Name____KEY P_____ (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!

P

KEY Possibly Useful Information

1 cal = 4.184 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 = mass/vol   Volume = $l \times h \times w$ $\lambda v = c$ $E = h\nu$ $\lambda = \dfrac{h}{mv}$

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

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

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

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

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Q.1   Which of the following is not a diprotic acid?
a) H_2SO_4 (aq)
(b)) HNO_2 (aq)
c) H_2CO_3 (aq)
d) H_2SO_3 (aq)
e) H_2S (aq)

Q.2   Calculate the density of CH_4 gas at 65°C and 725 torr.

a)   4.19 g/L
b)   0.419 g/L
(c))   0.55 g/L
d)   2.87 g/L
e)   0.349

$$\frac{g}{V} = \frac{P(mw)}{RT} = \frac{(725/760)(16.04)}{(.08206)(65+273)}$$

$$= 0.55 \; g/L$$

Q.3   A gas container has only N_2 at a pressure of 0.560 atm. If O_2 is pumped into it until the total pressure is 2.50 atm. What is the partial pressure of O_2?

a) 1.53 atm   b) 4.46 atm   c) 3.06 atm   d) 1.94 atm   e) 0.776 atm

$$P_{Total} = P_{N_2} + P_{O_2} \quad \therefore \quad P_{O_2} = 2.50 - P_{N_2} = 2.50 - 0.560 = 1.94 \ atm$$

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

a) BF_3 b) Br_2 c) O_3 d) $NaC\ell$ e) O_2

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

a) Ar 40 b) O_2 32 c) CO ~ 28 d) Kr 83.8 e) H_2 ~ 2

molar mass $CO_2 \approx 44 \ amu$

Q.6   Which of the following substances is amphoteric?
a)   NaOH
b) $Co(OH)_2$
c) $Ca(OH)_2$
d) $HC\ell$
e) $Sr(OH)_2$

$3.58 \ atm \times \dfrac{101.325 \ kPa}{1 \ atm} = 362.6 \ kPa$

Q.7   Convert 3.58 atmospheres to kPa.

a)   283 kPa
b)   0.363 kPa
c)   28.3 kPa
d)   2.83 kPa
e)   363 kPa

Q.8   Which of the following substances show(s) significant hydrogen bonding?
       Choose the "best" answer.
a) CH_3OH ✔
b) NH_3 ✔
c)   HF ✔
d)   a, b, and c
e)   a and b, only

Q.9   What is the molar mass of a gas if 8.40 g if the gas occupies a volume of 16.5 liters at 225 °C and a pressure of 0.950 atm?

a)   9.90 $\frac{g}{mol}$ (b) 21.9 $\frac{g}{mol}$ c) 0.456 $\frac{g}{mol}$ d) 10.1 $\frac{g}{mol}$ e) 45.6 $\frac{g}{mol}$

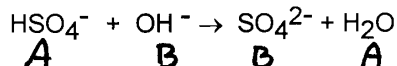$$mw = \frac{gRT}{PV} = \frac{(8.40)(.0821)(225+273)}{(16.5)(0.950)} = 21.9 \ g/mol$$

Q.10   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.11   Which of the following is the strongest acid?

a) $HClO_3$ b) $HClO_2$ c) $HClO$ (d) $HClO_4$ e) $HBrO$

Q.12   Choose the Brønsted-Lowry acids and bases in the following equation:
$$HSO_4^- + OH^- \rightarrow SO_4^{2-} + H_2O$$
$$A \qquad B \qquad B \qquad A$$

a)   acids SO_4^{2-}, OH^- bases H_2O, HSO_4^-
(b)   acids H_2O, HSO_4^- bases SO_4^{2-}, OH^-
c)   acids H_2O, SO_4^{2-} bases HSO_4^-, SO_4^{2-}
d)   acids H_2O, OH^- bases HSO_4^-, SO_4^{2-}
e)   acids HSO_4^-, SO_4^{2-} bases SO_4^{2-}, H_2O

Q.13   What mass of KOH is required to react exactly with 85.0 mL of 1.6 M H_2SO_4?

