

Name \_\_\_\_\_

**CHEMISTRY MIDTERM: Tuesday, January 23<sup>rd</sup> from 12-3pm in the gym\***

**THIS PACKET WILL BE COLLECTED THE DAY OF THE TEST!**

**Content covered:** Units 1-6 (not 6.12 or 6.13)

**Format:** 100 points

*Part A: Multiple choice (1-50)*

- The multiple choice of Part A tend to emphasize vocabulary and basic reference table usage

*Part B: Multiple choice (51-75), free response (76-80)*

- The multiple choice of Part B tend to be more mathematical
- All Part B free-response questions are mandatory and could be calculations, explanations, or basic identifications

*Part C: Free response—select 4 out of 6 groups of questions to answer (for a total of 20 questions/points)*

- Part C free-response questions come in groups of 5 questions related to a particular topic
- You must X out **two groups** of questions—you **cannot** cross out individual questions.
  - Only 4 groups of questions will be graded—if you answer more than 4 groups and do not put an X through those you don't want graded, we will grade the first 4 groups we see and ignore the rest.
- Part C questions could be calculations, explanations, or basic identifications

**Timing:** You will have 3 hours to complete this test. The *earliest* you could possibly leave is after 2 full hours (just like the Regents exam).

**Logistics:** The details

*Answer sheets: There will be 2 of them*

You will be filling out one answer sheet for Parts A, B, and C that we will be grading. It will look like a regular unit test answer sheet where you write in 1, 2, 3, or 4 for multiple choice questions and have space for explanations and calculations on free response. It should be filled out in pen.

- It is your responsibility to make sure your answer sheet accurately reflects the answer you want graded! Check your choices carefully!

You will be bubbling in a second answer sheet for the multiple choice questions only. This is a bubble sheet (pen). It will be handed out 1-1.5 hours into the test. This sheet will be used to analyze what types of questions you are getting correct/missing.

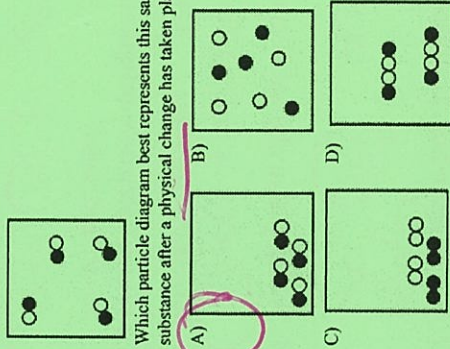

- It is your responsibility to make sure your answer sheet accurately reflects the answer you want graded! Check your bubbles carefully!

*Calculators: To simulate the Regents exam as closely as possible, we are asking you to use non-graphing calculators if you have them. We have a select few that can be borrowed, but certainly don't have enough for everyone. In the event that you do not have a non-graphing calculator and there are none left to provide to you, you will have to have your calculator's memory cleared.*

*Phones: As you would expect, don't even think about having them on or out during testing time.*

Part 1 Instructions: Use your notes, textbook, resources on Miss Virga's website, or teacher to find the definitions to the vocab words in the table. Then, use the definitions to help answer the practice problem!

Vocab Word	Definition	Practice Problem
alkali metal alkaline earth metal halogens noble gas	Group 1 Group 2 Group 17 Group 18	1. The element in Period 2 with the largest atomic radius is _____ <i>Table S</i> A) a halogen B) a noble gas C) an alkali metal D) an alkaline earth metal <i>Li Be F Ne</i> <i>30 99 60 62</i>
atomic number	identifies the element; same as the # of protons in the nucleus	2. The atomic number of an atom is always equal to the total number of A) neutrons in the nucleus B) protons in the nucleus C) neutrons plus protons in the atom D) protons plus electrons in the atom
atomic radius vs ionic radius	atomic radius $\downarrow$ ionic radius $\rightarrow$ Use Table S $\oplus$ ions are smaller are larger measured by TEMPERATURE!	3. Which element has an atomic radius that is greater than its ionic radius? A) $S^{2-}$ B) $K^+$ C) $F^-$ D) $O^{2-}$
average kinetic energy		4. Which of the following substances is made up of particles with the highest average kinetic energy? <i>temperature</i> A) Fe(s) at 35°C B) Br <sub>2</sub> (l) at 20°C C) H <sub>2</sub> O(l) at 30°C D) CO <sub>2</sub> (g) at 25°C

