	. Hoyt 11 am		Noble F 11 am		. Powe F 9 am		Noble /F 12 n		Franco F 2 pm	Dr. Franco online		:. Kuta 5:30 pm
01	W 4	05	W 12	13	W 10	22	W 3	38	F 12	50	75	T 7
02	W 10	06	Th 8	14	Th 1	23	F 10	39	T 2		76	Th 7
03	W 12	07	F 10	15	T 1	24	F 8	40	Th 12		77	Th 7
04	W 9	08	W 2	16	Т3	25	M 8	41	Т 3		78	Th 4:30
		09	Th 9	17	F 11	26	M 9	42	M 11		79	T 4:30
		10	F 1	18	Th 11	27	Т3	43	M 12		80	T 7
		11	M 1	19	W 1	28	W 8	44	W 12			
				20	M 10	29	Th 2					

This exam will be graded by the SCANTRON Form provided. Be certain that you fill it in correctly. On the front side in the spaces as shown below, enter your name (print and sign), your instructor's name, and the <u>number</u> for your recitation section (from the above list).

NAME	print your name and sign your name	
SUBJECT_	your instructor's name	TEST NO. <u>section number</u>
DATE		PERIOD

On the back side of the Form in the colored portion where it says "NAME", print your last name. BE CERTAIN TO ENTER THE CORRECT INFORMATION.

This exam has 35 questions. Part 1 has 15 questions worth four points each and covers newer material; this Part must be answered on the FRONT side of the SCANTRON Form in spaces 1-15. Part 2 has 20 questions worth two points each and covers older material; this Part must be answered on the BACK side of the SCANTRON Form in spaces 26-45. Because of this arrangement, THERE ARE NO QUESTIONS NUMBERED 16-25. Skip 16-25 on the SCANTRON Form.

Be certain no stray marks are on the Form. Be certain you fill in all spaces properly. Be certain you cleanly erase any changes. You must use a pencil.

For every question there is only <u>one</u> correct answer. Be certain you have all questions 1-15 and 26-45.

None of the exam pages will be collected. You may tear pages off. TURN IN ONLY THE SCANTRON CARD. Give the card to your (or another) TA in the room. Have your picture ID ready.

The key for the exam will be posted shortly afterwards at noblereaction.org/gc/201misc.htm. If you record your answers, you will be able to grade your exam.

INFORMATION PAGE

This page contains information which may or may not be needed.

SOLUBILITY TRENDS

For purposes of this course, we will use the following trends to predict whether a compound is soluble or insoluble. These guidelines are given in a priority sequence: use them in this order.

- 1. Group 1 compounds and ammonium compounds tend to be soluble.
- 2. Nitrates, acetates, chlorates, and perchlorates tend to be soluble.
- 3. Silver, lead, mercury(I) and copper(I) compounds tend to be INSOLUBLE.
- 4. Chlorides, bromides, and iodides tend to be soluble.
- 5. Sulfates tend to be soluble except calcium sulfate, strontium sulfate and barium sulfate.
- 6. Compounds with anions of 2- or 3- charge tend to be INSOLUBLE.
- 7. Hydroxides tend to be INSOLUBLE except calcium hydroxide, strontium hydroxide and barium hydroxide.

Avogadro's number

$$6.022 \times 10^{23}$$

Temperature conversion

$$T(K) = T(^{\circ}C) + 273$$

Gases

$$PV = nRT$$

$$R = 0.08206 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}} = 8.314 \frac{\text{J}}{\text{mol} \cdot \text{K}}$$

$$atm = 760 \text{ mmHg} = 760 \text{ Torr}$$

$$d = \frac{PM}{RT}$$

Standard Molar Enthalpies of Formation (in kJ/mol)

$$Cu_2O(s) -170.71$$

Electromagnetic Radiation

$$c = \lambda v = 3.00 \times 10^8 \,\text{m/s}$$

$$h = 6.626 \times 10^{-34} \,\text{J} \cdot \text{s}$$

$$E = hv = hc/\lambda$$

Transition Energy

$$\Delta E = -2.18 \times 10^{-18} \,\mathrm{J} \left(\frac{1}{n_{\text{final}}^2} - \frac{1}{n_{\text{initial}}^2} \right)$$

Molecular Orbital Approach

B/C/N:
$$(\sigma_{2s})(\sigma_{2s}^*)(\pi_{2p})(\sigma_{2p})(\pi_{2p}^*)(\sigma_{2p}^*)$$
 (and heteronuclear)

$$(\sigma_{2s})(\sigma_{2s}^{\bigstar})(\sigma_{2p})(\pi_{2p})(\pi_{2p}^{\bigstar})(\sigma_{2p}^{\bigstar})$$

KEEP YOUR WORK COVERED.

