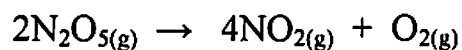


Exit Exam (Written Portion)

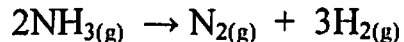
Name _____

Get at least 3/5 correct to pass.

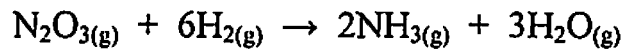
1) For the below reaction, the rate of disappearance of $\text{N}_2\text{O}_{5(\text{g})}$ at a certain temperature is $0.016 \text{ mol.L}^{-1}.\text{min}^{-1}$. What is the rate of formation of $\text{NO}_{2(\text{g})}$ in $\text{mol.L}^{-1}.\text{min}^{-1}$ at the same temperature ?



2) The standard enthalpy of formation of $\text{NH}_{3(\text{g})}$ is $-46.1 \text{ kJ.mol}^{-1}$. Calculate ΔH^0 for the following reaction.



3) According to the below equation, how many moles of $\text{NH}_3(\text{g})$ could be formed from the reaction of 0.22 moles of $\text{N}_2\text{O}_3(\text{g})$ with 0.87 moles of $\text{H}_2(\text{g})$?



4) In a solution of formic acid ($K_a = 1.7 \times 10^{-4}$), the $[H^+] = 2.3 \times 10^{-3}$. What is the concentration of formic acid in mol.L^{-1} ?

5) A sample of C_2H_6 gas initially at $50.0^\circ C$ and 720mmHg is heated to $100^\circ C$ in a container at constant volume. What is the new pressure (in mmHg) ?

ABBREVIATIONS AND SYMBOLS			
ampere	A	Faraday constant	<i>F</i>
atmosphere	atm	formula molar mass	<i>M</i>
atomic mass unit	u	free energy	<i>G</i>
atomic molar mass	<i>A</i>	frequency	<i>v</i>
Avogadro constant	<i>N_A</i>	gas constant	<i>R</i>
Celsius temperature	°C	gram	g
centi- prefix	c	heat capacity	<i>C_p</i>
coulomb	C	hour	h
electromotive force	<i>E</i>	joule	J
energy of activation	<i>E_a</i>	kelvin	K
enthalpy	<i>H</i>	kilo- prefix	k
entropy	<i>S</i>	liter	L
equilibrium constant	<i>K</i>	milli- prefix	m
		molal	<i>m</i>
		molar	<i>M</i>
		molar mass	<i>M</i>
		mole	mol
		Planck's constant	<i>h</i>
		pressure	<i>P</i>
		rate constant	<i>k</i>
		retention factor	<i>R_f</i>
		second	s
		temperature, K	<i>T</i>
		time	<i>t</i>
		volt	V

CONSTANTS
$R = 8.314 \text{ J}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$
$R = 0.0821 \text{ L}\cdot\text{atm}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$
$1 \text{ F} = 96,500 \text{ C}\cdot\text{mol}^{-1}$
$1 \text{ F} = 96,500 \text{ J}\cdot\text{V}^{-1}\cdot\text{mol}^{-1}$
$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$
$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$
$c = 2.998 \times 10^8 \text{ m}\cdot\text{s}^{-1}$
$0^\circ\text{C} = 273.15 \text{ K}$
$1 \text{ atm} = 760 \text{ mmHg}$

EQUATIONS		
$E = E^\circ - \frac{RT}{nF} \ln Q$	$\ln K = \left(\frac{-\Delta H^\circ}{R} \right) \left(\frac{1}{T} \right) + \text{constant}$	$\ln \left(\frac{k_2}{k_1} \right) = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$

PERIODIC TABLE OF THE ELEMENTS

1	18																
1A															8A		
1 H 1.008	2 He 4.003																
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (263)	109 Mt (266)	110 (269)	111 (272)	112 (277)	114 (277)					

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)

Exit Exam (Written Portion)

Name EXIT EXAM #3

Get at least 3/5 correct to pass.

