# **JOHN FRASER SECONDARY SCHOOL**

**SCH3U0** – **Practice Final Examination (1.5 hours)** 

YOUR NAME:	
YOUR STUDENT #:	
Teacher:	Mr. Martin

## **PLEASE NOTE:**

There should be 7 <u>exam question pages</u> plus <u>3 pages of reference tables and this cover sheet</u> in this exam paper - <u>check now that they are all there</u>

All questions are to be answered on the exam paper

Show ALL your work for the short answer section

Non-programmable calculators are allowed.

A periodic table and reference tables are provided at the end of the exam paper. Detach for quick reference.

	SECTION	MARKS	TIME
PART A	MULTIPLE CHOICE	22	
PART B	SHORT ANSWER	52	
TOTAL		74	90 MINUTES

/74

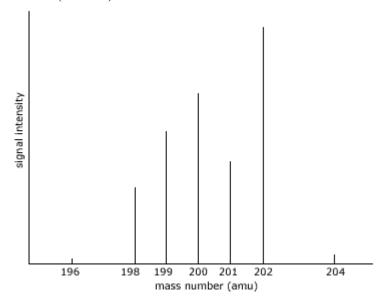
## PART A: MULTIPLE CHOICE- (22 MARKS)

1.		s structure shows e	lement 117, re	-	*		
	A) X C) X			B) D)	X X		
2	How many elec	etrons, protons, and	l neutrons are	in [ <sup>120</sup> <sub>2</sub>	so <b>Sn</b> 1 <sup>4+</sup>		
	A) 54 e, 50 j		i neurons ure		50 e, 54 p <sup>+</sup> , 70 n <sup>0</sup>		
	C) 46 e, 50 p	o <sup>+</sup> , 70 n <sup>0</sup>		D) 5	50 e, 50 p <sup>+</sup> , 120 n <sup>0</sup>		
3.	The name corre	sponding to the co	mpound with	the form	nula Cu(NO <sub>2</sub> ) <sub>2</sub> • 7 H <sub>2</sub> O is,		
		trate heptahydrate	В		er nitrogen dioxide heptahy		
	C) copper ni	trite septahydrate		D) cop	per(II) nitrite heptahydrate		
4			ion energy and		electron affinity. What is it	t most likely to be?	
	<ul><li>A) a haloger</li><li>C) a noble g</li></ul>				n alkali metal roup 16 (VIA) element		
	C) a noble g	as		D) a U	Toup To (VIA) element		
5. l	-	re represented in t		H <sub>4</sub> ) <sub>2</sub> HP(	$O_4$ ?	Y	
	A) 0 B) 2		D) 4 E) 16				
	C) 3		_, -,				
6 (	Consider the reac	tion shown below:					
0. (	$N_2O_4 \rightarrow 2N$					1	
		n is an example of:		ъ.			
	<ul><li>A) synthesis</li><li>C) combusti</li></ul>		Γ		) it is not a chemical reaction position reaction	on	
	C) comoustr	on reaction	L	) decoi	inposition reaction		
7. <b>'</b>		owing equations is	correctly bala	nced?	D) 014 . Cl . 14 Cl		
	A) $2H_2O -$ B) $HgO \rightarrow$				D) $2Mg + Cl_2 \rightarrow MgCl_2$ E) None of these		
	C) C + $O_2$ -				E) None of these		
0.1	r 1	1 6 16 1		. 1.00			
8. F	ow many moiec A) 9.63 x		de are present B) 1.54		mol of sulfur dioxide?		
	C) 3.76 x		D) 2.65				
9.9	A) The two re B) The hydro C) The oxyge	eactants are consur gen is limiting by	ned simultane about 700 g	ously	nthesis reaction. Which rea	agent is limiting?	
10.		es are in 2.55 g of s	sodium?				
	A) 58.6 m						
	B) 0.111 c C) 0.0554						
	D) 9.02 m						
11.	The molecular f	ormula of a compo	ound is represe	nted by	$X_2Y_3Z_4$ . What is the		
	empirical f						
	A) XYZ C) X <sub>2</sub> Y <sub>3</sub> Z				B) XY <sub>3</sub> Z <sub>2</sub> D) X <sub>6</sub> Y <sub>4</sub> Z <sub>3</sub>		
	C) A213Z	4			$D/\Lambda_0 14 Z_3$		
12.		entage compositio	n of aluminum	in alun			
	A) 36% C) 11%				B) 32% D) 25%		
					2) 20 %		
13.		is <i>not</i> characteristi		C)	advata alaatuisitu		
		henolphthalein pir itmus paper red	IK		nducts electricity acts with an active metal to	produce hydrogen gas	
14.	67.2 g of coppe of the solut		ssolved in enou	igh wat	er to make 250 mL of solut	tion. What is the molar concentration	on
	A) 2.5 mc		1.0 mol/L				
	B) 2.0 mg		0.50 mol/L				
15.	Identify the con	jugate acid for the	following reac	tion:			
	$CO_3^{2}(aq) + 1$	•	HCO <sub>3</sub> -(aq) +		(q)		
	A) CO <sub>3</sub> <sup>2</sup> -	-	B) HNC				
	C) HCO <sub>3</sub> -		D) NO <sub>3</sub>				

