chemistry 1

second exams

عندما تطمح في شيء وتسعى جادا في الحصول
عليه ..فإن العالم بأسره يكون في صفك
باولو كويلو

13

General Chem. 101

Time: 60 min. Second Exam Date: 19/12/2009

Student's Name: .... Reg. No: ....

Section No. ٤٤٣ يوم أحمد د. ملك القادري Seat No. ......51.......

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Physical constants and useful relations:

1 atm = 101.3 kPa = 1.013×10^5 Pa = 760. Torr; Planck's constant = 6.63×10^{-34} J.s,

Speed of light = 3.00×10^8 m/s; $E_n = -(2.18 \times 10^{-18}/n^2)$ J; $E = hc/\lambda$

R = 0.08206 L. atm/mol. K = 8.314 J / mol.K ; 1L. atm = 101.3 J; $\lambda = h/mu$

Av. No. = 6.022×10^{23} mol^{-1}, $PV = nRT$, $[P + a(n/V)^2](V - nb) = nRT$

$u_{rms} = (3RT/M)^{1/2}$; $\Delta E = q + w$, $\Delta H = \Delta E + P \times \Delta V$, $w = -P \times \Delta V$

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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. Which of the following statements concerning gases is ***correct***?

a) All gases behave ideally at high P and/or low T.
b) No gases behave ideally at low P and/or high T.
c) No gases behave ideally at high P and/or high T.
d) All gases behave ideally at low P and/or high T
e) Both *van der Waals* constants (a & b) are *the same* for all gases.

T→high

real T→low P→high

Ideal P→low T→high

2. Which of the following statements concerning *ideal* gases is *incorrect* (***not correct***)?

a) At constant n and T, $P_1 V_1 = P_2 V_2$.
b) The average molecular speed is higher for H_2 gas than for N_2 gas at same T.
c) The average kinetic energy is higher for H_2 gas than for N_2 gas at same T.
d) At constant n, $P_1 V_1 / T_1 = P_2 V_2 / T_2$.
e) At constant n and V, $P_1 / T_1 = P_2 / T_2$.

3. According to Kinetic Molecular Theory of gases, the root-mean square speed (u_{rms}) of N_2 gas (M = 28.0 g/mol) at 25°C is equal to

a) 411 m/s b) 515 m/s c) 610. m/s d) 682 m/s e) 742 m/s

$u_{rms} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3 \cdot 298 \cdot 8.314}{28 \cdot 10^{-3}}}$

4. Given that the density for an ideal gas (d= 1.801 g/L) at 1.00 atm and 25°C, the molar mass (M in g/mol) of the gas is equal to

a) 44.0 g/mol b) 30.0 g/mol c) 610. g/mol d) 58.0 g/mol e) 72.0 g/mol

$M = \frac{dRT}{P}$ $M = \frac{1,801 \cdot 0,082 \cdot 298}{1}$ $M = \frac{dRT}{P}$

5. The nitrogen (N_2) gas obtained from the decopmposition of sodium azide (NaN_3) according to the chemical reaction: $2\ NaN_{3(S)} \rightarrow 2\ Na_{(S)} + 3\ N_{2(g)}$ was collected over liquid water at a *total pressure* of 724 *torr* and 25°C where the vapor pressure of water was 24.0 torr. If the volume of the N_2 gas was 10.0 L, then the mass of N_2 gas is equal to.... (Molar mass of N_2 = 28.0 g/mole)

,95 atm 298 K. ,03

$P = \frac{m}{M} \frac{RT}{V}$ $m = \frac{PVM}{RT}$,952 − 0,03 (,928)

a) 5.27 g b) 15.8. g c) 10.5 g d) 21.1 g e) 38.7 g

$m = \frac{,928 \cdot 10. \cdot 28}{0,082 \cdot 298}$ $P = \frac{nRT}{V}$ $\frac{m}{M}$

6. Given that 4.00 g of CH_4 gas (M = 16.0 g/mol) and 22.0 g of C_3H_8 gas (M = 44.0 g/mol) were placed in a 25.0 L container at 25°C, then the total pressure (P in kPa) of the gas mixture would be equal to

a) 92.9 kPa b) 61.9 kPa c) 74.3 kPa d) 53.1 kPa e) 40.8 kPa

7- The combustion (oxidation) of propane (M = 44.0 g/mole) is described by the balanced equation

$C_3H_{8(g)} + 5\,O_{2(g)} \rightarrow 3\,CO_{2(g)} + 4\,H_2O_{(l)} \quad \Delta H = -2220$ kJ

Calaculate the mass of propane (in gram) must be burned to produce 175.5 kJ of heat.

a- 6.96 b- 13.9 c- 20.9 d- 3.48 e- 4.40

8- Given the following data:

	$2C_6H_{6(l)}$	+	$15O_{2(g)}$	→	$12CO_{2(g)}$	+	$6H_2O_{(l)}$
ΔH°_f (kJ/mol)	+49				-393.51		-285.83

Calculate the standard enthalpy of combustion of benzene in (kJ/mole benzene)

a) -3135.5 b) 6535.2 c) -6270.9 d) -3267.6 e) –6535.2

9- A gas is allawed to expand, at constant temperature, from a volume of 1.0 L to 10.1 L against an external pressure of 0.50 atm. If the gas absorbs 250 J of heat from the surroundings, what is the value of q, w, and ΔE?

	q	w	ΔE
a)	250 J	-4.55 J	245 J
b)	-250 J	-460 J	-710 J
c)	250 J	460 J	710 J
d)	-250 J	460 J	210 J
e)	250 J	-460 J	-210 J

10- A 100.0 ml of 0.200 M aqueous hydrochloric acid, is added to 100.0 ml of 0.200 M aqueous ammonia (NH_3) in a constant pressure calorimeter of negligible heat capacity. The initial temperature of both solutions is the same at 25.00 °C. The final temperature after mixing is 26.20 °C. Assuming the density of the solution = 1.00 g/ml and its specefic heat = 4.18 J/g.°C, calculate ΔH per mole of the reaction:

$HCl_{aq} + NH_{3aq} \rightarrow NH_4Cl_{aq}$

A) -58.6 kJ b) -54.3 kJ c) -50.2kJ d) -42.2 kJ e) -46.0 kJ

11- given the following data

					ΔH(kJ)
$N_{2(g)}$	+	$3/2\ O_{2(g)}$	→	N_2O_3	83.7
$N_{2(g)}$	+	$O_{2(g)}$	→	$2\ NO_{(g)}$	180.4
$½\ N_{2(g)}$	+	$O_{2(g)}$	→	$NO_{2(g)}$	33.2

Find ΔH(kJ) for the reaction

$NO_{2\,(g)}$ + $NO_{(g)}$ → N_2O_3

a) - 19.7 b) - 59.7 c) 49.7 d) - 29.7 e) - 39.7

12 What is the wavelength (λ in nm) of a photon whose energy is 1.2×10^{-14} J

a) 1.7×10^{-12} b) 17 c) 1.7×10^{-1} d) 1.7×10^{-3} e) 1.7×10^{-2}

13- An electron transition of hydrogen atoms is accompanied with emission of light at 2165 nm. If the value of n_f for lower level involved in this emission is 4, what is the value of n_i for the higher level from which the electron falls back?

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

14- For the electron configuration ($1s^2\ 2s^2\ 2p^4 3s^1$), how many electrons have the angular momentum quantum number (l) = 1?

a) 4 b) 1 c) 3 d) 2 e) 5

15- Calculate the wavelength (λ in meters) associated with an atom moving at a velocity of 1.0×10^5 m/s, given that the molar mass is 19.992 g/mol.

a- 1.0×10^{-12} b- 2.0×10^{-13} c- 1.0×10^{-14} d) 9.7×10^{-13} e- 2.0×10^{-14}

16- An atom with 23 electrons in its ground state will have..... unpaired electrons and is .....

a- 0, diamagnetic b- 2, diamagnetic c- 3, paramagnetic
d- 5, paramagnetic e- 7, paramagnetic

11/16

The University of Jordan
Date: 12/12/2010

General Chemistry 101
Second Exam

Chemistry Department
Time: 60 min.

