This print-out should have 25 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

Remember to bubble your version number and uteid.

001 4.0 points

When a gas phase reaction takes place...

1. some state functions may increase, others may decrease and some may stay constant.

2. all state functions must increase or stay constant.

3. all state functions must stay constant.

4. all state functions must change.

5. all state functions must decrease or stay constant.

002 4.0 points

Which of the following statements about gas laws is/are true?

I) Boyle's law says that above the boiling point, the pressure and volume of a gas are directly proportional.

II) Jacques Charles measured an inverse relationship between volume and temperature.

III) The ideal gas law is only accurate at very high concentrations.

1. II, III

2. I, II, III

3. II only

4. I, II

5. None are true

6. I only

7. III only

8. I, III

003 4.0 points

A 22.4 L vessel contains 0.02 mol H_2 gas, 0.02 mol N_2 gas, and 0.1 mol NH_3 gas. The total pressure is 700 torr. What is the partial pressure of the H_2 gas?

1. 28 torr

2. 100 torr

3. None of these

4. 14 torr

5. 7 torr

004 4.0 points

What volume will 40.0 L of He at 50.00°C and 1201 torr occupy at STP?

1. 26.7 L

2. 53.4 L

3. 12.8 L

4. 18.6 L

5. 31.1 L

005 4.0 points

If 250 mL of a gas at STP weighs 2 g, what is the molar mass of the gas?

1. 179 $g \cdot mol^{-1}$

2. 44.8 $g \cdot mol^{-1}$

3. 56.0 $g \cdot mol^{-1}$

4. 28.0 $g \cdot mol^{-1}$

5. 8.00 $g \cdot mol^{-1}$

006 4.0 points

A sample of nitrous oxide gas (NO) has a density of 12 g L^{-1}. What pressure does the

sample exert at 27 °C?

1. 9.9 atm

2. 1.0 atm

3. 997.9 atm

4. not enough information

5. 61.6 atm

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007 4.0 points

What is the final volume if 20 L methane reacts completely with 20 L oxygen

$$CH_4(g) + 2\,O_2(g) \rightarrow CO_2(g) + 2\,H_2O(\ell)$$

at 100°C and 2 atmospheres?

1. 10 L

2. 30 L

3. 20 L

4. Cannot be determined from the information given.

5. 15 L

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008 4.0 points

Consider the balanced reaction for the combustion of methane below.

$$CH_4(g) + 2\,O_2(g) \rightarrow CO_2(g) + 2\,H_2O(g)$$

If 100 g of methane react completely with 100 g of molecular oxygen in a sturdy, closed 100 L vessel at 227 °C, what is the approximate final pressure in the vessel?

1. 1.92 atm

2. 3.85 atm

3. 0.87 atm

4. 1.75 atm

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009 4.0 points

When two samples of ideal gases have the same ___?___ , their molecules must have the same ___?___ .

1. pressure; average kinetic energy

2. mass; average kinetic energy

3. density; mass

4. density; average kinetic energy

5. volume; average kinetic energy

6. volume; mass

7. pressure; mass

8. mass; density

9. temperature; speed

10. temperature; average kinetic energy

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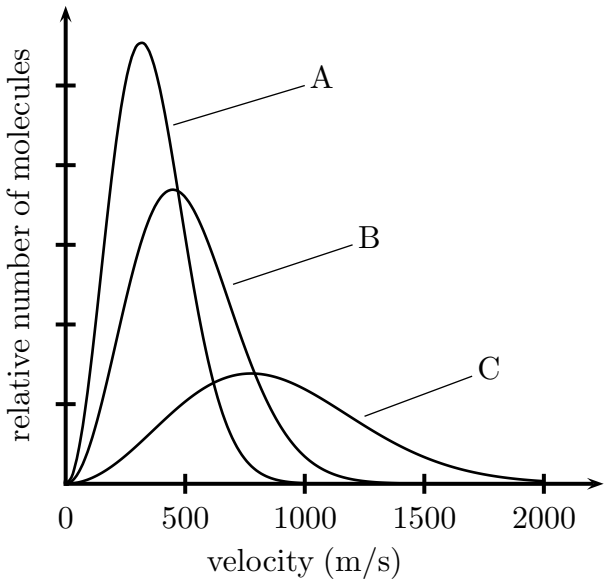
010 4.0 points

The graph shows the Maxwell distribution plots for a given gas at three different temperatures.



Which plot corresponds to the highest temperature?

1. C

2. Can not be determined from this type of plot.

3. B

4. A

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011 4.0 points

Calculate the ratio of the rate of effusion of He to that of CO_2 (at the same temperatures).

1. 1 : 11

2. $1 : 11^2$

3. $\sqrt{11} : 1$

4. 11 : 1

5. 1 : 1

6. $11^2 : 1$

7. $1 : \sqrt{11}$

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012 4.0 points

Under which of the following conditions is a real gas most likely to deviate from ideal behavior?

1. high volume

2. low density

3. if it is a noble gas

4. Tuesdays and Thursdays

5. zero pressure

6. low pressure

7. new moon

8. low temperature

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013 4.0 points

Gas X has a larger value than Gas Y for the van der Waals constant "a". This indicates that

1. the molecules of X have stronger intermolecular attractions for each other than the molecules of Y have for each other.

2. the molecules of gas X have a higher velocity than do the molecules of gas Y.

3. the molecules of X are larger than the molecules of Y.

4. the molecules of gas X repel other X molecules.

