B

King Abdulaziz University

Faculty of Science - Chemistry Department

Thursday 23 /07 /1435 H

Chem-110, Final Exam

Time: 120 minutes

Name:	Number:	Section:

•Useful information:

Speed of light,	$C = 3.0 \times 10^8$ m/s
Planck's const.,	$h = 6.626 \times 10^{-34}$ J.s
Avogadro's No.,	$N_{av} = 6.022 \times 10^{23}$ mol^{-1}
Rydberg const. for H atom	$R_H = 2.18 \times 10^{-18}$ J
Mass of the electron,	$m_e = 9.11 \times 10^{-31}$ kg
Gas constant,	$R = 0.082$ L atm K^{-1} mol^{-1}

PERIODIC TABLE

Key → Relative atomic mass to nearest whole number

12 / C → Symbol

→ Atomic number

1 H 1																	4 He 2
7 Li 3	9 Be 4											11 B 5	12 C 6	14 N 7	16 O 8	19 F 9	20 Ne 10
23 Na 11	24 Mg 12											27 Al 13	28 Si 14	31 P 15	32 S 16	35.5 Cl 17	40 Ar 18
39 K 19	40 Ca 20	45 Sc 21	48 Ti 22	51 V 23	52 Cr 24	55 Mn 25	56 Fe 26	59 Co 27	59 Ni 28	63.5 Cu 29	65 Zn 30	70 Ga 31	72.5 Ge 32	75 As 33	79 Se 34	80 Br 35	84 Kr 36
85.5 Rb 37	86 Sr 38	89 Y 39	91 Zr 40	93 Nb 41	96 Mo 42	(96) Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	139 La 57	178.5 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	(210) Po 84	(210) At 85	(222) Rn 86
(223) Fr 87	(226) Ra 88	(227) Ac 89	(261) Rf 104	(262) Db 105	(266) Sg 106	(264) Bh 107	(265) Hs 108	(268) Mt 109									

140 Ce 58	141 Pr 59	144 Nd 60	145 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162.5 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71
232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	(243) Am 95	(247) Cm 96	(247) Bk 97	(251) Cf 98	(252) Es 99	(257) Fm 100	(258) Md 101	(259) No 102	(262) Lr 103

Choose the correct answer

B-1 Which of the following elements is a metal?
a) Co   b) Ar   c) I   d) C

B-2 How many atoms are there in 5.4 g of boron?
a) 6.023×10^{23} atoms   b) 1.41×10^{23} atoms   c) 2.82×10^{23} atoms   d) 2.96×10^{23} atoms

B-3 A compound is composed of 40.92% carbon, 4.58% hydrogen and 54.5% oxygen by mass. Determine the empirical formula of this compound?
a) CHO   b) $C_2H_3O_2$ c) $C_3H_4O_3$ d) C_3HO_3

B-4 How many grams of water is produced by burning 23 g of C_2H_5OH according to the following equation:
$$2 C_2H_5OH + 6 O_2 \rightarrow 4 CO_2 + 6 H_2O$$
a) 9 g   b) 27 g   c) 18 g   d) 21.5 g

B-5 1 L of a 0.5 M NaCl solution is mixed with 0.5 L of 1 M NaCl. What is the concentration of NaCl in the final solution?
a) 0.367 M   b) 0.67 M   c) 0.55 M   d) 0.4 M

B-6 What is the chemical formula of Sulfur dioxide?
a) SO_4 b) SO_2 c) SO_3 d) SO

B-7 The correct formula of a compound consists of F and Mg is
a) Mg_2F_3 b) Mg_2F c) MgF_2 d) MgF

B-8 A photon with energy 1.80×10^{-19} J will be absorbed from hydrogen atom when its electron:
a) drops from the n=6 state to the n=3 state   b) jumps from the n=3 state to the n=6 state
c) jumps from the n=1 state to the n=6 state   d) drops from the n=6 state to the n=1 state

B-9 What is the density of a gaseous compound with molar mass of 194.2 g/mol at 373 K and 750 torr?
a) 3.54 g/L   b) 1.87 g/L   c) 5.9 g/L   d) 6.26 g/L

