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General Chem. 101
Second Exam

Date: 3/5/2012
Time: 60 min.

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PV=nRT , $\Delta U = q + w$, R = 0.08206 atm L/mol. K , $h = 6.63 \times 10^{-34}$ J.sec
$1m = 10^9$ nm $= 10^{12}$ pm , $N = 6.022 \times 10^{23}$, R= 8.314 J/mol.K,

$$U = \sqrt{\frac{3RT}{M}}, \quad E = h\nu, \quad \Delta E = h\nu = \frac{hc}{\lambda} = R_H\left(\frac{1}{n_i^2} - \frac{1}{n_f^2}\right), \quad c = 3.0 \times 10^8 \frac{m}{sec}$$

ANSWER SHEET

1.	a	b	c	**d**	e	9.	a	b	**c**	d	e
2.	a	b	**c**	d	e	10.	a	b	**c**	**d**	e
3.	a	b	c	**d**	**e**	11.	**a**	**b**	c	d	e
4.	a	b	c	**d**	**e**	12.	a	**b**	c	d	**e**
5.	a	**b**	c	d	e	13.	a	**b**	**c**	d	e
6.	a	**b**	**c**	d	e	14.	**a**	b	c	**d**	e
7.	**a**	b	**c**	d	e	15.	**a**	b	c	d	e
8.	**a**	b	c	**d**	e	16.	a	b	**c**	d	**e**

GOOD LUCK

GOOD LUCK

1. A sample of CO gas has a pressure of 58 mm Hg and a volume of 155 mL. When the CO is transferred to a 1.00 L flask at the same temperature the pressure of the gas in mm Hg will be

$P = \frac{58}{760} = 0.076$ atm

155×10^{-3} L

a) 4.34 b) 8990 c) 111 (d) 8.99 e) 2.67

$P_1V_1 = P_2V_2$

$0.076 * 155 \times 10^{-3} = P_2 \times 1$

P_1

2. If ideal gas behavior is assumed, what is the density of neon (AM=20.18) at STP (0°C & 1 atm) in g/L?

$Mw = \frac{\rho RT}{P}$ $\rho = \frac{MwP}{RT}$

a) 1.11 b) 448 (c) 0.901 d) 0.009 e) 1.783 $= \frac{20.18 * 1}{0.0821 * 273}$

$=$

$\frac{r_1}{r_2} = \frac{\sqrt{Mw_2}}{\sqrt{Mw_1}}$

3. Under identical conditions, gaseous CO_2 (MM=44) and CCl_4 (MM=154) are allowed to effuse through a pin hole. If the rate of effusion of the CO_2 is 0.063 mol/s, what is the rate of effusion of the CCl_4 in mol/s?

Mw_1

r_1

a) 0.063 b) 0.22 c) 0.018 (d) 0.12 e) 0.034

$\frac{r_1}{r_2} = \frac{\sqrt{Mw_2}}{\sqrt{Mw_1}}$

$\frac{0.063}{r_2} = \frac{\sqrt{44}}{\sqrt{154}} \Rightarrow r_2 = \frac{\sqrt{154} * 0.063}{\sqrt{44}}$

4. The best statement that describes ideal gases is

a) the particle have no volume.

b) the particle have no mass.

c) there are no attractive forces between particles.

d) the particles have no volume and there are no attractions forces amongst them.

(e) the particles have no mass and there are no attractions or repulsion forces amongst them.

5. A 2.50 L flask at 15 °C contains a mixture of three gases N_2, He and Ne at partial pressure of 0.32 atm for N_2, 0.15 atm for He, and 0.42 atm for Ne. If N_2 gas is removed calculate the volume (in L) at STP (0°C & 1 atm) occupied by He and Ne gases that are left.

a) 22.4 b) 1.35 c) 1.47 d) 1.11 e) 38.0

6. A 1.900 g sample of benzene C_6H_6 (MM=78.108) was completely burned in a constant volume bomb calorimeter with heat capacity of 9.623 kJ/°C. If the temperature increased from 24.800°C to 26.718 °C, what is ΔU for the reaction in kJ/mole benzene?

a) 19.684 b) 758.8 c) 17.354 d) 1201 e) 16.357

7. In which of the following reactions ΔH= ΔU?

a) $4Ag(s) + 2H_2S(g) + O_2(g) \rightarrow 2Ag_2S(s) + 2H_2O(l)$

b) $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

c) $C(\text{graphite}) + O_2(g) \rightarrow CO_2(g)$

d) $2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(l)$

e) $CO_2(g) + H_2O(l) \rightarrow H_2CO_3(l)$

8. How much heat is released when 6.38 grams of Ag(s) (AM=107.9) reacts by the equation shown below at standard state conditions?

