Name_____ __Key O_____ (Print last name in CAPS)

SECTION _____(same as your lab section)

1.	Read each question carefully before answering.
2.	Mark the choice that best answers the question or completes the statement.
3.	Use the scantron provided. Use a no. 2 pencil and clearly mark your choice. If you change an answer, completely erase your previous mark.
4.	Answer each question. There is no penalty for guessing. However, multiple answers are graded as incorrect, and blank answers are graded as incorrect.
5.	On the scantron, fill in your last name, first name and initial. Blacken the corresponding letters.
6.	Fill in your ID, the department=CHEM, Course no. = 101, and Section= your lab section. Blacken the corresponding letters and numbers.
7.	**If you want your score posted by a portion of your ID# mark A under the option column. They will be posted on the bulletin board where you got your seat assignment.**
8.	Use the test for scratch paper.
9.	Mark your answers on the test so you can check them with the key when it is posted.
10.	**✳✳✳Turning in a blank scantron results in a grade of zero. ✳✳✳**
11.	Turn in both the scantron and the exam, have your ID and your calculator ready to be checked.
12.	Work at a steady pace and you will have ample time to finish.
13.	The keys will be posted on my class web page as soon as possible. You may check your grade at the class web site. **Your password is the middle 5 numbers of your student ID followed by the first letter of your last name in CAPS.** Be patient and give the webmaster time to enter all of this information.

There are 35 questions for 125 points. Good Luck!

O

Possibly Useful Information

$1 \text{ cal} = 4.184 \text{ J}$ $M = \dfrac{\text{mol solute}}{\text{L soln}}$ $M_1V_1 = M_2V_2$

$q = \text{mass} \times \text{sp ht} \times \Delta T$ $\left(\dfrac{w}{w}\right)\% = \dfrac{\text{mass solute}}{\text{total mass}} \times 100$

$d = \text{mass/vol}$ $\text{Volume} = \ell \times h \times w$ $\lambda v = c$ $E = h\nu$ $\lambda = \dfrac{h}{mv}$

$PV = nRT$ $\dfrac{P_1V_1}{n_1T_1} = \dfrac{P_2V_2}{n_2T_2}$ $1 \text{ atm} = 101.325 \text{ kPa}$

$P_{total} = P_A + P_B + P_C + \ldots$ $P_A = X_A P_{total}$

$\dfrac{\text{Rate A}}{\text{Rate B}} = \sqrt{\dfrac{MW(B)}{MW(A)}}$ $\dfrac{\text{time A}}{\text{time B}} = \sqrt{\dfrac{MW(A)}{MW(B)}}$

$\ln\left(\dfrac{P_2}{P_1}\right) = \dfrac{\Delta H_{vap}}{R}\left(\dfrac{1}{T_1} - \dfrac{1}{T_2}\right)$

▶ ▶

Q.1 Molecules that have strong cohesive forces will have,
a) Low boiling points
b) Will be easily vaporized
(c) Low vapor pressures
d) High vapor pressures
e) None of these are correct.

Q.2 Use the Ideal Gas Law to predict the relationship between P and T as moles
and volume are held constant. $PV = nRT, \quad P = \left(\dfrac{nR}{V}\right)T = (const)T$

(a) $T \propto P$ b) $V \propto \dfrac{1}{P}$ c) $\dfrac{P}{R} = constant$ d) $PT = nRV$ e) $\dfrac{PV}{T} = n$

Q.3 A gas container has only N_2 at a pressure of 0.860 atm. If O_2 is pumped into it
until the total pressure is 1.50 atm, what is the partial pressure of O_2?

a) 2.36 atm   b) 0.573 atm   c) 1.74 atm   (d) 0.64 atm   e) 1.18 atm

$P_{TOTAL} = 1.50 \text{ atm} = P_{N_2} + P_{O_2} \therefore P_{O_2} = 1.50 - 0.860 = 0.64 \text{ atm}$

Q.4   Which one of the following substances would exhibit dipole -dipole
       intermolecular forces?

       a) NaCℓ   b) Br_2 c) O_2 d) BF_3 (e) O_3

Q.5   Which would have a lower rate of effusion than CO_2?

