Concordia University CHEM 205

Fall 2017, Dr. C. Rogers, Lec.02

LAST NAME:

FIRST NAME:

STUDENT ID:

Chem 205 - GENERAL CHEMISTRY I

MIDTERM EXAMINATION

PLEASE READ THIS BOX WHILE WAITING TO START

INSTRUCTIONS:

- Calculators are permitted; cell phones and other electronic devices are not allowed.
- This test paper includes 8 pages; please read over the whole test before starting.
- A periodic table (incomplete) is included and may be detached (not graded).
- Fill in your name & ID # on scansheet, in pencil (fill circles completely).
- Please write clearly and organize your work logically.
- Read the instructions to each section carefully.
- **Duration: 70 minutes. GOOD LUCK!**

Professor use - Grades:

Pages 2-4:	/ 40
Page 5:	/ 11
TOTAL:	/ 50 (MAX. 51)
PERCENT:	%

CHEM 205 Fall 2017 MIDTERM EXAM Student ID #: _____
Dr. C. Rogers, Lec.02, Wed/Fri lectures

PART A: MULTIPLE-CHOICE QUESTIONS – 2 marks each

Colour in final answer on scansheet, in pencil. Circle answer here too, as a backup.

 # 1. Which one statement concerning the substance CO_2 is true?

a) The percentage of C in CO_2 depends on where the sample is obtained.
b) CO_2 undergoes sublimation at -78°C and is a gas a room temperature.
b) CO_2 has properties similar to elemental carbon and oxygen gas.
c) CO_2 is composed of a 1:2 ratio of C^{4+} cations and O^{2-} anions.

 # 2. Which one of the following statements is false?

a) The Curies' experiments with radioactivity proved that atoms are made up of smaller particles.
b) Thomson incorrectly proposed that atoms consist of electrons embedded in a positive cloud.
c) Millikan's oil-drop experiment revealed the exact amount of negative charge on the electron.
d) Lavoisier believed that alchemy could be used to convert base metals into valuable metals.

 # 3. Which one of the following statements describes a chemical change?

a) calcium carbonate ($CaCO_3$) crystallizes from a solution
b) naphthalene ($C_{10}H_8$) from mothballs melts at 80°C
c) octane (C_8H_{18}) from gasoline burns in air
d) sugar ($C_{12}H_{24}O_{12}$) dissolves in coffee

 # 4. What choice below correctly describes percent relative error, which is used to describe accuracy?

a) 100 × (measured value – accepted value) ÷ accepted value
b) 100 × (measured value – accepted value) ÷ measured value
c) 100 × (measured value – average measured value) ÷ average measured value
d) 100 × (measured value – average measured value) ÷ measured value

 # 5. At atmospheric pressure, propane melts at 85 K and boils at 231 K. In which state is propane at -15°C?

a) a 1:1 mixture of liquid and gas
b) mainly liquid
c) mainly solid
d) mainly gas

 # 6. Chlorine has two isotopes: ^{35}Cl and ^{37}Cl. What is different about them?

a) ^{35}Cl has 17 p^+, 18 n^0 and 17 e^-, whereas ^{37}Cl has 17 p^+, 20 n^0 and 17 e^-.
b) ^{35}Cl has 17 p^+, 35 n^0 and 35 e^-, whereas ^{37}Cl has 17 p^+, 37 n^0 and 37 e^-.
c) ^{35}Cl has 18 p^+, 17 n^0 and 17 e^-, whereas ^{37}Cl has 20 p^+, 17 n^0 and 17 e^-.
d) ^{35}Cl has 18 p^+, 17 n^0 and 18 e^-, whereas ^{37}Cl has 20 p^+, 17 n^0 and 20 e^-.

 # 7. Chlorine has two isotopes: ^{35}Cl (34.968853 amu) and ^{37}Cl (36.965903 amu). The atomic mass of chlorine on the periodic table is 35.4527 amu. What is the natural abundance of each isotope?

a) 98.6% ^{35}Cl, 1.4% ^{37}Cl
b) 75.8% ^{35}Cl, 24.2% ^{37}Cl
c) 65.0% ^{35}Cl, 35.0% ^{37}Cl
d) 35.0% ^{35}Cl, 37.0% ^{37}Cl

CHEM 205 Fall 2017 MIDTERM EXAM Student ID #: _____
Dr. C. Rogers, Lec.02, Wed/Fri lectures

 # 8. Three of the following statements are true. Which statement is <u>not</u> true?

a) Transition metals can form cations by losing electrons, but they can also make covalent bonds.
b) When a halogen reacts, it gains 1 e^-/atom by making 1 covalent bond or by forming X^-.
c) When an alkali earth metal reacts, it loses 2 e^-/atom and forms an M^{2+} cation.
d) If an alkali metal reacts with a halogen, the product is a covalent compound.