<p>chemical vs physical change</p>	<p>Chemical <math>\rightarrow</math> new substance produced  <math>\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}</math>          ex. <math>\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}</math></p> <p>Physical <math>\rightarrow</math> no new substance produced          ex. <math>\text{H}_2\text{O}(s) \rightarrow \text{H}_2\text{O}(l)</math></p>	<p>5. Given the particle diagram representing four molecules of a substance:</p>  <p>Which particle diagram best represents this same substance after a physical change has taken place?</p> <p>A) <input checked="" type="radio"/> B) <input type="radio"/> C) <input type="radio"/> D) <input type="radio"/></p>
<p>compound</p>	<p>2 or more different elements (atoms) chemically combined in a fixed ratio          ex. <math>\text{O}_2</math></p>	<p>6. Which type of matter is composed of two or more different elements that are chemically combined in a definite ratio?</p> <p>A) a solution          B) a compound <input checked="" type="radio"/>          C) a homogeneous mixture          D) a heterogeneous mixture</p> 
<p>Covalent bond</p>	<p>when 2 nonmetals SHARE electrons to break down chemically</p>	<p>7. Which molecule contains a triple covalent bond?</p> <p>A) <math>\text{H}_2</math> B) <math>\text{N}_2</math> <input checked="" type="radio"/> C) <math>\text{O}_2</math> D) <math>\text{Cl}_2</math></p> <p><math>\text{N} \equiv \text{N}:</math></p>
<p>decompose</p>	<p>type of chemical reaction          1 reactant <math>\rightarrow</math> 2 products</p>	<p>8. Which statement best describes all compounds?</p> <p>A) They can be decomposed by chemical change. <input checked="" type="radio"/>          B) They can be decomposed by physical means.          C) They contain at least three elements.          D) They contain ionic bonds.</p>
<p>decomposition</p>	<p>What type of reaction is shown above?</p> <p>A) synthesis          B) decomposition <input checked="" type="radio"/>          C) single replacement          D) double replacement</p>	<p>9. <math>2 \text{SO}_3(g) \leftrightarrow 2 \text{SO}_2(g) + \text{O}_2(g)</math></p>

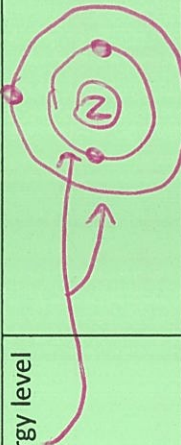

diatomic element	$H_2$ $O_2$ $F_2$ $Br_2$ $I_2$ $N_2$ $Cl_2$	10. Which element in Period 3 exists as diatomic molecules at STP? A) argon C) aluminum B) chlorine D) sodium
double replacement	type of chemical reaction "coupled" 2 products $\rightarrow$ 2 products	11. Which equation represents a double replacement reaction? A) $2 Na + 2 H_2O \rightarrow 2 NaOH + H_2$ B) $CaCO_3 \rightarrow CaO + CO_2$ C) $LiOH + HCl \rightarrow LiCl + H_2O$ D) $CH_4 + 2 O_2 \rightarrow CO_2 + 2 H_2O$
electron-dot diagram	element symbol w/ dots representing valence electrons	12. Which Lewis electron-dot structure is drawn correctly for the atom it represents? A) $\ddot{N}$ B) $\ddot{F}$ C) $\ddot{O}$ D) $\ddot{Ne}$
electron	orbits nucleus, discovered by negatively charged, J.J. Thomson	13. In a calcium atom in the ground state, the electrons that possess the <u>least</u> amount of energy are located in the A) first electron shell B) second electron shell C) third electron shell D) fourth electron shell
electronegativity	attraction for electrons in a chemical bond	17. Which atom has the strongest attraction for electrons? A) Cl B) F C) Br D) I <i>3.2 4.0 3.0 2.7 Tables</i>
endothermic phase changes	melting, boiling, sublimation $S \rightarrow L$ $S \rightarrow G$	14. Which phase change is endothermic? A) $H_2O(l) \rightarrow H_2O(g)$ B) $I_2(g) \rightarrow I_2(s)$ C) $Hg(l) \rightarrow Hg(s)$ D) $H_2S(g) \rightarrow H_2S(l)$
excited state	when an electron absorbs energy and moves to a higher shell	15. Which electron configuration represents an atom in an excited state? A) $2-2$ B) $2-2-1$ C) $2-8$ D) $2-8-1$