This includes your exam papers, your scrap work, and your Scantron card.

Part 1. Newer Material

1.	Ω^2		are paramagnet Mn ²⁺	Fe ²⁺	Zn ²⁺				
	O	(B) one		(D) three					
	. ,		,	, ,					
2.	Rank the foll	owing ionic com	pounds by incre	asing lattice e	nergy.				
	Na	ıCl NaI	MgO	MgS	KI				
	(A) NaI $<$ N	MaCl < MgO <	MgS < KI						
	(B) KI < Na	I < NaCl < M	IgS < MgO						
	(C) $MgO < 1$	MgS < KI < N	VaI < NaCl						
	(D) $MgO < 1$	MgS < NaI <	NaCl < KI						
	(E) $KI < Mg$	gS < NaI < Na	aCl < MgO						
3.	Which of the	following eleme	nts is the most e	electronegative	?				
	(A) Se	(B) Bi	(C) Ga	(D) In	(E) Pb				
4 .		_	nents is TRUE?						
	(A) Bond order is not related to the strength of the chemical bond.								
	(B) Both H ₂ S and CO ₂ have one lone pair of electrons on the central atom								
	(C) NF ₂ has two double bonds.								
	(D) IF ₄ has three lone pairs on the central atom.								
	(E) The cent	cal atom in SF ₄	has expanded va	alence.					
5.	Which one of	the following h	as resonance?						

(A) $\mathrm{H_2O}$ (B) $\mathrm{SiF_4}$ (C) $\mathrm{SO_2}$ (D) $\mathrm{CS_2}$ (E) $\mathrm{BCl_3}$

- 6. In the NO_4^{3-} ion, nitrogen has a formal charge of ___ and an oxidation number

- (A) 0, +3 (B) 0, +5 (C) +1, +3 (D) +1, +5 (E) +3, +3
- 7. How many of the following species have a tetrahedral shape?

 NF_3

- (A) one
- PO_4^{3-} SO_4^{2-} XeO_4 PCl_4^{+} (B) two (C) three (D) four
- (E) five

- 8. Which one of the following molecules is nonpolar?
 - (A) SO₂
- (B) HCl (C) CS_2 (D) CO (E) OCl_2

9. How many of the following molecules are polar?

 CH_{4}

CO

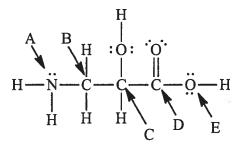
 CO_2 PH_3 SeCl_2

- (A) one
- (B) two (C) three (D) four
- (E) five

For Questions 10 and 11, consider the structure shown at right. Answer (A) - (E) according to the labels on the atoms which are shown.

- 10. Which of the labeled atoms in the structure has a trigonal pyramidal shape?
- 11. Which of the labeled atoms has sp^2 hybridization?

 π



12. How many sigma (σ) and pi (π) bonds are in the structure which is shown?

σ

(A)

(B) 1

(C) 1

(D) 1 (E)