16. What's the [H <sup>+</sup> ] of a solution with a pOH A) 1.2 x 10 <sup>-9</sup> mol/L C) 4.5 x 10 <sup>-2</sup> mol/L	B) 7.9 x 10 <sup>-6</sup> mol/L D) 3.1 x 10 <sup>-3</sup> mol/L
17. A solution with a pH of 10.8 is used in a A) 11.8 C) 10.7 B) 10.9 D) 9.8	ten-fold dilution. What is the pH of the new solution?
18. For the equation below, the volume of N $N_2$ (g) would be, $N_2$ (g) $+ 3$ $H_2$ (g) $-$ A) 44.8 L C) 3.0 L	
19. According to Boyle's law, the volume of temperature. How will an increase in the pre	a given mass of gas is inversely proportional to the pressure at a constant ssure exerted on a gas affect its density?
	B) Its density will increase D) The density of only some gases will increase
20. A particular gas occupies 15 L at 0°C. V constant?	What volume will the gas occupy at -35°C, assuming that the pressure remains
A) 13 L C) 2 L	B) 17 L D) 10 L
21. What is the mass of 5.6 L of gaseous amr A) 0.25 g B) 4.3 g C) 8.5 g D) 22.4 g	nonia, NH <sub>3</sub> , at STP?
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	react to produce ammonia, NH <sub>3</sub> , according to the following equation: seasured at 101.3 kPa and 273 K, are needed to react with 11.2 L of nitrogen
DADER CHODE ANGWED (DDG	DRI EM COL VIDIC
-	DBLEM SOLVING [52 MARKS] wided. FULL SOLUTIONS REQUIRED. For of significant digits and units where applicable.
1. a) Write the following in standar particles: <b>Cesium ion</b> (2 marks	ard atomic notation and determine the number of subatomic

b) State and explain the trends in atomic radius and ionization energy for the alkali metals (2 marks)

c) Use the given mass spectrometry data to determine the average atomic mass and thus the identity of the element (3 marks):



2. a) **Name** the following compounds (1 mark each, 5 marks total)

	2. a) Name the following compounds (1 mark each, 3 marks total)		
Chemical Formula		IUPAC Name	
$N_2S_3$			
Sn(SO <sub>4</sub> ) <sub>2</sub>			
$H_3AsO_{3(aq)}$			
MgO₂ • 6H <sub>2</sub> O			
$H_2S_{aq}$			

b) Draw the most appropriate Lewis structure for each of the following (2 marks each, 6 marks total)

i) SO <sub>2</sub>	ii) NH <sub>4</sub> CN
iii) HOCN	

- 3. Complete the following chemical equations by writing in the correct products (including state) and balancing where necessary. Classify each reaction by stating the type (2 marks each, 10 marks total).
- a) LiOH  $\rightarrow$
- b)  $C_5H_9O$  +  $O_2$   $\rightarrow$
- c)  $Fe_2O_3$  + Mg  $\rightarrow$
- d)  $CO_2$  +  $H_2O$   $\rightarrow$
- e)  $AlI_3$  +  $HgCl_2$   $\rightarrow$ 
  - 4. Calculate the average mass, in grams, of one atom of mercury (2 marks)