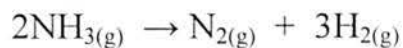
1) For the below reaction, the rate of disappearance of $\text{N}_2\text{O}_5(\text{g})$ at a certain temperature is $0.016 \text{ mol}\cdot\text{L}^{-1}\cdot\text{min}^{-1}$. What is the rate of formation of $\text{NO}_2(\text{g})$ in $\text{mol}\cdot\text{L}^{-1}\cdot\text{min}^{-1}$ at the same temperature?



Disappears at 0.016, from stoichiometry, ratio of $\text{N}_2\text{O}_5 : \text{NO}_2$
= 2 : 4

So rate of formation of $\text{NO}_2 = 0.016 \times \frac{4}{2} = \underline{\underline{0.032 \text{ mol}\cdot\text{L}^{-1}\cdot\text{min}^{-1}}}$
(2 sig figs)

2) The standard enthalpy of formation of $\text{NH}_3(\text{g})$ is $-46.1 \text{ kJ}\cdot\text{mol}^{-1}$. Calculate ΔH° for the following reaction.



$$\Delta H^\circ = (\Delta H_f^\circ \text{ PRODUCTS}) - (\Delta H_f^\circ \text{ REACTANTS})$$

$$= 0 - (2 \times -46.1)$$

$$= \underline{\underline{92.2 \text{ kJ/mol}}}$$

(3 sig figs)

3) According to the below equation, how many moles of $\text{NH}_3(\text{g})$ could be formed from the reaction of 0.22 mol of $\text{N}_2\text{O}_3(\text{g})$ with 0.87 mol of $\text{H}_2(\text{g})$?



$$\text{Moles of } \text{N}_2\text{O}_3 = 0.22$$

$$\text{Moles of } \text{H}_2 = 0.87$$

$$\text{Stoichiometry of } \text{N}_2\text{O}_3 : \text{H}_2 = 1 : 6$$

$$\therefore \text{limiting reagent is } \text{H}_2 \quad (0.22 \times 6 = 1.32)$$

$$\begin{aligned} \text{Ratio of } \text{NH}_3 : \text{H}_2 &= 2 : 6 \\ &= 1 : 3 \end{aligned}$$

$$\therefore \text{moles of } \text{NH}_3 = \frac{0.87}{3} = \underline{\underline{0.29 \text{ moles}}}$$



4) In a solution of formic acid ($K_a = 1.7 \times 10^{-4}$), the $[\text{H}^+] = 2.3 \times 10^{-3}$. What is the concentration of formic acid in mol.L^{-1} ?

$$K_a = \frac{[\text{H}^+][\text{HCO}_2^-]}{[\text{HCO}_2\text{H}]}$$



$$= 1.7 \times 10^{-4} = \frac{2.3 \times 10^{-3} \cdot 2.3 \times 10^{-3}}{[\text{HCO}_2\text{H}]}$$

$$\therefore [\text{HCO}_2\text{H}] = \underline{\underline{0.031 \text{ mol.L}^{-1}}}$$

5) A sample of C_2H_6 gas initially at $50.0^\circ C$ and 720mmHg is heated to $100^\circ C$ in a container at constant volume. What is the new pressure (in mmHg)?

$$P_1 V_1 = n R T_1$$

↓
 $V_1 = V_2$

$$\frac{720}{760} \cdot V_1 = n \cdot R \cdot (50.0 + 273.15)$$

$$\text{so } \frac{V_1}{n \cdot R} = 341.102$$

$$P_2 V_2 = n R T_2 \quad \text{and } V_1 = V_2 \quad \text{and } \frac{V_1}{n \cdot R} = 341.102$$

$$\text{so } \frac{V_2}{n R} = \frac{T_2}{P_2} = \frac{(100 + 273.15)}{P_2} = 341.102$$

$$\text{so } P_2 = 1.09 \text{ atm}$$

$$= \underline{\underline{831 \text{ mmHg}}} \quad (\text{3 sig figs})$$