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014 4.0 points

Some of the following terms characterize both the bonding within a molecule (*intra*molecular) and that between atoms and molecules (*inter*molecular). Which of the following is normally considered only when characterizing *inter*molecular forces?

1. ionic forces

2. covalent bonding

3. van der Waals forces

4. polar covalent bonding

5. electrostatic forces

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015 4.0 points

Dispersion (London) forces result from

1. the balance of attractive and repulsive forces between two polar molecules.

2. attraction between molecules in a liquid and molecules or atoms in a solid surface with which the liquid is in contact.

3. the formation of a loose covalent linkage between a hydrogen atom connected to a very electronegative atom in one molecule

and another very electronegative atom in a neighboring molecule.

4. distortion of the electron cloud of an atom or molecule by the presence of nearby atoms or molecules.

5. attractive forces between a molecule at the surface of a liquid and those beneath it which are not balanced by corresponding forces from above.

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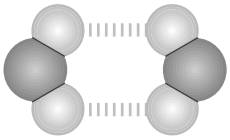
016 4.0 points

Which figure best describes the hydrogen bonding between two water molecules?

1.


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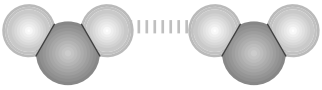

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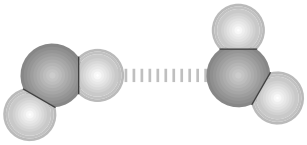

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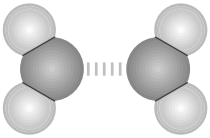

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017 4.0 points

Identify the dominant intermolecular force in the following species, respectively: RbCl, C_6H_6 (benzene), HI, Fe_2O_3, CH_2NH.

a) ionic forces
b) hydrogen bonding
c) dipole-dipole
d) instantaneous dipoles

1. a, c, c, d, b

2. a, d, c, a, b

3. a, b, c, b, a

4. a, b, d, a, c

5. c, b, d, c, c

6. b, d, c, d, d

7. c, d, a, a, b

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018 4.0 points

Acetic acid (CH_3COOH) forms a molecular solid. What type of forces hold it in a solid configuration?

I) London forces
II) dipole-dipole forces
III) hydrogen bonding

1. I only

2. I, II, and III

3. III only

4. II only

5. II and III only

6. I and II only

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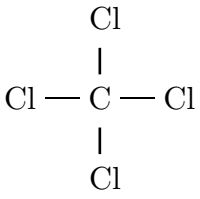
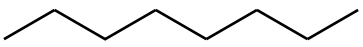
019 4.0 points

Carbon tetrachloride (CCl_4) and *n*-octane (C_8H_{18}) are both non-polar molecules. At standard pressure, they boil at 345 K and 399 K, respectively. Which answer choice below correctly explains their boiling points?





1. C_8H_{18} has a higher boiling point because its electron cloud is larger and allows it to form more instantaneous dipoles.

2. C_8H_{18} has a higher boiling point be-

cause its smaller surface area allows it to form stronger instantaneous dipoles.

3. CCl_4 has a lower boiling point because its smaller surface area allows it to form stronger instantaneous dipoles.

4. CCl_4 has a lower boiling point because its greater molecular weight enables it to form stronger instantaneous dipoles.

5. C_8H_{18} has a higher boiling point because its greater molecular weight enables it to form stronger instantaneous dipoles.

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020 4.0 points

H_2S has a lower boiling point than H_2O or H_2Se. Which of the following is NOT part of the explanation for this observation?

1. ΔEN for the O—H bond is larger than ΔEN for the S—H bond.

2. The strength of London forces is greater for H_2Se than for H_2S.

3. Hydrogen bonding is most significant for compounds containing electronegative atoms in the second row.

4. ΔEN for the Se—H bond is larger than ΔEN for the S—H bond.

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021 4.0 points

Surface tension describes

1. the resistance to flow of a liquid.

2. the forces of attraction between the surface of a liquid and the air above it.

3. adhesive forces between molecules.

4. the inward forces that must be overcome in order to expand the surface area of a liquid.

5. capillary action.

6. the forces of attraction between surface molecules of a solvent and the solute molecules.

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022 4.0 points

Which of the following substances would you predict might evaporate the fastest?

1. C_6H_{14}

2. C_8H_{18}

3. $C_{12}H_{24}$

4. $C_{10}H_{22}$

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023 4.0 points

Which of the following would you expect to have the highest heat of vaporization?

1. C_8H_{18}

2. CH_4

3. C_3H_6

4. C_5H_{12}

5. $C_{12}H_{26}$

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024 4.0 points

Arrange

Al_2O_3 Nb I_2 C(s) (diamond)

in the order metallic solid, covalent network, covalent solid, ionic solid.

1. C(s) (diamond); Nb, Al_2O_3; I_2

2. Nb, I_2; C(s) (diamond); Al_2O_3

3. Al_2O_3; C(s) (diamond); I_2; Nb

4. Nb; C(s) (diamond); I_2; Al_2O_3

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025 4.0 points

Put the following compounds

LiF, HF, F_2, NF_3

in order of increasing melting points.

1. NF_3, HF, F_2, LiF

2. NF_3, F_2, HF, LiF

3. LiF, NF_3, HF, F_2

4. F_2, HF, NF_3, LiF

5. F_2, NF_3, HF, LiF

6. LiF, HF, NF_3, F_2

7. LiF, F_2, HF, NF_3

8. LiF, HF, F_2, NF_3