B-10 200 mL of a gas at 303 K and 710 mmHg is compressed to a volume of 155 mL and the temperature is raised to 400 K. What is the new pressure of the gas?
a) 1500 mmHg   b) 1389 mmHg   c) 1293 mmHg   d) 1209 mmHg

B-11 The metal with the electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$ is
a) Co   b) Fe^- c) Mn^+ d) Cu^{2+}

B-12 Calculate the temperature of 1.0 mole of H_2 with volume of 1.0L at 30.6 atm?
a) 373 K   b) 273K   c) 300 K   d) 250K

B-13 Calculate the wavelength of a photon with E= 1.3×10^{-18} J.

   a) 920 nm   b) 259 nm   c) 153 nm   d) 537 nm

B-14 What is the correct Lewis dot symbol for Se?

    a) :S̈e: b) Se: c) :S̈e·   d) :S̈e:

B-15 What is the total number of valence electrons in NO_3^-

   a) 24   b) 26   c) 18   d) 20

B-16 For the reaction at equilibrium: $S_2O_6F_2 (g) \rightleftharpoons 2 SO_3 (g) + F_2 (g)$

If an equilibrium mixture contains 8.0 mol. of $S_2O_6F_2$, 4.0 mol. of SO_3 and 2.0 mol. of F_2 in 2.0 L flask. The equilibrium constant (K_c) is:

   a) 0.25   b) 1.0   c) 4.0   d) 0.50

B-17 The equilibrium constant for the following reactions at definite temperature is;
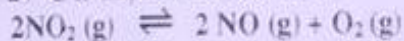
$$4SO_3 (g) \rightleftharpoons 4SO_2 (g) + 2 O_2 (g) \qquad K_1 = 6.25 \times 10^{-6}$$
$$4NO (g) + 2 O_2 (g) \rightleftharpoons 4 NO_2 (g) \qquad K_2 = 16$$
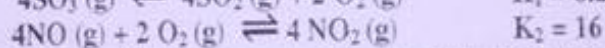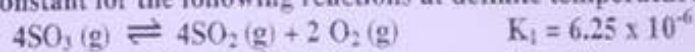
What is the value of the equilibrium constant for the following reaction?

$$4 SO_3 (g) + 4 NO (g) \rightleftharpoons 4 SO_2 (g) + 4 NO_2 (g) \qquad K_3 =??$$
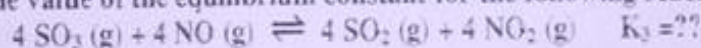
   a) 1.0×10^4 b) 1.0×10^5 c) 1.0×10^6 d) 1.0×10^{-4}

B-18 The value of K_P at 27°C is 12, for the reaction:

$$2NO_2 (g) \rightleftharpoons 2 NO (g) + O_2 (g)$$

Find the partial pressure of NO_2 at equilibrium if NO and O_2 have partial pressures at equilibrium of 4.0 atm & 3.0 atm respectively.

   a) 0.4×10^1 atm   b) 0.19×10^1 atm   c) 0.38×10^1 atm   d) 0.2×10^1 atm

B-19 The value of K_c for the above reaction:

   a) is more than the value of K_P b) is less than the value of K_P

   c) is the same as the value of K_P d) cannot be calculated at this temperature

B-20 Which equilibrium system would have the following expression

$$K_c = [CO]^5 [I_2O_5] / [I_2] [CO_2]^5$$

   a) $I_2 (g) + 5CO_2 (g) \rightleftharpoons 5 CO (g) + I_2O_5 (g)$
   b) $5 CO (g) + I_2O_5 (g) \rightleftharpoons I_2 (g) + 5CO_2 (g)$
   c) $I_2 (s) + 5CO_2 (g) \rightleftharpoons 5 CO (g) + I_2O_5 (s)$
   d) $5 CO (g) + I_2O_5 (s) \rightleftharpoons I_2 (s) + 5CO_2 (g)$

B-21 What effect would an increase in volume have on the position of the equilibrium

$$2 H_2 (g) + CO (g) \rightleftharpoons CH_3OH (g)$$
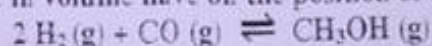
a) forms more CH_3OH b) forms more H_2 and CO   c) consumes some H_2 and CO   d) remain unchanged