2nd shell isn't filled, yet an  $e^-$  is in the 3rd

exothermic phase changes	condensing, freezing, deposition g → l    l → s    g → s	16. Which change of phase is exothermic? A) NaCl(s) → NaCl(l) B) CO <sub>2</sub> (s) → CO <sub>2</sub> (g) C) H <sub>2</sub> O(l) → H <sub>2</sub> O(s) D) H <sub>2</sub> O(s) → H <sub>2</sub> O(g)
first ionization energy	amount of energy to remove a valence electron * Table 5	18. Which element requires the <i>least</i> amount of energy to remove its most loosely bound electron? 520 738 810 890 A) Li    B) Mg    C) Ba    D) Ca
gram formula mass	the mass in grams of 1 mole of a substance	19. What is the gram formula mass of (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> ? N: 2(14) = 28 H: 8(1) = 8 S: 1(32) = 32 O: 4(16) = 64
ground state	electron configuration given on P.T. ; lowest energy / most stable	20. What is the total number of valence electrons in an atom of phosphorus in the ground state? A) 5    B) 2    C) 3    D) 7    2-8-5
group vs period	Group - column    Period - row	21. The element in Group 14, Period 3 on the Periodic Table is classified as a A) metal    B) noble gas C) metalloid    D) nonmetal    Ge
ideal gas conditions	high Temp & low pressure allow gas particles to move quickly and spread out	22. The behavior of a real gas would be most similar to the behavior of an ideal gas under conditions of A) high pressure and high temperature B) high pressure and low temperature C) low pressure and high temperature D) low pressure and low temperature
intermolecular force	particle attraction 3 types: H bonding    dipole-dipole    vander Waals ↑ strongest	23. Which intermolecular force of attraction accounts for the relatively high boiling point of water? A) hydrogen bonding    B) covalent bonding C) metallic bonding    D) ionic bonding

ion	<p>atoms turn into <u>ions</u> when they gain or lose electrons to reach stability</p> <p>ex: <math>\text{Na} \rightarrow [\text{Na}]^{+1}</math></p>	<p>24. An oxide ion (<math>\text{O}^{2-}</math>) formed from an oxygen-18 atom contains exactly</p> <p><del>A) 8 protons, 8 neutrons, 10 electrons</del>  <del>B) 8 protons, 10 neutrons, 8 electrons</del>  <b>C) 8 protons, 10 neutrons, 10 electrons</b>  <del>D) 10 protons, 8 neutrons, 8 electrons</del></p>
ionic bond	<p>transfer of electrons between metal &amp; nonmetal</p>	<p>25. Which element would most likely form an ionic bond with chlorine? <i>nm</i></p> <p>A) O B) N C) S <b>D) K</b></p>
isotope	<p>atoms of the SAME ELEMENT with DIFFERENT MASSES (same # of protons, diff. # of neutrons)</p>	<p>26. Atoms of every isotope of calcium have the same</p> <p><del>A) atomic mass</del>  <b>B) atomic number</b>  <del>C) number of neutrons</del>  <del>D) number of nucleons</del></p>
isotope notation	<p>mass # <math>\rightarrow B</math> <del>X</del>          atomic # <math>\rightarrow A</math></p>	<p>27. The most common isotope of chromium has a mass number of 52. Which notation represents a different isotope of chromium?</p> <p>A) <math>^{52}_{24}\text{Cr}</math> B) <math>^{54}_{24}\text{Cr}</math>  <del>C) <math>^{24}_{52}\text{Cr}</math></del> D) <math>^{24}_{54}\text{Cr}</math></p>
mass number	<p># of protons + # of neutrons</p>	<p>28. Which notation represents an atom of sodium with an atomic number of 11 and a mass number of 24?</p> <p><b>A) <math>^{24}_{11}\text{Na}</math></b> B) <math>^{11}_{24}\text{Na}</math> C) <math>^{13}_{11}\text{Na}</math> D) <math>^{35}_{11}\text{Na}</math></p>
metallic bonding	<p>sea of electrons attracted to positive metal ions</p>	<p>29. The ability to conduct electricity in the solid state is a characteristic of metallic bonding. This characteristic is best explained by the presence of</p> <p>A) high ionization energies          B) high electronegativities  <b>C) mobile electrons</b>          D) mobile protons</p>