Name: _____ _____. Registration Number ___

Instructor _____. Seat No.____ Day/Time _____

Answer Sheet

K = °C+273, 1atm = 760mmHg, R = 0.082057L.atm/(K.mol) = 8.314J/(K.mol), L.atm = 101.3J, N_A= 6.022x10^{23}, h=6.63x10^{-34} J.s, R_H=2.18x10^{-18} J,

c =3x10^8 m/s, $PV=nRT$, $u_{rms}=\sqrt{\overline{u^2}}=\sqrt{\frac{3RT}{M}}$, $KE=\frac{3}{2}RT=N_A(\frac{1}{2}m\overline{u^2})$, $\Delta E=\Delta H - P\Delta V$

$\Delta E=q+w$, $c=\lambda\nu$, $E=h\nu$, $E_n=-R_H(1/n^2)$, $\lambda=h/(mu)$,

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

$n = \frac{m}{MM}$ $\quad n = 0.018$

$P = \frac{nRT}{V}$ $\quad n = \frac{PV}{RT} = \frac{1 \times 0.401}{0.082057 \times 273.15}$

1] Determine the molar mass of a gas if 0.401 *L* weighs 1.55g at STP?

a) 69.3 *g/mol* *b)* 94.5 *g/mol* *c)* 86.6 *g/mol* *d)* 53.3 *g/mol* *e)* 43.3 *g/mol*

$Pt = P_{H_2} + P_{H_2O} \rightarrow P_{H_2} = 988 - 118 = 870\ mm\ Hg$

2] In a reaction of calcium metal with water, the volume of hydrogen gas collected at 50°C and pressure of 988 *mmHg* is 441 *mL*. What is the mass (*in grams*) of the hydrogen gas obtained? The vapor pressure of water at 50°C is 118 *mmHg*. (*Molar mass of* H_2=2.016 *g/mol*)

a) 0.0436g *b)* 0.0384g *c)* 0.0190g *d)* 0.0242g *e)* 0.0488g

$n = \frac{PV}{RT} =$

3] Calculate the mass of calcium (in *g*) that must be dissolved in sulfuric acid in order to obtain 500*ml* of hydrogen gas at 20°C and 770 *mmHg*? (*Molar mass* of Ca = 40.08 *g/mol*)

$Ca(s) + H_2SO_4(aq) \rightarrow CaSO_4(s) + H_2(g)$

a) 1.38 *g* *b)* 0.0425 *g* *c)* 1.24 *g* *d)* 0.84 *g* *e)* 1.18 *g*

$P_{H_2} = P_t - P_{H_2O}$

$n = \frac{PV}{RT} = \frac{770 \times 0.500}{0.082057 \times (20 + 273)}$

4] What is the kinetic energy of a *mole* of CO_2 at 200K (in *kJ*)?

a) 200 *kJ* *b)* 4.14×10^{-24} *kJ* *c)* 2.5×10^{-2} *kJ* *d)* 0.200 *kJ* *e)* 2.49 *kJ*

$\frac{3RT}{MM} = \frac{3 \times 8.315 \times 200}{12.01 + (2 \times 16)} \times 10^{-3}$ $\quad K.E = \frac{1}{2} m v^2$ $\quad \frac{3}{2} R T\ k$

K. mol. L. atm

5] Which of the following is a wrong statement?

a) H_2 gas behaves more ideally than CO_2 gas

b) CO_2 (44 *g/mol*) effuses faster than N_2(g) (28 *g/mol*) at STP

c) At the same temperature molecules of a gas with low molar mass have higher average velocity than heavier molecules

d) Average kinetic energy depends only on temperature

e) Real gases behaves as ideal gases at low pressure and high temperature

$P_1V_1 = P_2V_2$

$u_{rms} = \sqrt{\frac{3RT}{MM}} = \sqrt{}$

6] Calculate the root mean square velocity (u_{rms}) in (m/s) of CO_2 molecules in a sample of CO_2 gas at 1.0 °C [*molar mass* of CO_2 = 44.0 *g/mol*]

a) 394 *b*) 44.0 *c*) 1.24 *d*) 39.2 *e*) 12.5

7] A gas is allowed to expand, at constant temperature, from a volume of 3.0 L to 8.0 L against external pressure of 1.10 *atm*. If the gas absorbs 350 *J* of heat from the surroundings, then ΔE in *J*:

$q = +350\ J$

a) -345 *b*) +207 *c*) -907 *d*) +345 *e*) -207

$\Delta E = \Delta H - P\Delta V$

$\Delta E = q + w$ $\quad -5.5$ $\quad w = -P\Delta V$ $\quad w = -1.10 \times (8-3)$ $\quad \Delta V > 0$

8] Consider the combustion of isooctane C_8H_{18} (*Molar mass* = 114 *g/mol*):

$2\ C_8H_{18(l)} + 25\ O_2 \rightarrow 16CO_2 + 18H_2O_{(l)} \quad \Delta H = -10930$ kJ

Calculate the energy released when 105 *g* of isooctane are combusted in excess oxygen?

a) 2.19×10^4 *kJ* *b*) 1.01×10^4 *kJ* *c*) 5.03×10^3 *kJ* *d*) 2.52×10^3 *kJ* *e*) 2.01×10^4 *kJ*

$2 \rightarrow -10930$ $\quad \Delta E = q + w$ $\quad \Delta H = mS\Delta T$ $\quad \Delta E = \Delta H - P\Delta V$ $\quad \Delta H = H_f$

9] When 500.0 *mL* of 0.400 *M* $Ca(NO_3)_2$ is added to 500.0 *mL* of 0.800 *M* NaF, CaF_2 precipitates, as shown in the net ionic equation below. The initial temperature of both solutions is 20.00 °C. Assuming that the resulting solution has a mass of 1000.00 *g* and a specific heat of 4.18 *J/(g.°C)* calculate the final temperature of the solution.

$Ca^{2+}(aq) + 2F^-(aq) \rightarrow CaF_2(s) \quad \Delta H° = -11.5\ kJ$

a) 18.90 °C *b*) 20.00 °C *c*) 19.45 °C *d*) 20.55 °C *e*) 21.10 °C

$Ca(NO_3)$ 500 mL 0.400 M + NaF 500 ml 0.8 M $\quad m_{sol} = 1000$ g $\quad S = 4.18$

$20^\circ C$

$q = mS\Delta T \quad 2.395 \times 10^{-3} = \Delta T \quad T_f =$

$11.5 = 1000 \times 4.18 \times (T_f - 20)$

Bomb

10] When 3.50 *g* of sucrose undergoes combustion in a *constant-volume* calorimeter, the temperature rises from 25.00 °C to 29.00 °C. Calculate ΔH for the combustion of sucrose in (*kJ/mol*) sucrose. The heat capacity of the calorimeter is 3.7 *kJ/°C*. The molar mass of sucrose is 342.3 *g/mol*.

$\Delta H = -$

$$C_{12}H_{22}O_{11}(s)+12O_2(g)\rightarrow 12CO_2(g)+11H_2O(l)$$

a) -5.07×10^3 *b*) -1.45×10^3 *c*) $+1.45\times10^3$ *d*) -1.48×10^1 *e*) $+1.48\times10^1$

$q = c\Delta T$

$= 3.7 \times (29-25)$

$= 14.8\ kJ$

11] For the following reaction: $2C(s) + 2H_2O(g) \rightarrow CH_4(g) + CO_2(g)$ $\Delta H = ?$

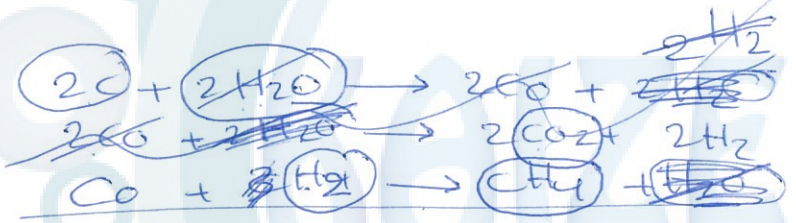
Use the following information to find ΔH for the reaction above.