       a) Ar   b) O_2 (c) Xe   d) H_2 e) CO

       Molar mass CO_2 ≈ 44 amu

Q.6   Convert 3.58 atmospheres to kPa.
a)   28.3 kPa
b)   283 kPa
c)   0.363 kPa
(d)   363 kPa
e)   2.83 kPa

$$3.58 \; atm * \frac{101.3256 \, Pa}{1 \, atm} = 362.7 \; kPa$$

Q.7   Which of the following substances shows significant hydrogen bonding?
       Chose the "best" answer.
a) CH_3OH ✔
b) NH_3 ✔
c) PH_3
d)   a, b, and c
(e)   a and b, only

Q.8   Water under a pressure of 1.5 atm would boil at,
a)   100 °C
b)   less than 100°C
(c)   greater than 100°C
d)   Water would not boil under these conditions.
e)   None of these

Q.9   What is the volume of one mole of butane, C_4H_{10}, gas at 600 °C and a
       pressure of 760 torr?
a)   49.3 L
(b)   71.7 L
c)   9.43 × 10^{-2} L
d)   94.3 L
e)   6.48 × 10^{-2} L

$$V = \frac{nRT}{P}$$

$$V = \frac{(1)(.0821)(600 + 273)}{1}$$

$$V = 71.67 \; L \Rightarrow 71.7 \; L$$
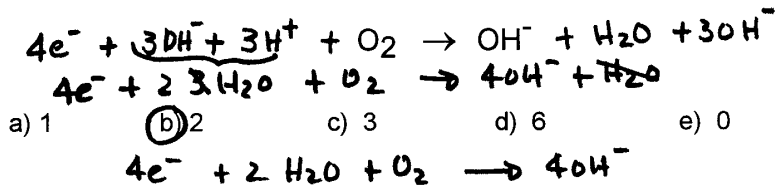
Q.10   Which of the following statements is correct?

a)   The volume of a liquid changes dramatically with increased pressure.
b)   Gas molecules do not attract or repel each other.
c)   The shapes of molecules has no effect on the boiling points.
(d)   A given mass of liquid occupies a much smaller volume than the same mass of that substance in the gas phase.
e)   None of these statements are correct.

Q.11   What is the molar mass of a gas if 4.40 g if the gas occupies a volume of 12.5 liters at 125 °C and a pressure of 0.500 atm?

a) $7.22 \frac{g}{mol}$ b) $1.38 \frac{g}{mol}$ (c) $23.0 \frac{g}{mol}$ d) $13.8 \frac{g}{mol}$ e) $27.6 \frac{g}{mol}$

$$mw = \frac{gRT}{PV} = \frac{(4.40\,g)(.0821)\frac{L \cdot atm}{mol \cdot K} \cdot (125+273)K}{0.500\,atm \quad 12.5\,L} = 23.0\ ^g/_{mol}$$

Q.12   When the following ½ - reaction is balanced in basic solution using the smallest integer coefficients, what is the coefficient of H_2O?

$$4e^- + 3OH^- + 3H^+ + O_2 \rightarrow OH^- + H_2O + 3OH^-$$
$$4e^- + 2\ 3\,H_2O + O_2 \rightarrow 4OH^- + H_2O$$

a) 1   (b) 2   c) 3   d) 6   e) 0

$$4e^- + 2\,H_2O + O_2 \rightarrow 4OH^-$$

Q.13   A soft drink contains an unknown amount of citric acid, $C_6H_8O_7$. If 200.0 mL of the soft drink requires 42.55 mL of 0.115 M NaOH to completely neutralize the citric acid, how many grams of citric acid (molar mass = 192.13 g/mol) does the soft drink contain per 200.0 mL? The reaction is :
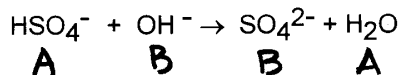
$$C_6H_8O_{7(aq)} + 3\ NaOH_{(aq)} \rightarrow Na_3C_6H_5O_{7(aq)} + 3\ H_2O\ (\ell)$$
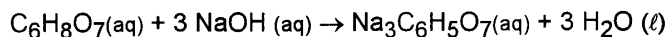
a)   0.940 g
b)   2.82 g
(c)   0.313 g
d)   0.104 g
e)   7.01 g

$$(0.04255)(0.115)\,mol\ NaOH \cdot \frac{(1)\,cit.}{(3)\,NaOH} \cdot \frac{192.13\,g}{1\,mol\ cit.} =$$