principal energy level	 <p>energy shells</p>	38. How many electrons are in the outermost principal energy level (shell) of an atom of carbon in the ground state? A) 6 B) 2 C) 3 D) 4 <i>z=4</i>
proton	subatomic particle	39. A proton has a charge that is opposite the charge of A) an alpha particle B) a neutron C) an electron D) a positron <i>+1</i>
regular geometric pattern	<p>SOLID</p> 	40. In which material are the particles arranged in a regular geometric pattern? A) CO <sub>2</sub> (g) B) NaCl(aq) C) H <sub>2</sub> O(l) D) C <sub>12</sub> H <sub>22</sub> O <sub>11</sub> (s)
Rutherford's gold foil experiment	<p>2 major conclusions</p> <p>① atoms consist of mostly empty space (most alpha particles went straight through)</p> <p>② atoms contain a dense, positively charged center (nucleus)</p> <p><i>some particles bounced back</i></p>	41. In Rutherford's gold foil experiments, some alpha particles were deflected from their original paths but most passed through the foil with no deflection. Which statement about gold atoms is supported by these experimental observations? A) Gold atoms consist mostly of empty space. B) Gold atoms are similar to alpha particles. C) Alpha particles and gold nuclei have opposite charges. D) Alpha particles are more dense than gold atoms.
single replacement	<p>type of chemical reaction</p> $A + BC \rightarrow B + AC$	42. Given the reaction: $\text{Mg(s)} + 2 \text{AgNO}_3(\text{aq}) \rightarrow \text{Mg(NO}_3)_2(\text{aq}) + 2 \text{Ag(s)}$ Which type of reaction is represented? A) single replacement B) double replacement C) synthesis D) decomposition



stable electron configuration	<p>filled valence shell (8 valence electrons)</p>	<p>43. An atom in the ground state has a stable valence electron configuration. This atom could be an atom of</p> <p>A) Al B) Cl C) Na D) Ne</p>
synthesis	<p>type of chemical reaction</p> <p>2 reactants → 1 product</p>	<p>44. <math>2\text{CO(g)} + \text{O}_2\text{(g)} \leftrightarrow 2\text{CO}_2\text{(g)}</math></p> <p>What type of reaction is shown above?</p> <p>A) synthesis B) decomposition C) single replacement D) double replacement</p>

Part 2 Instructions – Use your Reference Tables to fill in the table below!

