Name: Uni Lee Period 4 January 16

(First name) (Last name)

90%. Great job as always!

Unit Test # 4: Gases and Atmospheric Chemistry V2

Knowledge & Understanding	Communication	Thinking & Investigation	Application
~~10~~ 11 / 14	6 / 6	9½ / 10	10½ / 11

Part A: Knowledge & Understanding (14 marks)

Answer on the SCANTRON card provided. Choose the most correct answer.

1. A gas is most correctly described by which statement?
   a) A gas is always reactive.
   b) A gas is always diatomic in structure.
   c) A gas is highly compressible.
   d) A gas is in a state of low miscibility with other gases.
   e) A gas is more likely to be found at extremely high temperatures.

2. A sealed 4.0-L pickle jar is filled with O_2 gas. The jar is placed into the refrigerator. What will happen to the O_2 gas?
   a) The O_2 molecules will move farther apart.
   b) The O_2 gas will liquefy.
   c) The O_2 molecules will collide more frequently with the sides of the jar.
   d) The translational motion of the O_2 molecules will increase.
   e) The kinetic energy of the O_2 molecules will be reduced.

3. A real gas behaves differently than an ideal gas when:
   a) temperature and pressure are very low
   b) temperature is high
   c) they are under SATP conditions
   d) pressure is very high and temperature is very low
   e) they collide with the walls of the container rigorously

4. Which pair of variables are inversely proportional to one another when describing ideal gas laws?
   a) P and T
   b) V and T
   c) P and V
   d) n and V
   e) n and P

5. A sample of a gas has a volume of 1 L at 25°C and a pressure of 101.325 kPa. When the temperature and pressure increase, volume of the gas will:
   a) Decrease
   b) Increase
   c) Remain the same
   d) Become zero
   e) Increases or decreases, depends on the magnitude of pressure and temperature changes

6. A sample of O_3 is at 0°C. If both the volume and pressure double, what is the new temperature of this gas in Kelvin?
   a) 1092 K
   b) 546 K
   c) 273 K
   d) 135 K
   e) 68 K

   $\frac{PV}{T} = \frac{PV}{T}$

   $\frac{10(5)}{273K} = \frac{20(10)}{T}$

7. How many molecules of an ideal gas are contained in 8.2 L at −73°C and 50.6 kPa?
   a) 0.25
   b) 0.70
   c) 1.5×10^{23}
   d) 4.2×10^{23}
   e) -4.1×10^{23}

   V 8.2 L
   T 200.15 K
   P 50.6 kPa

   PV = nRT

   414.92 =

   Vm
   n
   m

8. Which of the following statements is NOT true according to the kinetic molecular theory of gases?
   a) Gas molecules occupy a negligible volume.
   b) Gas molecules have elastic collisions.
   c) Gas molecules do not interact with one another (no attraction).
   d) Gas molecules have point masses.
   e) Gas particles exert strong attractive and repulsive forces to the sides of their container.

9. Assuming constant volume, the pressure of an ideal gas increases with temperature because the:
   a) density of the gas decreases
   b) density of the gas increases
   c) molecules of N_2 move more rapidly
   d) molecules of N_2 break apart to form individual N atoms.
   e) collisions are less elastic, thereby giving off energy

10. A gas has a density at STP of 1.98 g/L. The most reasonable formula for this gas is
   a) He
   b) CO_2
   c) CH_4
   d) NH_3
   e) N_2

11. What pressure would be exerted by 76.0 g of fluorine gas in a flask with a volume of 1.50 L at a temperature of –37°C?
   a) 2.61×10^3 kPa
   b) 5.13×10^3 kPa
   c) 4.01×10^2 kPa
   d) 101.325 kPa
   e) 100.0 kPa

12. The number of O_2 molecules in 22.4 L of oxygen gas at STP is:
   a) 8.00
   b) 16.0
   c) 6.02×10^{20}
   d) 6.02×10^{23}
   e) None of the above

13. What is 1330 torr in kPa?
   a) 177.32
   b) 151.99
   c) 202.65
   d) 50.66
   e) 57.9

14. Which of the following is ***not*** true?
   a) Ozone can cause chronic respiratory issues
   b) Ozone can deteriorate metal
   c) Ozone is hazardous to human health in the upper atmosphere
   d) Ozone can react with nitrogen oxide
   e) None of the above

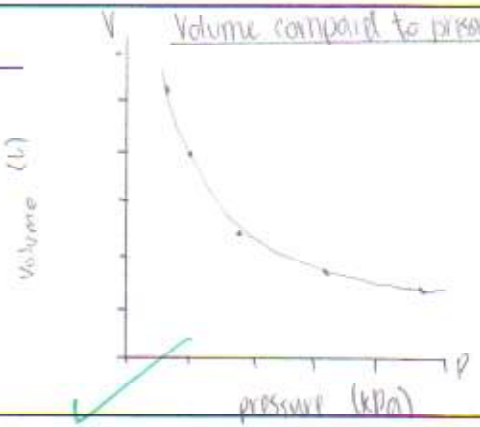
Answer the following questions in the space below. Show all work.