$CO(g) + H_2(g) \rightarrow C(s) + H_2O(g)$ $\Delta H = -131\ kJ$

$CO(g) + H_2O(g) \rightarrow CO_2(g) + H_2(g)$ $\Delta H = -41\ kJ$

$CO(g) + 3H_2(g) \rightarrow CH_4(g) + H_2O(g)$ $\Delta H = -206\ kJ$

a) -378 *kJ* *b*) 116 *kJ* *c*) 15 *kJ* *d*) -116 *kJ* *e*) -372 *kJ*



$\Delta H = 2(131)$

$\Delta H = 2(-41)$

$\Delta H = -206$

12] Using the information below, calculate ΔH_f° for PbO(s) in kJ/mol.

$$PbO(s)+CO(g)\rightarrow Pb(s)+CO_2(g),\ \Delta H_{rxn}^\circ = -131.4\ kJ/mol$$

Molecules	ΔH°_f (*kJ/mol*)
CO(g)	-110.5
CO_2(g)	-393.5

$\Delta H^\circ_{rxn} = 1\times\Delta H^\circ_f(CO_2) - \Delta H^\circ_f(CO) - \Delta H^\circ_f$ PbO

$-131.4 = -393.5 + 110.5 -$

a) -413.9 *kJ* *b*) -151.6 *kJ* *c*) +372.1 *kJ* *d*) +413.9 *kJ* *e*) -372.1 *kJ*

$2C + 2H_2O \rightarrow 2CO + 2H_2$ $\Delta H = 2(131)$

$2CO + 2H_2O \rightarrow 2CO_2 + 2H_2$ $\Delta H = (-41)2$

$CO + 3H_2 \rightarrow CH_4 + H_2O$ $\Delta H = -206$

$2C + 2H_2O + 2H_2O + CO + 3H_2 \rightarrow CH_4 + 2CO_2 + 2H_2 + H_2O$

$2C + 2H_2O \rightarrow 2CO + 2H_2$

$CO + H_2O \rightarrow CO_2 + H_2$

$CO + 3H_2 \rightarrow CH_4 + H_2O$

13] Use the given standard enthalpies of formation to calculate the *heat released per gram* $Fe_2O_3(s)$. (*molar mass of O=16.00 and Fe=55.85g/mol*)

$$3Fe_2O_3(s)+CO(g)\rightarrow 2Fe_3O_4(s)+CO_2(g)$$

Molecules	ΔH°_f (*kJ/mol*)
$Fe_2O_3(s)$	-824.2
$Fe_3O_4(s)$	-1118.4
$CO(g)$	-110.5
$CO_2(g)$	-393.5

a) -98.5 *kJ/g* *b*) 98.5 *kJ/mol* *c*) -101.9 *J/g* *d*) -98.5 *J/g* *e*) +101.9 *J/g*

14] Calculate the energy (in joules) of **1 mole** of photons with a wavelength of 10.00×10^{-2} nm (X ray region).

a) $1.20\times10^{9}\ J$ *b*) $1.99\times10^{-24}\ J$ *c*) $1.99\times10^{-15}\ J$ *d*) $3.30\times10^{-39}\ J$ *e*) $1.20\ J$

$$\Delta E = \frac{hc}{\lambda}$$

15] Calculate the wavelength (λ) of the light emitted by a hydrogen atom during a transition of its electron from the energy level with $n = 2$ to the level with $n = 1$.

a) 1.0×10^{-9} nm *b*) 95.0 nm *c*) 122 nm *d*) 97.3 nm *e*) 103 nm

$$\Delta E = -2.18\times10^{-18}\left(\frac{1}{1^2}-\frac{1}{2^2}\right)$$

$$\Delta E = -1.635\times10^{-18}$$

16] Calculate the frequency of a particle with mass = 1.00×10^{-26} g that is moving with a speed of 9.5×10^{2} *cm/s*.

a) $1.4\times10^{12}\ s^{-1}$ *b*) $4.3\times10^{19}\ s^{-1}$ *c*) $4.3\times10^{16}\ s^{-1}$ *d*) $4.3\times10^{14}\ s^{-1}$ *e*) $1.4\times10^{9}\ s^{-1}$

$$\lambda = \frac{h}{m\upsilon}$$

$$\lambda = 6.978\times10^{-11}$$

$$\Delta E = h\upsilon$$

الفصل الصيفي (Second)

General Chem.101
Second Exam

Date: 21/7/2013
Time: 60 min.

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

Instructor Name: ..... Seat No.: .....

$N_A = 6.022X10^{23}$ mol^{-1}, 1 L.atm= 101.3 J; $T_{(K)} = T_{(c)} + 273$: R = 0.0821 L.atm/mol.K; R = 8.314 J/mol.K; atm = 760 mm Hg; $U_{ms} = \sqrt{\frac{3RT}{\mu}}$; $\nu = c/\lambda$; $\lambda = h/m$ u; $h = 6.63 \times 10^{-34}$ J.s; $E = h.\nu$; c = 3.00X10^8 m/s; $E_n = -2.18 \times 10^{-18}$ J$(1/n^2)$; 1 nm = 10^{-9} m.
For molar masses always use the provided periodic table

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. Using the information in the table below, calculate the heat of released from the following reaction in KJ per g of NO. (Mw. of NO =30.01 g/mol)

$$4NH_{3(g)} + 5O_{2(g)} \longrightarrow 6H_2O_{(g)} + 4NO_{(g)}$$

	NH_3	H_2O	NO
$H_f°$(KJ/mol)	−46.1	−241.8	+ 90.3

a) -13.29 b) -8.372 c) -7.541 d) -30.16 e) -5.678

2. Given the following equations

$$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g} \quad \Delta H = -393.5 \text{ kJ/mol}$$
$$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)} \quad \Delta H = -296.8 \text{ kJ/mol}$$
$$C_{(s)} + 2S_{(s)} \longrightarrow CS_{2(l)} \quad \Delta H = 87.9 \text{ kJ/mol}$$

Calculate ΔH for the following reaction:

$$CS_{2(l)} + 3O_{2(g)} \longrightarrow CO_{2(g)} + 2SO_{2(g)}$$

a) -602.4 b) -1075.0 c) -899.2 d) -778.2 e) -288.0

3. In the following chemical equation:

$$CH_{4\,(g)} + 2\,O_{2\,(g)} \longrightarrow CO_{2\,(g)} + 2\,H_2O_{(l)}$$

Calculate the work associated (J) with the consuming of 48.00 g of O_2 at 70.00 °C.

a) + 5703 J b) + 22814 J c) +11407 J d) +8555 J e) + 4277 J

4. The density of an unknown gas at 28 °C and under pressure of 730 mm Hg is 1.244 g/L. Calculate the molar mass of this gas.

a) 71.0 b) 38.0 c) 32.0 d) 64.1 e) 28.0

5. As in the following equation:

$$S_{8(s)} + 8O_{2(g)} \longrightarrow 8SO_{2(g)}$$

When 64.0 g S_8 reacted, what is the volume (L) of SO_2 gas produced under 802 mm Hg at 33 °C.

