Concordia University CHEM 205

Winter 2017, Dr. C. Rogers, Section 03, Tues/Thurs

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 9 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:	%

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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 $MgBr_2$ is true?

a) The percentage of Mg in $MgBr_2$ depends on where the sample is obtained.
b) $MgBr_2$ has properties similar to magnesium metal and bromine gas.
c) $MgBr_2$ is composed of a 1:2 ratio of Mg^{2+} cations and Br^- anions.
d) Solid $MgBr_2$ is a homogeneous mixture.

 # 2. Which one of the following statements is <u>false</u>?

a) The Curies' experiments with radioactivity proved that atoms are made up of smaller particles.
b) Rutherford's experiments proved that atoms have a negatively charged nucleus at their core.
c) Thomson proposed that atoms' electrons are embedded in a cloud of positive charge.
d) Lavoisier introduced systematic terminology and the law of conservation of matter.

 # 3. ^{12}C is the most abundant stable isotope of carbon, but ^{14}C is radioactive. What is different about them?

a) ^{12}C has 6 p^+, 6 n^0 and 6 e^-, whereas ^{14}C has 6 p^+, 8 n^0 and 6 e^-.
b) ^{12}C has 6 p^+, 6 n^0 and 6 e^-, whereas ^{14}C has 7 p^+, 7 n^0 and 7 e^-.
c) ^{12}C has 6 p^+, 6 n^0 and 6 e^-, whereas ^{14}C has 8 p^+, 6 n^0 and 6 e^-.
d) ^{12}C has 12 p^+, 6 n^0 and 12 e^-, but ^{14}C has 14 p^+, 6 n^0 and 14 e^-.

 # 4. Which one of the following separations requires the use of chemical change?

a) isolating iron (Fe) from a mixture of iron filings and plastic beads
b) removing the salt (NaCl) from a mixture of table salt and pepper
c) removing the carbon dioxide (CO_2) from a carbonated beverage
d) isolating oxygen (O_2) from a pure sample of sugar ($C_{12}H_{24}O_{12}$)

 # 5. Which one formula represents a covalent compound?

a) NH_4NO_3
b) P_4O_{10}
c) NaBr
d) S_8

 # 6. What is used to quantitatively describe the accuracy of a measurement?

a) average deviation
b) significant figures
c) relative error
d) average

 # 7. The boiling point of oxygen is 90.15 K. At a temperature of -195.8°C, in which state is O_2 found?

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

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

a) When an ionic compound dissolves, ionic bonds break and ions are surrounded by solvent.
b) When a molecular compound dissolves, the covalent bonds within molecules do not break.
c) When a solute dissolves in a solvent, the resulting solution is a homogeneous mixture.
d) When a solute dissolves, the solute chemically reacts with the solvent molecules.
e) If the solvent is evaporated from a solution, the solute is recovered unchanged.

 # 9. The atomic mass of the element rhenium (Re) is 186.2 g/mol. Given that 37.1% of naturally occurring rhenium is rhenium-185, what is the other stable isotope (assuming 2 isotopes in total)?

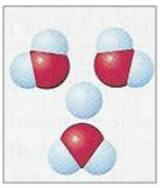
a) 183-Re
b) 185-Re
c) 186-Re
d) 187-Re
e) 189-Re

 # 10. What are the smallest coefficients needed to balance the equation for the combustion of ethanol?

$$\_\_\ C_2H_5OH(l) + \_\_\ O_2(g) \rightarrow \_\_\ CO_2(g) + \_\_\ H_2O(g)$$

a) 2, 7, 4, 6
b) 1, 3, 2, 3
c) 2, 2, 1, 4
d) 1, 2, 3, 2
e) 2, 4, 4, 2

 # 11. Consider the image in the box, where three water molecules surround an unidentified sphere. Based on the arrangement of the waters, what is the central sphere?



a) a bubble of hydrogen gas
b) a bubble of water vapour
c) a fourth water molecule
d) a dissolved cation
e) a dissolved anion

 # 12. Which of these are likely to be <u>insoluble</u> in water: Na_2CO_3, $AgNO_3$, ZnS, KOH, $Cu(OH)_2$, NH_4Cl?

a) ZnS and NH_4Cl
b) KOH and $Cu(OH)_2$
c) $AgNO_3$, $Cu(OH)_2$ and NH_4Cl
d) Na_2CO_3, ZnS and KOH
e) ZnS and $Cu(OH)_2$

