

General Chem. 101
Second Exam

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

Name: ~~.....~~ Reg. No.: ~~.....~~

Instructor Name: ~~.....~~ seat No.: 48

$PV=nRT$, $\Delta U=q+w$, $R=0.08206$ 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,

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



ANSWER SHEET

- | | |
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| <p>1. a b c <u>d</u> e</p> <p>2. a b <u>c</u> d e</p> <p>3. a b c <u>d</u> e</p> <p>4. a b c d <u>e</u></p> <p>5. a <u>b</u> c d e</p> <p>6. a b <u>c</u> d e</p> <p>7. <u>a</u> b c d e</p> <p>8. a b c <u>d</u> e</p> | <p>9. a b <u>c</u> d e</p> <p>10. a b <u>c</u> d e</p> <p>11. a <u>b</u> c d e</p> <p>12. a b c d <u>e</u></p> <p>13. a <u>b</u> c d e</p> <p>14. <u>a</u> b c d e</p> <p>15. <u>a</u> b c d e</p> <p>16. a b <u>c</u> d e</p> |
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GOOD LUCK

1. A sample of CO gas has a pressure of $\frac{58}{760} = 0.076 \text{ atm}$ and a volume of $155 \times 10^{-3} \text{ L}$. 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

- a) 4.34 b) 8990 c) 111 **d) 8.99** e) 2.67

$$P_1 V_1 = P_2 V_2$$

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

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?

- a) 1.11 b) 448 **c) 0.901** d) 0.009 e) 1.783
- $$\rho = \frac{M_w P}{RT} = \frac{20.18 \times 1}{0.0821 \times 273}$$

$$\frac{r_1}{r_2} = \sqrt{\frac{M_{w2}}{M_{w1}}}$$

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?

- a) 0.063 b) 0.22 c) 0.018 **d) 0.12** e) 0.034

$$\frac{r_1}{r_2} = \sqrt{\frac{M_{w2}}{M_{w1}}}$$

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

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

$$P_T = 0.15 + 0.42 = 0.57$$

$$PV = nRT$$

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/ $^\circ\text{C}$. 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

$$q = C\Delta T$$

$$= 9.623 \times 1.918$$

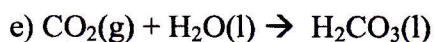
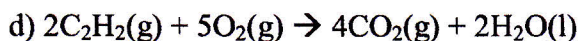
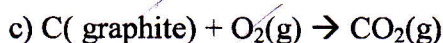
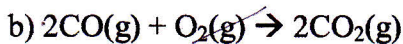
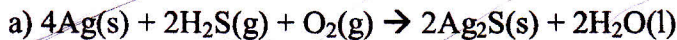
$$= 18.46$$

$$w = -nRT$$

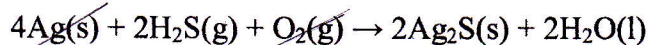
$$= -\frac{m}{M} \times 8.314 \times R$$

$$= -387.8$$

7. In which of the following reactions $\Delta H = \Delta U$?



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



$$n = 0.059$$

Substance	ΔH_f° (kJ/mol)
$\text{H}_2\text{S}(g)$	$2 \times -20.6 = -41.2$
$\text{Ag}_2\text{S}(s)$	$2 \times -32.6 = -65.2$
$\text{H}_2\text{O}(l)$	$2 \times -285.8 = -571.6$

product - reactant
 $(2(-32.6) + 2(-285.8)) - 2(-20.6)$
 $= -599.6$
 $\Delta H_{rxn} = \Delta H_f^\circ$

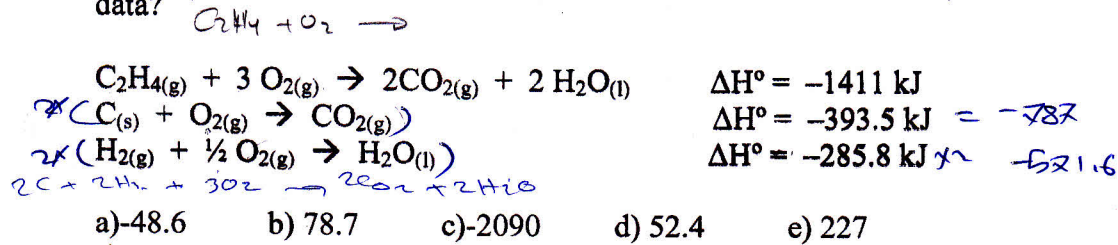
- a) 8.80 kJ b) 69.9 kJ c) 22.1 kJ d) 90.8 kJ e) 40.5 kJ

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. (1 atm.liter = 101.3 J).

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

$$\begin{aligned}
 w &= -nRT \\
 &= -P\Delta V \\
 &= -nRT \\
 &= -(2.5)(8.314)(298)
 \end{aligned}$$

10. Find the standard enthalpy of formation in kJ of ethylene $C_2H_4(g)$ from the following data?



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

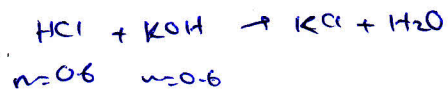
11. A solution of 400 mL of 0.600 M HCl was mixed with 400 mL of 0.500 M KOH in a constant pressure calorimeter of heat capacity of 65 J/°C. If the heat of neutralization is -56.2 kJ/mol calculate the rise in temperature as a result of the reaction. (Consider the specific heat of the solutions to be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

- a) 3.36 °C b) 3.86 c) 4.52 d) 4.85 e) 5.52 $d = \frac{m}{V}$

$$q = c \Delta T = sm \Delta T$$

$$0.57$$

$$\begin{aligned}
 1 &\rightarrow 56.2 \\
 0.66 &\rightarrow ?? \\
 &= 37.47
 \end{aligned}$$



