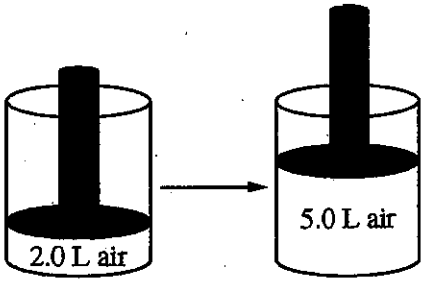
Gases, Liquids, Solids Name KEY

2. Which of the following could be the identity of a white crystalline solid that exhibits the following properties?

- It melts at 320°C.
- It does not conduct electricity as a solid.
- It conducts electricity in an aqueous solution. → ionic

(A) $C_6H_{12}O_6(s)$
(B) $NaOH(s)$
(C) $SiO_2(s)$ → glass – no specific m.p. not an ionic solid
(D) $Cu(s)$




7. The volume of a sample of air in a cylinder with a movable piston is 2.0 L at a pressure $P_1$, as shown in the diagram above. The volume is increased to 5.0 L as the temperature is held constant. The pressure of the air in the cylinder is now $P_2$. What effect do the volume and pressure changes have on the average kinetic energy of the molecules in the sample? → If T is constant, KE is constant

(A) The average kinetic energy increases.
(B) The average kinetic energy decreases.
(C) The average kinetic energy stays the same.
(D) It cannot be determined how the kinetic energy is affected without knowing $P_1$ and $P_2$.

6. Under which of the following conditions of temperature and pressure will $H_2$ gas be expected to behave most like an ideal gas? → Low P, High T, no IMFs

(A) 50 K and 0.10 atm
(B) 50 K and 5.0 atm
(C) 500 K and 0.10 atm
(D) 500 K and 50 atm

**Questions 14-16 refer to the following.**

The table below contains information about samples of four different gases at 273 K. The samples are in four identical rigid containers numbered 1 through 4. → same T, same n, n = n, P = P

| Container | Gas | Pressure (atm) | Mass of Sample (g) |
|---|---|---|---|
| 1 | He | 2.00 | ? /mole |
| 2 | Ne | 2.00 | ? /mole |
| 3 | ? | 2.00 | 16.0 /mole |
| 4 | $SO_2$ | 1.96 | 64.1 /mole |

Close!

14. On the basis of the data provided above, the gas in container 3 could be

(A) $CH_4$ → 16 g/mole
(B) $O_2$
(C) Ar
(D) $CO_2$

$KE = \frac{1}{2} m v^2$

15. Under the conditions given, consider containers 1, 2, and 4 only. The average speed of the gas particles is → smaller are faster!

(A) greatest in container 1
(B) greatest in container 2
(C) greatest in container 4
(D) the same in containers 1, 2, and 4

16. The best explanation for the lower pressure in container 4 is that $SO_2$ molecules → Bigger are slower

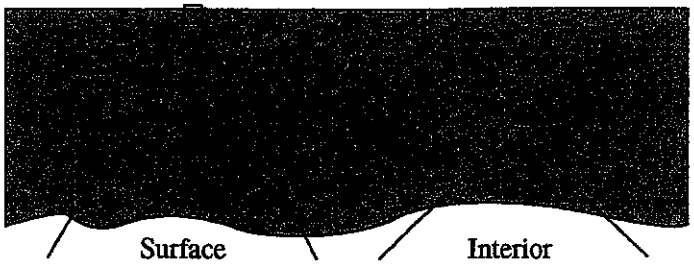
(A) have a larger average speed than the other three gases
(B) occupy a larger portion of the container volume than the other three gases
(C) have stronger intermolecular attractions than the other three gases
(D) contain π bonds, while the other gases contain only σ bonds → ridiculous!

1.

Bad picture!

42. Steel is an alloy consisting of Fe with a small amount of C. Elemental Cr can be added to steel to make the steel less likely to rust; Cr atoms react with oxygen in the air to form a nonreactive layer of chromium oxide on the surface of the steel, preventing the oxidation of underlying Fe atoms. A sample of steel-chromium alloy contains 15 percent Cr by mass. Which of the following diagrams best shows a particle-level view of a surface section and an interior section of the alloy represented below at the left? (The atomic radii of the atoms involved are given in the table below at the right.)

Sorry :(




| Element | Molar Mass (g/mol) | Atomic Radius (pm) |
|---|---|---|
| Fe | 55.85 | 125 |
| Cr | 52.00 | 127 |
| C | 12.01 | 77 |
| O | 16.00 | 73 |

(A) All ● are oxygens. → no Cr in either

(B) ● are oxygen; C

(C) no Cr in either

(D) ● are oxygen; C

All ● are carbon

1. A 0.5 mol sample of He(*g*) and a 0.5 mol sample of Ne(*g*) are placed separately in two 10.0 L rigid containers at 25°C. Each container has a pinhole opening. Which of the gases, He(*g*) or Ne(*g*), will escape faster through the pinhole and why?