 # 9. Which separation technique could be used to separate salty water into its components, to end up with a sample of water and a sample of salt?

a) chromatography
b) sublimation
c) distillation
d) filtration

 # 10. Which of these are strong electrolytes: NH_4Br, $PbCl_2$, Na_2SO_4, Fe_2O_3, KNO_3, $Ca(OH)_2$?

a) NH_4Br, Na_2SO_4, KNO_3, $Ca(OH)_2$
b) Na_2SO_4, KNO_3, $Ca(OH)_2$
c) $PbCl_2$, Fe_2O_3, $Ca(OH)_2$
d) NH_4Br, Na_2SO_4, KNO_3

 # 11. Combustion is a reaction with oxygen that releases large amounts of heat and light energy (*i.e.*, fire). What are the smallest whole-number coefficients needed to balance the equation for burning octane?

$$\_\_\ C_8H_{18}(\ell) + \_\_\ O_2(g) \rightarrow \_\_\ CO_2(g) + \_\_\ H_2O(g)$$

a) 3, 50, 24, 27
b) 2, 25, 16, 18
c) 1, 12, 8, 9
d) 1, 3, 2, 2

 # 12. Which choice is an incorrect way to describe what happens when you mix $CdCl_2(aq)$ with NaOH(aq)?

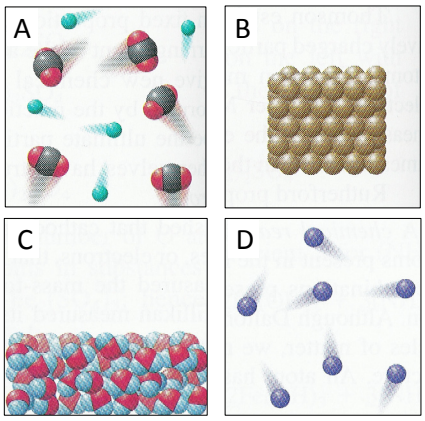
a) $Cd^{2+}(aq) + 2\ Cl^-(aq) + 2\ Na^+(aq) + 2\ OH^-(aq) \rightarrow Cd(OH)_2(s) + 2\ Na^+(aq) + 2\ Cl^-(aq)$
b) $CdCl_2(aq) + 2\ NaOH(aq) \rightarrow Cd(OH)_2(s) + 2\ NaCl(aq)$
c) $Cd^{2+}(aq) + 2\ OH^-(aq) \rightarrow Cd(OH)_2(s)$
d) $Na^+(aq) + Cl^-(aq) \rightarrow NaCl(aq)$

 # 13. Your doctor has diagnosed you as anemic (low blood iron), so you need to take iron supplements. Would you get more iron per 100. mg tablet if you took iron(II) sulfate, $FeSO_4$ or if you took iron(II) gluconate, $Fe(C_6H_{11}O_7)_2$ (a soluble compound)? How can you tell?

a) Both provide the same (1 Fe per formula unit); solubility plays no role in nutrient absorption.
b) $Fe(C_6H_{11}O_7)_2$ provides more (higher mass % Fe) and you would absorb it well (it is soluble).
c) $FeSO_4$ provides more (higher mass % Fe) and you would absorb it well (it is quite soluble).
d) $FeSO_4$ provides more (higher mass % Fe) but you might not absorb it all (it is insoluble).

CHEM 205 Fall 2017 MIDTERM EXAM
Dr. C. Rogers, Lec.02, Wed/Fri lectures

Student ID #: _____



 # 14. Which statement about diagrams A-B-C-D (at right) is wrong?

a) Diagram A = a mixture of two gas-phase elements
b) Diagram B = a pure solid element
c) Diagram C = a pure liquid compound
d) Diagram D = a pure gas-phase element

 # 15. Which one of the following compounds is named incorrectly?

a) $KMnO_4$, potassium permanganate
b) $(NH_4)_2CO_3$, ammonium carbonate
c) HgS, mercury(II) sulfide
d) ClF_3, chlorine fluoride

 # 16. Which statement related to chemical formulae is incorrect?

a) A substance with empirical formula CH and molar mass 26 g/mol has molecular formula C_2H_2.
b) In a covalent compound, the molecular formula describes the composition of each molecule.
c) Formulae of ionic compounds show the maximum ratio of ions that yields a neutral crystal.
d) The formula MnO_4^- indicates that the anion has a central Mn atom with 4 O's bonded to it.

 # 17. Which statement about the trends in reactivity of elements is incorrect?

a) Atoms lose or gain electrons until they have the same number of electrons as a noble gas.
b) The nonmetals with strongest pull on electrons are at the top right of the periodic table.
c) The metals with weakest pull on electrons are at the bottom left of the periodic table.
d) In reactions, metals gain electrons, by forming covalent bonds or forming anions.

