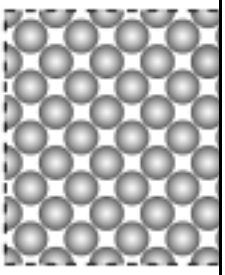
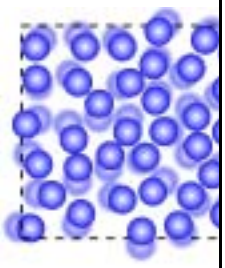
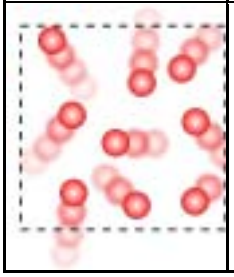
CHE107 Summer 2016 EX1

Your Name: _____ **Your ID:** _____

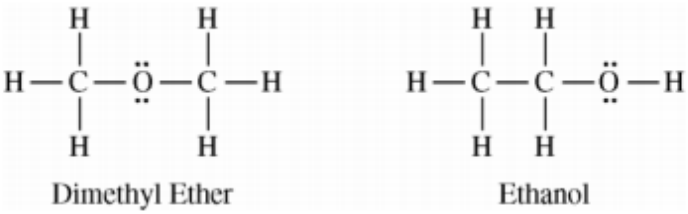
Question #: 1

Molecular View	State	Density	Shape	Volume	Strength of Intermolecular Forces
	solid	high	definite	1 [definite, indefinite]	strong
	liquid	2 [high, low]	3 [definite, indefinite]	definite	moderate
	gas	low	indefinite	indefinite	4 [strong, weak]

1. _____
2. _____
3. _____
4. _____

Question #: 2

Select the **true** statement based on this image.



A. Dimethyl ether has the higher boiling point.
B. Since both compounds have the same molar mass, they have the same boiling point.
C. Both compounds display intermolecular hydrogen bonding forces.
D. Ethanol has the higher melting point.

Question #: 3

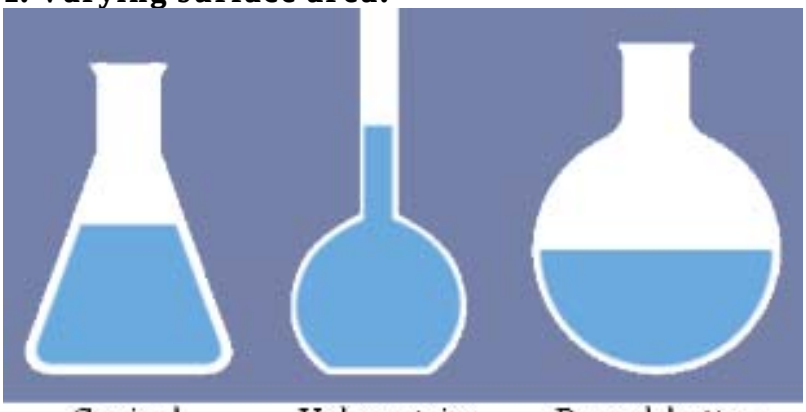
Which liquid has the **lowest** viscosity?

A. H_2O at 5 °C
B. H_2O at 55 °C
C. C_6H_{14} at 5 °C
D. C_6H_{14} at 55 °C

Question #: 4

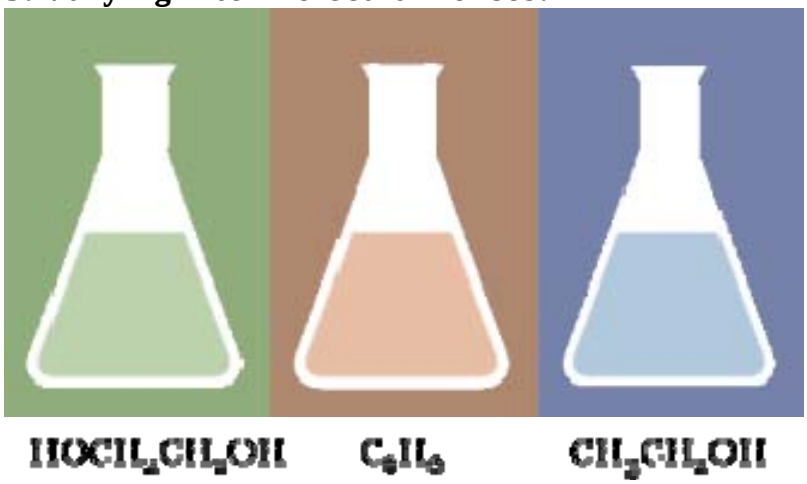
Three sets of containers are shown below with their differences noted (assume all other parameters are identical). Which container from each set will have the **lowest rate of vaporization**?

