2015 MUNSTER SO EVENT TEST - CHEMISTRY LAB

THIS EXAM IS NOT INTENDED FOR USE WITH ANY REFERENCE SHEETS, BINDERS, OR MATERIALS. ONLY A CALCULATOR IS REQUIRED.

hydrogen 1 H 1.0079																	helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078		scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62		yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 **	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununnilium 110 Uun [271]	unununium 111 Uuu [272]	ununbium 112 Uub [277]		ununquadium 114 Uuq [289]				

*Lanthanide series	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
**Actinide series	actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]

I. THE ATOM

Note: If you've learned any quantum mechanics, forget about it for a while. ***Think grade 9 level chem.***

Components of an atom: Electron
Neutron
Proton

1) Which component carries a positive charge? _____

2) Which component carries a negative charge? _____

3) Which component does not have mass? _____

4) Which component is not in the nucleus? _____

5) Complete the table:

Atomic #	**Element Name**	**Atomic Symbol**	**# of protons**	**# of neutrons**	**Mass #**
6	Carbon			6	
8			8	8	
				18	35

6) Sodium chloride (table salt) is composed of two atoms, sodium and chlorine atoms. This means that sodium chloride is a(n)… (circle answer)

A) element B) compound C) solution D) isotope E) ion

7) When an atom has lost or gained an electron it no longer has a neutral charge. The type of atom which carries either electrical charge is called a(n)… (circle answer)

A) element B) compound C) solution D) isotope E) ion

8) The atomic mass listed in the periodic table is not an integer (a whole number). It is a decimal number. Why?

II. CHEMISTRY SKILLS

Balance the following reactions:

1) ____ $H_{2(g)}$ + ____ $O_{2(g)}$ → ____ $H_2O_{(l)}$

2) ____ Li_3N + ____ KCl → ____ LiCl + ____ K_3N

3) ____ H_2 + ____ N_2 → ____ NH_3

4) ____ Al + ____ Br_2 → ____ $AlBr_3$

5) ____ $C_3H_{8(g)}$ + ____ $O_{2(g)}$ → ____ $CO_{2(g)}$ + ____ $H_2O_{(l)}$

6) Complete the following table:

Chemical Name	**Chemical Formula**
Sodium Chloride	
Lithium Hydride	
Calcium Carbonate	
Ammonium Nitrate	
Hypochlorous Acid	
	MgF_2
	CO_2
	CuO_2
	P_4O_{10}
	H_2SO_3

7) Copper (II) Oxide will decompose when it is heated strongly.

$4\ CuO_{(s)} \rightarrow 2\ Cu_2O_{(s)} + O_{2(g)}$

How many grams of oxygen can be obtained from 2.64 g $CuO_{(s)}$?

8.) 100. kg of glass (SiO_2) are reacted with excess carbon to produce 57.4kg silicon carbide (SiC). What is the % yield of silicon carbide? **(7pts)**

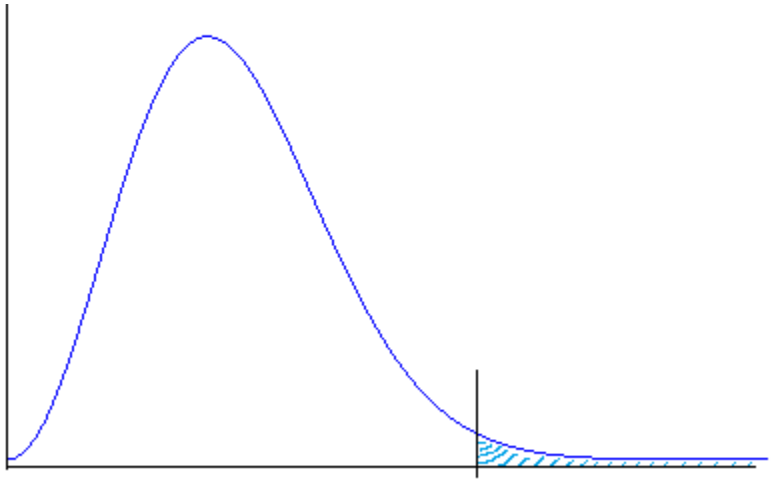
$SiO_{2\,(s)} + 3C_{(s)} \rightarrow SiC_{(s)} + 2\ CO_{(g)}$

III. Chemical Kinetics

A reaction is activated by a teacher inside the glow sticks he is using. The reaction gives off energy in the form of light. One glow stick is exposed to a cold environment, the other a warmer environment.

1. In which environment is the reaction occurring more quickly? _____

2. If this Maxwell-Boltzmann distribution represents the reacting molecules in the cold glow stick, draw a rough Maxwell-Boltzmann distribution representing the warm glow stick on the same graph below (write directly OVER the current graph, adding a 2nd line/area).



3) Given the following experimental data, find the rate law and the rate constant for the reaction:

$NO\ (g) + NO_2\ (g) + O_2\ (g) \rightarrow N_2O_5\ (g)$

Run	$[NO]_o$, M	$[NO_2[_o$, M	$[O_2]_o$, M	Initial Rate, Ms^{-1}
1	0.10 M	0.10 M	0.10 M	2.1×10^{-2}
2	0.20 M	0.10 M	0.10 M	4.2×10^{-2}
3	0.20 M	0.30 M	0.20 M	1.26×10^{-1}
4	0.10 M	0.10 M	0.20 M	2.1×10^{-2}

4) When the proper molecules collide for a reaction to take place, that reaction does not always happen. Name 2 reasons why a reaction may not occur even when reactants collide.

5. At 25°C the rate constant for a first order reaction is $2.0 \times 10^3\ s^{-1}$. The activation energy is 15.0kJ per mole. What is the rate constant at 75°C? ($R = 8.31\ J\ K^{-1}\ mol^{-1}$)

6) The mechanism of a reaction is shown below.

a) What is the overall reaction?
b) Which compounds are intermediates?
c) Predict the rate law based on this mechanism.
d) What is the overall order of the reaction?

$HOOH + I^- \rightarrow HOI + OH^-$ (slow)
$HOI + I^- \rightarrow I_2 + OH^-$ (fast)
$2OH^- + 2H_3O^+ \rightarrow 4\ H_2O$ (fast)

7) Derive the rate law that is consistent with the proposed mechanism in the formation of phosgene from Cl2 and CO. Solve for the rate constant in terms of k1, k2, and k3. What is the order of the reaction? (Equations I and II are both equilibria and should have double arrows after the first "M")

i. $Cl_2 + M = 2\ Cl + M$ (fast equilibrium, K_1)
ii. $Cl + CO + M \rightleftharpoons ClCO + M$ (fast equilibrium, K_2)
iii. $ClCO + Cl_2 \rightarrow Cl_2CO + Cl$ (slow, k_3)

The overall reaction is: $Cl_2 + CO = Cl_2CO$

IV. Reactions – Write net ionic equations matching the following descriptions.

1. Hydrochloric acid solution is treated with rubidium hydroxide solution.
2. Pentane (C_5H_{12}) is burned completely in excess oxygen gas.
3. A sample of solid iron(III) oxide is reduced completely with solid carbon.
4. Hydrazine (N_2H_4) is burned in a limited oxygen environment.
5. Equal volumes of equimolar sodium hydroxide and sulfuric acid are combined.
6. Nitric acid solution is dropped onto zinc ribbon.
7. Sodium oxide shavings are added to distilled water.
8. A solution containing silver(I) ion (an oxidizing agent) is mixed with a solution containing iron(II) ion (a reducing agent).
9. Bromine gas is bubbled into a solution of sodium iodide.
10. Phosphorus pentabromide is added to water.