MELBOURNE HIGH SCHOOL

YEAR 11

UNIT TWO CHEMISTRY

2006

MARKED PRACTICAL REPORTS

Name ____

Teacher ____ Chem group: _______

1. **Unless a statement to the contrary appears at the start of a specific exercise, all reports must be TOTALLY UNMARKED when the experimental work is being performed.**

2. **Only results and observations are to be written in the instruction booklet. The instruction booklet is NOT TO BE ANNOTATED in any way.**

3. **This booklet (and parts thereof) must remain on a table at the front of the room during class time - it must NOT be taken to the prac. benches.**

4. **Apart from graphs, all entries in this document must be made in INK.**

This booklet contains blank report forms for the 4 marked practical exercises that constitute 50% of your Multiskilling grade for Unit 2.

The writing up is to be done in class in **absolute silence** and without any reference to other students, notes, texts, etc. **This procedure is used for the SAC pracs in Units 3 & 4 in this school.**
It is strongly recommended that you are fully prepared for each exercise – this includes having thought about the answers to the questions before the class in which the practical exercise is being performed and reported.

The marked exercises in Unit 2 are: (but are presented in reverse order): **Do not tear out pages**

- empirical formula of magnesium oxide
- precipitation of calcium carbonate in order to determine the calcium chloride content of a solution
- acid content of vinegar
- determination of the molar volume of hydrogen

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2006 DETERMINATION OF THE MOLAR VOLUME OF HYDROGEN

Name : ______________________________ Partner : ______________________________ Chem Group: ____

All entries in this document must be made in ink.

H = 1.0, C = 12.0, O = 16.0, Mg = 24.3 density of magnesium = 1.71 g cm^{-3} R = 8.31 J K^{-1} mol^{-1}

Results and observations

- Observations

- Mass of cleaned magnesium ________________ g

- Volume of moist hydrogen ________________ mL

- Temperature ________________ °C = ________________ K

- Measured pressure ________________ kPa

Calculations

Note: You are NOT PERMITTED to use the accepted molar volume anywhere in your calculations. This figure must be your final answer – or, more likely, an approximation to it will be your final answer.

① Write equations for the reaction used in this exercise.

molecular ____

ionic ____

② Use Dalton's Law of Partial Pressures [ie $p_{total} = p_1 + p_2 + p_3 + ...$] and the table of saturated vapour pressures supplied to calculate the partial pressure of dry hydrogen. (Remember that the partial pressure of dry hydrogen is the contribution to the measured pressure that is due to hydrogen; or, putting it another way, it is what the pressure would be if hydrogen were the only gas in the container.)

③ Using this result, convert your measured volume of hydrogen to the volume at SLC that this hydrogen would occupy. [Note: the presence of water vapour does not affect the volume occupied by the hydrogen.]

④ Using your mass of magnesium, calculate the amount (in mol) of magnesium reacting with the hydrochloric acid.

⑤ Use the molecular equation to calculate the amount of hydrogen produced by this amount of magnesium.

⑥ Using your answers to steps ③ and ⑤, calculate the molar volume of hydrogen (in L mol^{-1}) at SLC.

<u>Questions</u>

➊ Why is it necessary to clean the magnesium ribbon at the beginning of the exercise?

❷ Why is copper wire, rather than iron wire, used to hold the magnesium in place in the funnel?

❸ Despite initially using concentrated hydrochloric acid, why is it safe to immerse your hand in the acid solution after the reaction is complete?

❹ Suggest **two** reasons why your calculated molar volume and the accepted molar volume of any gas at SLC might be different.

❺ Why does hydrogen gas behave as an ideal gas at high temperatures and low pressures?

❻. On an unknown planet a pure sample of hydrogen gas is placed in 450 litre balloon at a pressure of 80 kPa at a temperature of 23^{o}C and allowed to ascend skywards. At an altitude of 2,330m the volume of the balloon is recorded to be 350 litres and the pressure 30 kPa. What is the temperature at 2,330m?

❼ A mixture of gases contains 88 grams of carbon dioxide (CO_2) and 96 grams of oxygen (O_2) gas. If the pressure of the mixture is 150 kPa find the partial pressure of each gas.

❽ Calculate the mass of oxygen gas (O_2) that expands to a volume of 33.6L at 0 ^{o}C and 1.0 atm pressure.

End of report

<u>Marks</u>

• observations	(1)	
• results	(1)	
• calculations	(5),	① equations -1, ② - $^{1}/_{2}$, ③ - 1, ④ - 1, ⑤ - $^{1}/_{2}$, ⑥ - 1
• Questions	(8)	❶ & ❷ - ½ each, ❸ to ❺ - 1 each, ❻ - 2, ❼ & ❽ - 1 each
• **total**	**(15)**	

2006 ACID CONTENT OF VINEGAR

Name : ______________________________ Partner : _______________________________ Chem Group: ____

All entries in this document must be made in ink.

H = 1.0 C = 12.0 O = 16.0 Na = 23.0

Results

Brand of vinegar analysed ____

Volume of vinegar bottle _________________________

Cost of bottle of vinegar _________________________

Concentration of NaOH solution used. ______________________

Titration	1	2	3
Mass of vinegar (g)			
Final reading (mL)			
Initial reading (mL)			
Titre (mL)			

Calculations **(Show all working)**

① Write a molecular equation for the reaction between ethanoic acid (acetic acid) and sodium hydroxide.