 # 13. The density of metallic lead (Pb) is 11.35 g/cm^3. If you have a cube of metallic lead (Pb) that is 1.00 cm long on each side, how many atoms of lead are in the sample?

a) 5.48×10^{-1}
b) 2.56×10^{20}
c) 3.30×10^{22}
d) 6.83×10^{24}
e) 1.42×10^{27}

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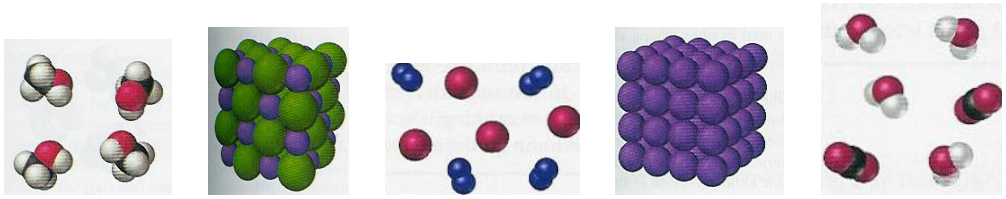
 # 14. Which one of the following compounds is named <u>incorrectly</u>?

a) $Fe_3(PO_4)_2$, iron (III) phosphate
b) NH_4Cl, ammonium chloride
c) N_2O_5, dinitrogen pentoxide
d) K_3P, potassium phosphide
e) SO_3, sulfur trioxide

 # 15. Which of the following observations of aluminum metal does <u>not</u> describe a physical property?

a) Aluminum dissolves in hydrochloric acid to produce hydrogen gas and $AlCl_3$.
b) A freshly cut surface of aluminum is extremely lustrous.
c) Aluminum is a good electrical conductor.
d) The density of aluminum is 2.70 g/cm^3.
e) Aluminum metal melts at 660 °C.

 # 16. Which one image represents a mixture of two elements?



A B C D E

 # 17. Which statement about the trends in reactivity of elements is <u>incorrect</u>?

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 right of the periodic table.
d) In reactions, nonmetals gain electrons, by forming covalent bonds or forming anions.
e) In reactions, metals tend to lose electrons, thereby forming cations.

 # 18. Which of the following descriptions of elements is <u>incorrect</u>?

a) Hydrogen, nitrogen, oxygen, fluorine, chlorine, bromine and iodine are all diatomic molecules.
b) Potassium metal is violently reactive with water, but K^+ is found in large amounts in bananas.
c) $N_2(g)$ is very unreactive but is pulled from the air by nitrogen-fixing bacteria in some plants.
d) Chromium (Cr), iron (Fe), nickel (Ni) and copper (Cu) are examples of transition metals.
e) Oxygen gas (O_2) is abundant in Earth's atmosphere because it is quite unreactive.

 # 19. Which of the following directions correctly describes the preparation of 0.500 L of 0.150 M NaOH from a 6.00 M stock solution?

a) Combine 12.5 mL of 6.00 M NaOH with 0.500 L of water.
b) Combine 0.200 L of 6.00 M NaOH with 0.500 L of water.
c) Dilute 12.5 mL of 6.00 M NaOH to a volume of 0.500 L.
d) Dilute 0.200 L of 6.00 M NaOH to a volume of 0.500 L.
e) Dilute 475 mL of 6.00 M NaOH to a volume of 0.500 L.

 # 20. Which solution of 0.10 mol compound per 1 L water contains the highest concentration of ions?

a) $CaI_2(aq)$
b) $FeCl_3(aq)$
c) $NH_4Br(aq)$
d) $NaNO_3(aq)$
e) $C_{12}H_{24}O_{12}(aq)$

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

 # 21. You mix together aqueous solutions of calcium chloride and potassium carbonate, and a solid forms.

a) **(2 marks)** Write the molecular equation for the reaction when aqueous $CaCl_2$ and K_2CO_3 are mixed.

b) **(2 marks)** Write the net ionic equation for the reaction when aqueous $CaCl_2$ and K_2CO_3 are mixed.

c) **(1 mark)** What is the name of the insoluble product that could be collected by filtration, and what is the name of the soluble product that could be collected by evaporating the solvent from the filtrate?

 # 22. (6 marks) Elemental analysis shows that Vitamin C contains 40.9% C and 4.58% H and remainder O by mass. Separate experiments reveal its molar mass to be about 180 g/mol. What is the empirical formula of Vitamin C, and what is its molecular formula?

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EXTRA SPACE / ROUGH WORK

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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)