|		**BLM 3.4.1**
ASSESSMENT	**Chapter 3 Test**	

Multiple-Choice Questions

Circle the letter for the choice that best completes the statement or answers the question.

**Use the following information to answer questions 1–3:**

  I   A gas's particles are in constant random motion.
 II   The particles of a gas do not interact except for elastic collisions.
III   The particles of a gas do interact when the gas nears its condensation point.
IV   The gas particles are point masses.

1. Which statements apply to an ideal gas?
    a) I and IV
    b) II, III, and IV
    c) I, II, and IV
    d) I, III, and IV

2. The statement that best explains the fact that gases are highly compressible is
    a) I
    b) II
    c) III
    d) IV

3. When a mixture of gases is in a container, the gases mix completely and there is uniform composition throughout the mixture. Which statements best explain this property of gases?
    a) I and IV
    b) I and II
    c) III and IV
    d) II and IV

4. The measurement equivalent to one atmosphere of pressure is
    a) 95 kPa
    b) bar
    c) 760 mmHg
    d) 100 Pa

5. Gas pressure is caused by particles colliding with the walls of its container. In the diagram at the top of the next page, a container of gas is shown before and after a weight is added to the piston. The temperature is kept constant. Which of the statements that appear under the diagram is correct concerning the molecules in this container after the weight is added?
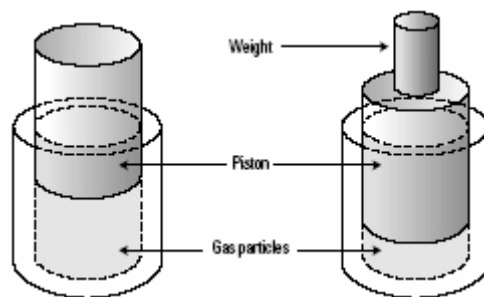
a) The molecules slow down, resulting in a decrease in pressure.
b) The molecules collide more often, causing the pressure to increase.
c) The molecules collide more often but with less force, so the pressure is constant.
d) The molecules slow down to keep the temperature constant.

6. A balloon of volume V is placed in a refrigerator. Which statement explains what is expected to happen to the volume?
    a) Volume increases because the molecules in the balloon are colliding more often.
    b) Volume decreases because the molecules move more slowly and collide less often.
    c) Volume decreases because the there are more collisions on the outside of the balloon.
    d) Volume increases because there is less pressure outside the balloon.

7. The graph below that best demonstrates Boyle's law is

**a)**   **b)**   **c)**   **d)**
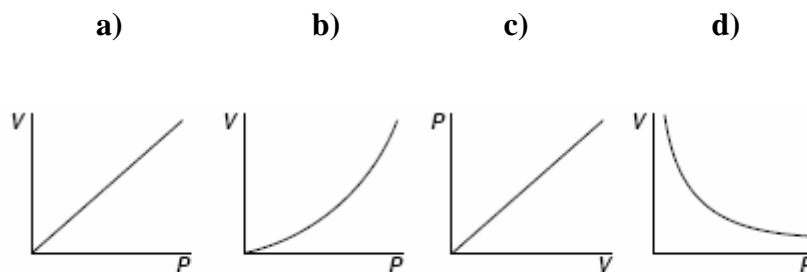
8. A bubble of air in a swimming pool rises to a place where the pressure on it is equal to half its original value. Assuming the temperature is constant, the new volume of the bubble will be
    a) twice its original volume
    b) half its original volume
    c) the same as its original volume
    d) one quarter of its original volume

9. A 20 L volume of gas at 120 kPa expands to 30 L with no temperature change. The pressure is now
    a) 80 kPa   c) 110 kPa
    b) 180 kPa   d) 720 kPa

ASSESSMENT

Chapter 3 Test

10. The freezing point of water, expressed to the nearest kelvin, is
    a) 0 K
    b) –273 K
    c) 273 K
    d) 373 K

11. Which temperature change will double the volume of a given mass of gas at constant pressure?
    a) 273 K to 473 K
    b) 135 K to 270 K
    c) 40 ^{o}C to 80 ^{o}C
    d) 273 K to 136.5 K

