CHEMISTRY 111 **Hand in this Sheet Only** NAME: _____

October 26, 2012 (Q 1-9 = 5 pts; 10 = 8 pts; 11 = 20 pts; 12 = 7 pts; 13-14 = 10 pts) EXAM #2 Version 22

1.	a	b	c	d	e	5.	a	b	c	d	e
2a.	a	b	c	d		6.	a	b	c		
2b.	a	b	c	d		7.	a	b	c	d	e
3.	a	b	c	d		8.	a	b	c	d	e
4.	a	b	c			9.	a	b	c	d	e f

10. What is the oxidation number of U in UO_3 : _____ Oxidation number of S in HSO_3^- : _____

Given the reaction, $Cu^{2+}(aq) + H_2(g) \rightarrow Cu(s) + 2\ H^+(aq)$

Which element is oxidized? _____ Which element is reduced? _____

What is the oxidizing agent? _____ What is the reducing agent? _____

11. For each of the following, write *the net ionic equation* for the reaction that occurs between the given reactants. If no reaction occurs, write "No Reaction." 5 points each.

a. $NaCl + Pb(NO_3)_2$

_____

b. $HCl + Ca_3(PO_4)_2$

_____

c. $HCl + NH_3$

_____

d. $Na_2CO_3 + HNO_3$

_____

12. The heating curves for water and benzene are shown here. Answer the following questions regarding them.

Part 1. Which has the greater heat of fusion?

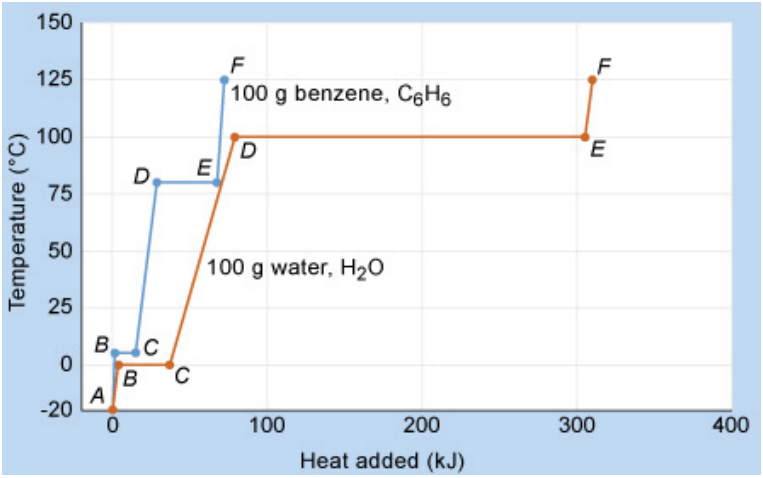
water or benzene

Part 2. From segment D to E for water, what type of energy (if any) is increasing?

a) no energy increase
b) kinetic energy
c) potential energy
d) both kinetic and potential energy

Part 3. Which has the higher melting point?

water or benzene



13. A titration is performed to determine the molar mass of an unknown monoprotic acid. A solution of 0.122 M NaOH is used to titrate 1.082 grams of acid. If 39.9 mL of the NaOH solution are required to titrate the acid, what is the molar mass of the acid?

14. When 10.0 g KOH is dissolved in 100.0 g of water in a coffee-cup calorimeter, the temperature rises from 25.18 °C to 47.53 °C. What is the enthalpy change per gram of KOH dissolved in the water? Assume that the solution has a specific heat capacity of 4.18 J/g·°C.

CHEMISTRY 111 **TAKE THIS PART WITH YOU WHEN DONE** NAME: _____

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1. What mass of $Na_2C_2O_4$ (Molar mass 134.0 g/mol) is needed to prepare 500 mL of a 0.0622 M solution?

a) 1.04 g b) 4.17 g c) 10.7 g d) 8.33 g e) 0.834 g

2a) What type of reaction is each of the following?

$$CaO(s) + CO_2(g) \rightarrow CaCO_3(s)$$

a) decomposition b) combination c) single displacement d) double displacement

2b) $Zn(s) + CuCl_2(aq) \rightarrow ZnCl_2(aq) + Cu(s)$

a) decomposition b) combination c) single displacement d) double displacement

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3. Which of the following are insoluble in water: $FeSO_4$, $CaCO_3$, H_3PO_4

a) all of them b) none of them c) only $CaCO_3$ d) $CaCO_3$ and H_3PO_4

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4. 5.00 grams of glass at 80 ^oC is brought into contact with 5.00 g of wood at 20 ^oC. When thermal equilibrium is reached, both objects are at a temperature of 39 ^oC. Which has a greater specific heat capacity?

a) glass b) wood c) not enough information is given to answer

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5. Determine the heat of vaporization of titanium(IV) chloride,

$TiCl_4\ (\vartheta) \rightarrow TiCl_4\ (g)$ $\Delta H° = ?$

given the enthalpies of reaction below.