a) 47.5 b) 35.7 c) 27.2 d) 11.8 e) 23.8

6. As in the equation below:

$$Mg_{(S)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$$

The volume of hydrogen gas collected over water at 45 °C and pressure of 988 mm Hg is 923 mL. What is the mass of Mg reacted (g)? (The pressure of water at 45 °C is 71.88 mm Hg)

a) 0.788 b) 1.04 c) 0.836 d) 0.532 e) 0.745

7. Calculate the root-mean-square speed (m/s) of fluorine molecules (F_2) at 20 °C.

a) 325 b) 488 c) 515 d) 304 e) 439

8. When 0.7022 g of oxalic acid ($C_2O_4H_2$) is burnt in a constant-volume calorimeter, the temperature increased by 1.602°C. The heat capacity of the calorimeter is 1.238 kJ/°C. Calculate the heat combustion of oxalic acid (kJ) on molar basic. (Mw. of oxalic acid = 90.04 g/mol)

a) -254.3 b) -3227 c) -2847 d) -2021 e) -1488

9. According to the kinetic molecular theory, which of the following statements is incorrect

a) Gas molecules are in constant, random, and rapid motion
b) Gases are consists of very small molecules in large space. The size the individual gas molecules added up is negligible compared to the volume of space which gas molecules are present in.
c) The rapid random motion result in enormous number of perfect elastic collisions
d) The average kinetic energy of the gas particles depends only on the mass of gas molecules.
e) Gas molecules exert neither attractive nor repulsive interaction.

10. Which of the following gases considered to be the most ideal under the same conditions of temperature and pressure.

a) H_2S b) He c) HCl d) NH_3 e) CH_4

11. When an electron transferred from state $n_i = 8$ to state $n_f = 4$, calculate the wave length of the emitted light in nm.

a) 1283 b) 434.4 c) 1946 d) 530.1 e) 2628

12. Which of the following sit of quantum numbers is incorrect

	n	l	m_l	m_s
a)	4	2	-1	+1/2
b)	3	3	-2	-1/2
c)	2	1	0	+1/2
d)	3	2	+1	+1/2
e)	1	0	0	-1/2

13. Which of the following elements is diamagnetic

a) Ba b) Si c) Rb d) Cu e) Br

14. Calculate the de Broglie wavelength (nm) of a beryllium atom moving the speed of 0.175 m/s.

a) 541 b) 176 c) 253 d) 367 e) 167

15. Which of the following elements has the highest first ionization energy?

a) Na b) P c) Br d) O e) N

16. Which of the following elements has electron affinity less than zero?

a) K b) Ar c) Na d) O e) Cl

hydrogen 1 H 1.008																		helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122												boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305												aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078		scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62		yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 **	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununnilium 110 Uun [271]	unununium 111 Uuu [272]	ununbium 112 Uub [277]		ununquadium 114 Uuq [289]				

*Lanthanide series	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
**Actinide series	actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]

[1] Calculate the heat released from the following reaction per g of NO_2?

$$(90.3 \times 4) + (6 \times 241.8) - (-46.1 \times 4)$$

$$= -905.2\ kJ$$

$$\frac{-905.2\ kJ}{30.01} = -30.16$$ (d)

[2] ΔH for the reaction:

$$-87.9 + 393.5 + (-296.8 \times 2)$$

$$= -288.0$$ (e)

(3) Work associated with the Consuming of 48.00 g of O_2 at 70.00 °C?

= (e) 4277 J

(4) density = 1.244 g/L

temp = 28°C

pressure = 730 mmHg

$$Mwt = \frac{d * R * T}{P} = \frac{1.244 * 0.0821 * (28+273)}{(730/760)}$$

= 32.0 (c)

5 $S_{8(s)} + 8O_{2(g)} \longrightarrow 8\,SO_{2(g)}$

64.0 g S_8 ⇒ Volume of SO_2 produced at 802 mm Hg? 33°C

$$n = \frac{\text{mass}}{\text{m.mass}} = \frac{64}{(32.06*8)} = 0.249 \text{ moles}$$

$1\ S_8 \longrightarrow 8\ SO_2$

$0.249 \longrightarrow ??$

$= 0.249 * 8 = 1.995$ moles SO_2

$PV = nRT$

$\left(\frac{802}{760}\right) * V = 1.995 * 0.0821 * (33+273)$

$V = 47.5$ (a)

6 $P_{total} = P_{H_2} + P_{H_2O}$

$988/760 = 1.3$ atm (mmHg)

$1.3 = P_{H_2} + 0.094$

$PH_2 = 1.206$ atm

$PV = nRT$

$1.206 * 423 * 10^{-3} = n * 0.0821 * (45+273)$

$n = 0.0426$

$1\ Mg \longrightarrow 1\ H_2$

$\therefore n = \frac{mass}{m.mass} \rightarrow mass = 0.0426 * 24.305$ ← الجرد الذري

$= 1.03$ g

(b)

7 Root mean Square ums

$= \sqrt{\frac{3RT}{M * 10^{-3}}} = \sqrt{\frac{3 * 8.314 * (20+273)}{37.998 * 10^{-3}}}$

$= 439$ (e)

8

$\Delta H = C * \Delta T$

$\Delta H = 1.258 * 1.602$

$= 1.9632$ kJ

(a) -254.3

9 Which sentence is incorrect?

(d) The average kinetic energy of the gas particles depends only on the mass of gas molecules

لأنه يعتمد على درجة الحرارة (temperature) وليس كتلة الغاز

10 (b) He, because it's a noble gas,
لأنه من الغازات النبيلة

11 $\Delta E = E_n \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$

$= 2.18 * 10^{-18} * \left(\frac{1}{4^2} - \frac{1}{8^2} \right)$

$= 2.18 * 10^{-18} * (0.046875)$

$= 1.021 * 10^{-19}$

$V = \frac{\Delta E}{h} = \frac{1.021 * 10^{-19}}{6.626 * 10^{-34}} = 1.548 * 10^{14}$ Hz

$\lambda = \frac{c}{V} = \frac{3 * 10^8}{1.548 * 10^{14}} = 19376$ m

$= 1946$ nm (c)

12 which set sof quantum numbers is wrong?

	n	l	m_l	m_s
(b)	3	3	-2	+1/2

13 diamagnetic? هي الذرات التي لا تمتلك الكترونات منفرده في توزيعها

(a) Ba

14 de Broglie wavelength:

bergillium atom

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

$$= 253\ nm$$

15 ionization energy ↑ ⟶

N (e)

16 (b) beense its a noble gas.

Date: 1/5/2013

1) A sample of helium gas initially at 12.4 L, 0.956 atm, and 23.0 °C undergoes a change so that its final temperature and pressure are 40.0 °C and 1.25 atm. What is its final volume (in L)?

a) 6.78 b) 7.33 c) 8.64 d) 10.0 e) 11.9

2) A certain element at 1000.°C and 10.0 mmHg has a density of 8.69×10^{-4} g/L in gaseous state. The element is:

a) Li b) B c) Na d) Al e) K

3) A sample of Zn metal is allowed to react completely with an excess of HCl:

$$Zn\,(s) + 2HCl\,(aq) \rightarrow ZnCl_2\,(aq) + H_2\,(g)$$

The H_2 gas produced was collected over water at 25.0 °C. The volume of the gas is 4.35 L, and the atmospheric pressure is 0.980 atm. Calculate the amount of Zn metal (in g) consumed in the reaction. (given: vapor pressure of water at 25.0 °C = 23.8 mmHg)

a) 7.02 b) 9.02 c) 11.0 d) 13.0 e) 17.0

4) Which of the following statements is *false*:

a) The average kinetic energies of molecules from samples of different ideal gases is the same at the same temperature.

b) The molecules of an ideal gas are relatively far apart.

c) Molecules of a gas undergo many collisions with each other and the container walls.

d) All molecules of an ideal gas do not have the same speed at constant temperature.

e) Molecules of grater mass have higher average speed than those of less mass at the same temperature.

5) At what temperature (in Kelvin) would F_2 have $u_{rms} = 344$ m/s?

a) 110. b) 180. c) 300. d) 390. e) 490.

