2.7-110

A yardstick laid on a table with a few inches hanging over the edge is easily flipped off when struck on the protruding end. The maneuver is repeated with a sheet of newspaper spread over the long end of the stick. The third time the same sheet of newspaper is crumpled up into a ball before placing it on the stick. How do you expect the motion in each of these trials to compare?

(a) trial 1 = trial 2 = trial 3

(b) trial 1 > trial 2 = trial 3

(c) trial 1 > trial 2 > trial 3

(d) trial 1 > trial 3 > trial 2

2.7-120

Which is not a correct unit for pressure?

(a) Bar

(b) Joule meter^{-3}

(c) Pascal

(d) Newton

2.7-131

A “Thunder Glass” or “Storm Glass” has a large bulb that is closed except for a small open spout emanating from the bottom. When the glass is partially filled with liquid, decreasing atmospheric pressure is indicated by

(a) rising liquid in the spout

(b) falling liquid in the spout

The pressure in the trapped pocket of gas in the bulb will

(a) increase

(b) decrease

(c) remain the same

2.7-132

A "Thunder Glass" or "Storm Glass" has a large bulb that is closed except for a small open spout emanating from the bottom. If the water (1 g/cm^3) that normally partially fills the glass is replaced by tetrabromomethane (CBr_4, 3 g/cm^3), the changes in the height of liquid in the spout, for a given change in atmospheric pressure, will be

(a) 3 fold greater

(b) 3 fold smaller

(c) the same

2.7-150

A marshmallow is placed in a flask and the opening of the flask is connected to a pump. When the pump is turned on, the marshmallow grows larger. The pump must therefore be pumping air

(a) into the marshmallow
(b) into the flask
(c) out of the marshmallow
(d) out of the flask

2.7-210

As a graphical test for ideal gas behavior, we can look for a straight line in each of the following graphs at constant temperature <u>except</u>

(a) P vs. V^{-1}

(b) PV vs. V

(c) log P vs. log V

(d) P vs. V

<u>2.7-220</u>

For an ideal gas, the slope for a graph of PV vs. V would be

(a) -1 (b) 0 (c) 1 (d) nRT

The slope for P vs. V^{-1} would be

(a) -1 (b) 0 (c) 1 (d) nRT

The slope for log P vs. log V would be

(a) -1 (b) 0 (c) 1 (d) nRT

2.7-225

To go sledding on a snow-tube, I would best inflate the snow-tube

(a) before leaving the house
(b) after going outdoors
(c) it doesn’t matter

2. 7-230

On a fine 27°C afternoon, I decide to go for a drive. Before I leave, I check my tires and find that the pressure (relative to the atmosphere) is 31 psi. After a while on the road, I check my tires again and find that the pressure is now 33 psi. Noting that the atmospheric pressure is 14.7 psi, and assuming that the tire volume has not changed significantly during my drive, which equation will give me the current temperature, T, of my tires in °C ?

(a) $(T)/(27) = (31)/(33)$

(b) $(T-273)/(27-273) = (33+14.7)/(31+14.7)$

(c) $(T+273)/(27+273) = (31-14.7)/(33-14.7)$

(d) $(T+273)/(27+273) = (33+14.7)/(31+14.7)$

2. 7-240

If 1 L of H_2 (MW=2) weighs 1 g at a given temperature and pressure, how much will 1L of O_2 (MW=32) weigh at that T and P?

(a) 8 g (b) 16 g (c) 32 g (d) 64 g

2.7-241

At what temperature will the density of SO_2 (MW 64) be the same as the density of O_2 (MW 32) at 27°C?

(a) 27°C (b) 54°C
(c) 327°C (d) 600°C

<u>2. 7-245</u>

A balloon filled with methane (CH_4) will

(a) rise (b) fall

in air (~ 80% N_2 and 20% O_2)

<u>2. 7-246</u>

A balloon filled with carbon dioxide (CO_2) will

(a) rise (b) fall

in air (~ 80% N_2 and 20% O_2)

2. 7-251

The difficulty with ballooning is that the buoyant gas in the balloon heats during the day and cools at night. If the balloon is fully expanded, heating during the day will cause

(a) the pressure to increase
(b) the pressure to decrease
(c) the volume to increase
(d) the volume to decrease

If the balloon is not fully expanded, heating during the day will cause

(a) the density to increase
(b) the density to decrease
(c) the pressure to increase
(d) the pressure to decrease

<u>2. 7-252</u>

Earthwinds balloons have an hourglass shape, with an upper balloon filled with helium and a lower ballast balloon filled with air. To maintain altitude during the warm hours of the day, the balloon operator should

