NAME: _____ Form 1 (blue)

October 31, 2001	QUIZ #3	CHEM 101

Useful Information: $w = -P\Delta V$; $\Delta H_{rxn} = \Sigma n_p \Delta H_f(\text{products}) - \Sigma n_r \Delta H_f(\text{reactants})$; $\lambda\nu = c$; $E = h\nu$; $c = 2.9979 \times 10^8$ m/s; $h = 6.626 \times 10^{-34}$ J s; Hz = s^{-1}; $\lambda = h/p$; $p = mv$; $\Delta x \Delta p \geq h/4\pi$; $E_n = -R_H(1/n^2)$ Avogadro's number = 6.02214×10^{23} mol^{-1}

1) In the reactions determine whether the press.-vol. work, w, is < 0, = 0 , or > 0. Use blanks. Assume the pressure is constant.

a) $Hg(l) \rightarrow Hg(g)$ **<0**

b) $3O_2(g) \rightarrow 2O_3(g)$ **>0**

c) $CuSO_4 \bullet 5H_2O(s) \rightarrow CuSO_4(s) + 5H_2O(g)$ **<0**

d) $H_2(g) + F_2(g) \rightarrow 2HF(g)$ **=0**

2) The overall reaction for photosynthesis in higher plants is shown below:

$$6CO_2(g) + 6H_2O(l) \rightarrow \text{Glucose}(C_6H_{12}O_6) + 6O_2(g)$$

If 18.0 g of glucose are produced, ΔH_{rxn} = 283.6 kJ.

a) Is the reaction exothermic or endothermic? (Circle one)

a) Given the information in the table below, calculate the ΔH_f of glucose.

Compound	ΔH_f (kJ/mol)
$CO_2(g)$	-393.5
$H_2O(l)$	-286

18.0 g gluc x (1 mol/180.156 g) = 0.100 mol gluc

ΔH_{rxn} = 283.6 kJ/0.100 mol = 2840 kJ/mol

$\Delta H_{rxn} = 2840 = \Sigma n_p \Delta H_f(\text{products}) - \Sigma n_r \Delta H_f(\text{reactants}) = \Delta H_f(\text{glucose}) - 6(-393.5) - 6(-286)$

$\Delta H_f(\text{glucose}) = [6(-393.5) + 6(-286) + 2840]$ kJ/mol = <u>-1240 kJ/mol</u>

3) The lenses of sunglasses that darken in light contain AgCl(s). Light causes the reaction $AgCl(s) \rightarrow Ag(s) + Cl(g)$ to take place and the silver atoms darken the glass. The energy needed to make the reaction take place is 310. kJ/mol.

(a) Calculate the maximum wavelength the photon can have to darken an AgCl molecule.

(310. kJ/mol AgCl) x (1000 J/kJ) x (1 mol/6.022 x 10^{23} molecules) = 5.15 x 10^{-19} kJ/molec.

$E = h\nu = hc/\lambda \rightarrow \lambda = hc/E = (6.626 \times 10^{-34}\ J\ s)(2.9979 \times 10^8\ m/s)/5.15 \times 10^{-19}\ J = 3.86 \times 10^{-7}$ m

<u>λ = 386 nm</u>

(b) Explain the fact that light from a match can darken the sunglasses whereas the radiation from a microwave cannot.

Light from a match extends into the ultraviolet. These wavelengths are shorter than 386 nm, thus they are higher energy and will darken the sunglasses. Microwaves are much longer than 386 nm and thus are not energetic enough to darken the sunglasses.

