

## General Chemistry I

1. If 65 J of heat are added to a system and the system performs 34 J of work on the surroundings. What is the total change in internal energy?

2. A system releases 78 J of energy to the surroundings and the surroundings perform 50 J of energy on the system. What is the final internal energy if the initial was 50 J.

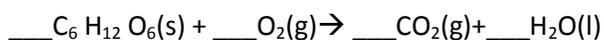
3. An exothermic gaseous reaction releases 150 J of energy to the surroundings while expanding from an initial volume of 50 ml to 100 ml against an external pressure of 4 atm. What is the total change in internal energy? ( $L \cdot atm = 101.325 J$ ).

4. A balloon contains 5 L of a gas at a pressure of 2 atm and a temperature of 298 K. What is the final volume of the gas if the balloon is submerged under water which is at a temperature of 290 K and a pressure of 4 atm?

5. Write all the gas formulas.

6. How much heat is added to 50 kg of ethanol ( $C_s = 2.42 J/g \cdot ^\circ C$ ) if the change in temperature is  $50^\circ C$ ?

7a. Find the  $\Delta H_{rxn}$  for the following reaction.



Substance	$\Delta H^\circ_{form} (Kj/mol)$
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$C_6H_{12}O_6 (s)$	- 1273.3
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$O_2 (g)$	0
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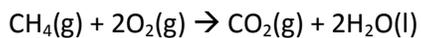
$CO_2 (g)$	- 393.5
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$H_2O (l)$	-285.8
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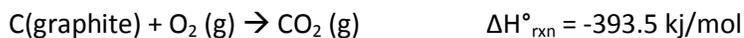
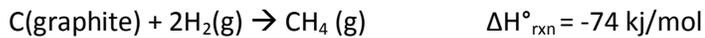
7b. If 5 grams of  $C_6H_{12}O_6$  react with 20 grams of  $O_2$  how much  $CO_2$  will form?

7c. How much heat will evolve if 5 grams of  $C_6H_{12}O_6$  reacts with excess  $O_2$ ?

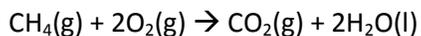
8. Use Hess Law to find the  $\Delta H^\circ_{rxn}$  following reaction:



Using these reactions:



9. Using the  $\Delta H^\circ_{\text{form}}$  find the  $\Delta H^\circ_{\text{rxn}}$  for the following reaction:



Substance	$\Delta H^\circ_{\text{form}}(\text{KJ/mol})$
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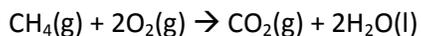
$\text{CH}_4(\text{g})$	-74.6
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$\text{O}_2(\text{g})$	0
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$\text{CO}_2(\text{g})$	-393.5
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$\text{H}_2\text{O}(\text{l})$	-285.8
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10. Using the bond dissociation energies find the  $\Delta H^\circ_{\text{rxn}}$  for the following reaction:



Bond	Bond Energy (kJ/mol)
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C—H	414
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O=O	498
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C=O	736
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O—H	464
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11. Give the root mean square velocity for gaseous  $\text{NO}_2$  at a temperature of 450 K.

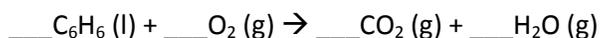
12. What is the molar mass of a gas that effuses 1.69 times faster than  $\text{SO}_2$ ?

## General Chemistry

1. A certain liquid compound contains C, H, O and Cl, and when it fully combusts it releases 7.806 g of  $\text{CO}_2$ , 3.194 g of  $\text{H}_2\text{O}$  and 2.070 g of  $\text{Cl}_2$  according to the following equation. What is the empirical and molecular formula for the compound if the molar mass is 186 g/mol?



2. Complete the following reaction:

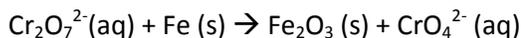


2a. If 5 liters of benzene ( $\text{C}_6\text{H}_6$ ) (density = 0.8737 g/ml) reacts with 2 kg of oxygen what is the theoretical yield of  $\text{CO}_2$  in grams?

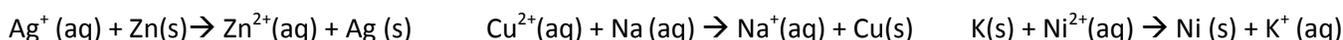
2b. If 2 liters of benzene react with excess  $\text{O}_2$  what is the theoretical yield of  $\text{CO}_2$  in ml if the reaction proceeds under STP conditions?

2c. If 2 liters of benzene react with excess  $\text{O}_2$  what is the theoretical yield of  $\text{CO}_2$  in ml if the reaction proceeds under a temperature of 600 K and 3 atm.

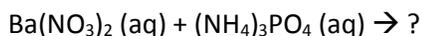
3. Give the oxidation and reduction half reactions for the following equation. (In acid and base)



4. Determine whether the following reactions would occur.



5. If 10 ml of 1.5 M  $\text{Ba}(\text{NO}_3)_2$  is mixed with 30 ml of 2.3 M  $(\text{NH}_4)_3\text{PO}_4$  how many grams of the solid product will form?



5b. If you observed that the following reaction raised the temperature of the solution by  $5^\circ \text{C}$ . Is the reaction exothermic or endothermic? Does the reaction have a (-) or (+)  $\Delta H$ ?

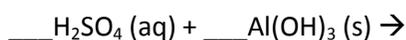
6. If you found that a reaction should have theoretically produced 50 grams of your product but you actually produced 31 grams. What is your percent yield?

## General Chemistry

7. Give the pH and pOH for the following solutions:

Solution	pH	pOH
0.98 M HCl		
1.34 M NaOH		
1.35 M Ba(OH) <sub>2</sub>		
3.5 M H <sub>2</sub> SO <sub>4</sub>		
2.67 M Al(OH) <sub>3</sub>		

8. Complete the following neutralization reaction:



8b. What volume of Al(OH)<sub>3</sub> is needed to neutralize 50 ml of 2.0 M H<sub>2</sub>SO<sub>4</sub>?

9. Give the Lewis structure, molecular shape, hybridization of the central atom for the following compounds:

9a. AlCl<sub>3</sub>      9b. SO<sub>4</sub><sup>2-</sup>      9c. XeF<sub>4</sub>      9d. I<sub>3</sub><sup>-</sup>      9e. SO<sub>2</sub>      9f. CO<sub>3</sub><sup>2-</sup>

10. Give the name for the following compounds:

10a. As<sub>2</sub>(CO<sub>3</sub>)<sub>5</sub>    10b. AsBO<sub>3</sub>    10c. Cr<sub>2</sub>(CO<sub>3</sub>)<sub>3</sub>    10d. ZnS    10e. Bi(IO<sub>3</sub>)<sub>3</sub>    10f. NiHPO<sub>4</sub>    10g. NaHCO<sub>3</sub>

11. Give the formula for the following names:

Zinc Phosphate      Manganese (II) Carbonate      Magnesium Iodate      Copper (I) Nitride

12. What is the wavelength emission of an electron that falls from n=4 to n=2?

13. What is the energy associated with a frequency of  $1.2 \times 10^{15}$  Hz?

14. What is the wavelength associated with a frequency of  $1.5 \times 10^{16}$  Hz?

15. What is the energy associated with a wavelength of 236 nm?

16. What is the wavelength associated with a ping pong ball that has a mass of 2 grams and is traveling at a speed of 15 mph?

17. Give the quantum numbers for the following elements last electron:

Cu    Sc    P    S    Ba    I    Xe    Tc    U    Au    Pb    C    F    Ca<sup>2+</sup>

