NAME _____

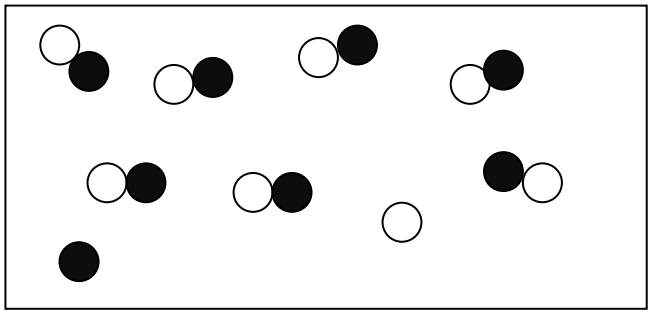
CHEMISTRY 101 SPRING 2010

EXAM 2 FORM B SECTION 502 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. Here is a particle view of a substance in water. Pick the compound that is represented by this particle view.



(a) HCl (b) AgOH (c) $LiCH_3COO$ (d) KOH (e) HF

3&4. Determine the oxidation number of phosphorus in the phosphite ion, PO_3^{3-}.

(a) +2 (b) +3 (c) +4 (d) +6 (e) +8

5&6. In Bronsted-Lowry Theory of acids and bases, a base is defined as:

(a) a proton donor (b) a hydroxide donor (c) an electron-pair acceptor
(d) a water-former (e) a proton acceptor

7&8. Which statement is FALSE?

(a) Energy is the capacity to do work.

(b) When two objects come into contact, they will in time be at the same temperature.

(c) A joule is a unit of energy.

(d) Heat flows from a cold object to a hot one.

(e) An endothermic reaction absorbs heat.

9&10. Assign oxidation numbers to each element in this **unbalanced** reaction. The reducing agent is:

$$P_4 + NO \rightarrow P_4O_6 + N_2$$

(a) P_4 (b) NO (c) P_4O_6 (d) N_2 (e) this is not a redox reaction

11&12. Consider this acid-base net ionic equation: $2H^+(aq) + Ni(OH)_2(s) \rightarrow Ni^{2+}(aq) + 2H_2O(\ell)$

Which of the following statements is TRUE?

(a) The acid is a weak acid.

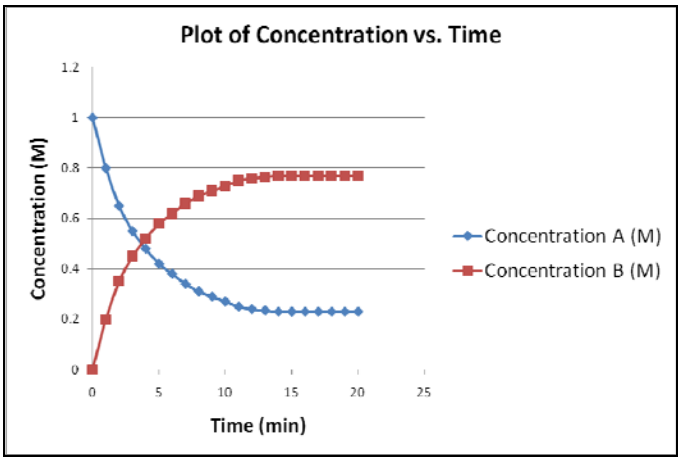
(b) The base is a weak electrolyte.

(c) The spectator ion could have been a NO_3^- ion.

(d) The salt is insoluble.

(e) The reaction is called a precipitation reaction.

13&14. Consider this graph representing A ⇄ B. Which is the FALSE statement?



(a) The reaction is reactant-favored.

(b) A and B reach equilibrium after 15 minutes.

(c) Even after 15 minutes, the system is very dynamic.

(d) After about 15 minutes, the concentrations of A and B seem to be about constant.

(e) After about 15 minutes, A is becoming B just as fast as B is converting to A.