(A) He(*g*) will escape faster because the He(*g*) atoms are moving at a higher average speed than the Ne(*g*) atoms.

(B) Ne(*g*) will escape faster because its initial pressure in the container is higher.

(C) Ne(*g*) will escape faster because the Ne(*g*) atoms have a higher average kinetic energy than the He(*g*) atoms.

(D) Both gases will escape at the same rate because the atoms of both gases have the same average kinetic energy.

V=V, n=n, T=T, P=P

same T → $KE = \frac{1}{2} m v^2$ (m: mass; v: velocity)

4. Which of the following diagrams best depicts an alloy of Ni and B ?

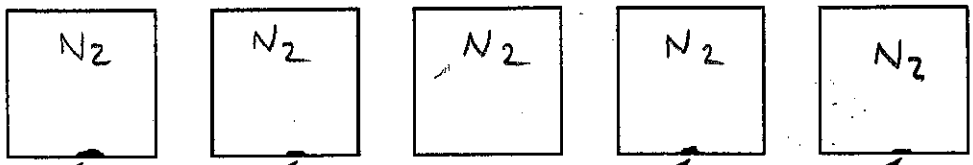
(A) Just atoms – Ni is larger than B → interstitial alloy *

(B)

(C) * Substitutional alloy 2.

(D) no ions

**Questions 7-9 refer to the following information.**




T = T
V = V
n = n
P = P

0.050 mol $NaHCO_3(s)$ 1 | 0.050 mol $NaBr(s)$ 2 | 3 | 0.050 mol $Cu(s)$ 4 | 0.050 mol $I_2(s)$ 5

At 27°C, five identical rigid 2.0 L vessels are filled with $N_2(g)$ and sealed. Four of the five vessels also contain a 0.050 mol sample of $NaHCO_3(s)$, $NaBr(s)$, $Cu(s)$, or $I_2(s)$, as shown in the diagram above. The volume taken up by the solids is negligible, and the initial pressure of $N_2(g)$ in each vessel is 720 mm Hg. All four vessels are heated to 127°C and allowed to reach a constant pressure.

7. At 127°C, the pressure in vessel 1 is found to be higher than that in vessel 2. Which of the following reactions best accounts for the observation?

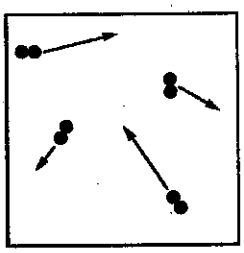
(A) $NaHCO_3(s) \rightarrow Na(s) + HCO_3(s)$
(B) $NaHCO_3(s) \rightarrow NaH(s) + CO_3(s)$
(C) $2\,NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$
(D) $2\,NaHCO_3(s) + N_2(g) \rightarrow 2\,NaNO_3(s) + C_2H_2(g)$

Carbonate decomp → $CO_{2(g)}$
Chlorate decomp → $O_{2(g)}$
Hydroxide decomp → $H_2O_{(g)}$

8. At 127°C, the entire sample of $I_2$ is observed to have vaporized. How does the mass of vessel 5 at 127°C compare to its mass at 27°C?

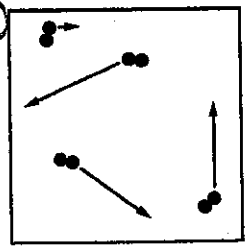
(A) The mass is less, since the $I_2$ is in the vapor phase.
(B) The mass is the same, since the number of each type of atom in the vessel is constant.
(C) The mass is greater, since the $I_2$ will react with $N_2$ to form $NI_3$, which has a greater molar mass.
(D) The mass is greater, since the pressure is greater and the particles have a higher average kinetic energy.

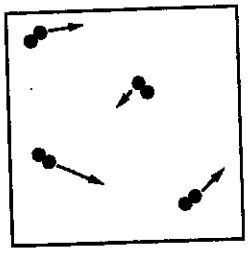
Just because the iodine went from (s) to (g) doesn't mean mass changed.

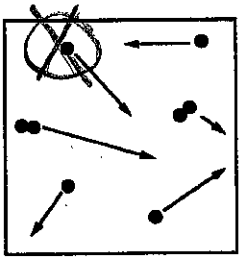


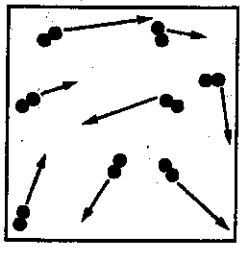
9. The gas particles in vessel 3 at 27°C are represented in the diagram above. The lengths of the arrows represent the speeds of the particles. Which of the following diagrams best represents the particles when vessel 3 is heated to 127°C?