B-22 for the following equilibrium reaction;
$$H_2 (g) + I_2 (g) \rightleftharpoons 2 HI (g) \quad ; K_c = 25.0$$
If we start the reaction with a concentration of 1.00 M of both H_2 and I_2 then the concentration at equilibrium for HI will be
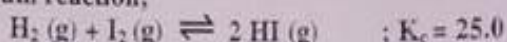
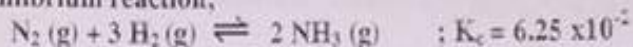a) 0.71 M
b) 0.14 M
c) 1.43 M
d) 0.28 M

B-23 The equilibrium reaction;
$$PCl_5 (g) \rightleftharpoons PCl_3 (g) + Cl_2 (g)$$
will be shifted to the right by
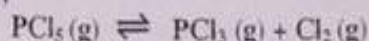
a) the addition of a catalyst
b) the removal of PCl_5
c) increasing the pressure
d) the removal of PCl_3

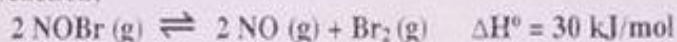B-24 For the following equilibrium reaction;
$$N_2 (g) + 3 H_2 (g) \rightleftharpoons 2 NH_3 (g) \quad ; K_c = 6.25 \times 10^{-2}$$
Predict the direction in which the reaction will proceed to reach the equilibrium in a mixture of 2.0 M N_2, 2.0 M H_2 & 2.0 M NH_3

a) the reaction will proceeds to right
b) the reaction will stop
c) the system will still be at equilibrium
d) the reaction will proceeds to left

B-25 The equilibrium reaction:
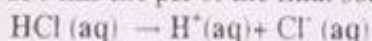$$2 NOBr (g) \rightleftharpoons 2 NO (g) + Br_2 (g) \quad \Delta H^\circ = 30 \text{ kJ/mol}$$
will be shifted to the left by

a) decreasing the pressure
b) increasing the volume
c) removing of NO
d) decreasing the temperature

B-26 The solution that is most basic is the one with:

a) pH= 11
b) pOH= 14
c) pH= 12
d) pOH= 1

B-27 If 100 mL of 1 M HCl is diluted to 250 mL the pH of the final solution is,
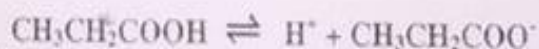$$HCl (aq) \rightarrow H^+(aq) + Cl^- (aq)$$

a) 0.2
b) 0.7
c) 0.4
d) 0.1

B-28 Which compound would be the less basic in 1 M solution

a) NH_3 ($K_b = 1.8 \times 10^{-5}$)
b) N_2H_4 ($K_b = 3.0 \times 10^{-6}$)
c) C_5H_5N ($K_b = 2.0 \times 10^{-9}$)
d) $C_6H_5NH_2$ ($K_b = 4.2 \times 10^{-10}$)

B-29 What is the K_a for a weak acid if a 3.2×10^{-3} M solution of the acid has a pH of 3.6

a) 2.0×10^{-5}
b) 5.0×10^{-7}
c) 7.8×10^{-6}
d) 3.1×10^{-4}

B-30 The percent ionization of a 1.0×10^{-2} M CH_3CH_2COOH solution which has a ($K_a = 1.8 \times 10^{-5}$) is
$$CH_3CH_2COOH \rightleftharpoons H^+ + CH_3CH_2COO^-$$

a) 13.4 %
b) 7.0%
c) 4.24%
d) 1.90%

B-31 The functional group for alcohol is:

a) C=O
b) R—O—R
c) R—OH
d) R—NR_2

B-32 Buffer solutions are:
a) Controlling the direction of chemical equilibriums
b) Converting all solutions to acidic medium
c) Resisting the change in the pH value of the solutions
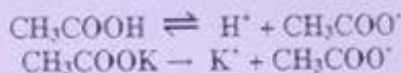d) Converting all solutions to basic medium