ANS:\_\_\_\_\_

5. A 5.015 g sample of a compound that contained hydrogen, carbon, and oxygen was combusted in a carbon-hydrogen analyzer. The combustion produced 7.35 g of carbon dioxide and 2.99 g of water. The molar mass of the compound is 60.05 g/mol. What is the molecular formula of the compound? (4 marks)

ANS:\_\_\_\_\_

The following reaction has a 71.7% yield: 2NO<sub>(g)</sub> + O<sub>2(g)</sub> → 2NO<sub>2(g)</sub>
 Calculate the actual mass of water that will form if 51.24 g of each reactant is used in the reaction. (4 marks)

ANS:\_\_\_\_

7. Refer to the given Solubility Curve (Figure 1), and answer the following:

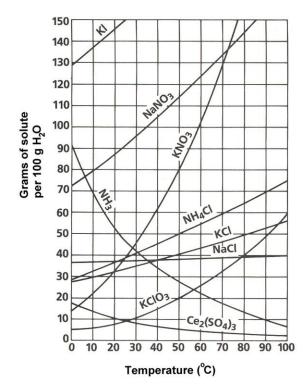


Figure 1: Solubility Curve

- a) What mass of NH<sub>4</sub>Cl will dissolve in 100 mL of water at 50 °C? (1 mark)
- b) What minimum temperature is required to dissolve 24 g of KNO<sub>3</sub> in 40 g of water? (1 mark)
- c) Determine the molarity of a saturated solution of NaCl at  $25~^{\circ}\text{C}$  (1 mark)
- d) What term best describes a solution that contains 60 g of dissolved KCl per 100 mL  $H_2O$  at 80 °C? (1 mark)
- e) Briefly explain why the curve for  $NH_3$  shows a different trend from the other curves. (2 marks)

8. Suppose a beaker contains 35.0 mL of 0.175 M sulfuric acid. How many milliliters of 0.250 M sodium hydroxide must be added to react completely with the sulfuric acid? (4 marks)

ANS:\_\_\_\_\_

9. A bubble of methane gas, CH<sub>4</sub>, is released from a deep bog. The temperature at the bottom of the bog is 12°C with a pressure of 375 kPa. If the bubble has a volume of 475 mL at the bottom, what will the new volume be, just underneath the surface of the bog water level, if the outside temperature is 35°C and the pressure is 99.5 kPa? (2 marks)

ANS:\_\_\_\_

10. Calculate the volume of water vapour that is produced from the combustion of 15.0 g of ethylene at 25°C and 100 kPa. (2 marks)

$$C_2H_{4(g)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 2H_2O_{(g)}$$

ANS:\_\_\_\_\_

## **Inorganic Nomenclature Reference Sheet**

**Table 1.1: Common Polyatomic Ions** 

Ion	Name	Ion	Name
CN <sup>-</sup>	cyanide	$H_2PO_3^-$	dihydrogen
			phosphite
CH <sub>3</sub> COO <sup>-</sup>	acetate	$H_2PO_4^-$	dihydrogen
			phosphate
ClO-	hypochlorite	MnO <sub>4</sub> -	permanganate
ClO <sub>2</sub> -	chlorite	NO <sub>2</sub> -	nitrite
ClO <sub>3</sub> -	chlorate	NO <sub>3</sub> -	nitrate
ClO <sub>4</sub>	perchlorate	OCN-	cyanate
HCO <sub>3</sub> -	hydrogen carbonate	HS <sup>-</sup>	hydrogen sulfide
HSO <sub>3</sub> -	hydrogen sulfite	OH-	hydroxide
HSO <sub>4</sub>	hydrogen sulfate	SCN <sup>-</sup>	thiocyanate

