ممتاز $\frac{16}{16}$

General Chem. 101 ***Second Exam*** **11/12/2011** **60 min.**

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Ideal gas equation: PV= nRT ; E_{photon}= hv; N = 6.022 x 10^{23} mol^{-1};
R(gas constant) = 0.08206 atm.L / mol.K ; h(Planck's constant) = 6.63 x 10^{-34} J.s
c(speed of light) = 3.00 x 10^{8} m/s ; E (for H atom) = $-(2.18 \times 10^{-18}/n^2)$ J ;
One nm = 10^{-9} m. ; $\lambda = h/mv$; $c = \nu\lambda$. atm.L =101.3 J

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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

1. The volume of a certain amount of a gas is 8.80 L at 127 °C and at pressure of 2.00 atm, calculate its volume at 27 °C and 3.00 atm.

a) 6.60 L b) 4.40 L c) 3.30 L d) 2.64 L e) 2.20 L

$\frac{V_1 P_1}{T_1} = \frac{V_2 P_2}{T_2} \Rightarrow \frac{(8.8)(2)}{(400)} = \frac{(V)(3)}{(300)} \Rightarrow V = 4.4$

2. Calculate the density of CO_2 gas (in g/ L) at 25°C and 1.30 atm. Molar mass of CO_2 is 44.0 g/mol.

a) 2.52 b) 2.70 c) 2.88 d) 2.10 e) 2.34

$M_m = \frac{dRT}{P} \Rightarrow d = \frac{PM_m}{RT} = \frac{(1.3)(44)}{(0.08206)(298)} = 2.34$

3. A sample of 1.75 g of a vapor occupies 0.559 L at 97°C and 0.967 atm. Calculate the molar mass of the compound.

a) 98.3 b) 78.6 c) 124 d) 144 e) 112

$M_m = \frac{dRT}{P} = \frac{(3.13)(0.08206)(370)}{0.967} = 98.3$

$d = \frac{m}{V} = 3.13$

4. A mixture of 0.260 moles O_2 and 0.540 moles N_2 has a total pressure of 10.0 atm. Calculate the partial pressure of O_2 in the mixture.

a) 1.30 atm b) 2.60 atm c) 3.25 atm d) 0.980 atm e) 1.95 atm

O_2 $n = 0.26$ N_2 $n = 0.54$ $P_{total} = 10$

$n_{total} = 0.8$

$\frac{n_{O_2}}{n_{total}} = \frac{P_{O_2}}{P_{total}} \Rightarrow \frac{0.26}{0.8} = \frac{P_{O_2}}{10} = 3.25$

5. For the following gases (given molar masses):

$F_2(38)$, $Cl_2(71)$, $CH_4(16)$ and $NO(30)$

The order of increasing rate of effusion is:

a) $CH_4 < NO < F_2 < Cl_2$ b) $F_2 < NO < Cl_2 < CH_4$

c) $CH_4 < NO < F_2 < Cl_2$ d) $Cl_2 < F_2 < NO < CH_4$

e) $Cl_2 < F_2 < CH_4 < NO$

$\frac{r_1}{r_2} =$

$Cl_2 < F_2 < NO < CH_4$

6. According to kinetic molecular theory, which of the following statements is **correct**?

a) The volume occupied by an ideal gas particles cannot be neglected.

b) The pressure of the gas is due to the collisions of the gas particles with the walls of the container.

c) Ideal gas particles repel each other, but do not attract each another.

d) At same temperature gases with larger molar masses have lower average kinetic energies.

e) All above statements are wrong.

7. A gas is allowed to expanded from an initial volume of 2.00 L to a final volume of 11.00 L under a constant external pressure of 2.00 atm. The value of work, w, is;

a) -1.82×10^3 J b) -5.79×10^3 J c) -2.74×10^3 J
d) -3.65×10^3 J e) -4.56×10^3 J

$\Delta V = 9 \Rightarrow w = -P\Delta V$
$= (-2)(9)(101.3) = -1823$ J $= -1820$ J $= -1.82 \times 10^3$

8. Which one of the following reactions has ΔH equals to ΔE?

$\Delta V = 0$
$\Delta n = 0$

a) $H_2O(l) \rightarrow H_2O(g)$ expand
b) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
c) $H_2(g) + 1/2O_2(g) \rightarrow H_2O(l)$
d) $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$
e) $H_2(g) + Br_2(g) \rightarrow 2HBr(g)$

9. 50.0 mL of 0.500 M HCl at 25.0°C is added to 50.0 mL of 0.500 M NaOH at 25.0°C in a coffee cup calorimeter, the temperature of the mixture rises to 28.1°C. What is ΔH of neutralization per mole H_2O produced? Assume the mixture has a specific heat of 4.18 J/g·°C and a density of 1.00 g/mL. Assume the calorimeter to have zero heat capacity.

a) −54 kJ/mol b) −57 kJ/mol c) − 52 kJ/mol
d) − 55 kJ/mol e) − 59 kJ/mol

$HCl + NaOH \rightarrow H_2O + NaCl$

50 ml 50 ml n = 0.025
0.5 0.5
25 25

$\Delta T = 3.1$

$\frac{(4.18)(100)(3.1)}{0.025} = 51832$ J $= 52$

$q_{rxn} = -q_{soln}$
$= sp\Delta T m$
$= (4.18)(100)(3.1)$
$= 1295.8$ J/dle
$= 1.2958$ kJ
$q_{rxn} = -1.2958$ kJ
$\Delta H = \frac{-1.2958}{0.025}$
$= 51.832$
≈ 52