B-33 What is the solubility product constant (K_{SP}) for $CaCl_2$ if the solubility of the salt is 0.5 g/L?

$$CaCl_2 \rightleftharpoons Ca^{+2} + 2Cl^-$$

a) 4.5×10^{-3}
b) 2.03×10^{-5}
c) 3.65×10^{-7}
d) 1.83×10^{-7}
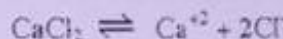
B-34 Calculate the pH value for a buffer solution consists of CH_3COOH (0.3M) and CH_3COOK (0.1M)? $K_a = 1.8 \times 10^{-6}$

$$CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$$
$$CH_3COOK \rightarrow K^+ + CH_3COO^-$$

a) 6.22
b) 5.26
c) 3.74
d) 8.74

B-35 The solubility product constant (K_{SP}) for $BaCO_3$ is 5×10^{-10}. Which one of the following statements is true for a solution consists of $[Ba^{2+}] = 1 \times 10^{-8}$ M and $[CO_3^{2-}] = 5 \times 10^{-7}$?

$$BaCO_3 \rightleftharpoons Ba^{+2} + CO_3^{-2}$$

a) The solution is saturated (no more $BaCO_3$ can be dissolved)
b) The solution is unsaturated (more $BaCO_3$ can be dissolved)
c) The solution is supersaturated ($BaCO_3$ can be precipitating)
d) No available information can be used to judge the solution.
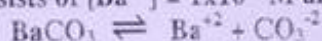
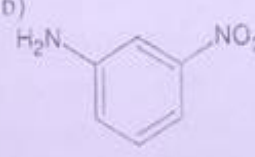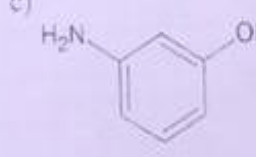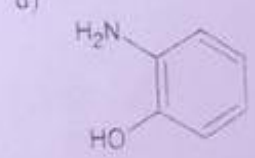B-36 The systematic name for the following compound is:
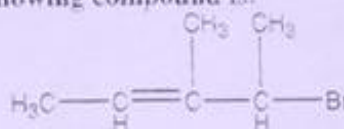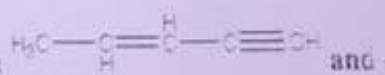
a) 4-Bromo-3-methyl-2-pentene
b) 1-Bromo-1,2-dimethylbutane
c) 4-Bromo-3,4-dimethyl-2-butene
d) 2-Bromo-3-methyl-4-pentene

B-37 What is the correct structure for p-nitroaminobenzene is:
a)
b)
c)
d)

B-38 There are -------------- carbon atoms with sp hybridization in .... and .... σ bonds

a) 4 , 3
b) 2 , 10
c) 4 , 10
d) 2 , 3

B-39 The only alkene compound in the following is:

a)

b)

c)

d)

B-40 The general formula for alkanes is:

a) C_nH_{2n+2} b) C_nH_n c) C_nH_{2n} d) C_nH_{2n-2}

Useful vocabulary

English	عربي	English	عربي
Above question	السؤال اعلاه	Judge	الحكم على
Absorbed	امتص	Jump	قفز
Buffer solution	محلول منظم	Percent ionization	نسبة التأين
Burning	احتراق	Position	موقع
Composed of	يحتوي على	Predict	تنبأ
Configuration	توزيع	Proceed to	ينجه الى
Consist of	يتكون من	Reaches	يصل
Controlling	تحكم	Remain unchanged	لا يتغير
Consume	يستهلك	Removal	ازالة
Converting	تحويل	Respectively	على التوالي
Direction	اتجاه	Resisting	مقاومه
Drop	سقط	Saturated	مشبع
Emitted	منبعث	Shift	ازاحه
Empirical	اولي	Solubility	ذائبيه
Equilibrium	الاتزان	Stage	مرحله
Flask	قاروره	Statement	عباره
Form	يكون	Supersaturated	فوق مشبع
Formula	صيغه	Towards	باتجاه
Functional group	مجموعات وظيفيه	Unsaturated	غير مشبع
Hybridization	تهجين	Valence	التكافؤ