$$= 0.31338 \Rightarrow 0.313\,g\ citric\ acid$$

Q.14   Choose the Brønsted-Lowry acids and bases in the following equation:

$$HSO_4^- + OH^- \rightarrow SO_4^{2-} + H_2O$$
$$A B B A$$

(a))   acids H_2O, HSO_4^- bases SO_4^{2-}, OH^-

b)   acids H_2O, SO_4^{2-} bases HSO_4^-, SO_4^{2-}

c)   acids H_2O, OH^- bases HSO_4^-, SO_4^{2-}

d)   acids HSO_4^-, SO_4^{2-} bases SO_4^{2-}, H_2O

e)   acids SO_4^{2-}, OH^- bases H_2O, HSO_4^-

Q.15   What mass of KOH is required to react exactly with 70.0 mL of 1.5 M H_2SO_4?

$$2 KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$$
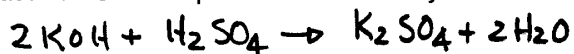
a) 5.90 g   (b)) 11.8 g   c) 23.6 g   d) 5.24 g   e) 2.62 g

$$(0.070)(1.5) \; mol \; H_2SO_4 \times \frac{(2) \; KOH}{(1) \; H_2SO_4} \times \frac{56.20 \, g}{1 \, mol \; KOH} = 11.8 \; g \; KOH$$

Q.16   The physical change of a substance from the gas phase to the liquid phase is called,

(a))   Condensation

b)   Evaporation

c)   Melting

d)   Sublimation

e)   Fusion

Q.17   A 4.50 g sample of a gas at STP occupies a volume of ...

(molar mass of the gas is 24.7 g/mol)

a)   101 L

b)   123 L

c)   1.10 L

(d))   4.08 L

e)   4.98 L

$$4.50 \, g \times \frac{1 \, mol}{24.7 \, g} = 0.182 \; mols$$

$$\frac{0.182 \, mol}{X \, L} = \frac{1 \, mol}{22.414 \, L}$$

$$X = 4.08 \; L$$

Q.18   A steel needle floats on water because of

a)   Differences in the density of the needle and the density of water at room
       temperature
b)   Differences in the temperature of the needle and the water
c)   Capillary action of the water on the needle
d)   A standard magic trick
(e)   The surface tension of the water

Q.19   A sample of N_2O_2 gas effuses through a small hole in 25.0 s. How long would
        it take a sample of O_2 (g) to effuse under the same conditions?

a)   34.2 s
(b)   18.3 s
c)   1.87 s
d)   50.0 s
e)   13.7 s

$$\frac{time\ N_2O_2}{time\ O_2} = \sqrt{\frac{N_2O_2}{O_2}} = \sqrt{\frac{60}{32}} = 1.39$$

$$time\ O_2 = \frac{25.0}{1.39} = 18.26 = 18.35\ s$$

Q.20   How many moles of KBr are needed to make up 150 mL of a 0.0235 M KBr
        solution?

a) 4.2×10^{-1} mol
(b) 3.5×10^{-3} mol
c) 2.3×10^{-1} mol
d) 6.4×10^{-3} mol
e) 1.6×10^{-1} mol

$$(0.150)(0.0235) = 3.525 \times 10^{-3}\ mols$$

Q.21   At room temperature, which of the following compounds has the strongest
        interparticle or intermolecular forces?

(a) $NaC\ell$ b) CO_2 c) H_2O d) CH_3OH e) C_2H_6

Q.22   Which of the following is not an amphiprotic species?

a) HS^- b) HCO_3^- **(c)** CH_4 d) OH^- e) $H_2PO_4^-$

Q.23   Which of the following substances is amphoteric?
a)   NaOH
b) $Ca(OH)_2$
c) $Co(OH)_2$
d)   HCℓ
e) $Sr(OH)_2$

Q.24   Which of the following is correctly paired?
a)   Lewis acid : proton donor
b)   Lewis base : electron pair acceptor
c)   Brønsted-Lowry acid : proton acceptor
d)   Brønsted-Lowry base : proton acceptor
e)   Brønsted-Lowry base : proton donor

Q.25   Which of the following is the strongest acid?

a) $HC\ell O_3$ b) $HC\ell O_4$ c) $HC\ell O$ d)$HC\ell O_2$ e) HBrO

Q.26   Hydrogen bonding,
a)   refers to the covalent bond of H to O
b)   is a weak dispersion force
c)   is a special case of ionic bonding
d)   is a special case of strong dipole-dipole interaction
e)   None of the above are correct statements.