(a) pump more air into the lower balloon

(b) release air from the lower balloon

<u>2. 7-260</u>

A balloon filled with CO_2 (MW 44) has become mixed up with a similar balloon filled
with SO_2 (MW 64) to the same pressure.
The SO_2 balloon must be the one that

(a) falls faster
(b) rises faster
(c) is fatter
(d) is thinner

2. 7-270

A clear plastic bottle is almost filled with water, a small balloon is pulled just below the surface by attaching it to a small weight, and the bottle is closed tightly. If the bottle is then squeezed firmly, the weighted balloon will

(a) descend further
(b) pop up through the surface
(c) remain in the same position

<u>2. 7-280</u>

Air is compressed in a vertical cylinder by the weight of a piston. When a weight is added to the piston, the volume of the gas decreases from 500 mL to 400mL. If another weight of the same magnitude is added the volume of the gas will decrease by

(a) another 100 mL
(b) less than 100 mL
(c) more than 100 mL

If 1 liter of O_2 at 1 atm pressure is combined with 1 liter of N_2 at 1 atm pressure, in a container of 2 liters, the total pressure will be

(a) 0.5 atm
(b) 1 atm
(c) 2 atm
(d) 4 atm

2.7-302

If 1 liter of O_2 at 1 atm pressure is combined with 1 liter of N_2 at 1 atm pressure, in a container of 1 liter, the total pressure will be

(a) 0.5 atm
(b) 1 atm
(c) 2 atm
(d) 4 atm

2.7-310

A mixture of helium and argon contains 3 mol of He for every 2 mol of Ar. The partial pressure of the Ar is

(a) 2/3 (b) 2/5 (c) 3/5 (d) 1/2

of the total pressure.

2.7-320

The manufacture of sulfuric acid begins with the burning of sulfur in oxygen. Suppose that the resulting gas mixture contains 100g of O_2 (MW=32) and 100g of SO_2 (MW = 64). The mole fraction of SO_2 is

(a) 1   (b) 2/3   (c) 1/2   (d) 1/3

If the total pressure is 600 mm Hg then the partial pressure of the O_2 is

(a) 500   (b) 400   (c) 300   (d) 200

2.7-410

For the reaction

$$2\ SO_3\ (g) \leftrightarrow 2\ SO_2\ (g) + O_2\ (g)$$

the relationship between K_p and K_c is

(a) $K_p - K_c = RT$

(b) $K_p / K_c = RT$

(c) $K_c - K_p = RT$

(d) $K_c / K_p = RT$

2.7-415

For the reaction

$$2\ NO\ (g) + Cl_2\ (g) \leftrightarrow 2\ NOCl\ (g)$$

the relationship between K_p and K_c is

(a) $K_p - K_c = RT$

(b) $K_p / K_c = RT$

(c) $K_c - K_p = RT$

(d) $K_c / K_p = RT$

2.7-420

For which of the following reactions is $K_p = K_c$?

(a) PCl_5 (g) $\leftrightarrow$ PCl_3 (g) + Cl_2 (g)

(b) 2 NO (g) + Cl_2 (g) $\leftrightarrow$ 2 NOCl (g)

(c) 3 O_2 (g) + 4 NH_3 (g) $\leftrightarrow$ 2 N_2 (g) + 6 H_2O (g)

(d) H_2 (g) + CO_2 (g) $\leftrightarrow$ H_2O (g) + CO (g)

<u>2. 7-440</u>

For the synthesis of ammonia

$$N_2 \text{ (g)} + 3\ H_2 \text{ (g)} \leftrightarrow 2\ NH_3 \text{ (g)}$$

at 400°C, $K_p = 1.9 \times 10^{-4}$ atm^{-2}. Suppose we start with partial pressures of N_2 and H_2 that are 1 atm and 6 atm respectively, the zeros of which equation give the equilibrium extent of reaction (in atm)?

(a) $1.9 \times 10^{-4}\ (1\text{-}x)\ (6\text{-}x)^3 - (x)^2$

(b) $1.9 \times 10^{-4}\ (2x)^2 - (1\text{-}x)\ (6\text{-}3x)^3$

(c) $1.9 \times 10^{-4}\ (1\text{-}x)\ (6\text{-}3x) - (2x)$

(d) $1.9 \times 10^{-4}\ (1\text{-}x)\ (6\text{-}3x)^3 - (2x)^2$

At a higher temperature, where K_p is larger, the equilibrium extent of reaction would be

(a) greater (b) smaller (c) the same

If the initial partial pressure of H_2 were greater, the equilibrium extent of reaction would be

(a) greater (b) smaller (c) the same

Consider a particle, with mass m and velocity v, bouncing between two walls of extent (x × y) spaced a distance z apart.

