO\(_3\) + KI → AgI + KNO\(_3\)
   d) H\(_2\)SO\(_4\) + 2NaOH → Na\(_2\)SO\(_4\) + 2H\(_2\)O
   e) CaO + SO\(_3\) → CaSO\(_4\)

5. Which one of the elements below would be the best choice for lining a tank intended for use in the storage of HCl?
   a) Iron (Fe)
   b) Copper (Cu)
   c) Zinc (Zn)
   d) Tin (Sn)
   e) Nickel (Ni)

6. Which one of the following contains 9.03 x 10\(^{23}\) atoms?
   a) 16.0 g O\(_2\)
b) 4.00 g He
c) 28.0 g N₂
d) 22.0 g CO₂
e) 8.0 g CH₄

7. Which of the following drawings quantitatively represents the products formed in the complete combustion of 1 molecule of propane (C₃H₈)?

A

B

C

D

E

= Hydrogen
= Oxygen
= Carbon

8. What is the molar concentration of NaOH in a solution prepared by mixing 25.0 mL of 0.100 M NaOH with 50.0 mL of water and 0.08 grams of NaOH?

a) 0.180 M
b) 0.090 M
c) 0.060 M
d) 0.050 M
e) 0.333 M
SHORT ANSWER:

9. Write the balanced net ionic equation for the following reactions. Show all intermediate steps (i.e. molecular equation, complete ionic equation). If you think there is no chemical reaction, state your reasoning. Make sure to indicate the physical state of each product (s, l, g, aq).

\[ \text{Rb}_2\text{S (aq)} + \text{CuSO}_4 \text{(aq)} \rightarrow \]

\[ (\text{NH}_4)_2\text{SO}_4 \text{(aq)} + \text{ZnCl (aq)} \rightarrow \]

10. Write the balanced chemical equation for the following reactions. Make sure to include the physical state of every compound.

Solid ammonium nitrate decomposes into gaseous dinitrogen oxide and water.

A solution of lead (II) nitrate and a solution of potassium iodide are mixed and create a yellow precipitate.

The neutralization of phosphous acid with calcium hydroxide

11. Sketch a molecular level drawing of the resulting solution when one molecule of each of the following compounds is added to its respective container of water.

HC$_2$H$_3$O$_2$  HCl  C$_2$H$_5$OH  Cu(OH)$_2$  C$_6$H$_{12}$O$_6$  NaOH

12. [Provide information related to electron pair geometry, geometric hybridization, or other chemistry concepts relevant to the question.]
following compounds/ions. Also indicate whether each species is polar or non polar.

[CO]^- 
AlCl_3 
PBr_3 
N_2H_4 

**CALCULATIONS: Show all of your work for each calculation.**

13. A compound contains only carbon, hydrogen, and oxygen. Combustion of 10.68 g of the compound yields 16.01 g of CO_2 and 4.37 g of water. The molar mass of the compound is somewhere between 160 and 180 g/mol. What is the molecular formula for the unknown substance?

14. How many milliliters of a 2.0 M solution of potassium hydroxide is needed to completely neutralize 500 mL of a 2.5 M sulfuric acid solution?

15. Over the years, the thermite reaction has been used for welding railroad rails, in incendiary bombs, and to ignite solid fuel rocket motors. The reaction is 

   \[
   \text{Fe}_2\text{O}_3(s) + 2\text{Al}(s) \rightarrow 2\text{Fe}(l) + \text{A1}_2\text{O}_3(s)
   \]

   a) What mass of iron(III) oxide must be used to produce 15.0 g iron?
   b) If you started with 10.0 g of Al and the amount of iron(III) oxide calculated in part a, how much aluminum metal is left over?

16. When 50.0 g of NaOH(aq) and 50.0 g MgCl_2(aq) reacted in a laboratory experiment, 25.0 g of precipitate was obtained. What is the identity of the precipitate? What is the percent yield of this reaction?