

CANADIAN CHEMISTRY CONTEST

CHEMISTRY

TOPIC QUESTIONS

King



5B The Gas Laws and Prerequisite Concepts



KingCh

- 10) The kinetic molecular theory describes the behaviour of ideal gases. Which of the following aspects of the particle theory of matter does not correspond to the kinetic molecular theory?
- Particles are always moving.
 - Different substances are made of different particles.
 - Particles move faster at higher temperatures.
 - Particles are all attracted to each other.
 - Identical substances are made of identical particles

CCC 2021

- 23) One source of oxygen in chemical oxygen generators for emergencies in submarines and aircraft is potassium perchlorate, which decomposes as follows:



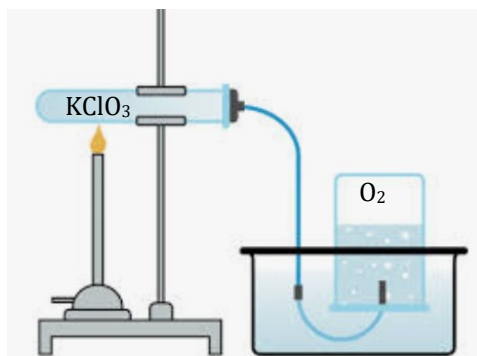
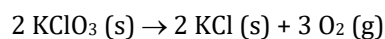
Assume ideal gas behaviour for the reaction, a temperature of 25.0°C and a pressure of 1.00 bar. If 138.5 grams of potassium perchlorate decompose inside an oxygen generator, what volume of oxygen does the reaction generate if there is a 78.0% yield?

- A) 9.65 L B) 19.3 L C) 24.8 L D) 38.6 L E) 49.6 L

CCC 2020

- 20) A vessel contains 2.50 mol of O₂ gas, 0.50 mol of N₂ gas and 1.00 mol of CO₂ gas. The total pressure is 200 kPa. The partial pressure exerted by the O₂ in the mixture is:
- A) 25 kPa B) 50 kPa C) 100 kPa D) 125 kPa E) 150 kPa

- 21) The O₂ (g) produced in the decomposition of 3.275 g mixture of potassium chlorate and potassium chloride which is 65.82% KClO₃ by mass is collected over water at 21.0 °C. Assume ideal gas conditions. If atmospheric pressure is 753.5 mmHg, water vapour pressure at 21.0°C is 18.7 mmHg, once the pressure in the gas collection vessel was equalized with atmospheric pressure, how many milliliters of O₂ gas would be produced according to the reaction:



- A) 130 mL B) 439 mL C) 563 mL
 D) 658 mL E) 1320 mL

CCC 2019

- 4) A 2.0 L balloon initially holds 3.0 mol of helium. When 3.0 mol of helium are added, the volume of the balloon increases to 4.0 L and the temperature remains unchanged. Which expression correctly describes the final pressure of the system in terms of the initial pressure, P ? Assume Ideal Gas behaviour.

A) P B) $2P$ C) $3P$ D) $4P$ E) $6P$

CCC 2018

- 8) Cows are one of the most significant sources of methane (CH_4) emitted into the atmosphere. The average cow produces 259 grams of methane per day. The lower explosive limit (LEL) is the lowest concentration at which there is a risk of an explosion. For methane, the LEL at SATP is 5.0% v/v. Assuming a constant rate of methane emission from cows, how long would it be safe to keep an average cow in a 10.0 m^3 enclosed space at 25°C and 100 kPa before there is a risk of explosion? The molar volume of a gas at SATP is 24.8 L.

A) 30 hours B) 60 hours C) 90 hours D) 600 hours E) 900 hours

CCC 2017

25) Flask 1
 2.0 g of H_2
 gas at 25°C
 and P_1



 Flask 2
 16.0 g of O_2
 gas at 25°C
 and P_2

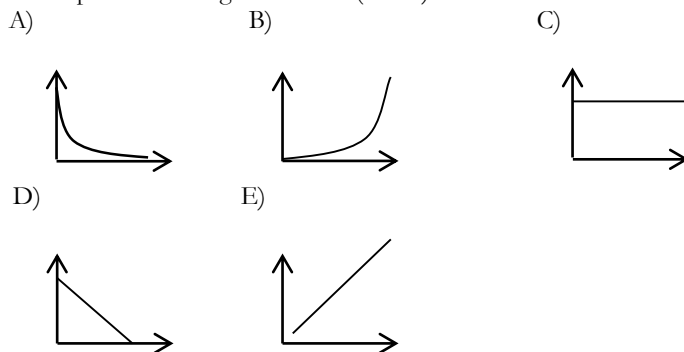


Both Flask 1 and Flask 2 have a volume of exactly 2.0 L, KE is the average kinetic energy, and P is pressure. Which statement below is **TRUE**?