↑T, ↑ avg KE, ↑ speed

(A)


(B)


(C)


(D)


| Name | Molecular Formula | Molar Mass (g/mol) |
|---|---|---|
| Ethane | $C_2H_6$ | 30 |
| Butane | $C_4H_{10}$ | 58 |

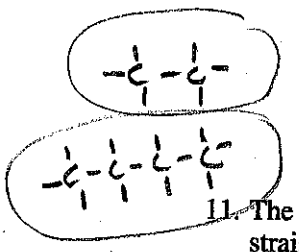
11. The molecular formula and molar mass of two straight-chain hydrocarbons are listed in the table above. Based on the information in the table, which compound has the higher boiling point, and why is that compound's boiling point higher?

(A) $C_4H_{10}$, because it has more hydrogen atoms, resulting in more hydrogen bonding

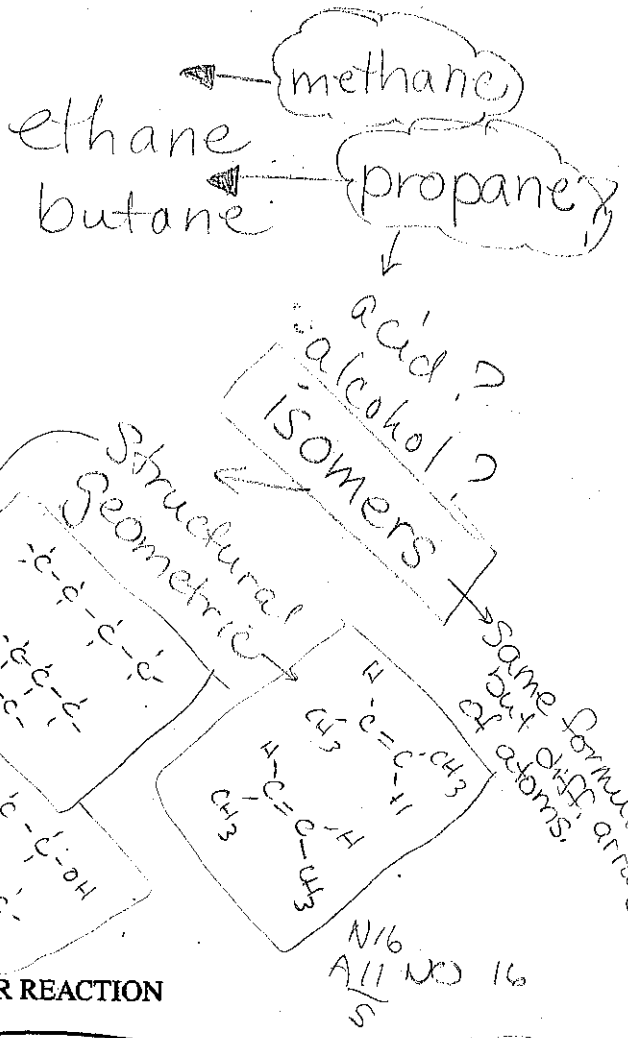
(B) $C_4H_{10}$, because it has more electrons, resulting in greater polarizability and stronger dispersion forces

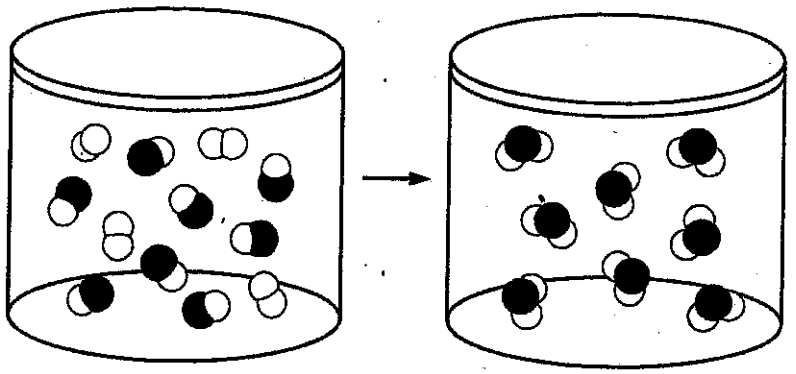
(C) $C_2H_6$, because its molecules are smaller and they can get closer to one another, resulting in stronger dispersion forces

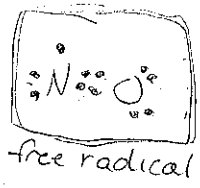
(D) $C_2H_6$, because its molecules are more polar, resulting in stronger dipole-dipole attractions



Both nonpolar!




$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$

24. The reaction between $NO(g)$ and $O_2(g)$ to produce $NO_2(g)$ in a rigid reaction vessel is represented in the diagram above. The pressure inside the container is recorded using a pressure gauge. Which of the following statements correctly predicts the change in pressure as the reaction goes to completion at constant temperature, and provides the correct explanation?

(A) The pressure will increase because the product molecules have a greater mass than either of the reactant molecules.

(B) The pressure will decrease because there are fewer molecules of product than of reactants.

(C) The pressure will decrease because the product molecules have a lower average speed than the reactant molecules.

(D) The pressure will not change because the total mass of the product molecules is the same as the total mass of the reactant molecules.

free radical