12. A pressure reading of 103.4 kPa is equivalent to _____ mmHg.
    a) 863.4
    b) 775.8
    c) 774.6
    d) 763.4

Use the following four graphs to answer question 13.
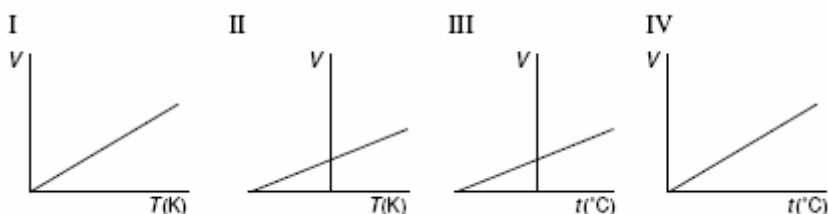
13. The graph(s) that express(es) the idea of Charles's law is/are
    a) III only
    b) III and IV only
    c) IV only
    d) I and III only

14. A sealed metal can full of air is heated from 20 ℃ to 120 ℃. The can was initially at 1.0 atmosphere of pressure. The final pressure will be
    a) 6.0 atm
    b) 0.017 atm
    c) 0.72 atm
    d) 1.3 atm

15. In an ideal gas, the particles are assumed to behave as point masses. What does this mean about the particles in the gas?
    a) They do not lose energy when they collide.
    b) The kinetic energy of the particles is conserved in a collision.
    c) They have no volume.
    d) They do not attract one another.

		BLM 3.4.1
ASSESSMENT	**Chapter 3 Test**	

Numerical Response Questions

For each numerical response question, record the answer in the following response box.

16.	
17.	
18.	
19.	
20.	

16. A helium balloon has a volume of 0.75 L at a room temperature of 22.0 $^{\circ}$C. In order for the balloon to rise and pass through an opening, the volume of the balloon must be reduced. What minimum change in the room temperature is required to lower the volume of the balloon to 0.69 L?

17. 150.0 mL of air is trapped in a syringe at 765 mmHg pressure. If the temperature remains constant, what must the pressure be increased to for the volume to change to 105.0 mL?

18. A swimmer is at the bottom of a swimming pool where the pressure is 138 kPa. She blows a bubble with a volume of 15.6 cm^3. The bubble rises to the surface, where the pressure is 101 kPa. If the temperature throughout the swimming pool is constant, then the volume of the bubble just before it breaks the surface will be _____ cm^3.

19. During a cryogenics demonstration, a balloon is filled with nitrogen at a temperature of 190 K. The volume of the balloon is 0.800 L. The nitrogen gas then warms up to room temperature, 20 °C. The new volume of the balloon will be _____ L.

20. A 5.00 L pail is placed in a deep freeze at a temperature of –45.0 ℃ and a pressure of 101 kPa. Once at this temperature, its lid is sealed. It is then brought out and placed into a water bath at 70.0 ℃. The pressure of the air inside the pail is now _____ kPa.

ASSESSMENT	**Chapter 3 Test**	**BLM 3.4.1**

Written Response Questions

Answer each question in the space provided. Use complete sentences and diagrams when necessary.

21. A group of students performed an experiment designed to measure the value of absolute zero. They sealed one end of a glass tube after placing a small slug of water inside it, as shown below. They placed the tube in substances of varying temperatures and recorded the height of the air column in each.
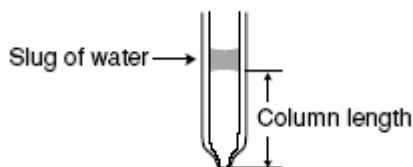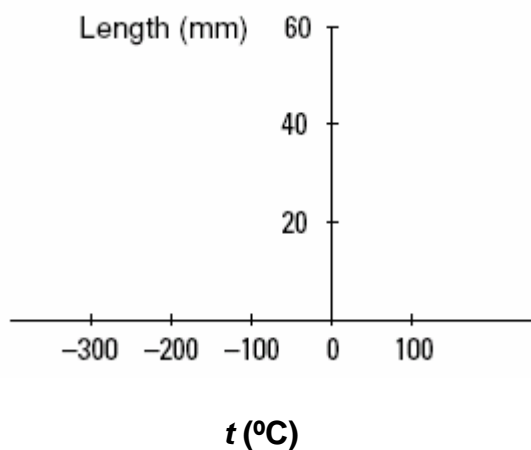

Here are the data they collected.

