KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

CHEMISTRY DEPARTMENT

The First Major EXAM

COURSE
CHEM101 - 052

TEST CODE NUMBER
000

STUDENT NUMBER: _____

NAME : _____

SECTION NUMBER: _____

INSTRUCTIONS

1. Type your student number, name, and section number on the *EXAM COVER* page.
2. Type your student number, section number, and your name on your *EXAM ANSWER* form.
3. With your pencil, bubble your student number and your section number on the A*NSWER* form.
4. With your pencil, bubble your answer's selections on the *EXAM ANSWER* form. You must not give more than *ONE* answer per question.
5. Return the *EXAM ANSWER* form to the proctor of the exam when you have finished.
6. The dauration of the *EXAM* is 80 min.

Important constants

Gas Constant (R)	= 0.0821	L.atm/(mol.K)
	= 8.31	J/(mol.K)
	= 8.31 x 10^7	g.cm^2/(sec^2.mol.K)
Planck's Constant (h)	= 6.626 x 10^{-34}	J.sec/particle
	= 6.626 x 10^{-34}	kg.m^2/(sec.particle)
Velocity of light (c)	= 2.998 x 10^8	m/sec
Avogadro's number (N)	= 6.022 x 10^{23}	particles/mole
Bohr's Constant (R_H)	= 2.179 x 10^{-18}	J/particle
Faraday (F)	= 96485	Coulombs
Specific heat of H_2O	= 4.18	I/(g.ºC)

PERIODIC TABLE OF THE ELEMENTS

	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB			IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 **H** 1.0079																1 **H** VIIA	2 **He** 4.0026
2	3 **Li** 6.941	4 **Be** 9.0122											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.180
3	11 **Na** 22.990	12 **Mg** 24.305											13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.066	17 **Cl** 35.453	18 **Ar** 39.948
4	19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.867	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.845	27 **Co** 58.933	28 **Ni** 58.693	29 **Cu** 63.546	30 **Zn** 65.39	31 **Ga** 69.723	32 **Ge** 72.61	33 **As** 74.922	34 **Se** 78.96	35 **Br** 79.904	36 **Kr** 83.80
5	37 **Rb** 85.468	38 **Sr** 87.62	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.76	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
6	55 **Cs** 132.91	56 **Ba** 137.33	57 **La*** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.23	77 **Ir** 192.22	78 **Pt** 195.08	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.2	83 **Bi** 208.98	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
7	87 **Fr** (223)	88 **Ra** (226)	89 **Ac**** (227)	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (264)	108 **Hs** (265)	109 **Mt** (268)	110 **Uun** (269)	111 **Uuu** (272)	112 **Uub** (277)	113	114	115	116	117	118

VIII B (groups 26, 27, 28)

58 ***Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.36	63 **Eu** 151.96	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 165.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97
90 ****Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)

1. A thermometer readable to $\pm 0.001^\circ$C gave five readings of the room temperature as 25.345 $^\circ$C, 25.347 $^\circ$C, 25.342 $^\circ$C, 25.346 $^\circ$C, and again 25.345 $^\circ$C. The 'true' temperature was 20.634 $^\circ$C. The thermometer is:
   A) not accurate but precise.
   B) accurate but not precise.
   C) neither accurate nor precise.
   D) both accurate and precise.
   E) without systematic errors.

2. An insoluble solid weighing 23.98 g was placed in a graduated cylinder with water inside. The water level with the solid fully immersed was 12.1 cm^3; that without the soild was 1.3 cm^3. What is the density of the material to the correct number of significant figures?
   A) 2.22 g/cm^3
   B) 2.2 g/cm^3
   C) 2.220 g/cm^3
   D) 0.5 g/cm^3
   E) 0.45 g/cm^3

3. The concentration of a solution is 2.34 mol/L. What is the concentration in mol/mm^3?
   A) 2.34 x 10^{-6} mol/mm^3
   B) 2.34 x 10^{-4} mol/mm^3
   C) 2.34 x 10^{6} mol/mm^3
   D) 2.34 x 10^{4} mol/mm^3
   E) 234 mol/mm^3

4. The burning of wood is a:
    A) chemical change
    B) physical change
    C) Chromatographic process
    D) Distillation process
    E) Filteration process

5. Which of the following statements is NOT correct?
    A) There can only be one compound formed by any pair of elements.
    B) All samples of sodium chloride have the same composition, no matter what the source.
    C) In chemical reactions the sum of the masses of the reactants equals the sum of the masses of the products.
    D) The amount of sodium that will combine with one gram of chlorine to form sodium chloride is a fixed number.
    E) In the group of compounds NO, N_2O and NO_2 each one is an example of the law of definite proportions.

