CHEMISTRY 101
EXAM 2   FORM C   SECTION 503

SPRING 2010
DR. KEENEY-KENNICUTT

Directions: (1) Put your name on PART 1 and your name and signature on PART 2 of the exam where indicated.
             (2) Sign the Aggie Code on PART 2 of this exam.
             (3) Each multiple choice question is actually 2 questions on your scanning sheet. If you are sure of an answer, **put the same answer down for both questions** for 5 pts. If you cannot decide between two answers, put your BEST answer down for the ODD/FIRST question for 3 pts and your SECOND BEST answer down for the EVEN/SECOND question for 2 pts. If there is an ambiguous multiple choice question, use the last page to explain your answer.
             (4) Do NOT write on the envelope.
             (5) When finished, put everything in the envelope and wait to be excused. At the table, take everything out of the envelope. You can pick up the multiple choice part with the answers outside my office after 2:30pm.
   (6) There are a total of 34 questions (18 actual questions).

PART 1

1&2.   In Bronsted-Lowry Theory of acids and bases, the conjugate acid of HSO_4^- is:

    (a) H_2SO_4 (b) SO_4^{2-} (c) H^+ (d) H_2O (e) H_3O^+

3&4. Determine the oxidation number of carbon in the hydrogen carbonate ion, HCO_3^-.

    (a) +2   (b) +4   (c) +6   (d) +7   (e) +8

**5&6.**   Assign oxidation numbers to each element in this reaction. The oxidizing agent is:

$$16\ H^+ \ + \ 2\ MnO_4^- \ + \ 10\ SO_4^{2-} \ \rightarrow \ 2\ Mn^{2+} \ + \ 5\ S_2O_8^{2-} + \ 8\ H_2O$$
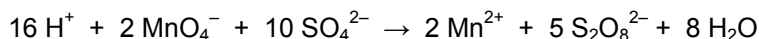
    (a) H^+ (b) MnO_4^- (c) SO_4^{2-} (d) Mn^{2+} (e) $S_2O_8^{2-}$

7&8. Which statement is FALSE?

    (a) An endothermic reaction requires heat.

    (b) The heat of vaporization has units of J/g.

    (c) Specific heat values are used to calculate the heat involved in changing phase.

    (d) When water freezes, heat is released.

    (e) A thermometer placed into a liquid will reach thermal equilibrium with the liquid.

9&10. Here is a particle view of a substance in water. Pick the compound that is represented by this particle view.

○ = cation or H

● = anion
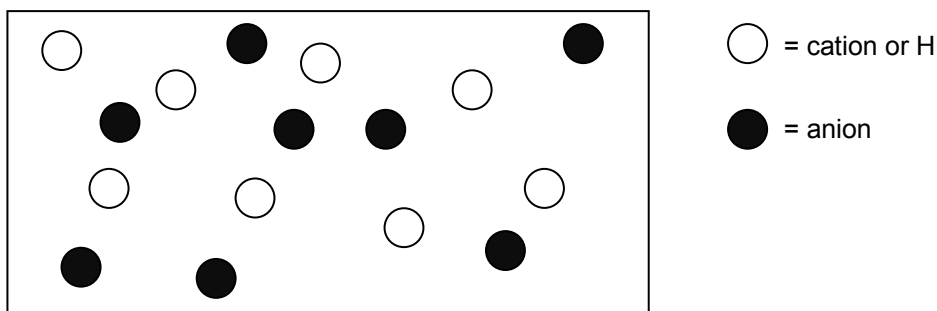
(a) NH_3 (b) AgOH   (c) RbOH   (d) HF   (e) FeS

11&12. Balance the equation with the SMALLEST WHOLE NUMBER COEFFICIENTS possible. Choose the number that is the SUM of the coefficients in the balanced equation. Don't forget coefficients of one.

$$Pb(NO_3)_2 \rightarrow PbO + NO_2 + O_2$$

(a) 9   (b) 10   (c) 11   (d) 12   (e) 13

13&14. Consider this acid-base net ionic equation: $HBrO(aq) + OH^-(aq) \rightarrow BrO^-(aq) + H_2O(\ell)$

Which of the following statements is <u>TRUE</u>?
(a) The acid is a strong acid.
(b) The base is insoluble.
(c) The reaction is called a precipitation reaction.
(d) The salt is a weak electrolyte.
(e) The spectator ion could have been Na^+ ion.

15&16. Consider this illustration. Which statement is FALSE?

(a) The substance may be water.

(b) For Step 1: heat = Sp.Ht. x mass x ΔT

(c) For Step 2: heat = Ht. of fusion x mass

(d) The substance is being cooled to a solid at its freezing point.

(e) At the intersection where Step 1 and Step 2 meet, the substance is a solid.