13.	For the Molec FALSE?	ular Orbital A	pproach for C_2 , wh	nich of the follow	ring statements is					
	(A) The bond order is two.									
	(B) There are	two electrons	in σ_{2p}^* .							
	(C) All electrons are spin paired.									
	(D) The π_{2p} orbitals are full.									
	(E) There are	a total of two	electrons in antibo	onding orbitals.						
14.	Consider the	following.								
	${f C_2}^-$	CN	NO O ₂	CO^+	N_2^+					
	-		ed electron in π_{2p}^*		- · <u>Z</u>					
			_							
	(A) one	(B) two	(C) three	(D) four	(E) five					
15	. Which one of	the following i	s paramagnetic?							
	(A) CN ⁻	(B) O_2^{2-}	(C) C_2^{2-}	(D) OF ⁻	(E) NO ⁻					
16			CES BLANK ON T ON THE BACKSI							
	GO 101	OMIDEIV 20								
		KEEP	YOUR WORK CO	OVERED.						
	This includes	s your exam pa	apers, your scrap v	vork, and your S	cantron card.					
Pa	rt 2. Older M	aterial								
26	. What is the m	nolar mass (in	g) of iron(III) oxal	ate?						
	(4) 50 14	/D) 00 00	(C) 199.95	(D) 901 79	(E) 275 76					
	(A) 59.14	(B) 88.02	(C) 122.25	(D) 291.73	(E) 375.76					
			27							
27	. Which of the	following com	oounds contains io	ns with a –2 cha	rge?					
	(A) $CrPO_4$	(B) Ti_3N	(C) PbS	(D) SO_2	(E) NH_4NO_3					

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28. Ores of elements from different places in the world often contain different isotope ratios. This information can be used to show, for example, where prehistoric artifacts were moved along trade routes, or to detect where ancient meteorites struck the earth.

A certain sample of a lithium ore contains the two major isotopes of lithium, ⁶Li and ⁷Li, in the following abundances. Calculate the atomic mass of lithium in this particular sample.

isotope	nuclear mass	abundance	
$^6\mathrm{Li}^{^2}$	6.015123	9.633%	
$^7{ m Li}$	7.016005	90.367%	

- (A) 6.3402
- (B) 6.5156
- (C) 6.9196
- (D) 6.941
- (E) 7.016

- 29. Which of the following statements is FALSE?
 - (A) Elements in the same period tend to have similar chemical properties.
 - (B) All of the nonmetals are Main Group elements.
 - (C) All of the transition elements are metals.
 - (D) Isotopes have the same number of protons, but different mass numbers.
 - (E) Hydrogen can form a +1 ion and a -1 ion.
- 30. Ammonia reacts with molecular fluorine to produce dinitrogen tetrafluoride and hydrogen fluoride. How many moles of ammonia are needed to react completely with 13.6 moles of molecular fluorine?
 - (A) 2.27
- (B) 5.44
- (C) 6.80
- (D) 27.2
- (E) 34.0

31. The following equation is balanced.

$$2 \operatorname{Fe}(s) + 3 \operatorname{Cl}_{2}(g) \rightarrow 2 \operatorname{FeCl}_{3}(s)$$

If a reaction begins with 25.6 g each of iron and of chlorine, how much FeCl₃ can be formed (in g)?

- (A) 26.0
- (B) 39.0
- (C) 51.2
- (D) 74.3
- (E) 113

32. Aluminum metal reacts with sulfuric acid according to the equation below.

$$2 \text{ Al}(s) + 3 \text{ H}_2 \text{SO}_4(aq) \rightarrow \text{Al}_2(\text{SO}_4)_3(s) + 3 \text{ H}_2(g)$$

If 10.0 g of Al react with excess H_2SO_4 , and 54.2 g of $Al_2(SO_4)_3$ are obtained, then what is the percent yield for the reaction?

- (A) 47.1%
- (B) 63.4%
- (C) 73.5%
- (D) 85.5%
- (E) 97.0%
- 33. Consider the combustion reaction of propane. Which of the following statements is FALSE?
 - (A) The balanced equation is: $C_3H_8 + 5 O_2 \rightarrow 3 CO_2 + 4 H_2O$
 - (B) If five molecules of propane react, then fifteen molecules of ${\rm CO_2}$ are formed.
 - (C) If five molecules of propane react, then 25 molecules of O_2 must also react.
 - (D) If fifteen molecules of O2 react, then nine molecules of H2O are formed.
 - (E) If twelve molecules of ${\rm CO}_2$ are formed, then four molecules of propane must have reacted.
- 34. Which of the following statements is TRUE?
 - (A) Mg(OH)₂ is a strong base.
 - (B) CO₂ is an acid.
 - (C) The formula of chromic acid is HCrO₄.
 - (D) Chlorous acid is a strong acid.
 - (E) Water is always one of the products of a neutralization reaction.
- 35. What are the oxidation numbers for each element in $C_2H_4F_2$?

