

KEY

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1. (8). Write the formula and proper name for the compounds containing the following ions:

Ions	Formula of Compound	Name of Compound
$\text{Fe}^{3+}$ and $\text{SO}_4^{2-}$	$\text{Fe}_2(\text{SO}_4)_3$	iron(III) sulfate
$\text{Mn}^{4+}$ and $\text{O}^{2-}$	$\text{MnO}_2$	manganese(IV) oxide

2. (6). Give each of the following compounds a proper name.



chromium(III) oxide



chromium(VI) oxide

3. (4). Calcium carbonate is a slightly soluble salt:  $\text{CaCO}_3(\text{s}) = \text{Ca}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq})$ . The equilibrium expression for the solubility product (sp) is given as  $K_{\text{sp}} = [\text{Ca}^{2+}][\text{CO}_3^{2-}]$ .

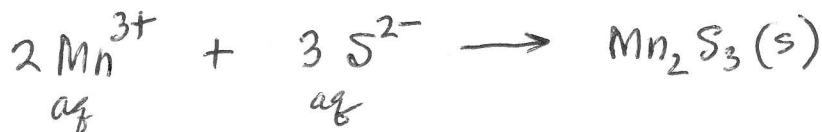
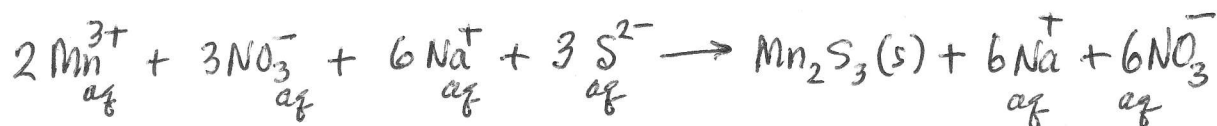
If a few crystals of  $\text{Na}_2\text{CO}_3$  are dissolved in a suspension of  $\text{CaCO}_3$  in water, how will the concentration of  $\text{Ca}^{2+}$  be affected? No effect \_\_\_\_;  $\text{Ca}^{2+}$  concentration increases \_\_\_\_;  $\text{Ca}^{2+}$  concentrations decreases ✓.

4. (12). Complete and balance the following reactions. If no reaction, write NR.

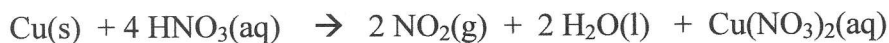


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5. (9). Write the balanced molecular, total ionic and net ionic equations for the reaction:



6. (10). Copper dissolves in concentrated nitric acid according to the following process.



- a. What mass (in grams) of copper is required to produce 2.00 moles of copper(II) nitrate?

$$2 \times 65 = 130 \text{ g.}$$

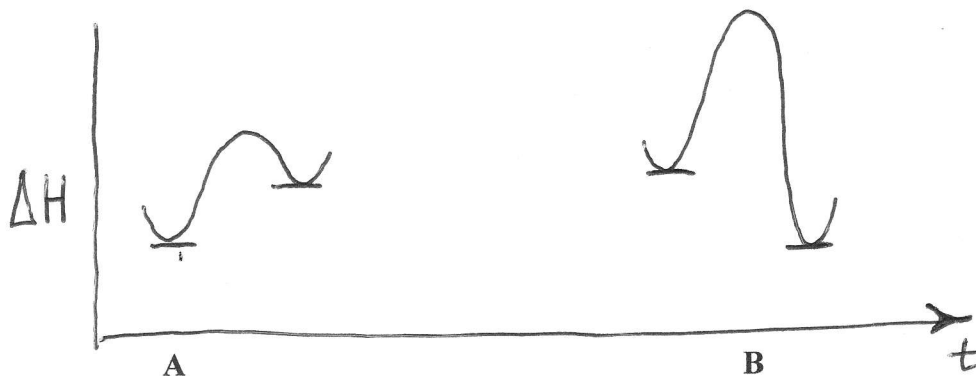
- b. How many moles of nitric acid are required to react exactly with 0.40 moles of copper?

$$\frac{4 \text{ moles HNO}_3}{1 \text{ mole Cu}} = \frac{x \text{ moles HNO}_3}{0.40 \text{ moles Cu}}$$

$$x = \frac{(4 \text{ moles HNO}_3)(0.40 \text{ moles Cu})}{1 \text{ moles Cu}} = 1.6 \text{ moles HNO}_3$$

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7. (6). Two curves are shown in the following energy diagram. Which curve represents the faster reaction? A. Which curve represents the spontaneous reaction? B



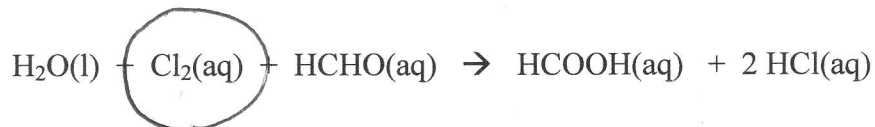
8. (4). Consider the following gas phase reaction:  $3 \text{H}_2(\text{g}) + \text{N}_2(\text{g}) \rightarrow 2 \text{NH}_3(\text{g})$ . Write the equation for the equilibrium constant.

$$K = \frac{[\text{NH}_3]^2}{[\text{H}_2]^3 [\text{N}_2]}$$

9. (4). What is the oxidation number of Cr in  $\text{K}_2\text{Cr}_2\text{O}_7$ ?