1. Varying surface area:



2. Varying temperature:

3. Varying intermolecular forces:



A. 1. Round-bottom flask
2. 600 K
3. C_6H_6
B. 1. Volumetric flask
2. 600 K
3. CH_3CH_2OH
C. 1. Volumetric flask
2. 200 K
3. $HOCH_2CH_2OH$
D. 1. Conical (Erlenmeyer) flask
2. 400 K
3. $HOCH_2CH_2OH$

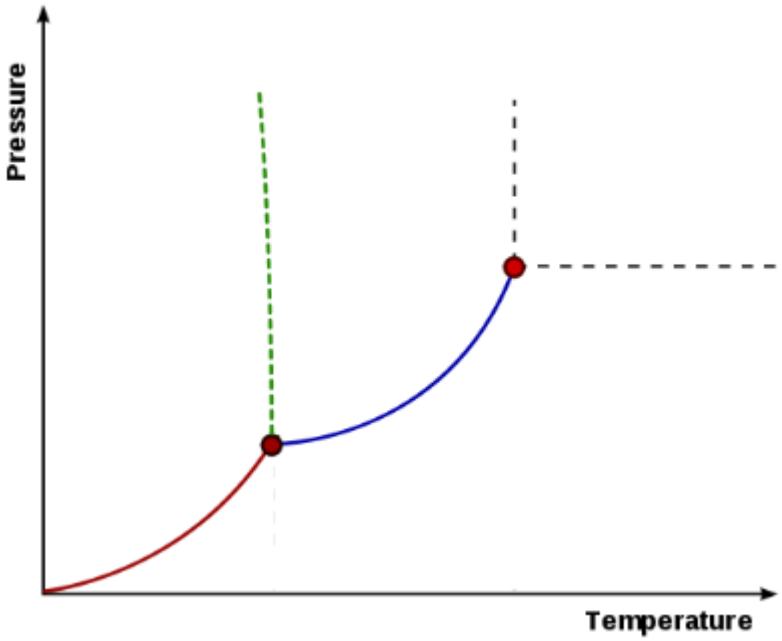
Question #: 5

The normal boiling point of benzene (C_6H_6) is 80.0 °C. What is benzene's vapor pressure at 45.0 °C?
The heat of vaporization, ΔH_{vap}, of benzene is 30.8 kJ/mol.

A. 0.315 atm
B. 0.217 atm
C. 1.10 atm
D. 0.868 atm

Question #: 6

Which statement is **false** about supercritical fluids?



A. The liquid phase cannot exist above a substance's critical temperature.
B. At the critical point of a substance, the densities of its gas and liquid phases become equal.
C. Supercritical fluids can act as good, selective solvents.
D. The gas phase cannot exist below a substance's critical pressure.

Question #: 7

The direct conversion from solid to gas is called __1__ and __2__ [completely, partially] overcomes a substance's intermolecular forces.
The direct conversion from solid to liquid is called __3__ (commonly known as "melting") and __4__ [completely, partially] overcomes a substance's intermolecular forces.

1. _____
2. _____
3. _____
4. _____

Question #: 8

$C_{10}H_{20}O(s)$ (levomenthol) sublimes at 298 K (room temperature), resulting in a minty aroma. ΔH_{fus} = 11.9 kJ/mol and ΔH_{vap} = 83.9 kJ/mol for levomenthol at 298 K. How much heat is required to convert 1.25 moles of solid, crystalline $C_{10}H_{20}O(s)$ to gaseous $C_{10}H_{20}O(g)$?