The impulse/collision is proportional to

(a) m (c) $m \bullet v$
(b) v (d) $m \bullet v^2$

The # collisions/time is proportional to

(a) $1 / z$ (c) v / z
(b) v (d) $v \bullet z$

The average force applied to a wall (impulse/time) is proportional to

(a) $m \bullet v / z$ (c) $m \bullet v^2 / z$
(b) $m \bullet v^2 / xy$ (d) $m \bullet v \bullet z$

The pressure on a wall (force/area) is proportional to

(a) $m \bullet v \bullet xy / z$ (c) $m \bullet v^2 / xyz$
(b) $m \bullet v^2 \bullet xy / z$ (d) $m \bullet v \bullet xyz$

2.7-630

A large container and a small container both contain the same number of moles of a gas at the same temperature. In the two containers

The velocity distribution is
(a) the same (b) different

The kinetic energy is
(a) the same (b) different

The impulse per collision is
(a) the same (b) different

The frequency with which collisions occur is
(a) the same (b) different

The pressure is
(a) the same (b) different

2.7-640

A container of gas is heated.

The average velocity is now
(a) greater (b) smaller (c) the same

The kinetic energy is now
(a) greater (b) smaller (c) the same

The impulse per collision is now
(a) greater (b) smaller (c) the same

The frequency of collisions is now
(a) greater (b) smaller (c) the same

The pressure is now
(a) greater (b) smaller (c) the same

2.7-660

A balloon filled with gas shrinks when cooled. When it is done shrinking, which of the following is the same as it was originally?

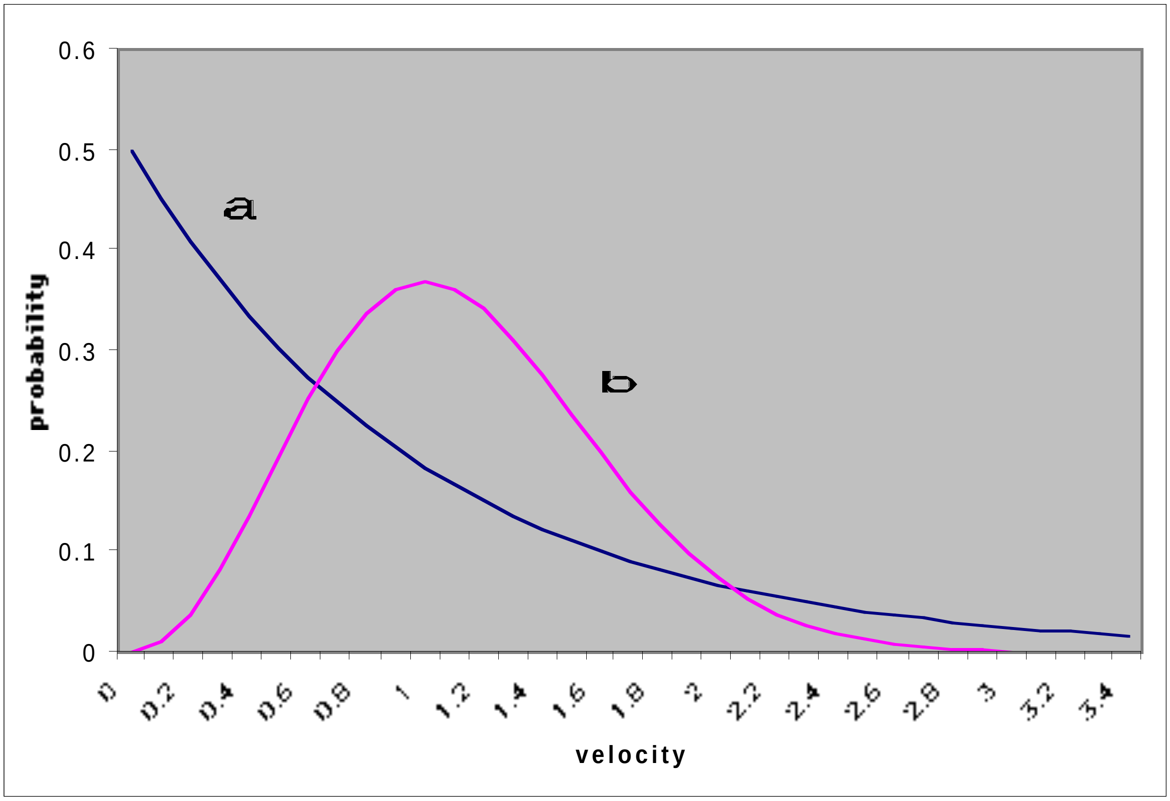
(a) the rms velocity of the gas particles
(b) the density of the gas
(c) the pressure in the balloon
(d) the kinetic energy of the gas particles