 # 18. Which of the following statements about elements is incorrect?

a) Oxygen exists as O_2 and O_3, both of which steal electrons from other atoms during reactions.
b) Elemental carbon has multiple allotropes, including diamond, graphite and carbon dioxide.
c) At 25℃, metals exist as solids made of tightly packed atoms, except Hg, which is a liquid.
d) Except for gold, all metals react with oxygen, even if the reaction happens quite slowly.

 # 19. Which solution of 1 mole compound per 1 L water contains the lowest concentration of ions?

a) $Na_3PO_4(aq)$
b) $NH_4Br(aq)$
c) $K_2SO_4(aq)$
d) $CuCl_2(aq)$

 # 20. Which of the following directions correctly describes the preparation of 0.750 L of 0.125 M $KMnO_4$ from a 5.00 M stock solution?

a) Add water to 18.8 mL of 5.00 M $KMnO_4$ to make a total volume of 0.750 L.
b) Add water to 46.8 mL of 5.00 M $KMnO_4$ to make a total volume of 0.750 L.
c) Mix together 18.8 mL of 5.00 M $KMnO_4$ and 0.750 L of water.
d) Mix together 46.8 mL of 5.00 M $KMnO_4$ and 0.750 L of water.

CHEM 205 Fall 2017 MIDTERM EXAM Student ID #: _____
Dr. C. Rogers, Lec.02, Wed/Fri lectures

PART B: SHOW COMPLETE WORK TO GET FULL CREDIT (answer on exam)

 # 21. (7 marks) A piece of nickel foil is fully consumed in a reaction with fluorine to produce a nickel fluoride:

$$\mathbf{Ni(s) + {}^{x}/_{2}\ F_2(g) \rightarrow NiF_x(s)}$$

a) **(3 marks)** If the nickel foil had dimensions 0.550 mm $\times$ 1.25 cm $\times$ 1.25 cm, how many moles of nickel were used? Note that the density of nickel is 8.902 g/cm^3.

b) **(4 marks)** If the reaction produced 1.261 g of NiF_x, what is the value of x?

 # 22. (4 marks) In the lab, you mix solutions of $Ni(NO_3)_2(aq)$ and $Na_3PO_4(aq)$, and a solid forms.

a) **(2 marks)** What is the balanced molecular equation for the reaction that occurred?

b) **(2 marks)** What is the <u>name</u> of the insoluble product that could be collected by filtration, and what is the <u>name</u> of the soluble product that could be collected by evaporating the solvent from the filtrate?

CHEM 205 Fall 2017 MIDTERM EXAM
Dr. C. Rogers, Lec.02, Wed/Fri lectures

Student ID #: _____

EXTRA SPACE / ROUGH WORK

CHEM 205 Fall 2017 MIDTERM EXAM
Dr. C. Rogers, Lec.02, Wed/Fri lectures

Student ID #: _____

EXTRA SPACE / ROUGH WORK

CHEM 205 Fall 2017 MIDTERM EXAM
Dr. C. Rogers, Lec.02, Wed/Fri lectures

Student ID #: _____

POTENTIALLY USEFUL INFORMATION

Atomic mass unit: 1 amu = 1.66054×10^{-27} kg Avogadro's number: N = 6.022×10^{23} mol^{-1}

PERIODIC TABLE OF THE ELEMENTS – missing 1st 20 elements

(this will not be graded)

1.008																	4.00
6.941	9.012											10.81	12.01	14.007	15.999	18.998	20.18
22.99	24.31											26.98	28.09	30.97	32.07	35.45	39.95
39.10	40.08	21 **Sc** 44.96	22 **Ti** 47.87	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.61	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (97.91)	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
55 **Cs** 132.91	56 **Ba** 137.33	**La-Lu**	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.84	75 **Re** 186.21	76 **Os** 190.2	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** 208.98	85 **At** 209.99	86 **Rn** 222.02
87 **Fr** 223	88 **Ra** 226.03	**Ac-Lr**	104 **Rf** (261)	105 **Db** (262)	106 **Sg** (263)	107 **Bh** (262)	108 **Hs** (265)	109 **Mt** (266)									

57 **La** 138.91	58 **Ce** 140.12	59 **Pr** 140.91	60 **Nd** 144.24	61 **Pm** (145)	62 **Sm** 150.35	63 **Eu** 151.97	64 **Gd** 157.25	65 **Tb** 158.93	66 **Dy** 162.50	67 **Ho** 164.93	68 **Er** 167.26	69 **Tm** 168.93	70 **Yb** 173.04	71 **Lu** 174.97
89 **Ac** 227.03	90 **Th** 232.04	91 **Pa** 231.04	92 **U** 238.03	93 **Np** (237)	94 **Pu** (245)	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** (260)