



Course Name: Chemistry 20 OL
Assignment: Unit B Summative Part B

Alberta Student Number: _____

Name: _____

Student Questions or Comments:

For Vista Virtual School Use Only

GRADE CALCULATIONS		
	MARKS	
	Earned	Maximum
Mark		55
Percent	%	

Date Received:

Assigned Teacher:

Marked By:

Date:

Teacher Notes:

- You must show all your work for each question.
- Include units in your answer and respond with the correct number of significant digits.
- The Alberta Education Chem 20/30 Data Booklet is required to complete this assignment.

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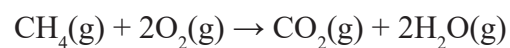
Vista Virtual School
New: September 2019

Total **Answer all questions and show all work for full marks.**
55

- 3
1. Albertans experience extreme temperature ranges from summer months to winter months. The air pressure inside a car tire in summer at $25.0\text{ }^{\circ}\text{C}$ is 310 kPa . If the volume remains fixed, what is the pressure in the winter at $-30.0\text{ }^{\circ}\text{C}$?
- 3
2. A balloon is filled with pure oxygen gas for a demonstration in a Chemistry 20 classroom. What is the predicted volume for a balloon containing 2.50 g of oxygen gas at SATP?

- ④ 3. A scientist isolates 2.366 g of a gas. The sample occupies a volume of 800.0 mL at 78.00 °C and 103.0 kPa. If the scientist uses the data, what is the calculated molar mass of the gas?

- ② 4. Methane is burned in a complete combustion reaction.



What volume of water vapor is produced when 56.0 L of methane is burned in a complete combustion reaction? Assume all volumes are measured under SATP conditions.

- 3 5. A weather balloon with a volume of 7.00 L at a pressure of 758 mm Hg and a temperature of 21.0 °C is released into the atmosphere. Calculate the final volume of the balloon when it reaches a level in the atmosphere with a pressure of 465 mm Hg and a temperature of -15.0 °C.

Use the following information to answer the questions 6 and 7.

A hyperbaric chamber may be used by sports teams to treat their injured players because it seems to speed the healing process. The reason for quicker healing of injuries may have to do with the extra supply of oxygen to the injured cells.

For the following, circle the words that correctly completes each statement.

- 1 6. Oxygen gas most closely exhibits **ideal** behaviour under conditions of (high / low) temperature and (high / low) pressure.
- 1 7. Taking into account that standard pressure is about 100 kPa, what would happen to the amount of oxygen available to cells if the chamber pressure had a pressure of 120 kPa? The oxygen level in the cells would (increase / decrease) by about 20% because the same amount of oxygen would take up 20% (less / more) space.

Use the following information to answer question 8.

Nitric acid, $\text{HNO}_3(\text{aq})$, is an important industrial chemical. Large quantities are required for the production of fertilizers such as ammonium nitrate, $\text{NH}_4\text{NO}_3(\text{s})$.

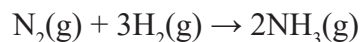
Numerical Response

- ① 8. One step in production of $\text{HNO}_3(\text{aq})$ occurs at a temperature of $850\text{ }^\circ\text{C}$. This temperature corresponds to a Kelvin temperature of _____ K.

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Use the following information to answer the question 9.

The manufacture of fertilizers is by far one of the most important uses of ammonia. Large quantities of ammonia gas can be produced in a catalyzed reaction of nitrogen and hydrogen.



- ① 9. The coefficients in the balanced equation for the production of $\text{NH}_3(\text{g})$ can be interpreted to correspond to which of the following equation quantities? Please select **all** that apply.
- ☐ masses
 - ☐ moles
 - ☐ molecules
 - ☐ volumes

Numerical Response

For this question, show your work and record your final answer in the format requested.

- ② 10. At 350 °C and 101.325 kPa, the volume occupied by 48.00 mol of $\text{NH}_3(\text{g})$ is $a.bc \times 10^d \text{ L}$.
The values of a , b , c , and d are _____, _____, _____, and _____.
(Record your four-digit answer.)

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- ③ 11. Carbon dioxide gas can be pumped into coal seams underground to release trapped methane gas. Calculate the molar volume of carbon dioxide gas at 700 °C and 6500 kPa.

Use the following information to answer the next questions 12 and 13.

A student measured the volume of a sample of air at different temperatures. All measurements were taken at 1 atm. The observations were recorded in a data table.

The Volume of an Air Sample at Various Temperatures

Temperature (°C)	Volume (L)
0	15.0
20	16.1
40	17.2
60	18.3

- 3 12. Identify the manipulated, responding, and two controlled variables in the investigation described above.

Manipulated: _____

Responding: _____

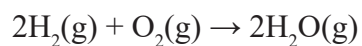
Controlled: _____

- 1 _____ 13. After analyzing the data, the student could conclude that

- A. volume divided by the temperature, in degrees Celsius, is a constant
- B. temperature, in degrees Celsius, times the volume is a constant
- C. volume divided by the temperature, in Kelvin, is a constant
- D. temperature, in Kelvin, times the volume is a constant

- 3 14. Sulfur dioxide gas, $\text{SO}_2(\text{g})$, contributes to acid rain. Natural sources of sulfur dioxide include volcanoes and decaying vegetation. To what temperature was a sample of sulfur dioxide gas heated to if a 500 mL sample initially at a temperature of $-15.0\text{ }^\circ\text{C}$ expands to a volume 600 mL?
- 3 15. Helium gas ($\text{He}(\text{g})$) is the second most abundant element in the universe, and it is present in all stars. What amount of helium gas occupies 12.6 L at STP?

- 2 16. Hydrogen gas is burned in a complete combustion reaction.



What volume of water vapour at STP is produced when 4.52 L of hydrogen at STP is burned in a complete combustion reaction?

- 3 17. Octane is a highly volatile and flammable substance that is a component of gasoline. The boiling point of liquid octane is approximately 125 °C. However, due to its volatility, it evaporates readily at normal temperatures and pressures. The pressure on 250 mL of octane gas is decreased from 103 kPa to 94.0 kPa, with temperature remaining constant. What is the resulting volume of octane?

- Work through the Virtual Investigation: Ideal Gas Law in Unit B, Section 2, Lesson 5.
- Use the information provided, and the data collected to respond to questions 18 to 20.

- 1 18. Write a problem or purpose for this investigation.

- 3 19. Construct a data table and populate it with the data you collected from the lab: Determining Molar Mass of a Gas.
- 4 20. Calculate the molar mass of the gas collected in this virtual investigation.

Use the following information to answer the question 21.

In an experiment to determine the molar mass of an unknown compound, the compound was vaporized and sealed in a pre-weighed flask. Then, the mass of the vapour and the flask were determined. A student collected the following data.

Mass of empty flask (g)	183.48
Mass of flask and vapour (g)	183.69
Volume of flask (mL)	150.00
Temperature ($^{\circ}\text{C}$)	24.0
Pressure (kPa)	102

21. Using the experiment and the data supplied, complete the following.

②

a. Calculate the number of moles of gas in the flask.

②

b. Calculate the experimental molar mass of the compound.

②

c. Based on your answer in part b., select the most likely formula of the gas from the following:

- ☐ CH_4
- ☐ $\text{H}_2(\text{g})$
- ☐ $\text{O}_2(\text{g})$
- ☐ $\text{CO}_2(\text{g})$

- ② d. Using your experimental value from part b. and the molar mass of the gas you chose for part c., calculate the percent error using the following formula.

$$\% \text{ error} = \left| \frac{\text{experimental value} - \text{theoretical value}}{\text{theoretical value}} \right| \times 100$$