The rms velocity and kinetic energy have
(a) increased (b) decreased

The density has
(a) increased (b) decreased

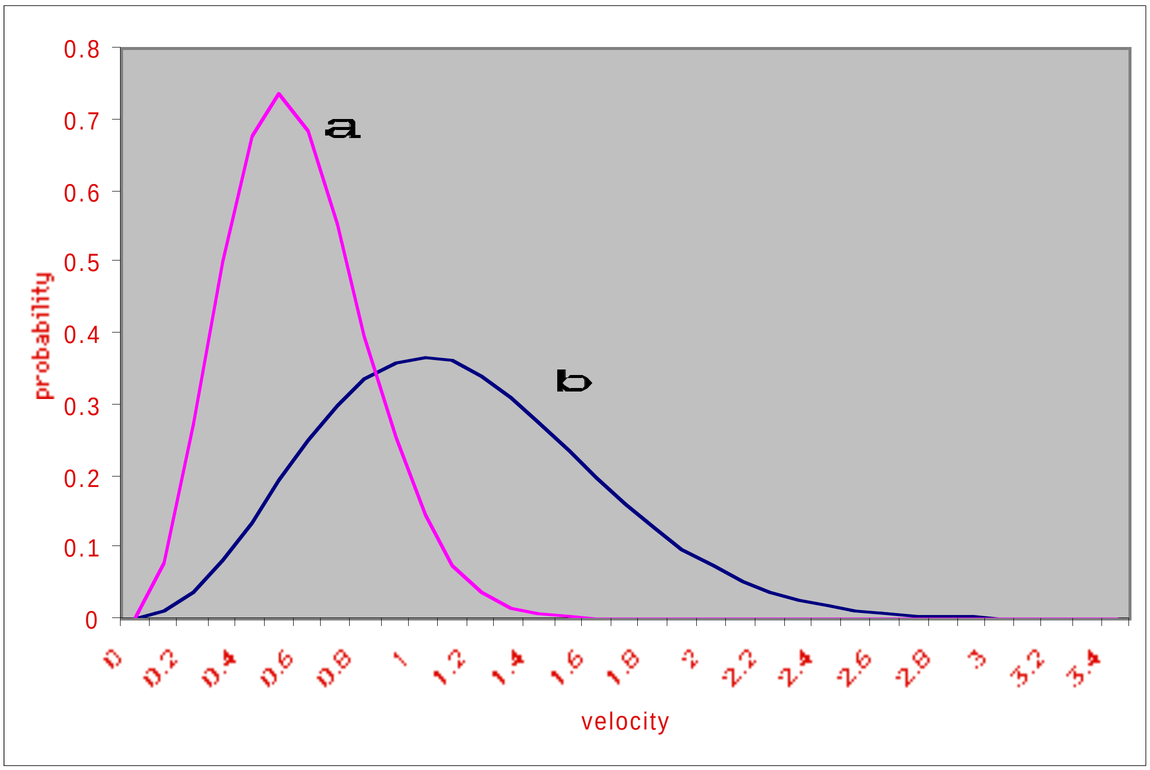
2.7-700

Which of the following does not represent a velocity distribution?