A. 18.6 kJ
B. 94.2 kJ
C. 103 kJ
D. 120. kJ

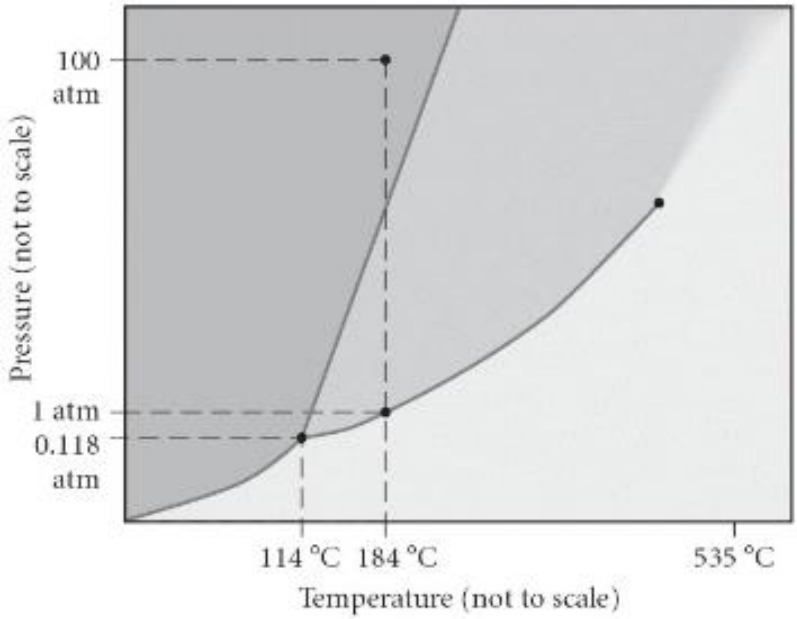
Question #: 9

How much energy is required to convert 180. g (10.0 mol) of $H_2O(l)$ at 20.0 °C to $H_2O(g)$ at 100.0 °C?
melting point = 0.00 °C
boiling point = 100.0 °C
ΔH_{fus} = 6.02 kJ/mol
ΔH_{vap} = 40.7 kJ/mol
C_s of $H_2O(s)$ = 2.09 J/g °C
C_s of $H_2O(l)$ = 4.18 J/g °C
C_s of $H_2O(g)$ = 2.01 J/g °C

A. 467 kJ
B. 92.3 kJ
C. 638 kJ
D. 359 kJ

Question #: 10

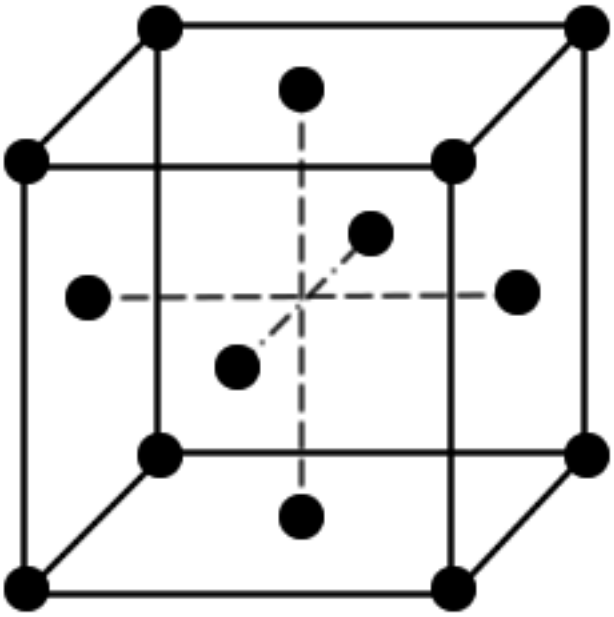
For the substance described by this phase diagram, what phase changes occur as the pressure is **increased** from 0.010 atm to 100 atm at a temperature of 184 °C?



