

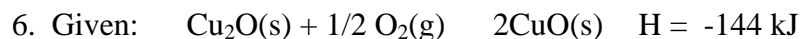
**DIRECTIONS:** Carefully mark the appropriate answer to each question on the Scantron sheet and show your work in the space provided. Each question is worth 1 point (20 points total). Write your name and the color (blue, green, yellow, pink) of the exam on the Scantron sheet. Please hand in both the quiz and the Scantron sheet.

Potentially useful information:

$$c = 2.9979 \times 10^8 \text{ m/s} \qquad h = 6.626 \times 10^{-34} \text{ J s}$$

$$c = \qquad E = h$$

- Which of the following frequencies corresponds to light with the longest wavelength?  
a.  $3.00 \times 10^{13} \text{ s}^{-1}$     b.  $4.12 \times 10^5 \text{ s}^{-1}$     c.  $8.50 \times 10^{20} \text{ s}^{-1}$   
d.  $9.12 \times 10^{12} \text{ s}^{-1}$     e.  $3.20 \times 10^9 \text{ s}^{-1}$
- When a hydrogen electron makes a transition from  $n = 3$  to  $n = 1$ , which of the following statements is *true*?  
I. Energy is emitted.  
II. Energy is absorbed.  
III. The electron loses energy.  
IV. The electron gains energy.  
V. The electron cannot make this transition.  
a. I, IV    b. I, III    c. II, III    d. II, IV    e. V
- Green light has a wavelength of  $5.50 \times 10^2 \text{ nm}$ . The energy of a photon of green light is  
a.  $3.64 \times 10^{-38} \text{ J}$     b.  $2.17 \times 10^5 \text{ J}$     c.  $3.61 \times 10^{-19} \text{ J}$   
d.  $1.09 \times 10^{-27} \text{ J}$     e.  $5.45 \times 10^{12} \text{ J}$
- In the phenomenon called the greenhouse effect the molecules  $\text{H}_2\text{O}$  and  $\text{CO}_2$  play an important role in retaining the atmosphere's heat.  
a. true    b. false
- When  $0.157 \text{ mol NH}_3$  is reacted with excess  $\text{HCl}$ ,  $6.91 \text{ kJ}$  of energy is released as heat. What is  $H$  for this reaction per mole of  $\text{NH}_3$  consumed?  
a.  $-22.7 \text{ J}$     b.  $-1.08 \text{ kJ}$     c.  $-44.0 \text{ kJ}$     d.  $+22.7 \text{ J}$     e.  $+44.0 \text{ kJ}$



Calculate the standard enthalpy of formation of  $\text{CuO}(\text{s})$ :  $\text{Cu}(\text{s}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{CuO}(\text{s})$

- a. -166 kJ      b. -299 kJ      c. +299 kJ      d. +155 kJ      e. -155 kJ

7. The  $\Delta H$  value for the reaction  $\frac{1}{2} \text{O}_2(\text{g}) + \text{Hg}(\text{l}) \rightarrow \text{HgO}(\text{s})$  is -90.8 kJ. How much heat is released when 32.5 g Hg is reacted with excess oxygen?

- a. 9.32 kJ      b. 90.8 kJ      c. 14.7 kJ      d. 40.0 kJ      e. 66.4 kJ

8. In the lab, you mix two solutions (each originally at the same temperature) and the temperature of the resulting solution decreases. Which of the following is true?

- a. The chemical reaction is releasing energy.
- b. The energy released is equal to  $s \times m \times T$ .
- c. The chemical reaction is absorbing energy.
- d. The chemical reaction is exothermic.
- e. Not enough data to decide.

9. What is the specific heat capacity of mercury if it requires 167 J to change the temperature of 15.0 g mercury from 25.0°C to 33.0°C?

- a.  $6.92 \times 10 \text{ J/g}^\circ\text{C}$       b.  $1.12 \times 10 \text{ J/g}^\circ\text{C}$       c.  $0.445 \text{ J/g}^\circ\text{C}$   
d.  $1.39 \text{ J/g}^\circ\text{C}$       e.  $313 \text{ J/g}^\circ\text{C}$

10. Which of the following are state functions?

- I. energy      II. work      III. enthalpy      IV. heat

- a. I, II
- b. I, III
- c. II, III
- d. I, II, III
- e. All are state functions.

11. For a particular process  $q = 20$  kJ and  $w = 15$  kJ. Which of the following statements is true?

- a. Heat flows from the system to the surroundings.
- b. The system does work on the surroundings.
- c.  $E = 35$  kJ.
- d. All of these are true.
- e. None of these are true.

12. How many of these statements are true?

- I.  $E = mc^2$
- II. Electromagnetic radiation can be thought of as a stream of particles called photons.
- III. The energy of matter is not continuous and is actually quantized.
- IV. Energy is not a state function.

- a. 4            b. 3            c. 2            d. 1            e. zero

13. What is the wavelength of a photon of red light (in nm) whose frequency is  $4.60 \times 10^{14}$  Hz?

- a. 652 nm            b.  $153 \times 10^6$  nm            c. 153 nm
- d. 460. nm            e. none of these

14. Under conditions of constant pressure, the heat flow that occurs during a chemical change is equal to

- a.  $E$             b.  $T$             c.  $H$             d.  $V$             e.  $w$

15. Calculate the work for the expansion of  $\text{CO}_2$  from 1.0 to 2.5 liters against a pressure of 1.0 atm at constant temperature.

- a. 1.5 liter atm            b. 2.5 liter atm            c. 0
- d. -1.5 liter atm            e. -2.5 liter atm

16. The device used to measure the heat associated with a chemical reaction is a

- a. heat-O-meter
- b. calorimeter
- c. bomb capacitor
- d. thermometer
- e. combustion chamber

17. According the first law of thermodynamics, energy can be

- a. created
- b. transformed
- c. changed into mass
- d. destroyed
- e. all of these

18. Consider the following processes:



Calculate the  $H$  for this reaction:

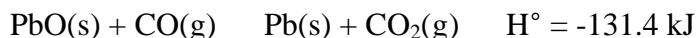


- a. 156 kJ
- b. -21 kJ
- c. 24 kJ
- d. 111 kJ
- e. 87 kJ

19. Equal amounts of heat are added to equal masses of metals A and B. The temperature increase of metal A is three times greater than the temperature increase of metal B, therefore the specific heat capacity of A must be:

- a. greater than the specific heat capacity of metal B
- b. less than the specific heat capacity of metal B
- c. equal to the specific heat capacity of metal B

20. Using the information below, calculate  $H_f^\circ$  for PbO(s).



$$H_f^\circ \text{ for CO}_2\text{(g)} = -393.5 \text{ kJ/mol}$$

$$H_f^\circ \text{ for CO(g)} = -110.5 \text{ kJ/mol}$$

- a. -151.6 kJ/mol
- b. -283.0 kJ/mol
- c. +282.0 kJ/mol
- d. -372.6 kJ/mol
- e. +252.1 kJ/mol