- (A) +1 -1 +1
- (B) +1 -1 -1
- (C) +1 +1 -1
- (D) -1 + 1 + 1
- (E) -1 + 1 1

36.	Wh	ich of the fo	llowing compou	nds i	s insoluble i	n water?		
	(A)	potassium	oxalate (B)	am	monium ph	osphate	(C) sil	ver acetate
		(D)	calcium hydro	xide	(E)	copper(II) a	ırsenate	
37.		er balancing fficients,	g the following re	edox	equation wi	th the small	est who	le-number
	N	VO ₃ +	$AgCl + H^+$	\rightarrow	Ag^+ +	Cl ₂ + N	1O +	$\mathrm{H_2O}$
	wha	at are the re	spective coeffici	ents	for NO ₃ an	d AgCl?		
	(A)	1 and 6	(B) 2 and 3	(C)	2 and 6	(D) 3 and 2	2 (E)	3 and 3
38.		O L of gas at sent?	28°C has a pre	essur	e of 4.10 atr	n. How man	y moles	of gas are
	(A)	0.747	(B) 0.913	(C)	1.00	(D) 2.33	(E)	8.47
39	The	o following a	quation is balan	book				
00.			+ 2 Al(s) +		$O(l) \rightarrow 2$ N	Ja Al(OH) .(ac	a) + 3	H_(g)
	Wh	at is the vol	ume (in L) of H ₂ treated with ex	whi	ch can be fo	-		_
	(A)	0.154	(B) 0.231	(C)	3.75	(D) 4.15	(E)	5.62
40.	Wh	ich of the fo	llowing gases ha	ıs a d	lensity of 2.	79 g/L at 25 '	°C and 2	2.00 atm?
	(A)	O_2	(B) CO ₂	(C)	SO ₂	(D) H ₂ S	(E)	$\mathrm{CH_3CH_3}$
					38			
41.	The	following e	quation is balan	ced.				
					4 Cu(s) +	-		
	For	a reaction v	which uses up 1.	50 ×	10 ⁴ kJ, how	much Cu (in	kg) is f	ormed?
	(A)	3.86	(B) 6.59	(C)	9.85	(D) 11.2	(E)	13.3

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4	2. What is the way	velength of the	photon which	has an energy	of 1.29 × 10	⁻²⁴ J?
	(A) 157 nm	(B) 458 nm	(C) 252 μm	(D) 658 μm	n (E) 15	4 mm
4	3. Which of the fol	lowing statem	ents is FALSE'	? (Assume grou	ınd state.)	
	(A) Atoms of al	l elements in (Froun 14 have f	our unnaired e	lectrons	
	(B) For every morbital.		_	_ •		n the 2s
	(C) In a sodium and 2p orbi		electron is shie	ded by the elec	trons in the	1s, 2s
	(D) Every cation configuration		ith 18 total elec	etrons has a nol	ole gas	
	(E) All electron paired.	s in atoms of a	all elements in (Groups 2, 12 ar	ıd 18 are spi	n
4	4. Which of the fol atom or ion?	lowing entries	s has the WRON	NG configuration	n for the inc	dicated
	(A) Bi, [Xe] $6s^2$ §	$5d^{10}6p^3$	(B) Ru ³⁺ , [K	$[{ m r}]4d^5$	(C) U ²⁺ , [F	$2n]5f^4$
	(D) As^{3-} , $1s^2 2s^2$	$^{2}2p^{6}3s^{2}3p^{6}4s^{2}$	$3d^{10}4p^6$ (E) $Ga^+, 1s^2 2s^2$	$2p^63s^23p^64s$	$^{2}3d^{10}$
4	5. Consider the fol	lowing atoms.				
	C	Si	´Ga	Ge	As	
	For these atoms	s, which of the	following state	ments is FALS	E?	
	(A) Three have	four valence e	lectrons.			8
	(B) Three have	18 core electro	ons.			
	(C) One has its	valence electr	ons in the $n=3$	shell.		
	(D) Ga has the	largest size.				
	(E) C has the st	rongest hold o	on its electrons.			