15&16. 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.

$$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$$

(a) 19 (b) 42 (c) 21 (d) 11 (e) 10

17&18. How many moles of P_4S_{10} will be produced when 0.50 moles of S_8 reacts with excess P_4 according to the following equation?

$$4\ P_4 + 5\ S_8 \rightarrow 4\ P_4S_{10}$$

(a) 0.32 mol (b) 0.40 mol (c) 0.46 mol (d) 0.50 mol (e) 0.54 mol

19&20. The pH of a 0.00329 M solution of HNO_3 is

(a) 4.03 (b) 5.72 (c) 1.00 (d) 2.48 (e) 2.15

21&22. The valuable solvent, carbon tetrachloride can be produced by the gas phase reaction of chlorine gas with methane.

$$4\ Cl_2 + CH_4 \rightarrow CCl_4 + 4\ HCl$$

Assuming this process is 87% efficient, how many kilograms of chlorine are required for the production of 35 kg of CCl_4, assuming excess CH_4?

(a) 56 kg (b) 18 kg (c) 67 kg (d) 83 kg (e) 74 kg

23&24. Calculate the mass of NaOH contained in 400. mL of a solution that is 20.0% NaOH by mass. The density of the solution is 1.22 g/mL.

(a) 32 g (b) 81 g (c) 98 g (d) 128 g (e) 160. g

25&26. How many milliliters of a 4.69 M HCl solution are required to make 500. mL of 0.100 M HCl solution?

(a) 14.7 mL (b) 235 mL (c) 17.9 mL (d) 10.7 mL (e) 25.0 mL

27&28. Consider the reaction: $5\ FeCl_2 + KMnO_4 + 8\ HCl \rightarrow MnCl_2 + 5\ FeCl_3 + 4\ H_2O + KCl$

If 10.0 g of each reactant were used for this reaction, the limiting reactant would be:

(a) $FeCl_2$ (b) $KMnO_4$ (c) HCl (d) $MnCl_2$ (e) $FeCl_3$

29&30. A 2.50 g sample of magnesite ore containing $MgCO_3$ reacted totally with 10.09 mL of 3.10 M hydrochloric acid until no more carbon dioxide gas was evolved according to:

$$MgCO_3 + HCl \rightarrow H_2O + MgCl_2 + CO_2 \quad \text{(UNBALANCED)}$$

What percentage of the sample was $MgCO_3$?

(a) 27.1% (b) 52.8% (c) 96.7% (d) 87.5% (e) 43.8%

31&32. If 0.800 g of HI was dissolved in enough water to give a pH of 2.13, what was the volume of the solution?

(a) 1640 mL (b) 712 mL (c) 843 mL (d) 595 mL (e) 322 mL

PART 2

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

(5 pts) **33.** Given: benzene (C_6H_6): m.p. 5.5°C, b.p. 80.0°C

heat of fusion = 127 J/g at 5.5°C
heat of vaporization = 395 J/g at 80.°C

specific heat (g) = 1.04 J/g°C
specific heat (ℓ) = 1.74 J/g°C
specific heat (s) = 0.89 J/g°C

Calculate the amount of heat that must be released to convert 322 g of gaseous benzene at 80.0°C to liquid benzene at 6.0°C (in kJ).

OVER ⇒

34. Consider the precipitation reaction between aqueous solutions of potassium carbonate and tin(IV) perchlorate. 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.

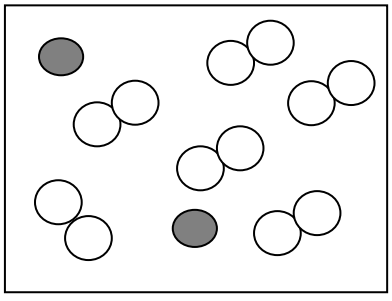
(2 pts) (c) What is/are the spectator ion/s, if any?

(2 pts) (d) What is the net ionic equation? Include the charge for every ion.

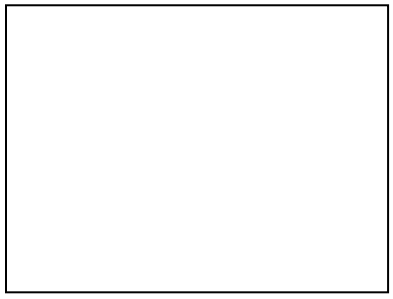
35. Consider this reaction: $S + O_2 \rightarrow SO_3$.

(2 pts) (a) Balance the equation.

(3 pts) (b) If you had 2 moles of S and 6 moles of O_2, draw the particle view that would represent the final situation. Let ● = S and ○ = O



Initial system



Final system

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

SCRAP PAPER OR COMMENTS ON EXAM

CHEMISTRY 101 **Spring 2010** NAME _____
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