____

② For **each titration**, calculate

- the amount (in mol) of NaOH titrated

- the amount of ethanoic acid in the conical flask

- the mass of ethanoic acid in the conical flask

- the concentration of ethanoic acid in the vinegar as a percentage by mass

③ What is the average concentration of ethanoic acid in the vinegar as a percentage by mass?

④ Use the answer from ③ to calculate the volume of vinegar that would contain 1.00 g of ethanoic acid.

⑤ Hence, calculate the cost of 1.00 g of ethanoic acid in your brand of vinegar

Discussion

❶ Use the class results indicate which brand is the best value for money in terms of ethanoic acid content. Indicate % difference between brands

(Your teacher will place a table on the board for each group to complete. Place values into the table in your Practical Work booklet and determine the average cost for each brand.).

❷ Convert your molecular equation into an ionic equation.

____

❸ Identify the Lowry-Brønsted acids in your ionic equation. ____________________

❹ Suggest 2 possible sources of error in the exercise relating to experimental procedure.

End of report

Marks

- results (2) results - 1, table – 1
- calculations (5) ① molecular equation – 1, ② -(4 x $^1/_2$ =) 2, ③ - $^1/_2$, ④ - 1, ⑤ - $^1/_2$
- discussion (3) ❶ - 1, ❷ - $^1/_2$, ❸ - $^1/_2$, ❹ - 1

total (10)

2006 PRECIPITATION OF CALCIUM CARBONATE IN ORDER TO DETERMINE THE CALCIUM CHLORIDE CONCENTRATION OF A SOLUTION

Name : ______________________________ Partner : ______________________________ Chem Group: ____

All entries in this document must be made in ink.

C = 12.0 O = 16.0 Na = 23.0 Cl = 35.5 Ca = 40.1

Results and observations

① Observations:

② Mass of named filter paper ____________________

③ Mass of dried filter paper and calcium carbonate ____________________

④ Mass of dry calcium carbonate ____________________

⑤ Molar mass of i. calcium carbonate ____________________

ii. calcium chloride ____________________

Calculations (Show all working)

Note: 0.4 M is the approximate concentration of the $CaCl_2$ solution. This figure must not be used anywhere in your calculations. Your aim is to determine the actual concentration of the solution.

① Write the molecular equation for the reaction.

____

② Calculate the amount (in mole) of calcium carbonate produced.

…/over

③ Hence, what amount of calcium chloride would have reacted to produce this amount of calcium carbonate?

④ Using your answer to ③ above, determine the mass of calcium chloride in 20.00 mL of calcium chloride solution.

⑤ Calculate the concentration of the original calcium chloride solution in

- mol/L

- g/L

Questions

❶ Convert your molecular equation to an ionic equation.

____

❷ How would your mass of dried calcium carbonate be different if you had not washed your precipitate before drying it? Explain your reasoning.

❸ Why was a pipette used deliver the calcium chloride solution whereas a less precise measuring cylinder was suitable for delivering the sodium carbonate solution?

❹ Describe the procedure used for rinsing the pipette in this experiment and explain why this procedure is used.

❺ Last year one group of students, who completed this prac, obtained a dry mass of 7.523 g for the $CaCO_3(s)$ they collected. The concentration of the $CaCl_2$ solution was 0.397 M and the volume used was the same as this prac.

a. Is the mass obtained more or less than expected? Show working

b. Give two possible reasons for the discrepancy. These reasons must be based on experimental procedures.

End of report

Marks

- observations (1)
- results (1)
- calculations (5) ① molecular equation – 1, ② to ⑤ - 1 each. (all working must be clearly set out)
- questions (8) ❶ to ❸ - 1 each, ❹ 1 + 1, ❺ 1 + 2
- **total** **(15)**

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2006 EMPIRICAL FORMULA OF MAGNESIUM OXIDE

Name : ______________________________ Partner : _______________________________ Chem Group: ____

Results

Mass of clean crucible and lid _____________ g

Mass of crucible, lid and cleaned magnesium ribbon _____________ g

∴ Mass of magnesium _____________ g

Mass of crucible, lid and magnesium oxide _____________ g

∴ Mass of magnesium oxide _____________ g

∴ Mass of oxygen reacted with the magnesium _____________ g

Calculations Molar masses: O = 16.0 Mg = 24.3 Al = 27.0

$n_{Mg} : n_O$

$= m_{Mg} / M_{Mg} : m_O / M_O$

= ____________ / 24.3 : _______________ / 16.0

= ____________ : _______________

= ____________ : _______________

⇒ from my calculations, the empirical formula of magnesium oxide is _________________ and

the accepted empirical formula of magnesium oxide is __________________ .

Questions

❶. Why was the magnesium ribbon cleaned with steel wool or emery paper before being weighed?

❷. How could you ensure that all the magnesium had reacted?

❸. If some magnesium had remained unreacted, what would be the effect on your calculated n_{MgO} : n_O ratio and thus your empirical formula?

❹. Why must the crucible be cooled before being reweighed?

❺. The percentage by mass of aluminium in alumina (aluminium oxide) is 52.9%. What mass of aluminium could theoretically be extracted from 800 tonnes of alumina? (1 tonne = 1 x 10^6 g)

End of report

Marks

• results	(2)	
• calculations	(2)	
• questions	(6)	❶ - 1, ❷ - 1, ❸ - 2, ❹ - 1, ❺ - 1
• **total**	**(10)**	