Ion	Name	Ion	Name
$CO_3^{2-}$	carbonate	$O_2^{2-}$	peroxide
$C_2O_4^{2-}$	oxalate	SiO <sub>3</sub> <sup>2</sup> -	silicate
CrO <sub>4</sub> <sup>2-</sup>	chromate	$SO_3^{2-}$	sulfite
$\text{Cr}_2\text{O}_7^{2-}$	dichromate	SO <sub>4</sub> <sup>2-</sup>	sulfate
HPO <sub>3</sub> <sup>2-</sup>	hydrogen phosphite	$S_2O_3^{2-}$	thiosulfate
HPO <sub>4</sub> <sup>2</sup> -	hydrogen phosphate		

Ion	Name	Ion	Name
$AsO_3^{3-}$	arsenite	PO <sub>3</sub> <sup>3</sup> -	phosphite
$AsO_4$ <sup>3-</sup>	arsenate	PO <sub>4</sub> <sup>3-</sup>	phosphate

Ion	Name
$\mathrm{NH_4}^+$	ammonium

Table 1.2: Naming oxyions (polyatomic ions containing oxygen)

Table Halling exploite (belyateline it	no containing oxygon,
Prefix and suffix	Number of oxygen atoms
hypoite	x-2 oxygen atoms
ite	x-1 oxygen atoms
ate	x oxygen atoms
perate	x+1 oxygen atoms

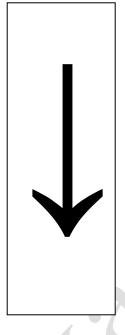
**Table 1.3: Numerical Prefixes for Covalent compounds** 

	Take to the trainer take to take the container to the con			
Number	Prefix	Number	Prefix	
1	mono	6	hexa	
2	di	7	hepta	
3	tri	8	octa	
4	tetra	9	nona	
5	penta	10	deca	

#### **Activity Series Halogen Series**

Metals Lithium\* Potassium\* Barium\* Calcium\* Sodium\* Magnesium Aluminum Zinc Chromium Iron Cadmium Cobalt Nickel Tin Lead Hydrogen Copper Mercury Silver Platinum Gold

#### **Halogens** Fluorine Chlorine Bromine Iodine



\*displace hydrogen from cold water

### **Solubility Rules**

The rules are meant as a guide only. There are exceptions to these rules- when an exception is encountered, do the OPPOSITE of the given rule.

1. Salts of the alkali metals are soluble. (Note: The alkali metals are in group 1.)

e.g. If M = Li, Na or K, then MX,  $M_2X$ ,  $M_3X$ , etc. are soluble regardless of what X is.

2. Ammonium (NH<sub>4</sub><sup>+</sup>) salts are soluble.

e.g. NH<sub>4</sub> X, (NH<sub>4</sub>)<sub>2</sub>X, (NH<sub>4</sub>)<sub>3</sub>X, etc. are soluble regardless of what X is.

3. Nitrates (NO<sub>3</sub><sup>-</sup>) are soluble.

e.g. MNO<sub>3</sub>, M(NO<sub>3</sub>)<sub>2</sub>, M(NO<sub>3</sub>)<sub>3</sub>, etc. are soluble regardless of what M is.

4. Halides i.e. chlorides (Cl $^{\scriptscriptstyle -}$  ), bromides (Br $^{\scriptscriptstyle -}$  ) and iodides (I $^{\scriptscriptstyle -}$  ) are soluble

Exceptions: Ag+, Hg+, Hg2+, Cu+, Pb2+

e.g. If X = Cl, Br or I, then MX, MX<sub>2</sub>, MX<sub>3</sub>, etc. are soluble unless M = Pb, Hg or Ag.

5. Sulfates (SO4 $^2$ -) are soluble Exceptions: Ca $^2$ +, Sr $^2$ +, Ba $^2$ +, Pb $^2$ +, Hg $^2$ +, Ag $^+$ e.g. M2SO4, MSO4, M2(SO4)3, etc. are soluble unless M is from group 2 (the alkaline earths) or M = Pb, Hg or Ag.