Part B: Communication (6 marks) – Choose 3 of the following 4 questions.

1. Sketch a labelled graph that represents the behaviour of gases according to Boyle's Law. Explain how the gas law is verified by the data. [2 marks]
2. Using Kinetic Molecular Theory explain how the volume of a balloon will change when it is put in a **cold** water bath. Use diagrams to support your answer. [2 marks]
3. Describe **two** differences between an ideal and a real gas. What affect does the non-ideal gas behaviour have on the Avogadro Law? [2 marks]
4. Explain how the Molar Mass is related to the Ideal Gas Law. Use appropriate calculations (with correct conditions) to support your answer. [2 marks]

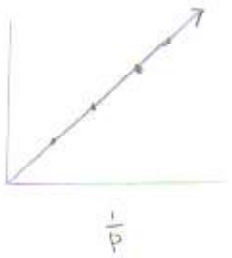
Choice 1

Boyle's Law

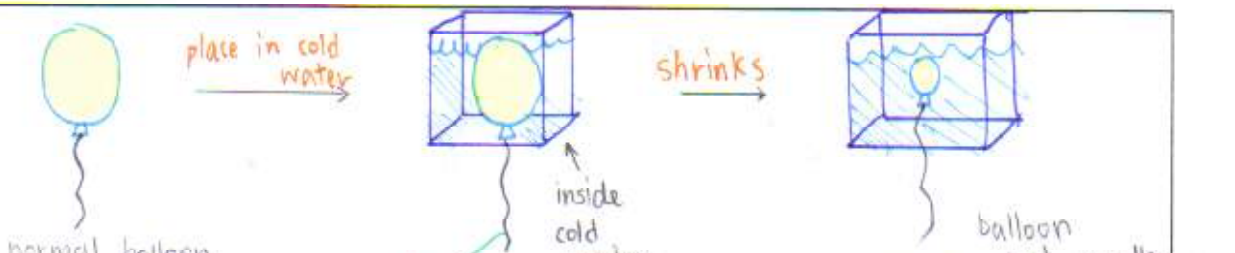


the gas law means that as pressure increases, volume decreases, and as pressure decrease, volume increase. its a curve

$V \propto \frac{1}{P}$



Choice 2



when the air inside gets colder from the water, they slow down and it bounces off the balloon less so it shrinks

Choice 3

- an ideal gas at STP has a molar volume of 22.4 L/mol
- However, real gas is a bit off. a little more or less than 22.4 L/mol

They behave differently when pressure is high and temperature is low.

they will move not in straight line, and will have inter molecular forces

6

Part C: Thinking & Investigation (10 marks)

1. At STP, a container holds exactly 28.02 g of nitrogen gas, 32.00 g of oxygen gas, 132.00 g of carbon dioxide gas, and 34.08 g of ammonia gas. What is the volume of the container? [4 marks]

STP = 0°C 273.15 K 101.325 kPa 22.4 L/mol

Find Volume of container

Nitrogen	28.02 g	N_2	28 g/mol	1 mol
Oxygen	32.00 g	O_2	32 g/mol	1 mol
Carbon dioxide	132.00 g	CO_2	44 g/mol	3 mol
ammonia	34.08 g	NH_3	17 g/mol	2 mol +
				7 mol

$22.4 \frac{L}{mol} \times 7\ mol$

$= 156.8\ L$

$= 1.568 \times 10^2\ L$

Therefore, the volume of the container is 1.568×10^2 L

2. 1 345 kg of coal burns to produce carbon dioxide. Assume that the coal is 85% pure carbon and the combustion is 92% efficient. How many litres of carbon dioxide are produced at SATP? (**Hint**: The mole ratio of C(s) to CO_2(g) is 5:4.) [6 marks]

SATP = 25°C 298.15 K 24.8 L/mol

1345000 g coal × 0.85 = 1143250 grams of carbon

1143250 × 0.92 = 1051790 g of carbon used for CO_2

i thought i didn't need the ratio if i used this way

(-1) ER

$5C_{(s)} + O_2 \longrightarrow 4CO_2$

m	1051790 g	
M	12 g/mol	
Vm		24.8 L/mol
V		2173699.33 L = 2.174×10^6 L
T		
P		
n	87649.17 mol	87649.17 mol

Therefore, if you burn 1345 kg of coal, you will get 2.174×10^6 L at SATP

9½

Part D: Application (11 marks)

