SUPeR Chemistry
CH 221 Practice Exam

This exam has been designed to help you practice working multiple choice problems over the topics that will be covered on the second exam. The actual exams for each section of CH 221 will be different and you should not assume that this practice exam is representative of those exams.

Possibly useful information:

specific $heat_{(water)}$ = 4.184 J/g·°C

$density_{(water)}$ = 1.00 g/mL

Multiple Choice: Select the *one* best answer.

1. Which of the following solutions will be the poorest conductor of electrical current?
   A. sucrose, $C_{12}H_{22}O_{11}(aq)$
   B. sodium chloride, $NaCl(aq)$
   C. potassium nitrate, $KNO_3(aq)$
   D. lithium hydroxide, $LiOH(aq)$
   E. oxalic acid, $H_2C_2O_4$

2. When an aqueous solution of lead(II) nitrate is reacted with an aqueous solution of potassium carbonate, one would observe
   A. the formation of a precipitate, $PbCO_3$.
   B. the formation of a gas, CO_2.
   C. both the formation of $PbCO_3$ precipitate and CO_2 gas.
   D. the formation of two precipitates, $PbCO_3$ and KNO_3.
   E. no reaction.

3. Which of the following is not expected to fully dissociate in water?
   A. H_2SO_4
   B. HNO_3
   C. HF
   D. HI
   E. all of the above will fully dissociate in water

4. What is the net ionic equation for the reaction that occurs when aqueous solutions of sodium hydroxide and magnesium nitrate are mixed?
   A. $Mg^{2+}(aq) + 2NO_3^-(aq) \rightarrow Mg(NO_3)_2(s)$
   B. $Na^+(aq) + OH^-(aq) \rightarrow NaOH(s)$
   C. $Mg^{2+}(aq) + 2OH^-(aq) \rightarrow Mg(OH)_2(s)$
   D. $Na^+(aq) + NO_3^-(aq) \rightarrow NaNO_3(s)$
   E. no reaction occurs

5. What is the molar concentration of sulfate ions in a 0.150 M Na_2SO_4 solution?
   A. 0.075 M
   B. 0.150 M
   C. 0.300 M
   D. 0.450 M
   E. 0.500 M

6. In which acid is the oxidation number of phosphorus lowest?
   A. $H_4P_2O_7$
   B. H_3PO_4
   C. H_3PO_2
   D. H_3PO_3

7. Select the classification for the following reaction.

$$Fe(s) + 2Fe^{3+}(aq) \rightarrow 3Fe^{2+}(aq)$$

   A. precipitation
   B. neutralization
   C. oxidation - reduction
   D. none of the above

8. In the chemical reaction,

$$Zn_{(s)} + CuSO_{4(aq)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)},$$

   A. metallic zinc is the reducing agent.
   B. metallic zinc is reduced.
   C. copper ion is oxidized.
   D. copper sulfate ion is the reducing agent.

9. What volume of 0.150 M potassium permanganate solution would be required to react completely with 75.0 mL of a 0.150 M hydrogen peroxide solution?

$$2MnO_4^- + 5H_2O_2 + 6H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$$

A. 15.0 mL

B. 30.0 mL

C. 45.0 mL

D. 75.0 mL

E. none of these

10. When 45.0 g of an alloy at 100.0 °C is dropped into 100.0 mL of water at 25.0 °C, the final temperature is 37.0 °C. What is the specific heat of the alloy?

A. 0.423 J/g·°C

B. 1.77 J/g·°C

C. 9.88 J/g·°C

D. 48.8 J/g·°C

E. 57.2 J/g·°C

11. Consider the following specific heats of metals:

Metal	Specific Heat (J/g·°C)
manganese	0.477
sodium	1.225
strontium	0.301
aluminum	0.899
beryllium	1.823

If the same amount of heat is added to 100.0 g samples of each of the metals that are all at the same temperature, which metal will have the lowest temperature?

A. Mn

B. Na

C. Sr

D. Al

E. Be

12. Consider the thermal energy transfer during a chemical process. When heat is transferred to the system, the process is said to be _____ and the sign of q is _____ .

A. exothermic, positive

B. exothermic, negative

C. endothermic, positive

D. endothermic, negative

E. isomorphic, unpredictable

13. Calculate the $\Delta H°_{rxn}$ for the following reaction.

$SiO_2(s) + 4HCl(g) \rightarrow SiCl_4(g) + 2H_2O(g)$

Compound	ΔH_f^0 (kJ)
$SiO_2(s)$	-910.9
$SiCl_4(g)$	-657.0
$HCl(g)$	-92.3
$H_2O\ (g)$	-241.8

A. -139.5 kJ

B. -104.4 kJ

C. 104.4 kJ

D. 139.5 kJ

E. -517.6 kJ

14. Calculate the enthalpy change for the reaction

$NO(g) + O(g) \rightarrow NO_2(g)$

from the following reactions:

$NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g)$ $\Delta H = -198.9$ kJ

$O_3(g) \rightarrow 3/2\ O_2(g)$ $\Delta H = -142.3$ kJ

$O_2(g) \rightarrow 2O(g)$ $\Delta H = 495.0$ kJ

A. -551.6 kJ

B. -304.1 kJ

C. 0.00 kJ

D. 153.8 kJ

E. 438.4 kJ

15. Consider the highly exothermic thermite reaction, in which aluminum reduces iron(III) oxide to elemental iron:

$$2Al(s) + Fe_2O_3(s) \rightarrow 2Fe(s) + Al_2O_3(s) \qquad \Delta H = -850 \text{ kJ}$$

What mass of iron is formed when 725 kJ of heat is released?

A. 47 g

B. 65 g

C. 95 g

D. 130 g

E. 725 g

16. For which one of the following equations is the enthalpy change equal to the heat of formation of the product?

A. $Xe(g) + 2F_2(g) \rightarrow XeF_4$

B. $CH_4(g) + 2Cl_2(g) \rightarrow CH_2Cl_2(l) + 2HCl(g)$

C. $N_2(g) + O_3(g) \rightarrow N_2O_3(g)$

D. $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

E. $C_2H_4(g) + H_2(g) \rightarrow C_2H_6(g)$