A. condensation followed by freezing
B. sublimation followed by vaporization
C. freezing followed by vaporization
D. sublimation followed by condensation

Question #: 11

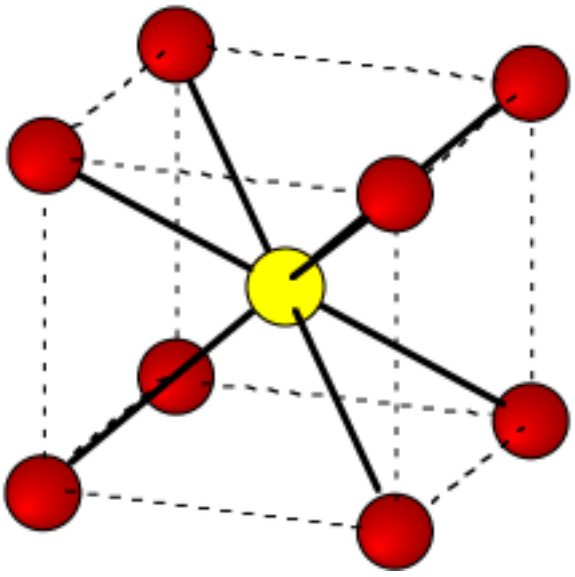
Iridium (192 g/mol) crystallizes in a face-centered cubic structure as shown below. The volume of the unit cell is 5.66×10^{-23} cm^3. What is the the **density** of iridium?



A. 4.49×10^{-8} g/cm^3
B. 18.1 g/cm^3
C. 22.6 g/cm^3
D. 8.92 g/cm^3

Question #: 12

β-Brass has the stucture shown below at 300 °C. The red circles represent Zn atoms and the yellow circle represents a Cu atom.
The formula of β-brass is __1__.
Enter your answer without spaces or subscripts, e.g., AlF3.



1. _____

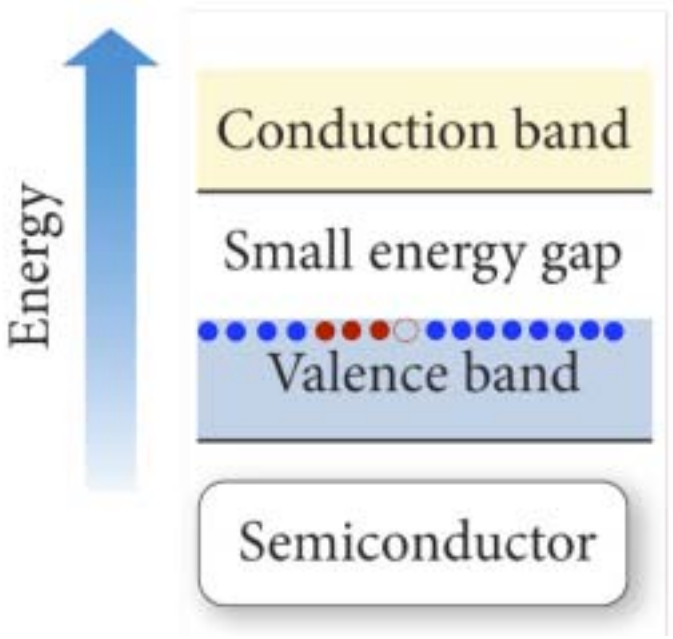
Question #: 13

Octasulfur, $S_8(s)$, is a(n) __1__ [molecular, ionic, nonbonding atomic, metallic, network covalent] crystalline solid.
As such, $S_8(s)$ has a relatively __2__ [low, high] melting point.

1. _____
2. _____

Question #: 14

Germanium is doped, resulting in the material with the band diagram below.

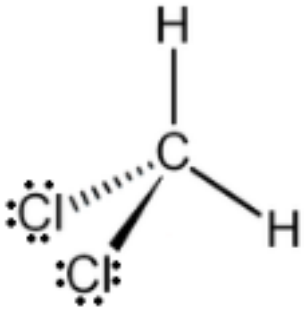


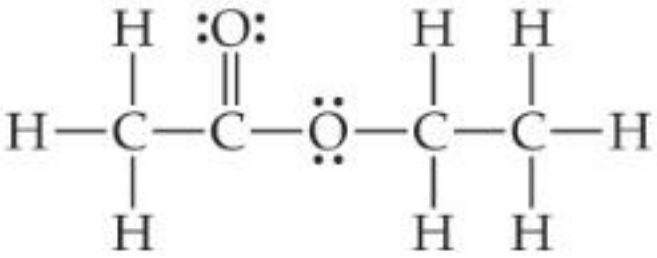
If the blue dots represent electrons from germanium, red dots represent electrons from the dopant, and the open circle represents an electron hole, what is the **identity of the dopant** and the **type of semiconductor** formed?