1. The atmosphere of the imaginary planet Avogadrom is made up entirely of poisonous chlorine gas, Cl_2. The atmospheric pressure of this inhospitable planet is 137.0 kPa, and the temperature is 78°C. What is the density of the atmosphere? [3 marks]

density g/L

1000 grams per 300.13978 L

	Cl_2	If
m		1000g
M	71g/mol	
V_m		
n		14.0845 mol
V		
T	351.15 K	
P	137.0 kPa	

$$\frac{1000\ g}{300.13978\ L} = 3.332\ g/L$$

$= 3.3 \times 10^0$ g/L

Therefore, the density of the atmosphere is 3.3×10^0 g/L

$PV = nRT$

$137\ kPa\ (V) = (14.0845)(8.314)(351.15\ K)$

$V = 300.13978\ L$

2. A container of chlorine gas weighs 6.35 g and has a volume of 3.57 L at 0.0°C and 1.0 atm. The empty container weighs 4.23 g. Find the molar volume of the chlorine gas at 25°C and 100.0 kPa. [3 marks]

6.35g - 4.23g

	initial	final
m	2.12g	
M	71 g/mol	
V_m	22.4 L/mol	?
n	0.02986 mol	0.02986 mol
P	101.325 kPa	100.0 kPa
T	273.15 K	298.15 K
V		0.74 L

$$\frac{0.74\ L}{0.02986\ mol} = 2.48 \times 10^1\ L/mol$$

Therefore, the molar volume of the chlorine gas at 25°C and 100.0 kPa is 2.48×10^1 L/mol

$PV = nRT$

$100\ kPa\ (V) = (0.02986)(8.314)(298.15)$

$V =$

6

3. One method of producing ammonia gas involves the reaction of ammonium chloride, with sodium hydroxide; water and aqueous sodium chloride are also products of the reaction. During an experiment, 120 mL of ammonia gas was collected using water displacement. If the gas was collected at 23.0°C and 790 mmHg, determine the amount of sodium hydroxide that must have reacted. [5 marks]

$NH_4Cl_{(aq)} + NaOH_{(aq)} \longrightarrow NaCl_{(aq)} + NH_{3(g)} + HOH_{(l)}$

m	0.2053g	
M	40 g/mol	17 g/mol
V_m		
V		0.120 L
T		296.15 K
P		105.325 kPa
n	0.005133 mol	0.005133 mol

$790 \text{ mmHg} \times \frac{101.325 \text{ kPa}}{760 \text{ mmHg}} = 105.32467 \text{ kPa}$

no idea what water displacement is,

$PV = nRT$

$(105.325)(0.12L) = n\,(8.314)(296.15\text{ K})$

$12.639 = 2462.19\,n$

$n = 0.005133 \text{ mol}$

Therefore, the amount of NaOH that was reacted was 2.05×10^{-1} g

4½

SUBJECTIVE SCORE INSTRUCTOR USE ONLY

100	90	80	70	60
50	40	30	20	10
9	8	7	6	5
4	3	2	1	0

PART 1

#	(T) %	(F) 2	3		KEY 5	Marginal mark
1	A	B	●	D	E	
2	A	B	C	D	●	
3	A	B	C	●	E	
4	A	B	●	D	E	
5	A	B	●	D	E	E
6	●	B	C	D	E	
7	A	B	●	D	E	
8	A	B	C	●	E	E
9	●	B	C	D	E	C
10	A	●	C	D	E	
11	●	B	C	D	E	
12	A	B	C	●	E	
13	●	B	C	D	E	
14	A	B	●	D	E	✗ ✓
15	A	B	C	D	E	
16	A	B	C	D	E	
17	A	B	C	D	E	
18	A	B	C	D	E	
19	A	B	C	D	E	
20	A	B	C	D	E	
21	A	B	C	D	E	
22	A	B	C	D	E	
23	A	B	C	D	E	
24	A	B	C	D	E	
25	A	B	C	D	E	

11 78.5%

IMPORTANT

- USE NO. 2 PENCIL ONLY
- MAKE DARK MARKS
- ERASE COMPLETELY TO CHANGE
- EXAMPLE: A B ● D E

TO USE SUBJECTIVE SCORE FEATURE:

- Mark total possible subjective points
- Only one mark per line on key
- 163 points maximum

EXAMPLE OF STUDENT SCORE: 125

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PERIOD	4

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The benifits of good ozone

- Small concentrations of ozone occur naturally in the statosphere, which is part of the earth's upper atmosphere.
- At that level, ozone helps protect life on earth by absorbing ultraviolet radiation from the sun, particularly UVB radiation that can cause skin cancer and cataracts, damage crops and destroy some type of marine life

depletion of statospheric ozone poses serious health risks for humans and evironmental hazards for the planet.

http://environment.about.com/od/ozonedepletion/a/whatisozone.htm

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