6) Calculate the standard enthalpy of formation of $NH_{3\,(g)}$

$$3\,H_{2\,(g)} + N_{2\,(g)} \longrightarrow 2\,NH_{3\,(g)} \qquad \Delta H = -92.2\,kJ/\,mol$$

a) −92.2 b) −31.1 c) −36.1 d) −41.1 e) −46.1

7) A balloon of helium gas lost 36.4 kJ of heat while it was raising up, simultaneously, the helium gas expanded from 64.0 L to 80.0 L against 563 mmHg pressure. Calculate the change in the internal energy (ΔU) of helium gas (in kJ).

a) −31.6 b) −33.6 c) −35.6 d) −37.6 e) −39.6

8) In the following thermochemical equation:

$2\,H_2S_{(g)} + 3\,O_{2(g)} \longrightarrow 2\,H_2O_{(l)} + 2\,SO_{2(g)}$ $\Delta H = -1123.94$ kJ/mol

If 362.94 kJ of heat released, calculate the mass of O_2 consumed

a) 21.00 b) 25.00 c) 31.00 d) 35.00 e) 41.00

9) A hot 245.7 g sample of metal was placed in constant pressure calorimeter contains 134.6 g water at 22.6 °C. The final temperature of the water and metal was 34.6 °C. If no heat was lost to the surroundings what was the temperature of the hot metal? (The specific heat of the metal = 0.580 J/g·°C and water = 4.184 J/g·°C).

$q = mS\Delta t$

a) 75.0 b) 82.0 c) 89.0 d) 94.0 e) 97.0

10) Using the following thermochemical equations

$CH_{4\,(g)} + O_{2\,(g)} \longrightarrow H_2CO_{(g)} + H_2O_{(g)}$ $\Delta H = -284$ kJ/mol

$CO_{2\,(g)} + H_2O_{(g)} \longrightarrow H_2CO_{(g)} + O_{2\,(g)}$ $\Delta H = +488$ kJ/mol

$H_2O_{(l)} \longrightarrow H_2O_{(g)}$ $\Delta H = +44.1$ kJ/mol

Calculate the enthalpy of the following reaction

$CH_{4\,(g)} + 2\,O_{2\,(g)} \longrightarrow CO_{2\,(g)} + 2\,H_2O_{(l)}$

a) −860.2 b) −880.2 c) −900.2 d) −910.2 e) −930.2

دورات تجاعيد دروس فردية

11) Calculate the wavelength (in nm) for a photon that will be emitted from the Hydrogen atom when the electron goes down from energy level = 7 to energy level = 4

a) 1.3×10^3 b) 2.2×10^3 c) 3.3×10^3 d) 3.9×10^3 e) 4.3×10^3

12) Calculate the wavelength (nm) associated with a neutron ($m = 1.675 \times 10^{-27}$ kg) moving at a speed of 0.660 m/s

a) 400. b) 500. c) 600. d) 699 e) 800.

13) Which of the following is a correct set of quantum numbers for an electron in a 4d orbital

a) $n = 4, l = 2, m_l = -1$
b) $n = 4, l = 3, m_l = +2$
c) $n = 4, l = 5, m_l = +3$
d) $n = 3, l = 2, m_l = +2$
e) $n = 4, l = 1, m_l = -2$

14) Which of the following elements is diamagnetic in its gaseous state?

a) $_{11}Na$ b) $_{15}P$ c) $_{29}Cu$ d) $_{30}Zn$ e) $_{16}S$

15) Which of the following statements is NOT correct?

a) According to Hund's rule the most stable arrangement of electrons in subshells is the one with the highest number of parallel spins.
b) Pauli Exclusion Principle states that no two electrons in an atom can have the same four quantum numbers.
c) Paramagnetic substances are the ones that contain a net unpaired electron spins.
d) Djamagnetic substances do not attract to magnetic field.
e) Shielding in many-electron atoms result in orbitals with equal n value being equal in energy.

16) The ionization energies of the first 4 electrons of an element are: 570, 1825, 2800 and 11700 kJ/mol. To which of the following elements do these values corresponds?

a) Be b) Al c) Mg d) Si e) S

17) Arrange the following atoms in order of decreasing atomic radius?

Na, Mg, Al, P, Cl

a) Cl > P > Al > Mg > Na
b) Cl > Al > P > Na > Mg
c) Al > Cl > Mg > P > Na
d) Na > Mg > Al > P > Cl
e) Mg > Na > P > Al > Cl

1 على القانون مباشرة

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\rightarrow \frac{0.956 \times 12.4}{(23+273)} = \frac{1.25 \times V_2}{40+273}$$

after calculating

$$3710.4 = 370 \times V_2$$

$$\boxed{V_2 = 10.0\ L} \quad (d)$$

2 أولاً يجب تحويل الـ °C إلى K و الـ mmHg إلى atm

$$M_w = \frac{mRT}{PV} \Rightarrow \text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\therefore M_w = \frac{8.69 \times 10^{-4} \times 0.0821 \times (1000+273)}{(10 \div 760)} = 6.9$$

من الجدول الدوري Li (a)

3 $PV = nRT$

We have to calculate the number of moles

$$n = \frac{PV}{RT}$$

$$n = \frac{0.980 \times 4.35}{0.0821 \times (25+273)} = 0.174$$

according to the balanced equation

$$1\,Zn \longrightarrow 1\,H_2$$

∴ n of moles of Zn = n of moles of H_2

mass Zn = n of moles × m.mass

$= 0.174 \times 65.39$

$= 11$ (d)

4 (e) is false, molecules with a greater mass have less average speed.

5 $(344)^2 = \left(\sqrt{\frac{3 * 8.314 * T}{38 * 10^{-3}}}\right)^2$

$$118336 = \frac{3 * 8.314 * T}{38 * 10^{-3}}$$

$$4496.768 = 3 * 8.314 * T$$

$$= 180 \text{ Kelvin} \quad (b)$$

6 Standard Enthalpy of formation:-

$$\Delta H = -92.2 \text{ kJ/mol} \longrightarrow 2\,NH_3$$

$$\therefore NH_3 = \frac{-92.2}{2} = -46.1 \quad (e)$$

7

$\Delta U = \Delta H - P\Delta V$

$P = 563/760 = 0.740$ atm

$\Delta V = 80.0 - 64.0 = 16$

$\Delta H = -36.4$ (lost)

$\Delta U = -37.6$

(d)

8 $2H_2S + 3O_2 \rightarrow 2H_2O + 2SO_2$ $\quad \Delta H = -1123.94$ KJ/mole.

$3 \longrightarrow -1123.94$ KJ/mole.

$2? \longleftarrow -362.94$ KJ/mole

$= 0.9687$ moles $O_2 = \frac{\text{mass}}{\text{m.mass}}$

mass = 31 (c)

11 $\Delta E = 2.18 * 10^{-18} \left(\frac{1}{4^2} - \frac{1}{7^2} \right)$

after calculations

$$\Delta E = 9.176 * 10^{-20} = 6.6 * 10^{-34} * \frac{3 * 10^8}{\lambda}$$

after calculations

$\lambda = 2.2 * 10^3$ (b)

$\Delta E = h * \frac{c}{\lambda}$ ← we want to find

12 $\lambda = \frac{h}{mv}$

$$= \frac{6.626 * 10^{-34}}{1.675 * 10^{-27} * 0.660} = \frac{5.66 * 10^{-7}}{10^{-9}} = \boxed{600 \text{ nm}}$$

(c)

13 which one is a 4d orbital?