Q.27   When a substance is above its critical temperature and pressure,

a)   It is considered a plasma
b)   It is unstable and explosive
c)   It can no longer be condensed to a liquid
d)   It is constantly boiling
e)   All the above are incorrect

Q.28   Which of the following is correctly paired?

a)   critical point : solid phase
b)   hydrogen bonding: H_2
c)   heat of fusion : evaporation
d)   Clausius-Clapeyron Equation : vapor pressures at different temperatures
e)   condensation point : STP
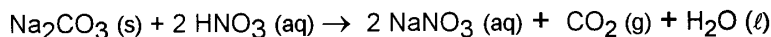
Q.29   Which of the following is not a diprotic acid?
a) H_2SO_4 (aq)
b) H_2CO_3 (aq)
c) HNO_2 (aq)
d) H_2SO_3 (aq)
e) H_2S (aq)

Q.30   Which of the following would you expect to have the highest boiling point?
     a) CH_4 b) C_2H_2 c) Xe   d) C_2H_5OH e) NO_2

Q.31   How many grams of Na_2CO_3 (molar mass = 106.0 g/mol) are required for
complete reaction with 75.0 mL of 0.125 M HNO_3?

$$Na_2CO_3 \text{ (s)} + 2\ HNO_3 \text{ (aq)} \rightarrow 2\ NaNO_3 \text{ (aq)} + CO_2 \text{ (g)} + H_2O \text{ (}\ell\text{)}$$

a)   0.994 g
b)   177 g
c)   17.7 g
d)   8.83 g
e)   0.497 g

$$(0.0750\ L)(0.125\ \tfrac{mol}{L}) * \frac{① Na_2CO_3}{② HNO_3} * \frac{106.0\ g}{1\ mol\ Na_2CO_3} =$$

$$= 0.4968\ g \Rightarrow \underline{0.497\ g\ Na_2CO_3}$$

Q.32   Consider three 1-L flasks at STP. Flask A contains N_2 gas, flask B contains
O_2 gas, and flask C contains O_3 gas. Which flask contains the largest number
of molecules?

     a) B & C   b) A   c) C   d) B   e) all are the same

Q.33   When the following ½ reaction is balanced in acid using the smallest integer
coefficients, the sum of the coefficients(including moles of electrons) is ...

$$2e^- + H^+ + HBrO \rightarrow Br^- + H_2O$$

a)   4   b) 6   c) 8   d) 10   e) 12

$$\Sigma = 2 + 1 + 1 + 1 + 1 = 6$$

Q.34   In the reaction Fe_2O_3 (s) + 3 H_2 (g)→ 2 Fe (s) + 3 H_2O (ℓ), how many moles
of iron can be produced using 35.7 liters of hydrogen at STP?

a) 3.10   b) 1.06   c) `2.38   d) 1.19   e) 1.59

$$\frac{X}{35.7\,L} = \frac{1\,mol}{22.414\,L} \quad \therefore X = 1.592\,mol\ H_2 * \frac{② Fe}{③ H_2} = 1.06\,mol\ Fe$$

Q.35   Calculate the density of CO gas at 55°C and 735 torr.

a)   4.6 g/L
b)   6.0 g/L
c)   0.17 g/L
d)   1.0 g/L
e)   0.99 g/L

$$PV = \frac{g}{mw} RT$$

$$P = \left(\frac{g}{V}\right)\frac{RT}{mw}$$

$$\frac{g}{V} = \frac{P(mw)}{RT} = \frac{(735/760)(28.01)}{(.0821)(55+273)} = 1.0056 = 1.0\ g/L$$

End of Test

p.9

KEY Ex3 FORM O Magnuson 101   21 Nov 2002

Total points = 125   Each question = 3.572 points

	1	C
	2	A
	3	D
	4	E
	5	C
	6	D
	7	E
	8	C
	9	B
	10	D
	11	C
	12	B
	13	C
	14	A
	15	B
	16	A
	17	D
	18	E
	19	B
	20	B
	21	A
	22	C
	23	C
	24	D
	25	B
	26	D
	27	C
	28	D
	29	C
	30	D
	31	E
	32	E
	33	B
	34	B
	35	D