6. Which of the following combinations of C, H_2, and O_2 is NOT in the same proportions as in C_2H_4O?
    A) $2C + 4H_2 + O_2$
    B) $12C + 12H_2 + 3O_2$
    C) $8C + 8H_2 + 2O_2$
    D) $4C + 4H_2 + O_2$
    E) $16C + 16H_2 + 4O_2$

7. Which one of the following is named **correctly**?
    A) aluminum nitride, AlN
    B) ammonia, NH_4^+
    C) calcium sulfide, $Ca(HS)_2$
    D) iron(III) oxide, FeO
    E) bromic acid, $HBrO_2$

8. An element has 36 electrons and 44 neutrons. What isotope is it?

   A) $^{78}_{34}Se^{2-}$

   B) $^{80}_{36}Kr$

   C) $^{78}_{34}Se^{-}$

   D) $^{78}_{34}Se$

   E) $^{44}_{36}Kr$

9. A bromine atom is about four times heavier than a neon atom. How many grams of neon will contain about the same number of atoms as 1,000 g of bromine?

   A) 250   g Ne
   B) 4   g Ne
   C) 400   g Ne
   D) 1,000 g Ne
   E) 4,000 g Ne

10. Which of the following is the molecular formula of a compound containing 85.6% C and 14.4% H by mass?

    A) C_2H_4
    B) CH_4
    C) C_3H_4
    D) C_2H_6
    E) C_3H_8

11. What is the coefficient of H_2SO_4 when the following equation is properly balanced with the smallest set of whole numbers?

    ___ $Ca_3(PO_4)_2$ + ___ H_2SO_4 → ___ $CaSO_4$ + ___ H_3PO_4

    A) 3
    B) 5
    C) 6
    D) 2
    E) 4

12. When octane (C_8H_{18}) is burned in a particular internal combustion engine according to the equation:

$$2\,C_8H_{18}(l)\ +\ 25\,O_2(g)\ \rightarrow\ 16\,CO_2(g)\ +\ 18\,H_2O(l)$$
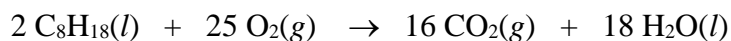
the yield of carbon dioxide and water is 93%. What mass of carbon dioxide will be produced in this engine when 15.0 g of octane is burned with 15.0 g of oxygen gas?
A) 12 g
B) 13 g
C) 21 g
D) 54 g
E) 43 g

13. In which of the following does the chlorine atom (Cl) have an oxidation number of +5?
A) ClO_3^-
B) HCl
C) ClO^-
D) $HClO_4$
E) ClF_3

14. The oxidation-reduction reaction,

$$Cl_2\,(g)\ \rightarrow\ Cl^-\,(aq)\ +\ OCl^-\,(aq)$$
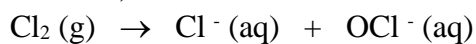
occurs in a basic medium. On balancing this reaction the sum of the stoichiometric coefficients of all the reactants and products is:
A) 6
B) 4
C) 8
D) 5
E) 7

15. In the reaction,

$$16H^+ + 2MnO_4^- + 10Br^- \rightarrow 5Br_2 + 2Mn^{2+} + 8H_2O$$
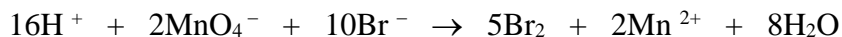
The reducing agent is:
A) Br^-
B) Br_2
C) MnO_4^-
D) H^+
E) Mn^{2+}

16. A solution of 0.13110 g of potassium hydrogen phthalate ($KHC_8H_4O_4$) in water required 27.2 mL of a calcium hydroxide ($Ca(OH)_2$) solution to be neutralized. The molarity of the $Ca(OH)_2$ solution is:
A) 0.0118 M
B) 0.0236 M
C) 0.0472 M
D) 0.00590 M
E) 0.118   M

17. Consider separate 1.0 L samples of $UF_6(g)$ and $He(g)$ containing the same number of moles. What temperature (*Kelvin*) ratio for the UF_6 sample to the He sample would produce the same root mean square velocity?
A) 87.93
B) 0.01137
C) 15.00
D) 2.5
E) 5.5

18. The partial pressure of $O_2(g)$ is 0.250 atm and that of $CH_4(g)$ is 0.175 atm in a mixture of the two gases. If the mixture occupies a volume of 10.5 L at 65 °C, the number of grams of $O_2(g)$ in the mixture would be,
A) 3.03
B) 1.06
C) 5.22
D) 12.4
E) 8.24

19. Air contains 78 % N_2, 21% O_2, and 1% Ar, by volume. What is the density of air (in g/L) at 1000. torr and -10 °C? (Assume ideal gas behavior)
    A) 1.8
    B) 6.1
    C) 0.67
    D) 1.0
    E) 2.4

20. If equal masses of $O_2(g)$ and HBr(g) are in separate containers of equal volume and temperature, which one of the following statements is TRUE?
    A) The pressure in the O_2 container is greater than that in the HBr container.
    B) There are more HBr molecules than O_2 molecules.
    C) The average velocity of the O_2 molecules is less than that of the HBr molecules.
    D) The average kinetic energy of HBr molecules is greater than that of O_2 molecules.
    E) The pressures of both gases are the same.

Answer Key

1. A
2. A
3. A
4. A
5. A
6. A
7. A
8. A
9. A
10. A
11. A
12. A
13. A
14. A
15. A
16. A
17. A
18. A
19. A
20. A