$4Ag(s) + 2H_2S(g) + O_2(g) \rightarrow 2Ag_2S(s) + 2H_2O(l)$

Substance	ΔH_f°(kJ/mol)
$H_2S(g)$	-20.6
$Ag_2S(s)$	-32.6
$H_2O(l)$	-285.8

a) 8.80 kJ b) 69.9 kJ c) 22.1 kJ d) 90.8 kJ e)40.5 kJ

9. Calculate the work in kJ done when 2.50 moles of liquid water is converted to vapor at 1 atm and 25°C. Assume that the volume of liquid water is negligible compared to that of the formed vapor. (1atm.liter = 101.3 J).

a) 4.01 b) 5.98 c) 6.19 d) 5.26 e) 4.61

$W = -nRT$
$= -P\Delta V$
$= -nRT$
$= -(2.5)(8.314)(298)$

10. Find the standard enthalpy of formation in kJ of ethylene $C_2H_{4(g)}$ from the following data?

$C_2H_4 + O_2 \rightarrow$

$C_2H_{4(g)} + 3\ O_{2(g)} \rightarrow 2CO_{2(g)} + 2\ H_2O_{(l)}$ $\Delta H° = -1411$ kJ

$2 \times (C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)})$ $\Delta H° = -393.5$ kJ $= -787$

$2 \times (H_{2(g)} + \frac{1}{2}\ O_{2(g)} \rightarrow H_2O_{(l)})$ $\Delta H° = -285.8$ kJ $\times 2 = -571.6$

$2C + 2H_2 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

a) -48.6 b) 78.7 c) -2090 d) 52.4 e) 227

11. A solution of 400 mL of 0.600 M HCl was mixed with 400 mL of 0.500 M KOH in a constant pressure calorimeter of heat capacity of 65 J/°C. If the heat of neutralization is -56.2 kJ/mol calculate the rise in temperature as a result of the reaction. (Consider the specific heat of the solutions to be 4.10 J/g°C, and the density of the solution 1.00g/mL)

$V = 0.4L$ $V = 0.4L$

a) 3.36 °C b) 3.86 c) 4.52 d) 4.85 e) 5.52

$d = \frac{m}{V}$

$q = C\Delta T$
$= s m \Delta T$

0.57

$1 \rightarrow 56.2$
$0.66 \rightarrow ??$
$= 37.4$

$HCl + KOH \rightarrow KCl + H_2O$
$n = 0.6 \quad n = 0.6$

12. When light of frequency equal to $2.11 \times 10^{15}\ s^{-1}$ shines on the surface of gold metal, the kinetic energy of ejected electrons is found to be 5.83×10^{-19} J. The work function of gold in jouls is ($h = 6.63 \times 10^{-34}$ Js)

ϵ

a) 1.98×10^{-18} b) 8.16×10^{-19} c) -8.16×10^{-19} d) 8.79×10^{14} e) 1.39×10^{-18}

$\epsilon = h\nu$
$= 6.63 \times 10^{-34} \times 2.11 \times 10^{15}$

$E = R_H\left(\frac{1}{n_i^2} - \frac{1}{n_f^2}\right)$

13. An electron in the hydrogen atom makes a transition from an energy state of principle quantum number n_i to the n= 2 state. If the photon emitted has a wave length of 434 nm, the value of n_i is
($A=R_H= 2.18 \times 10^{-18}$J)(c=3.0 x 10^8m/s) (h=6.63 x 10^{-34}Js) $E = \frac{hc}{\lambda}$

a) 3 b) 4 c) 5 d) 6 e) 7

2.17.

$E = \frac{(6.63\times10^{-34})(3\times10^8)}{434\times10^{-9}}$

$= 4.58\times10^{-19}$

$4.58\times10^{-19} = 2.18\times10^{-18}\left(\frac{1}{n_i^2} - \frac{1}{4}\right)$

$4.58\times10^{-19} = \frac{2.18\times10^{-8}}{n_i} - 5.45\times10^{-19}$

14. Protons can be accelerated to speeds near that of light in particle accelerators. Determine the wavelength in meters of such a proton moving at 2.90×10^8 m/s. (mass of a proton is 1.673×10^{-30} g) (h=6.63 x 10^{-34}Js)

a) 1.37×10^{-12} b) 2.73×10^{-12} c) 1.37×10^{-6} d) 1.37×10^{-9} e) 4.40×10^{-9}

$\lambda = \frac{h}{ms}$

$= \frac{6.63\times10^{-34}}{1.673\times10^{-30}\times2.90\times10^8}$

15. Indicate the unacceptable or incorrect set of quantum numbers (n, l m_l, m_s) among the following sets of quantum numbers

a) (1, 0, 1/2, +1/2) b) (3, 0, 0, -1/2) c) (2,2,1,+1/2) d) (4,3,-2,+1/2) e) (3,2,1,+1/2)

16. Which of the following is the correct electronic configuration of Tellurium, Te (Z= 52)?

a) [kr]$4d^{10}5p^6$ b) [Rb]$5s^24d^{10}5p^3$ c) [Ar]$5s^24d^{10}5p^4$ d) [kr]$5s^24d^85p^6$
e) [kr]$5s^24d^{10}5p^4$

PERIODIC TABLE OF THE ELEMENTS