Station	Temperature (°C)	Column length (mm)
Container of dry ice	−75	33
Pail with ice, salt, and water	−15	44
Pail of ice water	0	46
Sink of room temperature water	22	50
Beaker of hot water	66	57

a) Plot a graph of the column length as a function of the temperature.

Air in tube, length vs. temperature

t (ºC)

b) Use the graph to find an experimental value for absolute zero. Explain your reasoning.

_____

_____

_____

_____

_____

_____

_____

_____

c) How would the graph change if the experiment was repeated with the glass tube filled with helium instead of air?

_____

_____

_____

_____

_____

_____

_____

_____
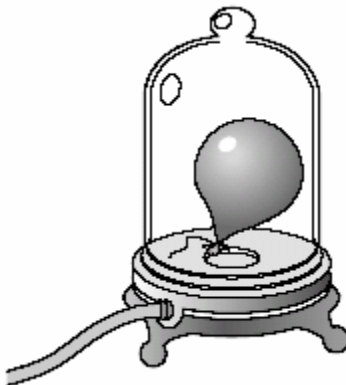
22. A bell jar is a glass container from which air can be removed using a vacuum pump. A balloon is placed in a bell jar and the vacuum pump is turned on, as shown below.

     a)   Describe the effect this will have on the balloon and explain why.

_____

_____

_____

_____

_____

_____

     b)   Identify which gas law this demonstration represents and justify your answer.

_____

_____

_____

_____

_____

_____

23. Three containers of equal volume and temperature are connected as shown below.
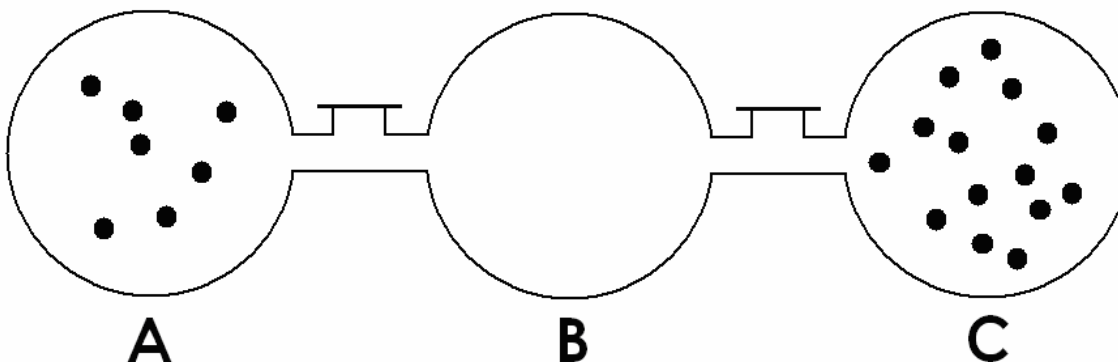
Initially, there are 1.0×10^{22} of molecules in A and 2.0×10^{22} molecules in C. Container B is a vacuum. The initial pressure registered in container A is 100.0 kPa. When both stopcocks are opened, what will be the resulting pressure in container B and how many molecules will be in this container? Assume there is no change in temperature when both stopcocks are opened.

_____

_____

_____

_____

24. By what factor must the pressure change to have the same effect on a 5.0 L volume of gas as lowering the temperature from 90.0 °C to 20.0 °C?

_____

_____

_____

_____

_____

_____

25. Apply the concepts of the kinetic molecular theory to explain why a car tire may appear to be slightly "flat" on a very cold morning in Alberta.

_____

_____

_____

_____

26. A cylinder of compressed gas holds 20.0 L of gas at 1600 kPa pressure. If there is no change in temperature, what volume of gas can be obtained from this cylinder at 100 kPa pressure?

_____

_____

_____

_____

_____

_____

_____