(a) 15.3 g   b) 7.64 g   c) 1.53 g   d) 3.06 g   e) 30.6 g

$$2 KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$$
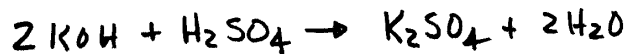
$$(.085)(1.6) \ mol \ H_2SO_4 \times \frac{② \ KOH}{① \ H_2SO_4} \times \frac{56.20 \ g}{1 \ mol \ KOH} = 15.28 \ g \ KOH$$

Q.14 The physical change of a substance from the liquid phase to the gas phase is called,
a) Condensation
b) Evaporation
c) Melting
d) Sublimation
e) Fusion

Q.15 A mixture of gases contains, He at a partial pressure of 0.348 atm and Ar at a partial pressure of 0.588 atm. What is the mol fraction of Argon in this mixture?

a) 1.69
b) 0.592
c) 0.098
d) 0.362
e) 0.628

$$P_{Total} = .348 + .588 = 0.936 \ atm$$

$$P_{Ar} = X_{Ar} P_T \ \therefore \ X_{Ar} = \frac{P_{Ar}}{P_T} = \frac{.588}{.936} = .628$$

Q.16 A steel needle floats on water because of

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

Q.17 Water under a pressure of 1.5 atm would boil at,
a) less than 100°C
b) greater than 100°C
c) 100 °C
d) Water would not boil under these conditions.
e) None of these

Q.18 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.19   Which of the following statements is correct?
a)   The shapes of molecules has no effect on the boiling points.

b)   The volume of a liquid changes dramatically with increased pressure.

c)   A given mass of liquid occupies a much smaller volume than the same mass of that substance in the gas phase.

d)   Gas molecules do not attract and repel each other.

e)   None of these statements are correct.

Q.20   A sample of N_2 gas effuses through a small hole in 15.0 s. How long would it take a sample of CO_2 (g) to effuse under the same conditions?

a)   12.0 s
b)   53.2 s
c)   18.8 s
d)   23.6 s
e)   10.5 s

$$\frac{time\ N_2}{time\ CO_2} = \sqrt{\frac{N_2}{CO_2}} = \sqrt{\frac{28}{44}} = 0.7977$$

$$\frac{15.0}{x} = .7977 \therefore x = 18.8s$$

Q.21   How many grams of Na_2CO_3 (molar mass = 106.0 g/mol) are required for complete reaction with 85.0 mL of 0.165 M HNO_3?

$$Na_2CO_3 \text{ (s)} + 2\ HNO_3 \text{ (aq)} \rightarrow 2\ NaNO_3 \text{ (aq)} + CO_2 \text{ (g)} + H_2O \text{ (}\ell\text{)}$$
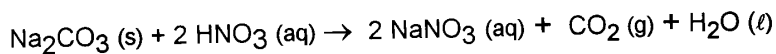
a)   1.49 g
b)   0.743 g
c)   27.3 g
d)   13.6 g
e)   6.82 g

$$(.085)(.165)\,mol\ HNO_3 * \frac{\text{(1) } Na_2CO_3}{\text{(2) } HNO_3} * \frac{106.0\ g}{1\ mol\ Na_2CO_3} =$$

$$= 0.743\ g\ Na_2CO_3$$

Q.22   How many moles of KBr are needed to make up 250 mL of a 0.0425 M KBr solution?

a) 2.2×10^{-2} mol
b) 3.5×10^{-3} mol
c) 2.3×10^{-1} mol
d) 1.1×10^{-2} mol
e) 1.8×10^{-1} mol

$$0.250\ L * 0.0425\ \frac{mol}{L} = 1.06 \times 10^{-2}\ mol$$

$$= 1.1 \times 10^{-2}\ mol\ KBr$$

Q.23   At room temperature, which of the following compounds has the strongest interparticle or intermolecular forces?

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

Q.24   Which of the following is not an amphiprotic species?

