

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).
- Answer the multiple-choice questions on the scan sheet, in pencil.
- Please write clearly and organize your work logically.
- Read the instructions to each section carefully.
- **Duration: 70 minutes. GOOD LUCK!**

Professor use - Grades:

Page 2. / 10

Page 3. / 10

Page 4. / 12

Page 5. / 11

Page 6. / 8

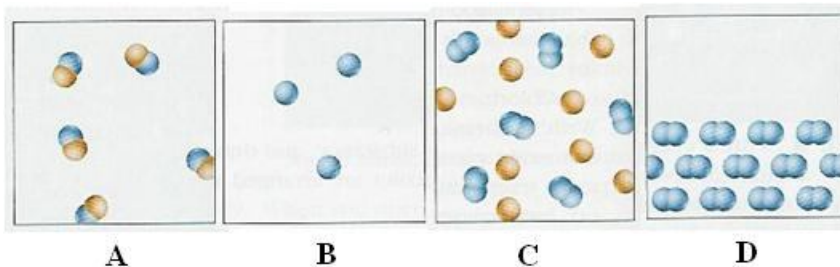
Page 7. / 10

TOTAL: / 60 (MAX. 61)

PERCENT: %

PART A: MULTIPLE-CHOICE QUESTIONS (answer on scan sheet, in pencil)**# 1. (2 marks)** Which of the following figures represents a mixture?

- a) A
- b) B
- c) C
- d) D
- e) They all do.

**# 2. (2 marks)** What type of statement is this? *“The total mass of materials is not affected by a chemical change in those materials”....*

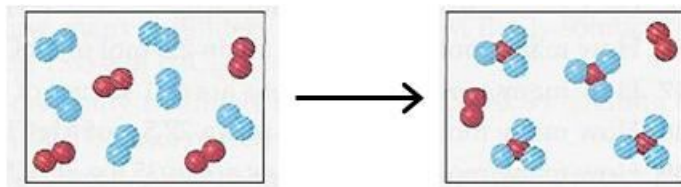
- a) a measurement
- b) an observation
- c) an experiment
- d) a natural law
- e) a theory

3. (2 marks) The statements below summarize various scientists' contributions to the understanding of atomic structure. Which statement incorrectly describes the scientist's work?

- a) J. Dalton proposed his atomic theory, in which he (incorrectly) postulated that all atoms of the same element are identical.
- b) The Curies showed that some types of atoms can spontaneously disintegrate, based on their experiments involving radioactivity.
- c) J.J. Thomson proposed the plum-pudding model of the atom, based on his cathode-ray tube experiments.
- d) R. Millikan proposed the law of conservation of matter, using his “oil-drop” experiments.
- e) E. Rutherford proposed the nuclear model of the atom, based on his gold-foil experiments.

4. (2 marks) The reaction between reactant A (darker spheres) and reactant B (lighter spheres) is shown in the diagram below. Based on the diagram, which balanced equation best describes the reaction?

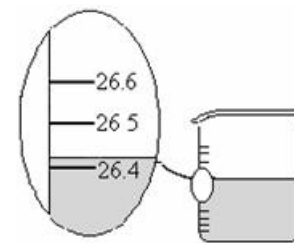
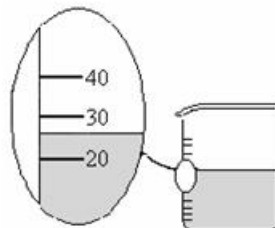
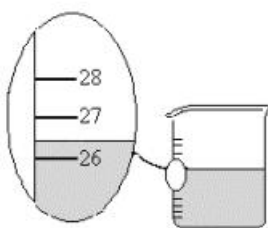
- a) $3 A + B \rightarrow A_3B$
- b) $A + 3 B \rightarrow AB_3$
- c) $A_2 + 3 B_2 \rightarrow 2 AB_3$
- d) $8 A + 12 B \rightarrow 4 AB_3 + 2 A_2$
- e) $4 A_2 + 6 B_2 \rightarrow 4 AB_3 + 2 A_2$

**# 5. (2 marks)** Which of the following statements (1-3) concerning the kinetic-molecular theory of matter is/are CORRECT?

- a) 1 only
 - b) 2 only
 - c) 3 only
 - d) 1 and 2
 - e) 1, 2 and 3
1. Particles in a liquid vibrate back and forth about an average position.
 2. Particles in a solid are packed closely together, but are not confined to specific positions.
 3. Particles in a gas fly about randomly, colliding with themselves and the walls of their container.

6. (2 marks) Suppose you pour the water from the three beakers shown below into one container. Based on the precision of the three beakers, how should you report the new total volume to the correct number of significant figures?

- a) 78.817 mL
- b) 78.82 mL
- c) 78.8 mL
- d) 80 mL
- e) 79 mL



7. (2 marks) A piece of antimony with a mass of 17.41 g is submerged in 46.3 cm³ of water in a graduated cylinder. The water level increases to 48.9 cm³. According to these data, what is the correct value for the density of antimony?

- a) 17.4 g/cm³
- b) 6.7 g/cm³
- c) 2.8 g/cm³
- d) 0.36 g/cm³
- e) 0.15 g/cm³

8. (2 marks) In the following redox reaction, which type of atom is oxidized?



- a) hydrogen
- b) oxygen
- c) sodium
- d) iodine
- e) sulfur

9. (2 marks) When solutions of strontium chloride and sodium carbonate react, which of the following species is a spectator ion? (Note: Strontium has the symbol Sr; Z = 38.)