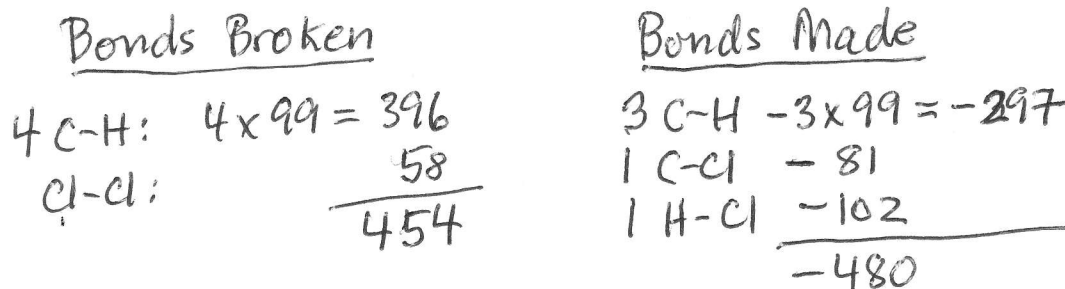
+6

10. (4). Circle the oxidizing agent in the following reaction:



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11. (12). Estimate the energy of the following reaction, given these bond dissociation energies (kcal/mol): C-H = 99; Cl-Cl = 58; C-Cl = 81; H-Cl = 102.



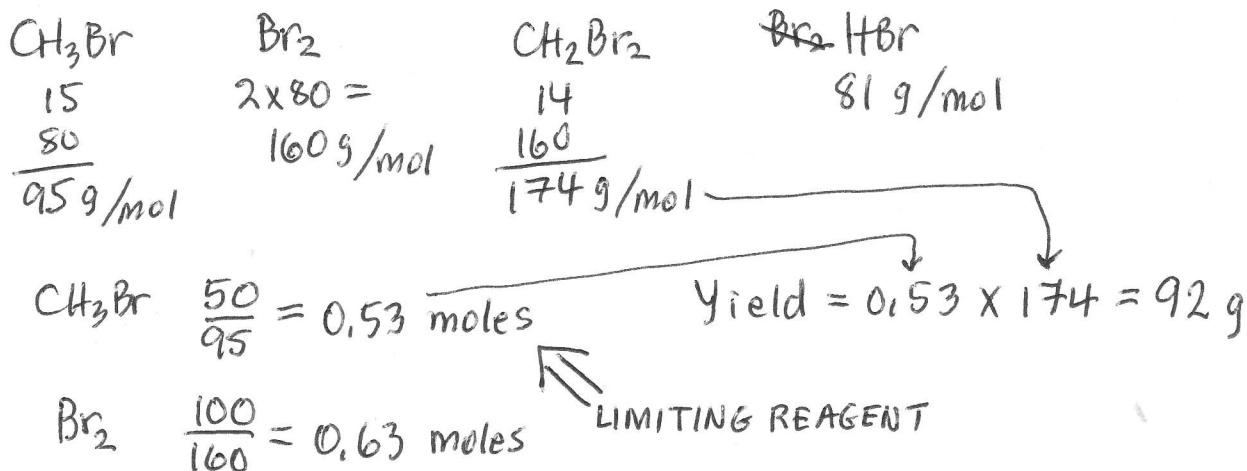
$$\Delta H = 454 - 480 = -26 \text{ kcal/mol}$$

According to your calculation, is this reaction exothermic  or endothermic .

12. (10). Consider the following reaction:



If 50 grams of  $\text{CH}_3\text{Br}$  are reacted with 100 grams of  $\text{Br}_2$ , what is the theoretical yield of  $\text{CH}_2\text{Br}_2$  product? (Hint: Which is the limiting reagent?).



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13. (8). What are the signs (+ or -) of  $\Delta H$ ,  $\Delta S$  and  $\Delta G$  for the melting of ice at 20 deg C?

(The melting point of ice is 0 deg C).



$\Delta H$  +;  $\Delta S$  +;  $\Delta G$  -. Is this process <sup>exothermic?</sup> ~~spontaneous?~~ Yes; \_\_\_ No.

14. (6). Based on your knowledge of the periodic table, do you think the following reaction is spontaneous ✓; or non-spontaneous \_\_\_?



How would you classify this reaction? **Circle** all that apply.

Single displacement. Double displacement. Precipitation. Redox. Neutralization.