

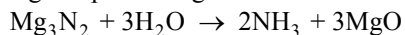
MQ12 study Guide

NOTE: Doing all of these will take you an incredible amount of time. You need to do enough that you can simply look at a problem and say (confidently) 'this is how I would do this problem...'. Meaning, work out the PROCESS that you would follow if you were to actually do the problem. Of course, you might actually want to do some of them too.

Study how we did textbook questions 5.56, 5.57 and 5.58

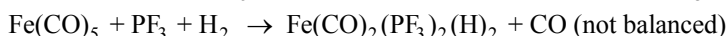
Additional text questions 5.67, 5.98, 5.99a

2) A 3.82-g sample of magnesium nitride is reacted with 7.73 g of water.



The yield of MgO is 3.60 g. What is the percent yield in the reaction?

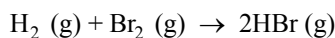
3) Pentacarbonyliron ($\text{Fe}(\text{CO})_5$) reacts with phosphorous trifluoride (PF_3) and hydrogen, releasing carbon monoxide:



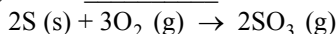
The reaction of 5.0 mol of $\text{Fe}(\text{CO})_5$, 8.0 mol of PF_3 and 6.0 mol of H_2 will release _____ mol of CO.

4) The change in the internal energy of a system that releases 2,500 J of heat and that does 7,655 J of work on the surroundings is _____ J.

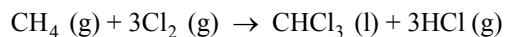
5) The value of ΔH° for the reaction below is -72 kJ. _____ kJ of heat are released when 1.0 mol of HBr is formed in this reaction.



6) The value of ΔH° for the reaction below is -790 kJ. The enthalpy change accompanying the reaction of 0.95 g of S is _____ kJ.



6) The value of ΔH° for the reaction below is -336 kJ. Calculate the heat (kJ) released to the surroundings when 23.0 g of HCl is formed.

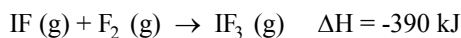


8) A sample of aluminum metal absorbs 9.86 J of heat, upon which the temperature of the sample increases from 23.2°C to 30.5°C. Since the specific heat capacity of aluminum is 0.90 J/g-K, the mass of the sample is _____ g.

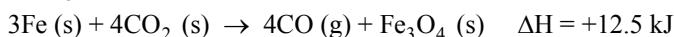
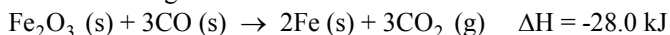
9) The specific heat of liquid bromine is 0.226 J/g-K. How much heat (J) is required to raise the temperature of 10.0 mL of bromine from 25.00°C to 27.30°C? The density of liquid bromine: 3.12 g/mL.

10) The ΔH for the solution process when solid sodium hydroxide dissolves in water is 44.4 kJ/mol. When a 13.9-g sample of NaOH dissolves in 250.0 g of water in a coffee-cup calorimeter, the temperature increases from 23.0°C to _____ °C. Assume that the solution has the same specific heat as liquid water, i.e., 4.18 J/g-K.

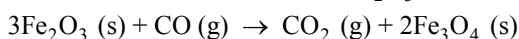
11) ΔH for the reaction



12) Given the following reactions



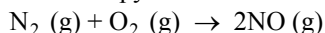
Calculate the enthalpy of the reaction of Fe_2O_3 with CO



13) Given the following reactions



Calculate the enthalpy of the reaction of the nitrogen to produce nitric oxide



15) The internal energy of a system is always increased by _____.

- A) adding heat to the system
- B) having the system do work on the surroundings
- C) withdrawing heat from the system
- D) adding heat to the system and having the system do work on the surroundings
- E) a volume compression

16) When a system _____, ΔE is always negative.

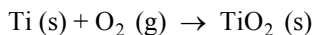
- A) absorbs heat and does work
- B) gives off heat and does work
- C) absorbs heat and has work done on it
- D) gives off heat and has work done on it
- E) none of the above is always negative.

19) Given the equation



Calculate the mass of liquid water (in grams) at 100°C that can be converted to vapor by absorbing 2.400 kJ of heat.

20) The combustion of titanium with oxygen produces titanium dioxide:



When 0.721 g of titanium is combusted in a bomb calorimeter, the temperature of the calorimeter increases from 25.00°C to 53.80°C . In a separate experiment, the heat capacity of the calorimeter is measured to be 9.84 kJ/K. The heat of reaction for the combustion of a mole of Ti in this calorimeter is _____ kJ/mol.

21) A 50.0-g sample of liquid water at 25.0°C is mixed with 29.0 g of water at 45.0°C . The final temperature of the water is _____ $^\circ\text{C}$. The specific heat capacity of liquid water is 4.18 J/g-K.

Other review stuff, some of which will be on the quiz!

1. Consider a single 3p orbital (only one) and a single 3d orbital.

- a. (3) Which quantum number (name please) is the same (for sure) for each of these orbitals?
- b. (3) Which quantum number (name please) *could be* the same for these orbitals?
- c. (3) Which quantum number (name please) is definitely NOT the same for these orbitals?

2. (3) Give the complete electronic configuration for your favorite (ground state, neutral) element whose outermost electrons are in the 2p orbital set. *Make sure you tell me which atom it is.*

3. Name the following species

- a. $\text{Fe}(\text{NO}_3)_3$
- b. SiCl_4
- c. H_2CrO_4 (an acid)
- d. VSO_4

4. Give the complete chemical symbol for the following isotopes:

- a. Arsenic-75
- b. Sodium-24