- A) $P_1 = P_2$
 B) the KE of the particles in flask 1 < the KE of the particles in flask 2
 C) the number of particles in flask 1 > the number of particles in flask 2
 D) the number of collisions in flask 1 = number of collisions in flask 2
 E) $2 P_1 = P_2$

CCC 2016

6. Given a fixed mass of gas in a closed, expandable container at constant pressure, which graph shows the variation in the volume of gas (y-axis) versus the temperature in degrees Kelvin (x-axis)?



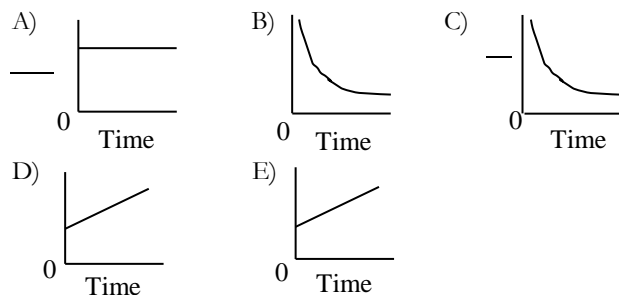
CCC 2015

8. A closed 2.0 L container initially holds 4.0 mol of oxygen and 2.0 mol of nitrogen at temperature T . If the pressure remains constant when 2.0 mol of oxygen are removed, which expression correctly describes the final temperature of the system in terms of the initial temperature, T ? Assume Ideal Gas behaviour.

A) B) $2T$ C) D) $3T$ E) T

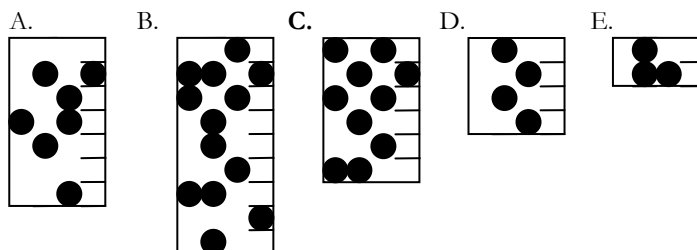
CCC 2014

9. Nitrogen gas is pumped into a completely flexible balloon that contains some air at 20°C . The balloon expands against atmospheric pressure. Which of the following graphs most accurately describes the change in conditions inside the balloon over time?

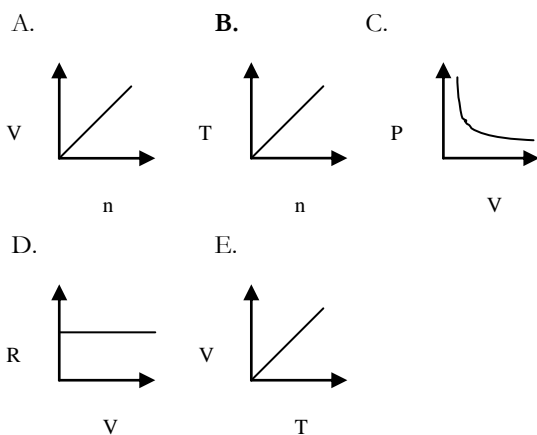


CCC 2013

6. Each of the following represents a cylinder at 25°C with molecules of a theoretical gas W whose relative number of particles is represented by the black circles. The cylinder containing the gas at the highest pressure is:



25. Which one of the following graphs does NOT correctly describe the Ideal Gas Law?

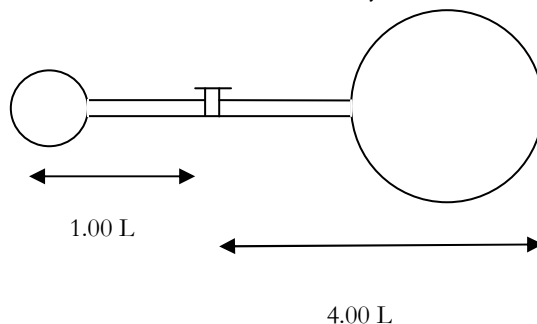


CCC 2011

10. Equimolar amounts of two gases (X and Y) are mixed in a 1.00L container at room temperature and pressure. Gas Y has a molar mass that is twice that of gas X. Which **one** of the following statements is FALSE for the mixture of gases X and Y?

- A. On average, molecules of gas X move faster than molecules of gas Y.
- B. The kinetic energy distributions of the two gases are identical.
- C. Gas X makes less of a contribution to the average density of the mixture than gas Y.
- D. Gas X has a smaller partial pressure than gas Y.
- E. The mole fractions of gas X and gas Y are identical.

23. Given the diagram below of a two bulb system filled with the same gas, the pressure in the 1.00 L bulb is 1.50 atm and the pressure in the 4.00 L bulb is 2.00 atm. If the temperature remains constant and the valve between the two bulbs is opened so that the gas can move freely, what is the final pressure if the total volume of the two bulb system is 5.00 L?



- A. 1.75 atm B. 1.80 atm C. 1.85 atm D. 1.90 atm E. 1.95 atm

CCC 2010