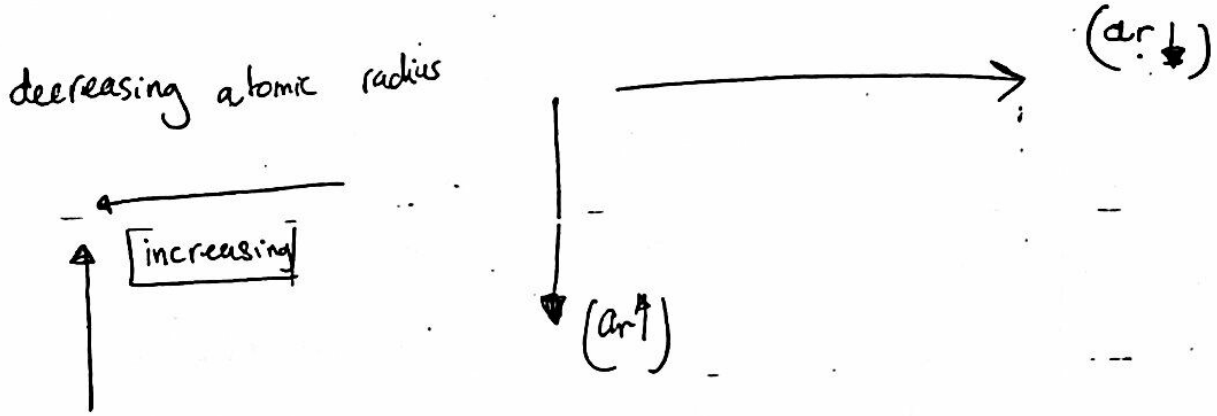
(a) $n = 4, \ell = 2, m = -1$

15

e) Shielding in many-electron atoms results in orbitals with equal n value being equal in energy.

16 b) Al

17 d) Na > Mg > Al > P > Cl



General Chem. 101 *Second Exam* 11/12/2012 70 min.

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

Instructor and time :..... ..... Seat No.: .....

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

Answer Sheet

1-	a	b	c	d	e	10-	a	b	c	d	e
2-	a	b	c	d	e	11-	a	b	c	d	e
3-	a	b	c	d	e	12-	a	b	c	d	e
4-	a	b	c	d	e	13-	a	b	c	d	e
5-	a	b	c	d	e	14-	a	b	c	d	e
6-	a	b	c	d	e	15-	a	b	c	d	e
7-	a	b	c	d	e	16-	a	b	c	d	e
8-	a	b	c	d	e	17-	a	b	c	d	e
9-	a	b	c	d	e						

Answer each of the following questions and put "X" on the correct choice on front page.

1. **Balance the following redox reaction that occurs in an acidic solution.**

$$H^+ + C_2H_5OH + Cr_2O_7^{2-} \rightarrow CO_2 + Cr^{3+} + H_2O$$

The ratio of coefficients H_2O/ C_2H_5OH in the balanced equation is:

a) 11 / 2 b) 2/11 c) 11/4 d) 8/1 e) 11/1

2. **Balance the following redox reaction that occurs in a basic solution.**

$$CN^- + MnO_4^- \rightarrow CNO^- + MnO_2$$

The ratio of coefficients of H_2O / CNO^- in the balanced equation is:

a) 3/1 b) 1/1 c) 3/2 d) 1/3 e) 1/2

3. An ideal gas contained in a cylinder with a volume of 6.20 L at a temperature of 32 °C and a pressure of 608 mmHg. The gas is then compressed to 4.20 L and its temperature is raised to 242 °C. Calculate the new pressure of the gas.

a) 2.62 atm b) 1.99 atm c) 1.16 atm d) 6.98 atm e)3.81 atm

4. The density of a gas is 3.17 g/L under STP conditions. Calculate its molar mass (in g/mol).

a) 44.1 b) 32.0 c) 71.0 d) 18.0 e) 58.0

5. A sample of 600.0 mL of oxygen is collected over water at 25 °C and a total pressure of 684 mmHg. At 25 °C the partial pressure of water is 23 mmHg. Calculate the mass of oxygen collected. (Molar mass of O_2 = 32.0 g/mol)

a) 0.683 g b) 0.341g c) 0.569 g d) 0.455 g e) 0.228 g

6. The rate of effusion of an unknown gas was measured and found to be 18.9 mL/min. Under the same conditions, the rate of effusion of O_2 was found to be 24.6 mL/min. Calculate the molar mass of the unknown gas(in g/mol).

a) 37.9 b) 15.9 c) 43.9 d) 28.0 e 54.2

7. Which of the following statements is **not correct**?

a) The pressure of the gas is due to the collisions of the gas particles with the walls of the container.
b) There are attractive forces between real gas particles.
c) At the same temperature, gases with larger molar masses have lower root mean square velocities (rms).
d) Under the same conditions of volume and temperature, real gases have higher pressure than ideal gases.
e) The volume occupied by real gas particles cannot be neglected.

8. A gas is allowed to contract from an initial volume of 15.0 L to a final volume of 10.0 L under a constant external pressure of 0.500 atm. The value of work, *w*, is;

a) 25.3 J b) 253 J c) -2.5 J d) - 253 J e) 2.53×10^3 J

9. A 0.220-g sample of acetic acid, CH_3COOH, (molar mass =60.0g/mol) is burned in a bomb calorimeter that has a heat capacity of 1.65 kJ/°C. The temperature of the calorimeter increased by 1.95 °C . Calculate the energy of combustion (in kJ/mol CH_3COOH).

a) -7.39×10^2 b) -1.37×10^3 c) -3.16×10^2 d) -1.19×10^3 e) -8.78×10^2

10. Which one of the following reactions has ΔH equals to ΔU?

a) $H_2(g) + Br_2(l) \rightarrow 2HBr(g)$
b) $4Ag(s) + 2H_2S(g) + O_2(g) \rightarrow 2Ag_2S(s) + 2H_2O(l)$
c) $S(s) + O_2(g) \rightarrow SO_2(g)$
d) $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$
e) $2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(l)$

11. Given the following thermochemical equations:

$H_2(g) + 1/2\ O_2(g) \rightarrow H_2O(l)$ $\Delta H = -285.8$ kJ/ mol

$N_2O_5(g) + H_2O(l) \rightarrow 2HNO_3(l)$ $\Delta H = -76.6$ kJ/ mol

$1/2\ N_2(g) + 3/2\ O_2(g) + 1/2\ H_2(g) \rightarrow HNO_3(l)$ $\Delta H = -169.1$ kJ/ mol

Calculate ΔH for the reaction in kJ/mol):
$2N_2(g) + 5\ O_2(g) \rightarrow 2\ N_2O_5(g)$

a) 48.4 b) 68.4 c) 28.4 d) 92.4 e) 76.4

12. Given the following:
ΔH°_f (in kJ/mol) : $H_2S(g) = -20.6$; $Ag_2S(s) = -32.6$ and $H_2O(l) = -285.8$.
Calculate the amount of heat released when 3.38 g Ag(s) (atomic weight =107.9) reacts with H_2S and O_2 according to the balanced equation:
$4Ag(s) + 2\ H_2S(g) + O_2(g) \rightarrow 2\ Ag_2S(s) + 2\ H_2O(l)$

a) 8.80 kJ b) 7.42 kJ c) 6.04 kJ d) 4.66 kJ e) 3.28 kJ

13. When light of frequency equal to $8.62 \times 10^{15}\ s^{-1}$ shines on the surface of potassium metal the kinetic energy of ejected electrons is found to be 6.21×10^{-19}J. What is the work function of potassium?

a) 5.51×10^{-18} b) 5.37×10^{-18} c) 5.23×10^{-18}
d) 5.17×10^{-18} e) 5.09×10^{-18}

14. An electron in the $n = 6$ level in hydrogen atom emits a photon with a wavelength of 93.8 nm. To what energy level does the electron move?

a) 1 b) 2 c) 3 d) 4 e) 5

15. The wave length of the wave associated with a particle moving at a speed of 45.0 m/s is 1.84×10^{-22} nm. Calculate the mass of this particle in gram.