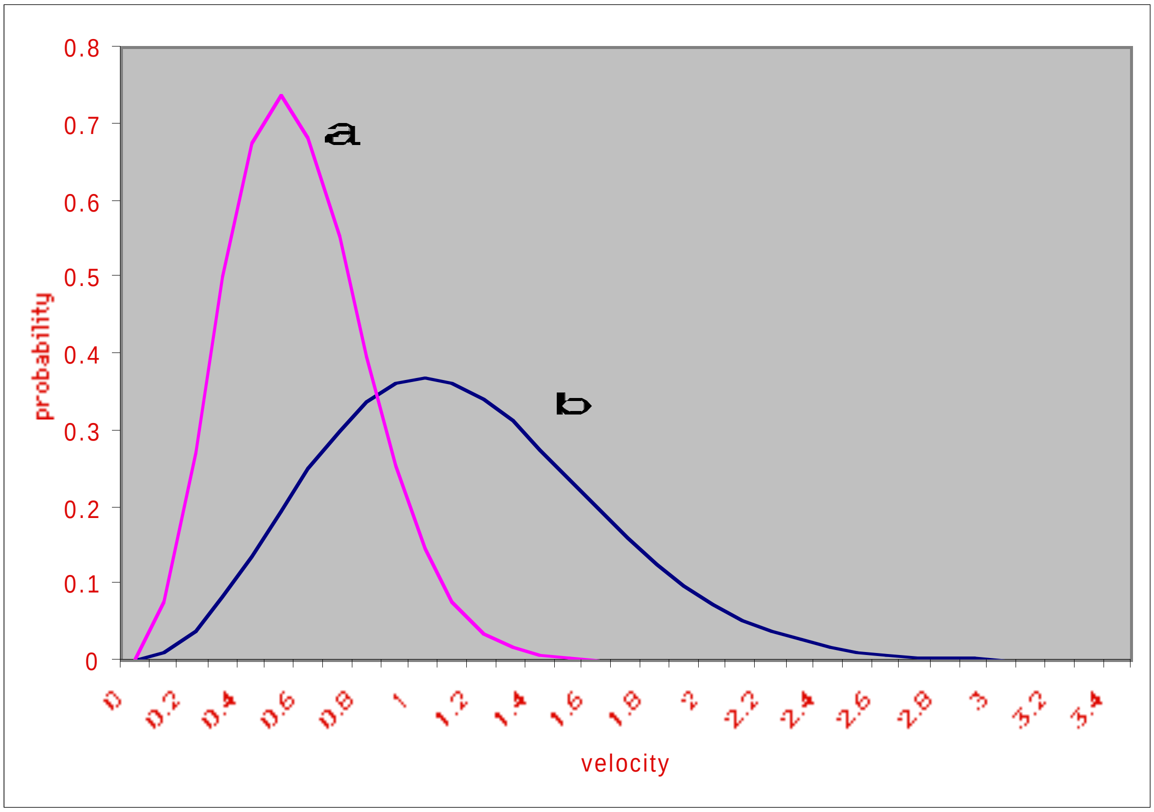
2.7-710

Which of the following velocity distributions belongs to the gas with the higher molecular mass?



2.7-720

Which of the following velocity distributions belongs to the gas with the higher temperature?



2.7-731

At what temperature will the average velocity of SO_2 molecules (MW 64) be the same as the average velocity for O_2 molecules (MW 32) at 27°C?

(a) 27°C
(b) 54°C
(c) 327°C
(d) 600°C

At what temperature will the average kinetic energy of SO_2 molecules (MW 64) be the same as the average kinetic energy for O_2 molecules (MW 32) at 27°C?

(a) 27°C
(b) 54°C
(c) 327°C
(d) 600°C

2.7-740

A container contains gaseous N_2 and another just like it, at the same temperature, contains an equal number of moles of gaseous CO_2. For the CO_2 compared to the N_2 :

The average velocity is
(a) greater (b) smaller (c) the same

The frequency of collisions is
(a) greater (b) smaller (c) the same

The pressure is
(a) greater (b) smaller (c) the same

The kinetic energy is
(a) greater (b) smaller (c) the same

The impulse per collision is
(a) greater (b) smaller (c) the same

2.7-810

NH_3 (MW 17.0) and HCl (MW 36.5) gases react to form a NH_4Cl, a white powder. If the two gases are introduced at opposite ends of a long tube, the powder will form

(a) exactly midway from the two ends
(b) closer to the HCl end
(c) closer to the NH_3 end

The ratio of the distance from the HCl end to the distance from the NH_3 end should be

(a) $(36.5)^2 : (17.0)^2$
(b) $(36.5)^{1/2} : (17.0)^{1/2}$
(c) $(36.5)^{-1/2} : (17.0)^{-1/2}$
(d) $(36.5)^{-2} : (17.0)^{-2}$

<u>2.7-830</u>

A balloon filled with air at 1 atm is placed in a box filled with He at 1 atm. The balloon will

(a) not change volume
(b) expand and then contract
(c) contract and then expand

<u>2.7-910</u>

Since gas molecules have a finite volume, a gas will occupy a volume greater than that predicted from the ideal gas equation. This consideration is expected to be most important when

(a) pressure and temperature are high

(b) pressure and temperature are low

(c) pressure is high and temperature is low

(d) pressure is low and temperature is high

<u>2.7-960</u>

If gas molecules are attracted to one another, the pressure of the gas will be

(a) greater than
(b) less than
(c) the same as

predicted by the ideal gas equation

2.7-970

When 1 L of gas A at 1 atm and 1 L of gas B at 1 atm are combined in a 2 L vessel, the pressure of the mixture is *less* than 1 atm. This means that

(a) molecules of gas B are attracted to themselves more than to molecules of gas A
(b) molecules of gas B are attracted to molecules of gas A more than to themselves
(c) molecules of gas B are repelled by molecules of gas A
(d) there is equal attraction among all of the molecules in the mixture