Question	Answer	What table did you use?
1. What is the definition of STP, and give the values?	<p>Standard Temperature &amp; Pressure  <math>\downarrow</math>            273K or 0°C</p>	A
2. Name $\text{C}_2\text{H}_3\text{O}_2^-$ or $\text{CH}_3\text{COO}^-$	Acetate	E
3. What is the freezing point of fluorine?	53 K (same as MP)	S
4. What are the units for the heat of fusion, and what do they mean?	J/g Joules/gram	B
5. What is the symbol for the mole?	mol	D
6. What is the vapor pressure of water at 75°C?	~39 kPa	H

7. What is the prefix for 1/1000 of a meter?	$10^{-3} \rightarrow$ milli	C
8. What is the formula for the permanganate ion?	$MnO_4^-$	E
9. Name <del><math>CH_3COOH</math></del>		
10. What is the atomic mass of silver?	107.868	P.T.
11. What is the electronegativity of chlorine?	3.2	S
12. What is the ionization energy of Rb?	403 KJ/mol	S
13. Which atom is more likely to lose electrons, Al or Zn? 1.6 1.7 5.78 9.06	Al - has a lower EN $\hat{=}$ First IE	S
14. What is the atomic number of Te?	52	P.T.
15. What is the atomic radius of Bromine?	117 pm	S
16. What is the oxidation state of sulfur?	-2 (or +4, +6)	P.T.
17. Write the electron configuration of potassium.	2-8-8-1	P.T.

18. At what temperature will water boil, when the atmospheric pressure is 55 kPa?	85°C	H
19. What is the trend of atomic radii across period 3?	decreases $\overset{124}{\text{Na}} \quad \overset{140}{\text{Mg}} \quad \overset{174}{\text{Al}}$	S
20. What is the heat of vaporization of water?	2260 J/g	B
21. What is the density of tin?	7.287 g/cm <sup>3</sup>	S
22. What phase of matter is zinc in at STP?	Solid MP = 693K > 273	S
23. What is the total number of electrons in the principle energy level that has the greatest amount of energy for an atom of calcium in the ground state?	2-8-8-2	P.T.
24. What relative atomic masses based on/what is the atomic mass unit defined as? (hint: check key on Periodic Table)	1/12 C <sup>12</sup> atom	P.T.
25. Which ion would form colored solutions? Mn or Ca (hint, only transition metal ions formed colored solutions)	Mn	P.T.
26. How many kilojoules are equivalent to 10 joules?	$10\text{J} \times \left(\frac{1\text{kJ}}{1000\text{J}}\right) = 0.01\text{kJ}$	C
27. What is the normal boiling point of water in degrees Celsius?	100°C	H

28. Which substance has the strongest IMFs? Your choices are: ethanoic acid, propanone, ethanol, or water.	ethanoic acid	H
29. What is the total number of protons, neutrons, and electrons in the most common isotope of sodium?	mass# = 23 11p, 12n, 11e	P.T.

Using Table T, solve the following problems:

Problem	Which equation do you need?	Solution (SHOW WORK)
1. If the accepted value for the mass of an object is 10.3g and a student found that the mass was 10.1g, what is the student's percent error?	$\% \text{ error} = \frac{mv - av}{av} \times 100$	$\% = \frac{10.1 - 10.3}{10.3} \times 100$ $= -1.94\%$
2. If a peanut is burned in a calorimeter containing 50g of water, and the water temperature changes from 45°C to 57°C, how many joules of energy were released by the peanut?	$q = mc\Delta T$	$q = (50)(4.18)(57 - 45)$ $q = 2508 \text{ J}$
3. How much heat does it take to convert 20g of water to steam at 100°C?	$q = mH_v$	$q = (20)(2260)$ $q = 45,200 \text{ J}$

4. A sample of gas has a volume of 60. mL at 40.0 kPa. What will be the new volume of the gas if the pressure is increased to 75.0 kPa and the temperature remains constant?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

\* don't need to worry about T in this problem b/c

$$(40)(60) = (75.0)(x)$$

$$\frac{2400}{75} = \frac{75x}{75}$$

$$x = 32 \text{ mL}$$

5. What is the percent by mass of oxygen in NaOH?

$$\% \text{ comp} = \frac{\text{part}}{\text{whole}} \times 100$$

GFM  
NaOH (23) = 23

O : 1 (16) = 16

H : 1 (1) = 1

40

$$\% = \frac{16}{40} \times 100$$

$$\% = 40$$