a) 0.0600 b) 0.0500 c) 0.0800 d) 0.0400 e) 0.0700

16. Which of the following is a correct set of quantum numbers for an electron in a 3p orbital ?

a) $n = 3, l = 2, m_l = -1$ b) $n = 3, l = 1, m_l = 0$
c) $n = 2, l = 1, m_l = 1$ d) $n = 3, l = 3, m_l = +2$
e) $n = 3, l = 1, m_l = -2$

17. Which of the following elements is diamagnetic in its elemental gaseous state? (given atomic numbers)

a) Sr(38) b) S(16) c) Cu(29) d) K(19) e) Al(13)

6081760 = 0.8 atm

3 $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

$= \frac{0.8 * 6.20L}{(32+273)} = \frac{P_2 * 4.20L}{(242+273)}$

$0.01626 = \frac{P_2 * 4.20}{515}$

$P_2 * 4.20 = 8.3739$

$P_2 = 1.99$ atm (b)

4 $Mw = \frac{d * R * T}{P}$

STP = 1 atm, 273°K

$= \frac{3.17 * 0.0821 * 273}{1} = 71$ (c)

5) $P_{total} = P_{H_2O} + P_{O_2}$

$\text{GIVEN} = 23 + PO_2$

$PO_2 = 661\ mmHg = 0.8697\ atm$

$PV = nRT$

$0.8697 * 600 * 10^{-3} = n * 0.0821 * (25+273)$

$n = 0.021\ moles\ O_2$

$n = \frac{mass}{molar\ mass} \Rightarrow 0.021 = \frac{mass}{32} \rightarrow mass = 0.683g$ (a)

4) $\frac{\text{Rate of effusion gas1}}{\text{Rate of effusion gas2}} = \sqrt{\frac{Mw_2}{Mw_1}}$

$\left(\frac{12.9}{24.6}\right)^2 = \left(\sqrt{\frac{32}{Mw_1}}\right)^2$

$0.590 = \frac{32}{Mw_1}$

$32 = Mw_1 * 0.590$

$= 54.2$ (e)

7 (d) is not correct

because at the same conditions of pressure and temperature, real gases have lower pressure than ideal gases.

8 $W = -P * \Delta V$

$= -0.500 * (10 - 15)$

$= 2.5$ atm/L → لازم نحولها الى J

$2.5 * 101.3 = 253$ J (b)

9 $m = 0.220$ g $Mw = 60$ g/mol

$C = 1.65$ KJ/mol $\Delta T = 1.95$ °C

$\Delta E = ?$

$\Delta E = C * \Delta T$

$= 1.65 * 1.95 = -3.21$ KJ

$n_{CH_3COOH} = \frac{m}{m.mass} = \frac{0.220}{60} = 3.6 * 10^{-3}$

$3.6 * 10^{-3} \longrightarrow -3.21$ KJ

$1 \longrightarrow x$

(e) $x = -8.78 * 10^{2}$

10 $\Delta H = \Delta U$?

(c) $S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$

11 ΔH for the reaction:-

$$2N_{2(g)} + 5O_{2(g)} \longrightarrow 2N_2O_{5(g)}$$

$\frac{1}{2}N_2 \longrightarrow 2N_2$ $(-69.1 + 4)$

$\Delta H = 48.4$ kg/mol.

12 $4\,Ag_{(s)} + 2\,H_2S + O_2 \rightarrow 2\,Ag_2S + 2\,H_2O$

amount of heat released
$= 4.66$ FJ

13 Work function of potgium
$= 5.09 \times 10^{-18}$

14 $\Delta E = h * \frac{c}{\lambda}$

$$\Delta E = \frac{6.6 * 10^{-34} * 3 * 10^{8}}{93.8 * 10^{-9}}$$

$$= 2.11 * 10^{-17}$$

$$\Delta E = 2.18 * 10^{-18} \left(\frac{1}{n_1^2} - \frac{1}{6^2} \right)$$

$$2.11 * 10^{-17} = 2.18 * 10^{-18} \left(\frac{1}{n_1^2} - \frac{1}{6^2} \right)$$

$$n_1^2 = 1$$

$\boxed{n = 1}$ (a)

15 $\lambda = \frac{h}{m * v} \Rightarrow 8.28 * 10^{-22} * 10^{-9} = \frac{6.626 * 10^{-34}}{m * 45}$

$$m = 0.0800 \quad (c)$$

16 Correct Set of quantum numbers:-

(b) $n = 3 , l = 1 , m_l = 0$

17 diamagnetic → لا تمتلك ذرات الكترونات منفردة

أداة تستبعد الذرات ذات الأعداد الذرية المنفردة، يبقى $S_{(16)}$ و $Sr_{(38)}$

لتوزع مدارها الأخير (ليس توزيعها كلها)

a) $Sr_{(38)}$ → غلافها الأخير
$5s^2$
$\uparrow\downarrow$

الجواب (a)

b) $S_{(16)}$ غلافها الأخير
$3p^4$
$\uparrow\downarrow \; \uparrow \; \uparrow$
ذرات منفردة ، إذا ليت diamagnetic

Instructor Name: ......[illegible]......

Section: ...2 – 3...

[illegible]

Useful data: $N_A = 6.02 \times 10^{23}$/mol; $T(K) = T(°C) + 273$;

$R = 8.315$ J/mol.K = 0.0821 L.atm/mol.K; $u_{rms} = \sqrt{(3RT/M)}$

ANSWER SHEET

1. a b c d e
2. a b c d e
3. a b c d e
4. a b c d e
5. a b c d e
6. a b c d e
7. a b c d e
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13. a b c d e
14. a b c d e
15. a b c d e
16. a b c d e

Q1) In the following reaction, which atom is oxidized?

$$8NaI + 5H_2SO_4 \rightarrow 4I_2 + H_2S + 4Na_2SO_4 + 4H_2O$$

a) Na b) H c) O d) I e) S

Q2) What mass of solute, in g, is contained in 356 mL of a 0.895 M ammonium chloride, NH_4Cl, solution? (Molar mass of NH_4Cl = 53.5 g/mol)

a) 12.3 b) 26.6 c) 17.0 d) 30.5 e) 21.8

Q3) A 51.24-g sample of Ba(OH)2 is dissolved in enough water to make 1.20 L of solution. How many mL of this solution must be diluted with water in order to make 1.00 L of 0.120 M Ba(OH)2? (Molar mass of Ba(OH)2 = 171.3 g/mol)

a) 643 b) 482 c) 278 d) 562 e) 401

Q4) Calculate the mass in g of cadmium sulfide, CdS, precipitated when 250.0 mL of 0.15 M $(NH_4)_2S$ solution is mixed with 120.0 mL of 0.063 M $CdSO_4$. Molar mass of CdS = 144.4 g/mol. The balanced equation for the reaction is:

$$(NH_4)_2S(aq) + CdSO_4(aq) \rightarrow CdS(s) + (NH_4)_2SO_4(aq)$$

a) 1.7 b) 1.3 c) 0.92 d) 1.5 e) 1.1

Q5) A 0.207-g sample of an unknown monoprotic acid is titrated to the end point using 35.2 mL of 0.106 M NaOH. Calculate the molar mass, in g/mol, of the acid.

a) 82.3 b) 136 c) 55.5 d) 151 e) 109

Q6) Calculate the number of moles of an ideal gas contained in a cylinder with volume of 1.81 L at a pressure of 177 atm and temperature of 25°C. → 25 + 273

a) 13.1 b) 16.5 c) 10.9 d) 14.6 e) 18.3

Q7) Calculate the density, in g/L, of CO_2 gas at 27 °C (T) and 0.70 atm (P) pressure. Molar mass of CO_2 = 44.01 g/mol.

a) 1.3 b) 0.21 c) 1.6 d) 0.89 e) 0.54

Q8) Which of the following statement about Kinetic Molecular Theory of gases is correct?