4) State which of the following sets of quantum numbers would be possible and which impossible for an electron in an atom. Circle the appropriate answer.

a)	n = 1, l = 1, m_l = 0, m_s = +1/2	possible	**impossible**
b)	n = 0, l = 0, m_l = 0, m_s = +1/2	possible	**impossible**
c)	n = 1, l = 0, m_l = 0, m_s = -1/2	**possible**	impossible
d)	n = 2, l = 1, m_l = -1, m_s = +1/2	**possible**	impossible
e)	n = 2, l = 1, m_l = -2, m_s = -1/2	possible	**impossible**

NAME: _____ Form 2 (green)

October 31, 2001	QUIZ #3	CHEM 101

Useful Information: $w = -P\Delta V$; $\Delta H_{rxn} = \Sigma n_p \Delta H_f(\text{products}) - \Sigma n_r \Delta H_f(\text{reactants})$; $\lambda\nu = c$; $E = h\nu$; $c = 2.9979 \times 10^8$ m/s; $h = 6.626 \times 10^{-34}$ J s; Hz = s^{-1}; $\lambda = h/p$; $p = mv$; $\Delta x \Delta p \geq h/4\pi$; $E_n = -R_H(1/n^2)$
Avogadro's number = 6.02214×10^{23} mol^{-1}

1) In the reactions determine whether the press.-vol. work, w, is < 0, = 0 , or > 0. Use blanks. Assume the pressure is constant.

a) $Hg(l) \rightarrow Hg(g)$ **<0**

b) $3O_2(g) \rightarrow 2O_3(g)$ **>0**

c) $CuSO_4 \bullet 5H_2O(s) \rightarrow CuSO_4(s) + 5H_2O(g)$ **<0**

d) $H_2(g) + F_2(g) \rightarrow 2HF(g)$ **=0**

2) The aerobic oxidation reaction of glucose in the body (respiration) is shown below:

$$\text{Glucose}(C_6H_{12}O_6) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$$

If 18.0 g of glucose are oxidized, $\Delta H_{rxn} = -283.6$ kJ.

b) Is the reaction exothermic or endothermic? (Circle one)

b) Given the information in the table below, calculate the ΔH_f of glucose.

Compound	ΔH_f (kJ/mol)
$CO_2(g)$	-393.5

18.0 g gluc x (1 mol/180.156 g) = 0.100 mol gluc

ΔH_{rxn} = -283.6 kJ/0.100 mol = -2840 kJ/mol

$\Delta H_{rxn} = -2840 = \Sigma n_p \Delta H_f(\text{products}) - \Sigma n_r \Delta H_f(\text{reactants}) = 6(-393.5) + 6(-286) - \Delta H_f(\text{glucose})$

$\Delta H_f(\text{glucose}) = [6(-393.5) + 6(-286) - (-2840)]$ kJ/mol = <u>-1240 kJ/mol</u>

3) The light sensitive substance on most black-and-white photographic film is silver bromide, AgBr. The energy required to darken silver bromide is 100. kJ/mol

(a) Calculate the maximum wavelength the photon can have to darken an AgBr molecule.

(100. kJ/mol AgBr) x (1000 J/kJ) x (1 mol/6.022 x 10^{23} molecules) = 1.66 x 10^{-19} kJ/molec.

$E = h\nu = hc/\lambda \rightarrow \lambda = hc/E = (6.626 \times 10^{-34}$ J s)(2.9979 x 10^8 m/s)/1.66 x 10^{-19} J = 1.19 x 10^{-6} m

<u>λ = 1190 nm</u>

(b) Explain the fact that light from a match can expose photographic film whereas the radiation from a microwave cannot.

Light from a match is visible, which is between 400 nm – 700 nm. These wavelengths are Shorter than 1120 nm, thus they are higher energy and will expose the film. Microwaves Are much longer than 1120 nm and thus are not energetic enough to expose the film.

4) State which of the following sets of quantum numbers would be possible and which impossible for an electron in an atom. Circle the appropriate answer.

a)	n = 0, l = 0, m_l = 0, m_s = +1/2	possible	**impossible**
b)	n = 1, l = 1, m_l = 0, m_s = +1/2	possible	**impossible**
c)	n = 1, l = 0, m_l = 0, m_s = -1/2	**possible**	impossible
d)	n = 2, l = 1, m_l = -2, m_s = -1/2	possible	**impossible**
e)	n = 2, l = 1, m_l = -1, m_s = +1/2	**possible**	impossible