$Ti(s) + 2\ Cl_2(g) \rightarrow TiCl_4(\vartheta)$ $\Delta H° = -804.2$ kJ

$Ti(s) + 2\ Cl_2(g) \rightarrow TiCl_4(g)$ $\Delta H° = -763.2$ kJ

a) -1567.4 kJ b) -41.0 kJ c) +1.054 kJ d) +41.0 kJ e) +1567.4 kJ

6. Wood is burning in a fireplace. This reaction is...

a) endothermic b) exothermic c) not enough information is given to answer

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7. Which of the following chemical equations corresponds to the standard molar enthalpy of formation of SO_3?

a) $SO_2(g) + ½\ O_2(g) \rightarrow SO_3(g)$

b) $2\ SO_2(g) + O_2(g) \rightarrow 2\ SO_3(g)$

c) $S(s) + 12\ O_2(g) \rightarrow 8\ SO_3(g)$

d) $2\ S(s) + 3\ O_2(g) \rightarrow 2\ SO_3(g)$

e) $S(s) + 3/2\ O_2(g) \rightarrow SO_3(g)$

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8. Calculate $\Delta H°$ for the combustion of gaseous dimethyl ether,

$$CH_3OCH_3(g) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 3\ H_2O(\text{ℌ})$$

using standard molar enthalpies of formation.

molecule	$\Delta H_f°$ (kJ/mol)
$CH_3OCH_3(g)$	-184.1
$CO_2(g)$	-393.5
$H_2O(\text{ℌ})$	-285.8

a) -76.4 kJ b) -495.2 kJ c) -863.4 kJ d) -1460.3 kJ e) -1828.5 kJ

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9. You have an unlabeled vial that contains one of the following solutions:

You mix portions of this solution with each of the following other solutions and observe the following results:

Mix with:	KCl	Na_2SO_4	$Pb(NO_3)_2$	NaOH	HCl
Observe:	no reaction	precipitate	precipitate	precipitate	no reaction

Which of the following could be the unknown solution?

a) $AgNO_3(aq)$ d) $Na_2CO_3(aq)$

b)NaCl(aq) e) HCl(aq)

c) $CaCl_2(aq)$ f) $Ba(NO_3)_2(aq)$

Solubility Rules

SOLUBLE COMPOUNDS	EXCEPTIONS
Almost all salts of Na^+, K^+, NH_4^+	
Salts of nitrate, NO_3^- chlorate, ClO_3^- perchlorate, ClO_4^- acetate, $CH_3CO_2^-$	
Almost all salts of Cl^-, Br^-, I^-	Halides of Ag^+, Hg_2^{2+}, Pb^{2+}
Compounds containing F^-	Fluorides of Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Pb^{2+}
Salts of sulfate, SO_4^{2-}	Sulfates of Ca^{2+}, Sr^{2+}, Ba^{2+}, Pb^{2+}, Ag^+

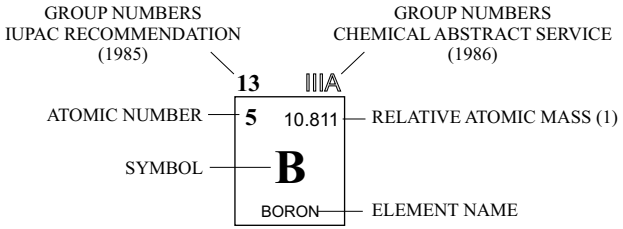
INSOLUBLE COMPOUNDS	EXCEPTIONS
Most salts of carbonate, CO_3^{2-} phosphate, PO_4^{3-} oxalate, $C_2O_4^{2-}$ chromate, CrO_4^{2-}	Salts of NH_4^+ and the alkali metal cations Na^+, K^+ are exceptions for all of these
Most metal sulfides, S^{2-}	BaS is soluble
Most metal hydroxides OH^- and oxides O^{2-}	$Ba(OH)_2$ is soluble

Weak Acids	Weak Bases
CH_3COOH	CH_3COO^-
NH_4^+	NH_3
H_2CO_3	CO_3^{2-}
$H_2C_2O_4$	$C_2O_4^{2-}$
H_2SO_3	SO_3^{2-}
H_2S	S^{2-}
H_3PO_4	PO_4^{3-}
HCN	CN^-
HF	F^-
NHO_2	NO_2^-
HClO	ClO^-

$$\Delta H^o_{rxn} = \sum \Delta H^o_f(\text{products}) - \sum \Delta H^o_f(\text{reactants})$$