a) At a given temperature, molecules with a greater molar mass will have a higher average kinetic energy.
b) As the temperature of a gas increases, the average kinetic energy decreases.
c) The average kinetic energy of a gas is dependent on temperature, molar mass, and speed.
d) Molecules with a greater molar mass will have a higher speed.
e) The most probable speed increases as temperature increases.

$$\frac{r_1}{2r_2} = \sqrt{\frac{M_1}{M_2}}$$

Q9) What is the molar mass, in g/mol, of a gas that effuses through a small hole twice faster the rate of chlorine gas, Cl_2, at the same temperature? Molar mass of Cl_2 = 70.9 g/mol.

a) 38.5 b) 17.7 c) 14.2 d) 24.6 e) 64.0

Q10) Calculate the root-mean-squared speed, u_{rms}, of oxygen, O_2, molecules in a sample at 25°C. Molar mass of O_2 = 32.00 g/mol.

a) 442 m s^{-1} b) 681 m s^{-1} c) 515m s^{-1} d) 482 m s^{-1} c) 593 m s^{-1}

$\sqrt{3RT}$

Q11) Which one of the following statements is *false*?

a) The change in internal energy, ΔU, for a process is equal to the amount of heat absorbed at constant volume, q_v.
b) The change in enthalpy, ΔH, for a process is equal to the amount of heat absorbed at constant pressure, q_p.
c) If q_p for a process is negative, the process is exothermic.
d) The freezing of water is an example of an exothermic process.
e) Work is a state function.

Q12) Calculate the work, in (L . atm), associated with the expansion of a gas from 152.0 L to 189.0 L at a constant pressure of 16.0 atm.

a) -666 b) -518 c) -444 d) -592 e) -359

Q13) A 140.0-g sample of water at 25.0°C is mixed with 80.0 g of a certain metal at 100.0°C. After thermal equilibrium is established, the final temperature of the mixture is 29.6°C. What is the specific heat of the metal? Specific heat of water = 4.184 J/g°C.

a) 0.38 J/g°C b) 0.77 J/g°C c) 0.48 J/g°C d) 0.89 J/g°C e) 0.55 J/g°C

$q_1 = -q_2$

$m s \Delta t = -m s \Delta t$

$140 \times (29.6 - 25) = -80 \times 4.184 \times (29.6 - 100)$

Q14) The ΔH value for the reaction $(1/2)O_2(g) + Hg(l) \rightarrow HgO(s)$ is –90.8 kJ/mol. How much heat is released when 22.5 g Hg is reacted with excess oxygen? Molar mass of Hg = 200.6 g/mol.

a) -23.8 kJ b) -10.2 kJ c) -30.2 kJ d) -19.2 kJ e) -14.7 kJ

Q15) Determine the standard enthalpy change $\Delta H°_{rxn}$, in kJ/mol, for the reaction of of Fe_2O_3 with aluminum metal according to the equation:

$$Fe_2O_3(s) + 2Al(s) \rightarrow Al_2O_3(s) + 2Fe(l)$$

Given the following::

Substance	$\Delta H_f°$ kJ/mol
$Fe_2O_3(s)$	-825.5
$Al_2O_3(s)$	-1675.7
$Fe(l)$	12.4

a) -931.8 b) -657.1 c) -825.4 d) -460.0 e) -754.0

Q16) calculate the standard enthalpy change, $\Delta H°_{rxn}$, in kJ/mol, for the the following reaction:

$$2NO(g) + O_2(g) \rightarrow N_2O_4(g)$$

Using the following thermochemical data:

$$\tfrac{1}{2}\, N_2(g) + \tfrac{1}{2} O_2(g) \rightarrow NO(g) \qquad \Delta H° = 90.4 \text{ kJ/mol}$$
$$\tfrac{1}{2}\, N_2(g) + O_2(g) \rightarrow NO_2(g) \qquad \Delta H° = 33.8 \text{ kJ/mol}$$
$$2NO_2(g) \rightarrow N_2O_4(g) \qquad \Delta H° = -58.0 \text{ kJ/mol}$$

a) 171.2 b) –114.6 c) 114.6 d) -171.2 e) 88.6

كل الشكر للطالبه

انيسه ابو ارشيد

على حل الاسئله

Q1 :-

(d) I

Q2 :-

$$0.895 \frac{mol}{L} * ,35^{-}6L * \frac{53.5g}{mol}$$

(c) 17.0 g

Q3 :-

$M_i . V_i = M_f . V_f$

⇓

??

$$51.24g * \frac{mol}{171.3g} = ,2991 \text{ (No. of mols of Solute)}$$

$$M_i = \frac{,2991}{1.20} = ,249 \ mol/L$$

$M_i V_i = M_f \cdot V_f$

$,249 \times V_i = ,120 \times 1 \Rightarrow V_i = \frac{,249}{120}$

$= ,481L \times 10^{+3} \frac{ml}{L}$

(b) 482

Q4 :-

$0.063 \frac{mol}{L} * ,120L * 144.4 \frac{g}{mol}$

(e) 1.1 g

Q5 :-

$0106 \frac{mol}{L} * ,035-2L = ,00373$ mol of NaOH which = No. of mols of acid

molar mass $= \frac{0.207}{,00373}$

(c) 55.5

Q6 :-

$PV = nRT$

$(177)(1.81) = n\ (0.0821)(25+273)$

(a) 13.1

Q7 :-

$P * \text{molar mass} = d * R * T$

$(0.70)(44.01) = d\,(0.0821)(27+273)$

(a) 1.3

Q8 :-

(e)

Q9 :-

Supose that ⟹ Unknown gas has r_1

Cl_2 gas has r_2

From question $r_1 = 2r_2$.

$$\frac{r_1}{r_2} = \sqrt{\frac{\text{molar mass 2}}{\text{molar mass 1}}} \Rightarrow \frac{2r_2}{r_2} = \sqrt{\frac{\text{molar mass 2}}{\text{molar mass 1}}}$$

$4(\text{Molar mass}_1) = \text{Molar mass 2}$

$= 70.9$

$$\text{molar mass 1} = \frac{70.9}{4}$$

(b) 17.7 .

Q30 :-

(d) 482

$$\overline{U}_{rms} = \sqrt{\frac{3RT}{M}}$$

$$= \sqrt{\frac{3 * (0.0821) * (25 + 273)}{.032 \times 10^{-3}}}$$

Q11 :-

(e)

Q12 :-

$$W = -P\Delta U$$

$$W = -(16.0)(189.0 - 152.0)$$

(d) -592

Q13 :-

$$ms\Delta T = -msA\Delta T$$

$$30(s)(29.6-100) = -[140.0(4.184)(29.6-25.0)]$$

(c) 0.49 J/g.°C

Q14 :-

$$22.5g * \frac{mol}{200.6g} = ,112\ mol$$

$$-90.8\ \frac{kJ}{mol} * ,112\ mol$$

(b) $-10.2\ kJ$

Q15 :-

$$\Delta H^\circ_{rex} = n\Delta H^\circ_f(Products) - m\Delta H^\circ_f(Reactant)$$

$$= 2(12.4) + (-167.7) - [-825.5]$$

(c) -825.4

Q16:-

ΔH°

*-2 $[\frac{1}{2}N_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow NO_{(g)}$ 90.4]

*2 $[\frac{1}{2}N_{2(g)} + O_{2(g)} \rightarrow NO_{2(g)}$ 33.8]

$2NO_{2(g)} \rightarrow N_2O_{4(g)}$ -58.0

$2NO_{(g)} \rightarrow N_{2(g)} + O_{2(g)}$ -180.8

$N_{2(g)} + 2O_{2(g)} \rightarrow 2NO_2$ 67.6

$2NO_{2(g)} \rightarrow N_2O_{4(g)}$ -58.0

$2NO_{(g)} + O_{2(g)} \rightarrow N_2O_4$ g

(d) -171.2