Chem 121a, Quiz 3 Name: _____
Fall Semester, 1998 SSN:_____

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:

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

$c = \lambda \nu \quad \Delta E = h \nu$

1. Which of the following frequencies corresponds to light with the longest wavelength?

a. $3.00 \times 10^{13}\ s^{-1}$ b. $4.12 \times 10^{5}\ s^{-1}$ c. $8.50 \times 10^{20}\ s^{-1}$
d. $9.12 \times 10^{12}\ s^{-1}$ e. $3.20 \times 10^{9}\ s^{-1}$

2. 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

3. Green light has a wavelength of 5.50×10^{2} nm. The energy of a photon of green light is

a. 3.64×10^{-38} J b. 2.17×10^{5} J c. 3.61×10^{-19} J
d. 1.09×10^{-27} J e. 5.45×10^{12} J

4. In the phenomenon called the greenhouse effect the molecules H_2O and CO_2 play an important role in retaining the atmosphere's heat.

a. true b. false

5. When 0.157 mol NH_3 is reacted with excess HCl, 6.91 kJ of energy is released as heat. What is ΔH for this reaction per mole of NH_3 consumed?

a. -22.7 J b. -1.08 kJ c. -44.0 kJ d. +22.7 J e. +44.0 kJ

6. Given: $Cu_2O(s) + 1/2\ O_2(g) \rightarrow 2CuO(s)$ $\Delta H = -144$ kJ

$Cu_2O(s) \rightarrow Cu(s) + CuO(s)$ $\Delta H = +11$ kJ

Calculate the standard enthalpy of formation of CuO(s): $Cu(s) + \_\ O_2(g) \rightarrow CuO(s)$

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

7. The ΔH value for the reaction $\_\ O_2(g) + Hg(l) \rightarrow HgO(s)$ 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 x m x 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 x 10 J/g°C b. 1.12 x 10 J/g°C c. 0.445 J/g°C
d. 1.39 J/g°C e. 313 J/g°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. ΔE = 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 4.60×10^{14} Hz?

a. 652 nm b. 153×10^6 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. ΔE b. ΔT c. ΔH d. ΔV e. Δw

15. Calculate the work for the expansion of 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:

$A + 2B \rightarrow G$ $\Delta H = +45.0$ kJ/mol

$C + 4B \rightarrow E + 2G$ $\Delta H = -66.0$ kJ/mol

Calculate the ΔH for this reaction:

$E + 2A \rightarrow C$

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 ΔH_f^o for PbO(s).

$PbO(s) + CO(g) \rightarrow Pb(s) + CO_2(g)$ $\Delta H° = -131.4$ kJ

ΔH_f^o for $CO_2(g) = -393.5$ kJ/mol

ΔH_f^o for $CO(g) = -110.5$ 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