10. Given the following thermochemical equations:

$NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g)$, $\Delta H = -198.9$ kJ/ mol
$O_3(g) \rightarrow 1.5O_2(g)$, $\Delta H = -142.3$ kJ /mol
$O_2(g) \rightarrow 2O(g)$. $\Delta H = +495.0$ kJ /mol

Calculate the enthalpy change for the reaction: $NO(g) + O(g) \rightarrow NO_2(g)$

a) −302.1 kJ/mol
b) −304.1 kJ/mol
c) −306.1 kJ/mol
d) −308.1 kJ/mol
e) −300.1 kJ/mol

11. Use the following data to calculate the standard enthalpy of formation, ΔH°_f, of manganese(IV) oxide, MnO_2 (*s*), in kJ/mol. $= \Delta H_p$

$2MnO_2(s) \rightarrow 2MnO(s) + O_2(g)$ $\Delta H = +264$ kJ/mol
$MnO_2(s) + Mn(s) \rightarrow 2MnO(s)$ $\Delta H = -241$ KJ/mol

a) −505
b) −512
c) −508
d) −516
e) −527

$\cancel{2MnO} + O_2 \rightarrow 2MnO_2$ -264
$MnO_2 + Mn \rightarrow \cancel{2MnO}$ -241
$Mn + O_2 \rightarrow MnO_2$

12. What is the wavelength of a photon of electromagnetic radiation whose frequency is 5.80×10^{15} Hz.

a) 71.4 nm
b) 32.6 nm
c) 98.4 nm
d) 51.7 nm
e) 41.7 nm

$\lambda = \frac{c}{\nu} = \frac{(3 \times 10^8)}{(5.8 \times 10^{15})} = 51.7$

13. Calculate the wavelength of the wave associated with a proton (mass $= 1.67 \times 10^{-24}$ g) moving at a speed of 2.60×10^3 m/s

a) 0.426 nm
b) 0.209 nm
c) 0.153 nm
d) 0.137 nm
e) 0.180 nm

$\lambda = \frac{h}{mv} = \frac{(6.63 \times 10^{-34})}{(1.67 \times 10^{-27})(2.6 \times 10^3)} = 0.153$

14. Calculate the frequency (in Hz) of the electromagnetic radiation emitted by the hydrogen atom in undergoing a transition from the $n = 7$ level to the $n = 3$ level.

a) 2.74×10^{14} b) 7.64×10^{14} c) 1.60×10^{14} d) 2.34×10^{14} e) 2.98×10^{14}

15. Which one of the following sets of quantum numbers is **not acceptable**?

a) $n = 3$, $l = 2$, $m_l = -2$, $m_s = +\frac{1}{2}$
b) $n = 3$, $l = 1$, $m_l = +1$, $m_s = -\frac{1}{2}$
c) $n = 3$, $l = 2$, $m_l = +1$, $m_s = +\frac{1}{2}$
d) $n = 3$, $l = 3$, $m_l = 0$, $m_s = +\frac{1}{2}$
e) $n = 3$, $l = 0$, $m_l = 0$, $m_s = -\frac{1}{2}$

16. Which of the following is the correct electronic configuration of Ga ($Z = 31$)?

a) [Ar] $3d^{10}\,4p^3$ b) [Ar] $4s^2\,3d^{10}\,4p^1$ c) [Ar] $4s^2\,4p^1\,4d^{10}$

d) [Kr] $4s^2\,3d^{10}\,4p^1$ e) [Ne] $4s^2\,3d^{10}\,4p^1$

PERIODIC TABLE OF THE ELEMENTS

IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	O
1 H 1.0079																	2 He 4.0026
3 Li 6.941	4 Be 9.0122											5 B 10.81	6 C 12.011	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.179
11 Na 22.9898	12 Mg 24.305											13 Al 26.9815	14 Si 28.086	15 P 30.9738	16 S 32.06	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.08	21 Sc 44.9559	22 Ti 47.90	23 V 50.9414	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 Zn 65.38	31 Ga 69.72	32 Ge 72.60	33 As 74.91	34 Se 78.96	35 Br 79.916	36 Kr 83.80
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 98.7062	44 Ru 101.07	45 Rh 102.9055	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 Cs 132.9054	56 Ba 137.34	57 *La 138.9055	72 Hf 178.49	73 Ta 180.9479	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.22	78 Pt 195.09	79 Au 196.9665	80 Hg 200.59	81 Tl 204.37	82 Pb 207.2	83 Bi 208.9804	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0254	89 †Ac (227)															

*LANTHANIDE SERIES	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 Dy 162.50	67 Ho 64.930	68 Er 167.26	69 Tm 168.9342	70 Yb 173.04	71 Lu 174.97
†ACTINIDE SERIES	90 Th 232.0381	91 Pa 231.0359	92 U 238.029	93 Np 237.0482	94 Pu (244)	95 Am (243)	96 Cm (245)	97 Bk (247)	98 Cf (249)	99 Es (249)	100 Fm (255)	101 Md (256)	102 (No) (254)	103 Lr (257)