Chemistry 211 Name: _____
Spring 2024 Please Print
Test 2

Multiple Choice: (4 points each. Put answers in left margin as capital letters.)

1. Two isotopes of an element exist in the ratio 26.400 g/mol (47.222%) and 28.522 g/mol (52.778%). What is the weighted average of this sample (g/mol)?

   A) 26.400 B) 27.402 C) 27.520 D) 27.461 E) 28.522

2. Tomato soup is a

   i) compound iii) heterogenous mixture v) solution
   ii) pure substance iv) homogeneous mixture

   A) i B) ii C) iii D) iv E) v
   F) i and ii G) iii and v H) iv and v

3. Which of the following aqueous acids is a weak acid?

   A) HCl B) $HClO_4$ C) HNO_3 D) H_3PO_4 E) H_2SO_4

4. Which of the following is a combustion reaction?

   A) $Cu(OH)_{2\,(aq)} + 2\ HNO_{3\,(aq)} \rightarrow Cu(NO_3)_{2\,(aq)} + 2\ H_2O_{(\ell)}$
   B) $CH_{4\,(g)} + 2\ O_{2\,(g)} \rightarrow CO_{2\,(g)} + 2\ H_2O_{(\ell)}$
   C) $FeCl_{3\,(s)} + 3\ AgNO_{3\,(g)} \rightarrow 3\ AgCl_{(s)} + 3\ Fe(NO)_{3\,(aq)}$
   D) $Na_2CO_{3\,(s)} \rightarrow NaO_{(s)} + CO_{2\,(g)}$
   E) None is a combustion reaction.

5. What is the oxidation number of the sulfur atom in $MgSO_3$?

   A) -2 B) 0 C) +2 D) +4 E) +6

6. For the reaction: $Cu(OH)_{2\,(aq)} + 2\ HNO_{3\,(aq)} \rightarrow Cu(NO_3)_{2\,(aq)} + 2\ H_2O_{(\ell)}$, which element is reduced?

   A) Cu B) H C) N D) O E) None are reduced

7. Enthalpy is the _____ for a system.

   A) energy change
   B) energy change with no heat
   C) energy change with no work
   D) heat change
   E) heat change at constant pressure

8. Which of the following represents a heat of formation reaction?

A) $2\ C_4H_{10\,(g)} + 13\ O_{2\,(g)} \rightarrow 8\ CO_{2\,(g)} + 10\ H_2O_{(\ell)}$
B) $CaO_{\,(s)} + H_2O_{(\ell)} \rightarrow Ca(OH)_{2\,(s)}$
C) $2\ HgO_2 \rightarrow 2\ Hg_{(\ell)} + O_{2\,(g)}$
D) $Ca_{(s)} + Cl_{2\,(g)} \rightarrow CaCl_{2\,(s)}$
E) None are formation reactions

9. What is ΔH for the net reaction below?

$Pb + PbO_2 + 2SO_3 \longrightarrow 2PbSO_4$	$\Delta H = -775$ kJ
$SO_3 + H_2O \longrightarrow H_2SO_4$	$\Delta H = -113$ kJ
$Pb + PbO_2 + 2H_2SO_4 \longrightarrow 2PbSO_4 + 2H_2O$	$\Delta H = ?$

A) -1001 kJ B) -888 kJ C) -549 kJ D) 888 kJ E) 1001 kJ

Discussion Questions: (Show your work to receive credit.)

1. Provide names/formulae as appropriate. (10 points)

H_3PO_4 – potassium acetate –

VS_2 – hydriodic acid –

2. When silver(I) nitrate is mixed with calcium chloride according to the reaction:

$$2\ AgNO_{3\,(aq)} + CaCl_{2\,(aq)} \longrightarrow 2\ AgCl_{(s)} + Ca(NO_3)_{2\,(aq)}$$

silver(I) chloride forms. What is the maximum mass of silver(I) chloride that can be produced by combining 3.00 g of each reactant? What is the precent yield if 1.50 g AgCl is produced? (15 points)

3. Complete the following: (10 points)

___ $NH_{3\,(g)}$ + ___ $O_{2\,(g)}$ ⟶ ___ $N_{2\,(g)}$ + ___ $H_2O_{(\ell)}$

Calcium chloride reacts with potassium carbonate to yield calcium carbonate and potassium chloride. (Use solubility rules to predict the state of each material.)

4. When a 5.00 g sample of KCl is dissolved in water in a calorimeter that has a total heat capacity of 3.04 $kJ \bullet K^{-1}$, the temperature decreases by 0.380 K. Calculate the molar heat of solution of KCl. (5 points)

5. Is the following reaction endothermic or exothermic? Explain. (5 points)

$CH_{4\,(g)} + 2\ O_{2\,(g)} \longrightarrow CO_{2\,(g)} + 2\ H_2O_{(\ell)}$

6. A system gains 782 kJ of heat, resulting in a change in internal energy of the system equal to +251 kJ. How much work is done? (5 points)

7. From the following data: (14 points)

$4\ NH_{3\,(g)} + 5\ O_{2\,(g)} \rightarrow 4\ NO_{(g)} + 6\ H_2O_{(g)}$ $\Delta H^{o}_{rxn} = -904.0$ kJ

a) Is the reaction endothermic or exothermic?
b) How much energy would be absorbed or released if 13.75 g of nitrogen monoxide formed?
c) If an unknown quantity of ammonia is burned with a heat change of -425 kJ, what mass of ammonia burned?