
2007 UNITED STATES NATIONAL CHEMISTRY OLYMPIAD

PART III — LABORATORY PRACTICAL

Student Instructions

Introduction

These problems test your ability to design and carry out laboratory experiments and to draw conclusions from your experimental work. You will be graded on your experimental design, on your skills in data collection, and on the accuracy and precision of your results. Clarity of thinking and communication are also components of successful solutions to these problems, so make your written responses as clear and concise as possible.

Safety Considerations

You are required to wear approved eye protection at all times during this laboratory practical. You also must follow all directions given by your examiner for dealing with spills and with disposal of wastes.

Lab Problem 1

You have been given seven pipets that contain solutions of AgNO_3 , BaCl_2 , $\text{Cu}(\text{NO}_3)_2$, CuSO_4 , $\text{Pb}(\text{NO}_3)_2$, KI , and $\text{Na}_2\text{S}_2\text{O}_3$, though not necessarily in this order. Using the materials provided, devise and carry out an experiment to correctly determine the contents of each pipet.

Lab Problem 2

Given a sample of an unknown metal carbonate, M_xCO_3 , and 3.0M hydrochloric acid, $\text{HCl}(\text{aq})$, a balloon, and some laboratory equipment, devise and carry out an experiment by combining these two substances to determine the volume of the gas produced *and* the unknown metal. The possible metals are Ba, Ca, Li, or Na.

Room Temp. = 25°C, Standard Pressure = 1 atm

Answer Sheet for Laboratory Practical Problem 1

Student's Name: _____

Student's School: _____ **Date:** _____

Proctor's Name: _____

ACS Section Name : _____ **Student's USNCO test #:** _____

1. Give a brief description of your experimental plan.

Before beginning your experiment, you must get approval (for safety reasons) from the examiner.
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Examiner's Initials:

2. Record your data and other observations.

3. Based on your observations, write the relevant equations that led to your conclusions.

4. Conclusions

Pipet	Contents	Justification
#1		
#2		
#3		
#4		
#5		
#6		
#7		

Answer Sheet for Laboratory Practical **Problem 2**

Student's Name: _____

Student's School: _____ **Date:** _____

Proctor's Name: _____

ACS Section Name : _____ **Student's USNCO test #:** _____

1. Give a brief description of your experimental plan.

Before beginning your experiment, you must get approval (for safety reasons) from the examiner.	Examiner's Initials:
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2. Record your data and other observations.

3. Calculations and Conclusions.

4. Conclusions: The volume of gas produced:

The unknown metal:

5. Sources of Error in this experiment (please number):

PERIODIC TABLE OF THE ELEMENTS

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											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 181.0	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 226.0	89 Ac 227.0	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 Ds (269)	111 Rg (272)	112 Uub (277)		114 Uuq (277)		116 Uuh (277)		118 Uuo (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 237.0	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 (260)