PERIODIC TABLE OF THE ELEMENTS

http://www.ktf-split.hr/periodni/en/



PERIOD	1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8	9 VIIIB	10	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIIIA
1	1 1.0079 **H** HYDROGEN																	2 4.0026 **He** HELIUM
2	3 6.941 **Li** LITHIUM	4 9.0122 **Be** BERYLLIUM											5 10.811 **B** BORON	6 12.011 **C** CARBON	7 14.007 **N** NITROGEN	8 15.999 **O** OXYGEN	9 18.998 **F** FLUORINE	10 20.180 **Ne** NEON
3	11 22.990 **Na** SODIUM	12 24.305 **Mg** MAGNESIUM											13 26.982 **Al** ALUMINIUM	14 28.086 **Si** SILICON	15 30.974 **P** PHOSPHORUS	16 32.065 **S** SULPHUR	17 35.453 **Cl** CHLORINE	18 39.948 **Ar** ARGON
4	19 39.098 **K** POTASSIUM	20 40.078 **Ca** CALCIUM	21 44.956 **Sc** SCANDIUM	22 47.867 **Ti** TITANIUM	23 50.942 **V** VANADIUM	24 51.996 **Cr** CHROMIUM	25 54.938 **Mn** MANGANESE	26 55.845 **Fe** IRON	27 58.933 **Co** COBALT	28 58.693 **Ni** NICKEL	29 63.546 **Cu** COPPER	30 65.39 **Zn** ZINC	31 69.723 **Ga** GALLIUM	32 72.64 **Ge** GERMANIUM	33 74.922 **As** ARSENIC	34 78.96 **Se** SELENIUM	35 79.904 **Br** BROMINE	36 83.80 **Kr** KRYPTON
5	37 85.468 **Rb** RUBIDIUM	38 87.62 **Sr** STRONTIUM	39 88.906 **Y** YTTRIUM	40 91.224 **Zr** ZIRCONIUM	41 92.906 **Nb** NIOBIUM	42 95.94 **Mo** MOLYBDENUM	43 (98) **Tc** TECHNETIUM	44 101.07 **Ru** RUTHENIUM	45 102.91 **Rh** RHODIUM	46 106.42 **Pd** PALLADIUM	47 107.87 **Ag** SILVER	48 112.41 **Cd** CADMIUM	49 114.82 **In** INDIUM	50 118.71 **Sn** TIN	51 121.76 **Sb** ANTIMONY	52 127.60 **Te** TELLURIUM	53 126.90 **I** IODINE	54 131.29 **Xe** XENON
6	55 132.91 **Cs** CAESIUM	56 137.33 **Ba** BARIUM	57-71 **La-Lu** Lanthanide	72 178.49 **Hf** HAFNIUM	73 180.95 **Ta** TANTALUM	74 183.84 **W** TUNGSTEN	75 186.21 **Re** RHENIUM	76 190.23 **Os** OSMIUM	77 192.22 **Ir** IRIDIUM	78 195.08 **Pt** PLATINUM	79 196.97 **Au** GOLD	80 200.59 **Hg** MERCURY	81 204.38 **Tl** THALLIUM	82 207.2 **Pb** LEAD	83 208.98 **Bi** BISMUTH	84 (209) **Po** POLONIUM	85 (210) **At** ASTATINE	86 (222) **Rn** RADON
7	87 (223) **Fr** FRANCIUM	88 (226) **Ra** RADIUM	89-103 **Ac-Lr** Actinide	104 (261) **Rf** RUTHERFORDIUM	105 (262) **Db** DUBNIUM	106 (266) **Sg** SEABORGIUM	107 (264) **Bh** BOHRIUM	108 (277) **Hs** HASSIUM	109 (268) **Mt** MEITNERIUM	110 (281) **Uun** UNUNNILIUM	111 (272) **Uuu** UNUNUNIUM	112 (285) **Uub** UNUNBIUM		114 (289) **Uuq** UNUNQUADIUM				

LANTHANIDE

57 138.91 **La** LANTHANUM	58 140.12 **Ce** CERIUM	59 140.91 **Pr** PRASEODYMIUM	60 144.24 **Nd** NEODYMIUM	61 (145) **Pm** PROMETHIUM	62 150.36 **Sm** SAMARIUM	63 151.96 **Eu** EUROPIUM	64 157.25 **Gd** GADOLINIUM	65 158.93 **Tb** TERBIUM	66 162.50 **Dy** DYSPROSIUM	67 164.93 **Ho** HOLMIUM	68 167.26 **Er** ERBIUM	69 168.93 **Tm** THULIUM	70 173.04 **Yb** YTTERBIUM	71 174.97 **Lu** LUTETIUM

ACTINIDE

89 (227) **Ac** ACTINIUM	90 232.04 **Th** THORIUM	91 231.04 **Pa** PROTACTINIUM	92 238.03 **U** URANIUM	93 (237) **Np** NEPTUNIUM	94 (244) **Pu** PLUTONIUM	95 (243) **Am** AMERICIUM	96 (247) **Cm** CURIUM	97 (247) **Bk** BERKELIUM	98 (251) **Cf** CALIFORNIUM	99 (252) **Es** EINSTEINIUM	100 (257) **Fm** FERMIUM	101 (258) **Md** MENDELEVIUM	102 (259) **No** NOBELIUM	103 (262) **Lr** LAWRENCIUM

(1) Pure Appl. Chem., **73**, No. 4, 667-683 (2001)

Relative atomic mass is shown with five significant figures. For elements have no stable nuclides, the value enclosed in brackets indicates the mass number of the longest-lived isotope of the element.

However three such elements (Th, Pa, and U) do have a characteristic terrestrial isotopic composition, and for these an atomic weight is tabulated.

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