



© Scott Adams, Inc./Dist. by UFS, Inc.

$$q = mc\Delta T$$

$$c = \lambda\nu$$

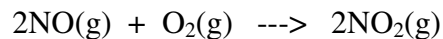
$$c = 3.00 \times 10^8 \text{ m/s}$$

$$E = h\nu$$

$$h = 6.626 \times 10^{-34} \text{ Js}$$

$$1 \text{ nm} = 10^{-9} \text{ m}$$

1. (10) For the reaction

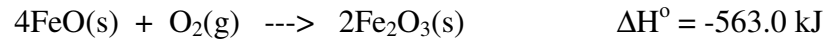


$$\Delta H^\circ = -114.2 \text{ kJ.}$$

(a) When 25.2 g of NO_2 forms from NO and O_2 , how much heat is released?

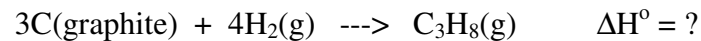
(b) If all of the heat in (a) is absorbed by 252 g of water initially at a temperature of 5.0°C , what will be the final temperature of the water?

2. (6) Iron (II) oxide can be oxidized to iron (III) oxide according to the following equation:

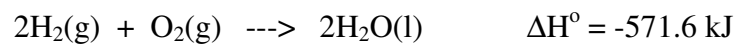
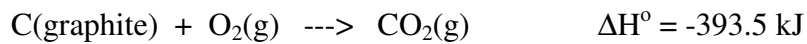
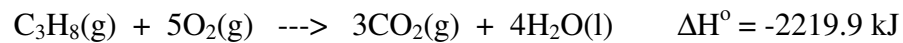


Given that ΔH_f° of $\text{FeO}(s) = -272.0 \text{ kJ/mol}$, what is ΔH_f° of $\text{Fe}_2\text{O}_3(s)$?

3. (8) Find the standard enthalpy of reaction for the process



given the following information:



4. (6) Rank the following photons in terms of increasing energy:

(a) a radio frequency photon with a wavelength of 10 m

(b) a visible photon with a wavelength of 440 nm

(c) a visible photon with a frequency of 5.0×10^{14} 1/s

5. (10) An electron in a hydrogen atom makes a transition from the $n = 4$ to the $n = 3$ energy level.

(a) What is the energy of the photon that is released, in joules?

(b) What is the wavelength of this photon of light?

6. (6) Classify each of the following processes as endothermic or exothermic:

(a) freezing of ice

(b) $\text{O}_2(\text{g}) \rightarrow 2\text{O}(\text{g})$

(c) $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$

7. (10) Fill in a possible value of each quantum number, and indicate the orbital designation (2p, 4s, etc). There may be more than one correct answer in each case.

	n	l	m_l	m_s	orbital designation
(a)	3	_____	-1	-1/2	_____
(b)	_____	0	_____	_____	_____
(c)	3	2	_____	+1/2	_____
(d)	5	_____	3	-1/2	_____

8. (15) For the following questions regarding quantum numbers, electron configurations, and periodic properties, no explanations are needed.

(a) How many p electrons (allowing for all values of n) are there in an arsenic atom?

(b) In a cadmium (Cd) atom, how many electrons have $n = 3$?

(c) How many different values of m_l are allowed for an electron in the 4d level?

(d) How many d electrons are there in a Ni^{2+} ion?

(e) Which will form the more acidic oxide, Cr or Cl?

9. (9) Write the ground state electron configuration for each atom. You may use the noble gas abbreviation.

(a) O

(b) Sr

(c) Po

10. (12) Select the atom or ion in each group with the property indicated. Explain your answers in 1-3 sentences each. Be sure that you explain the underlying reason in each case, rather than just stating the trend.

(a) Larger radius: Te or I

(b) Larger radius: Rb^+ or Br^-

(c) Greater ionization energy: K or Rb

11. (8) Sometimes, electron configurations and periodic properties can be difficult to predict.

(a) Give one reason why you would expect Cr to have the electron configuration $[\text{Ar}]4s^23d^4$, and one reason why you would expect it to have the configuration $[\text{Ar}]4s^13d^5$. Use complete sentences.

(b) Give one reason why you would expect P to have a higher electron affinity than S, and one reason why you would expect P to have a lower electron affinity than S. Use complete sentences.