- a) carbonate ion
- b) strontium ion
- c) chloride ion
- d) sodium ion
- e) two of these

10. (2 marks) When solutions of phosphoric acid and iron(III) nitrate react, which of the following terms will be present in the balanced molecular equation?

- a) HNO₃(aq)
- b) 3 HNO₃(aq)
- c) 2 FePO₄(s)
- d) 3 FePO₄(s)
- e) 2 HNO₃(aq)

11. (2 marks) What is the melting point of sodium chloride (801 °C) on the Kelvin scale?

- a) 503 K
- b) 528 K
- c) 801 K
- d) 1074 K
- e) 1099 K

12. (2 marks) Which one of the following properties is not characteristic of nonmetals?

- a) tend to form negative ions in chemical reactions with metals
- b) appear in the upper right-hand corner of the periodic table
- c) often bond to each other by forming ionic bonds
- d) do not have a shiny (lustrous) appearance
- e) are poor conductors of electricity

13. (2 marks) How many neutrons are in a neutral atom of ^{25}Mg (magnesium-25)?

- a) 0
- b) 5
- c) 12
- d) 13
- e) 25

14. (2 marks) Which of the following statements is true?

- a) Heating water with a Bunsen burner results in a 2:1 mixture of hydrogen and oxygen gases.
- b) Ions are formed by adding or removing protons or electrons.
- c) Scientists believe that solids are mostly open space.
- d) At least two of the above statements (A-C) are true.
- e) All of the statements (A-C) are false.

15. (2 marks) What is the correct description and formula of chromium (III) sulfate?

- a) molecular, Cr_3SO_4
- b) molecular, CrSO_4
- c) ionic, $\text{Cr}_2(\text{SO}_4)_3$
- d) ionic, $\text{Cr}_3(\text{SO}_4)_2$
- e) ionic, CrSO_4

16. (2 marks) What is the correct description and name of P_2O_5 ?

- a) molecular, diphosphorus pentoxide
- b) ionic, diphosphorus pentoxide
- c) molecular, phosphorus oxide
- d) ionic, phosphorus (V) oxide
- e) ionic, phosphorus oxide

17. (2 marks) When sodium hydroxide dissolves in water, the solution contains Na^+ , H^+ and O^{2-} ions.

- a) True
- b) False

18. (2 marks) Boron, silicon, germanium, arsenic, antimony and tellurium are all metalloids.

- a) True
- b) False

19. (2 marks) KMnO_4 , O_2 and HNO_3 are all examples of strong oxidizing agents.

- a) True
- b) False

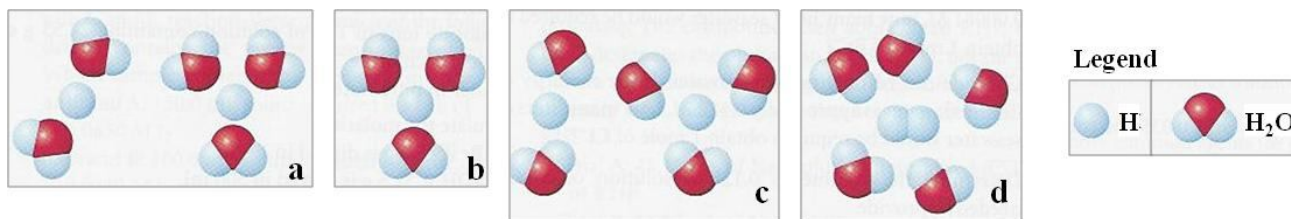
PART B: DRAWINGS & SHORT WRITTEN ANSWERS (answer on exam)

20. Think about hydrogen gas dissolving in water.

a) (1 mark) Which substance is the solute and which substance is the solvent?

b) (1 mark) Is the solute molecular or ionic in nature? How do you know?

c) (3 marks) Which diagram (a-d) best represents aqueous hydrogen gas? **Explain.**



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

- # 21. (8 marks)** Menthol (MM 156.3 g/mol) is a strong-smelling substance that is used in cough drops. By mass, it is 76.83% carbon, 12.91% hydrogen and 10.26% oxygen. What is its molecular formula?
Include explanatory comments at each step of your calculation.

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

22. (10 marks) An Alka-Seltzer® pain-relieving antacid tablet contains 324 mg of aspirin ($C_9H_8O_4$) plus about 2 g of baking soda ($NaHCO_3$) and 1 g of citric acid ($H_3C_6H_5O_7$).

a) **(3 marks)** Calculate the number of molecules of aspirin ($C_9H_8O_4$) in one tablet. **Show your work.**

The fizz produced when an Alka-Seltzer® tablet is dissolved in water has nothing to do with the aspirin. It is due to the reaction between baking soda ($NaHCO_3$) and citric acid ($H_3C_6H_5O_7$):



b) **(1 mark)** Fill in the missing stoichiometric coefficients needed to balance the reaction equation.

c) **(3 marks)** What type of reaction is this? **Circle all that apply, and explain your choice(s).**

acid-base gas-forming oxidation-reduction precipitation

d) **(3 marks)** This reaction is product-favoured. What drives it to produce a high yield of product? **Explain briefly.**

CHEM 205 Fall 2011 MIDTERM EXAM
Dr. C. Rogers, Section 01 Tues/Thurs

Student ID #: _____

EXTRA SPACE FOR ROUGH WORK

POTENTIALLY USEFUL INFORMATIONAtomic mass unit: 1 amu = 1.66054×10^{-27} kgAvogadro's number: $N = 6.022 \times 10^{23}$ 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)