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

Q.25   What is the volume of one mole of pentane, C_5H_{12}, gas at 500 °C and a pressure of 860 torr?

a)   49.3 L
b)   71.8 L
c)   7.38 × 10^{-2} L
d)   36.3 L
e)   56.1 L

$$V = \frac{nRT}{P} = \frac{(1)(.0821)(500+273)}{(860/760)}$$

$$V = 56.08 \text{ L}$$

Q.26   A soft drink contains an unknown amount of citric acid, $C_6H_8O_7$. If 200.0 mL of the soft drink requires 12.55 mL of 0.175 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 :

$$C_6H_8O_{7(aq)} + 3\ NaOH\ _{(aq)} \rightarrow Na_3C_6H_5O_{7(aq)} + 3\ H_2O\ (\ell)$$
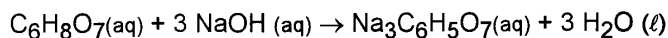
a)   0.141 g
b)   0.844 g
c)   26.8 g
d)   0.104 g
e)   0.282 g

$$(0.01255)(0.175)\ mol\ NaOH * \frac{① \text{ cit.}}{③ \text{ NaOH}} * \frac{192.13\ g}{1\ mol\ citri}=$$

$$= 0.1406\ g\ \text{citri acid}$$

$$= 0.141\ g$$

Q.27   Hydrogen bonding,
a)   is a special case of ionic bonding
b)   is a weak dispersion force
c)   is a special case of strong dipole-dipole interaction
d)   refers to the covalent bond of H to O
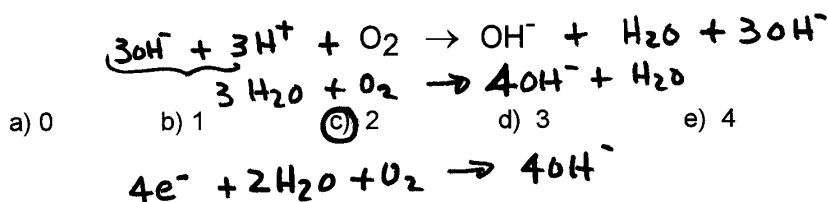e)   None of the above are correct statements.

Q.28   When a substance is above its critical temperature and pressure,

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

Q.29   Which of the following statements is true?
(a)   Volatile liquids have high vapor pressures.
b)   Volatile liquids have low vapor pressures.
c)   Vapor pressure decreases as temperature increases.
d)   High molecular weight substances have higher vapor pressures than low
        molecular weight substances.
e)   a and c are correct.

Q.30   When the following ½ - reaction is balanced in basic solution using the
        smallest integer coefficients, what is the coefficient of H_2O?

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

a) 0   b) 1   (c) 2   d) 3   e) 4

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


Q.31   Which of the following is correctly paired?

a)   critical point : solid phase
b)   hydrogen bonding: H_2
c)   heat of fusion : evaporation
d)   condensation point : STP
(e)   Clausius-Clapeyron Equation : vapor pressures at different temperatures

Q.32   Consider three 1-L flasks at STP. Flask A contains H_2 gas, flask B contains
        O_3 gas, and flask C contains O_2 gas. Which flask contains the largest number
        of molecules?

        a) A & 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 ...

$$2e^- + H^+ + HBrO \rightarrow Br^- + H_2O$$
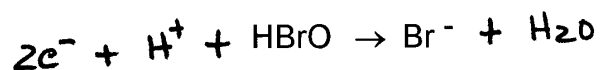
a)   4   (b) 6   c) 8   d) 10   e) 12

$$Z = 2+1+1+1+1 = 6$$

Q.34   In the reaction Fe_2O_3 (s) + 3 H_2 (g)$\rightarrow$ 2 Fe (s) + 3 H_2O (ℓ), how many moles
       of iron can be produced using 55.7 liters of hydrogen at STP?

       a) 0.268   b) 3.73   c) `2.49   (d) 1.66   e) 0.0670

$$\frac{X}{55.7} = \frac{1\,mol}{22.414} \quad \therefore X = 2.485 \; mol \; H_2$$

$$2.49 \; mol \; H_2 * \frac{(2) \; Fe}{(3) \; H_2} = \boxed{1.66 \; mol \; Fe}$$

Q.35   What is the volume in liters of one mole of an ideal gas at – 65.0°C and 1 atm
       pressure?

       a) 25.3   (b) 17.1   c) 5.34   d) 10.7   e) 87.4

$$V = \frac{nRT}{P} = \frac{(1)(.0821)(-65.0+273.15)}{1}$$

$$V = 17.089 \Rightarrow \underline{17.1 \; L}$$

End of Test

KEY Ex3 FORM P Magnuson 101   21 Nov 2002

Total points = 125   Each question = 3.572 points

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