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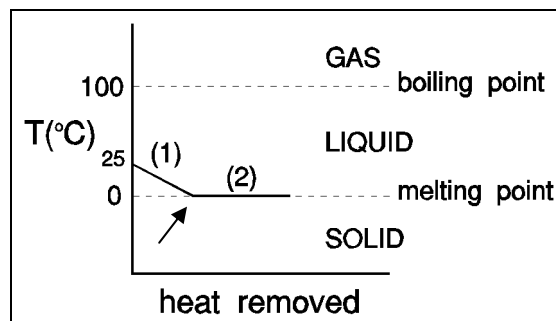
17&18. The pH of a 0.000266 M solution of $HClO_4$ is

(a) 2.94   (b) 4.12   (c) 1.00   (d) 3.58   (e) 8.23

19&20. What mass of O_2 could be produced by the decomposition of 25 g of KIO_3? The **<u>unbalanced</u>** equation for the reaction is:

$$KIO_3 \rightarrow KI + O_2 \quad \text{(UNBALANCED)}$$
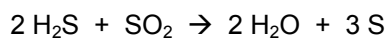
(a) 6.7 g   (b) 4.1 g   (c) 2.5 g   (d) 3.5 g   (e) 5.6 g

21&22. If 8.51 grams of sodium sulfate, Na_2SO_4, are dissolved in 100.00 g of water, what is the percent Na_2SO_4 by mass in the solution?

(a) 8.4%   (b) 8.0%   (c) 8.2%   (d) 7.8%   (e) 7.5%

23&24. What is the percentage yield of elemental sulfur if 7.54 grams of sulfur are obtained from the reaction of 6.00 grams of SO_2 with an excess of H_2S?

$$2\ H_2S\ +\ SO_2\ \rightarrow\ 2\ H_2O\ +\ 3\ S$$

(a) 76.1%   (b) 79.4%   (c) 83.8%   (d) 88.4%   (e) 91.4%

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25&26. Consider the reaction: $2\ KCrO_2\ +\ 3\ H_2O_2\ +\ 2\ KOH\ \rightarrow\ 2\ K_2CrO_4\ +\ 4\ H_2O$

If 20.0 g of each reactant were used for this reaction, the limiting reactant would be:

(a) $KCrO_2$ (b) H_2O_2 (c) KOH (d) K_2CrO_4 (e) H_2O

27&28. What concentration of HBr will be made when 45.0 mL of 2.00 M HBr is diluted to 100.0 mL?

(a) 2.25 M   (b) 44.4 M   (c) 0.0440 M   (d) 0.900 M   (e) 0.621 M

29&30. If 1.00 g of HCl was dissolved in enough water to give a pH of 2.04, what was the volume of the final solution?

    (a) 2.50 L   (b) 3.00 L   (c) 0.340 L   (d) 0.811 L   (e) 4.33 L

31&32. The iron in a 5.675 g sample of iron ore was first converted to Fe^{2+} ions, then titrated with 12.42 mL of 0.1467 M $K_2Cr_2O_7$ according to the following balanced net ionic equation:

$$6\ Fe^{2+}\ +\ Cr_2O_7^{2-}\ +\ 14\ H^+\ \rightarrow\ 6\ Fe^{3+}\ +\ 2\ Cr^{3+}\ +\ 7\ H_2O$$
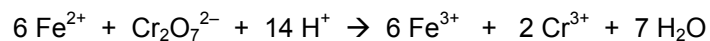
What is the percentage of Fe in the ore sample?

    (a) 1.536%   (b) 13.11%   (c) 6.391%   (d) 5.114%   (e) 10.76%

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PART 2

**Please read and sign: "On my honor, as an Aggie, I have neither given
nor received unauthorized aid on this exam."** _____

33. Consider the precipitation reaction between aqueous solutions of sodium phosphate and copper(II) chloride. If you have problems with the nomenclature, make something up and go with that to get partial credit.

(4 pts) (a) What is the balanced formula unit equation? Include the phase for every compound.

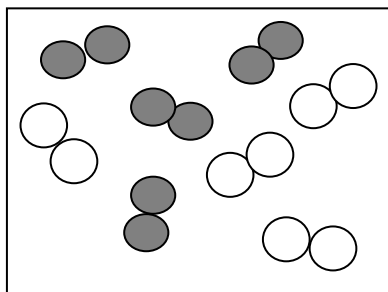(2 pts) (b) What is/are the spectator ion/s, if any?

(2 pts) (c) What is the net ionic equation? Include the charge for every ion.
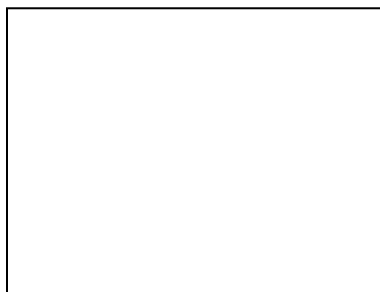
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34. Consider this reaction: $N_2 + O_2 \rightarrow NO_2$.

(2 pts) (a) Balance the equation.

(3 pts) (b) If you had 4 moles of N_2 and 4 moles of O_2, draw the particle view that would represent the final
situation.   Let ⬤ = N and ◯ = O

Initial system   Final system

(2 pts) (c) What is the limiting reactant? _____

(5 pts) **35.** A 588 g chunk of iron is heated to 97.5°C. It is then immersed in 247 grams of water originally at
20.7°C. The final temperature of both the iron and the water is 36.2°C. Calculate the specific heat
of iron. The specific heat of water is 4.18 J/g•°C.

SCRAP PAPER OR COMMENTS ON EXAM

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