- 6. Carbonates (  $CO_3^{2-}$ ), phosphates ( $PO_4^{3-}$ ), and sulfides ( $S^{2-}$ ) are insoluble except for
- (i) the carbonates/phosphates/sulfides of the alkalis (because of Rule 1), and
- (ii) ammonium carbonate/phosphate/sulfide (because of Rule 2).

7. Hydroxides (OH<sup>-</sup>) are insoluble or slightly soluble except for the hydroxides of the alkalis (because of Rule 1).

Note: The hydroxides of group 2 (the alkaline earth metals) are slightly soluble. Virtually all other hydroxides are insoluble. Also, ammonium hydroxide is slightly soluble.

	0	0	0	0	0	0	# tium	£ _	the man
2	2 <b>He</b> Helium 4.0	10 <b>Ne</b> Neon 20.2	18 <b>Ar</b> Argon 39.9	36 <b>Kr</b> Krypton 83.8	54 <b>Xe</b> Xenon 131.3	86 <b>Rn</b> Radon (222)	Uuo* Ununoctium (294)	71 (Lu Lutetium 175.0	103 3. Lr Lawrencium (262)
	17	1 - 0	1 - e	1- ne	1-1	1- J)		3+ +2 0.	3+ 3+ 3)
		9 <b>F</b> Fluorine 19.0	17 Chlorine 35.5	35 <b>Br</b> Bromine 79.9	53 <b> </b> lodine 126.9	85 <b>At</b> Astatine (210)		70 <b>Yb</b> Ytterbium 173.0	102 No Nobelium (259)
	16	. 8 2- <b>O</b> Oxygen 16.0	2-1	2- nium 0	2- ium 7.6	2+ 4+ 4+ 9)	Uuh* Uunh* Ununhexium (292)	* Temporary names    68	101 2+ Md 3+ Mendelevium (258)
			. 16 Suffur 32.1	34 <b>Se</b> Selenium 79.0	52 <b>Te</b> Tellurium 127.6	84 <b>Po</b> Polonium (209)		rary nan 69 <b>Tm</b> Thullum 168.9	
	15	7 3– <b>N</b> Nitrogen 14.0	15 3- <b>P</b> Phosphorus 31.0	6. 0 o.	51 3+ <b>Sb</b> 5+ Antimony 121.8	83 3+ <b>Bi</b> 5+ Bismuth 209.0	Uup* Ununpentium (288)	Tempor 68 3+ <b>Er</b> Erbium	100 3+ Fm Fermium (257)
		7 <b>N</b> itroger 14.0	15 <b>P</b> Phosph 31.0	<b>As</b> Arsenic 74.9			115 Uul (288 * Ten		
	13 14	6 <b>C</b> Carbon 12.0		4+ 32 4+ <b>Ge</b> Germanium 72.6	50 4+ <b>Sn</b> 2+ Tin 118.7	82 2+ <b>Pb</b> 4+ Lead 207.2	Uuq* Ununquadium (289)	67 3+ <b>Ho</b> Holmium 164.9	99 3+ Es Einsteinium (252)
					3+ 50 <b>Sn</b> = 118	1+ 82 3+ <b>Pb</b> Lead		+	+
		5 <b>B</b> Boron 10.8	10 11 12 Aluminum 27.0	2+ 31 3+ <b>Ga</b> Gallium 69.7	E 45	m 4.	113 <b>Uut</b> * Ununtrium (284)	rrosiu	98 3+ Cf Californium (251)
						2+ 81 1+ <b>T</b> Thal		3+ 66 4+ <b>Dy</b>	3+ 98 4+ <b>Cf</b> 0 Calif
				30 2 <b>Zn</b> Zinc 65.4	48 2 Cd Cadmium 112.4	80 2 <b>Hg</b> 1 Mercury 200.6	112 <b>Uub</b> * Ununbium (285)	65 3 4 4 4 1 Tebium 158.9	97 3 BK 4 Berkelium (247)
ents	(S)	Db synthetic		2+ 3 1+ 2 8	+ 4 0 9 +	++ ∞ <b>-</b> ≥ α		+	+ c a a
Periodic Table of the Elements	narge(			29 2 Cu copper 63.5	47 Ag Silver 107.9	79 Sold Gold 197.0	H11 Rg Roentgenium (272)	64 3. <b>Gd</b> Gadolinium 157.3	96 (Cm Curium (247)