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

- 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}**

$$\begin{aligned}
 E &= h\nu \\
 &= 6.63 \times 10^{-34} \times 2.11 \times 10^{15}
 \end{aligned}$$

$$E = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

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

($A=R_H=2.18 \times 10^{-18} \text{J}$) ($c=3.0 \times 10^8 \text{m/s}$) ($h=6.63 \times 10^{-34} \text{Js}$) $E = \frac{hc}{\lambda}$

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

$$E = \frac{(6.63 \times 10^{-34}) (3 \times 10^8)}{434 \times 10^{-9}}$$

$$= 4.58 \times 10^{-19}$$

2.17

$$4.58 \times 10^{-19} = 2.18 \times 10^{-18} \left(\frac{1}{n_1^2} - \frac{1}{4} \right)$$

$$4.58 \times 10^{-19} = \frac{2.18 \times 10^{-18}}{n_1^2} - 5.45 \times 10^{-19}$$

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 $2.90 \times 10^8 \text{m/s}$. (mass of a proton is $1.673 \times 10^{-27} \text{g}$) ($h=6.63 \times 10^{-34} \text{Js}$)

- 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}

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

$$= \frac{6.63 \times 10^{-34}}{1.673 \times 10^{-27} \times 2.90 \times 10^8}$$

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

PERIODIC TABLE OF THE ELEMENTS

IA	1 H 1.0079	2	3 Li 6.941	4 Be 9.0122	5	6	7	8	9	10 Ne 20.179
IIA	11 Na 22.9898	12 Mg 24.305	13	14	15	16	17	18	19	20
IIIB	19 K 39.098	20 Ca 40.08	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28
IVB	37 Rb 85.4678	38 Sr 87.62	39 Y 88.9059	40 Zr 91.22	41 Nb 92.9064	42 Mo 95.94	43 Tc 98.9062	44 Ru 101.07	45 Rh 102.9055	46
VB	55 Cs 132.9054	56 Ba 137.34	57 La 138.9055	58 Ce 140.12	59 Pr 140.9077	60 Nd 144.24	61 Pm (147)	62 Sm 150.4	63	64
VB	87 Fr (223)	88 Ra 226.0254	89 Ac (227)	90 Th 232.0377	91 Pa 231.0369	92 U 238.0289	93 Np 237.0482	94 Pu 244	95	96
IVB	29 Cu 63.546	30 Zn 65.38	31 Ga 69.72	32 Ge 72.60	33 As 74.91	34 Se 78.96	35 Br 79.904	36 Kr 83.80	37	38
VB	47 Ag 107.868	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.9045	54 Xe 131.30	55	56
VB	77 Ir 192.22	78 Pt 195.08	79 Au 196.9665	80 Hg 200.59	81 Tl 204.37	82 Pb 207.2	83 Bi 208.9804	84	85	86
VB	63 Eu 151.96	64 Gd 157.25	65 Tb 158.9254	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.9342	70 Yb 173.04	71 Lu 174.97	72
VB	95 Am (243)	96 Cm (245)	97 Bk (247)	98 Cf (249)	99 Es (251)	100 Fm (253)	101 Md (255)	102 No (259)	103 Lr (261)	104
IVB	28 Ni 58.71	29 Cu 63.546	30 Zn 65.38	31 Ga 69.72	32 Ge 72.60	33 As 74.91	34 Se 78.96	35 Br 79.904	36 Kr 83.80	37
VB	46 Pd 106.4	47 Ag 107.868	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.9045	54 Xe 131.30	55
VB	76 Os 190.2	77 Ir 192.22	78 Pt 195.08	79 Au 196.9665	80 Hg 200.59	81 Tl 204.37	82 Pb 207.2	83 Bi 208.9804	84	85
VB	61 Pm (147)	62 Sm 150.4	63 Eu 151.96	64 Gd 157.25	65 Tb 158.9254	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.9342	70
VB	91 Pa 231.0369	92 U 238.0289	93 Np 237.0482	94 Pu 244	95 Am (243)	96 Cm (245)	97 Bk (247)	98 Cf (249)	99 Es (251)	100
IVB	21 Sc 44.9559	22 Ti 47.88	23 V 50.9415	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.71	29 Cu 63.546	30
VB	39 Y 88.9059	40 Zr 91.22	41 Nb 92.9064	42 Mo 95.94	43 Tc 98.9062	44 Ru 101.07	45 Rh 102.9055	46 Pd 106.4	47 Ag 107.868	48
VB	57 La 138.9055	58 Ce 140.12	59 Pr 140.9077	60 Nd 144.24	61 Pm (147)	62 Sm 150.4	63 Eu 151.96	64 Gd 157.25	65 Tb 158.9254	66
VB	89 Ac (227)	90 Th 232.0377	91 Pa 231.0369	92 U 238.0289	93 Np 237.0482	94 Pu 244	95 Am (243)	96 Cm (245)	97 Bk (247)	98
IVB	31 Ga 69.72	32 Ge 72.60	33 As 74.91	34 Se 78.96	35 Br 79.904	36 Kr 83.80	37	38	39	40
VB	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.9045	54 Xe 131.30	55	56	57	58
VB	81 Tl 204.37	82 Pb 207.2	83 Bi 208.9804	84	85	86	87	88	89	90
VB	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.9342	70 Yb 173.04	71 Lu 174.97	72	73	74	75
VB	98 Cf (249)	99 Es (251)	100 Fm (253)	101 Md (255)	102 No (259)	103 Lr (261)	104	105	106	107

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