	Number —			† † † †	<i>t.</i> ±	2++ +++ # ## +++	5.5		
f th				28 <b>Ni</b> Nickel 58.7	90.7 46 <b>Pd</b> Palladium 106.4		110 DS Darmstad (281)	63 (63 Eu Europium 152.0	95 3+ Am 4+ Americium 6+ (243)
e 0.				44	£ <del>†</del>	£ <del>†</del>		+ +	4 4 6 6 4 4 4 6 6 4 4 4 6 6 6 6 6 6 6 6
abl		O natural	6	27 <b>Co</b> Cobalt 58.9	45 <b>Rh</b> Rhodium 102.9	77	109 Mt Meitnerium (266)	62 3 <b>Sm</b> 4 Samarium	94 4+ Pu 6+ Puronium 5+ (244)
<u>:</u>				5 4 5	# 4 <sub>E</sub> _	£ 4 5 01	5 -	3+ nium	4.5 + 4.3 +
rioc			∞	26 <b>Fe</b> Iron 55.8	44 3. <b>Bu</b> 4. Ruthenium 101.1	76 <b>Os</b> Osmium 190.2	108 Hs Hassium (265)	61 3- Pm Promethium (145)	93 5+ Np 3+ Neptunium 6+ (237)
Pe			7	2+ 3+ 4+ ese	7+ tium	4 t = 2	u ()	3+ S	6+ + 4+ 0
	Atomic Symbol Name		17	25 2- <b>Mn</b> 3- Manganese 54.9	43 7 TC Technetium (98)	75 <b>Re</b> Rhenium 186.2	107 Bh Bohrium (262)	60 3- <b>Nd</b> Neodymium 144.2	92 <b>U</b> Uranium 238.0
		metalloid non-metal	9	3+ 2+	52.0 42 2+ <b>Mo</b> 3+ Molybdenum 95.9	74 6+ W Tungsten 183.8	Sg Seaborgium (263)	59 3+ <b>Pr</b> 4+ Praseodymium	91 5+ <b>Pa</b> 4+ Protactinium 231.0
	metal			24 3 <b>Cr</b> 2 Chromium 52.0	42 <b>Mo</b> Molybde 95.9			59 <b>Pr</b> Praseodyr	91 <b>Pa</b> Protactinii 231.0
			2	5+ 4+ 9	\$ <del>1</del> 2 <del>1</del> 3	73 5+ <b>Ta</b> Tantalum 180.9		£ + +	4 + 0:
				23 <b>V V</b> Vanadium 50.9				58 <b>Ce</b> Cerium 140.1	90 <b>Th</b> Thorium 232.0
			8 4	4+ 3+ 9	40 4+ <b>Zr</b> Zirconium 91.2	4+ 3.5	Ac Rf Actinium Rutherfordium (227) (261)		- <del> </del>
				22 <b>Ti</b> Titanium 47.9		La Hf Hamium Hamium 138.9		.00	Any value in parentheses is the mass of the most stable or best known isotope for elements that do not occur naturally.
				Scandium 45.0	39 × Yttrium 88.9			at 12	
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	2	4 2+ <b>Be</b> Beryllium 9.0	12 2+ <b>Mg</b> Magnesium 24.3	20 2+ <b>Ca</b> Calcium 40.1	38 2+ <b>Sr</b> Strontium 87.6	56 2+ <b>Ba</b> Barium 137.3	88 2+ <b>Ra</b> Radium (226)	s of (	paren f the knov do n
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<b>—</b>	1 1+ <b>H</b> Hydrogen 1.0	3 1+ <b>Li</b> Lithium 6.9	11 1+ Na Sodium 23.0	19 1+ <b>K</b> Potassium 39.1	37 1+ <b>Rb</b> Rubidium 85.5	55 1+ <b>Cs</b> Cesium 132.9	87 1+ <b>Fr</b> Francium (223)	ed or	Any value in parenthese is the mass of the most stable or best known iso elements that do not oc
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