A. arsenic; n-type
B. indium; p-type
C. silicon; p-type
D. gallium; n-type

Question #: 15

Dichloromethane (CH_2Cl_2) and ethyl acetate ($C_4H_8O_2$) spontaneously mix with one another because





A. they form strong hydrogen bonds with one another.
B. there is a large increase in potential energy for the mixed liquids compared to the two pure liquids.
C. there is a large increase in entropy for the mixed liquids compared to the two pure liquids.
D. there are strong ion-dipole attractions between dichloromethane and ethyl acetate.

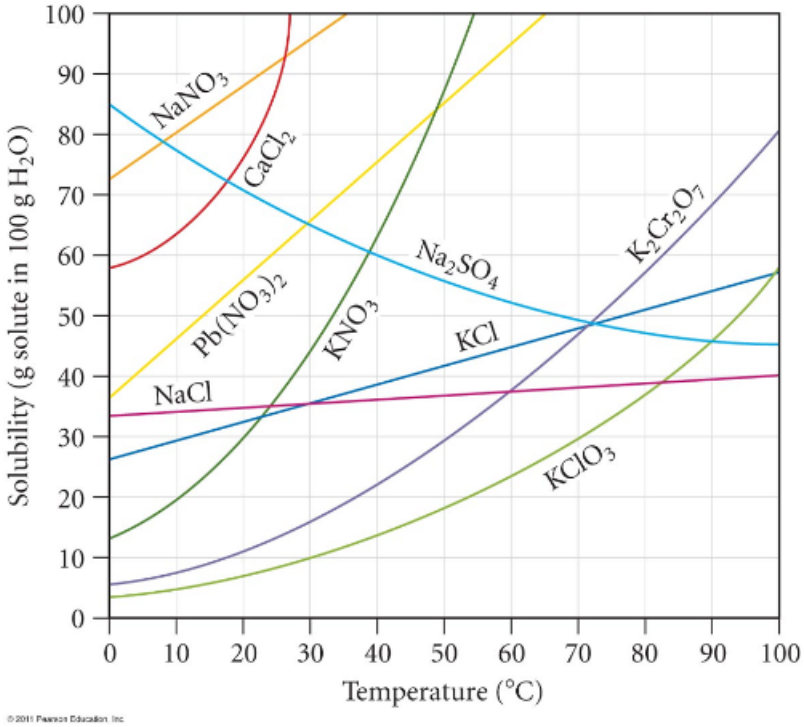
Question #: 16

In a(n) __1__ [saturated, supersaturated, unsaturated] solution, the dissolved solute is in dynamic equilibrium with any undissolved solute; additional solute will not dissolve.
Added solute will dissolve in a(n) __2__ [saturated, supersaturated, unsaturated] solution until equilibrium is reached.
A(n) __3__ [saturated, supersaturated, unsaturated] solution is an unstable solution in which more than the equilibrium amount of solute is dissolved.

1. _____
2. _____
3. _____

Question #: 17

A 35.0 g sample of solid KNO_3 is added, with stirring, to 200.0 g of water at 20.0 °C. What results?



A. All of the $KNO_3(s)$ dissolves at 20.0 °C and the solution remains unsaturated.

B. All of the $KNO_3(s)$ dissolves at 20.0 °C and the solution becomes saturated.

C. All of the $KNO_3(s)$ dissolves at 20.0 °C and the solution becomes supersaturated.

D. Most, but not all, of the $KNO_3(s)$ dissolves at 20.0 °C and the solution becomes saturated.

Question #: 18

Which set of conditions results in the **lowest** solubility of $O_2(g)$ in water?

A. high water temperature, low pressure of O_2 above the water
B. low water temperature, high pressure of O_2 above the water
C. low water temperature, low pressure of O_2 above the water
D. high water temperature, high pressure of O_2 above the water

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Question #: 19

What is the molality of a solution of 25.9 g $CuCl_2$ (134 g/mol) dissolved in 250. g of water?

A. 0.773 *m*
B. 0.00882 *m*
C. 0.119 *m*
D. 1.21 *m*

Question #: 20

What is the concentration in parts per million (ppm) of K^+ in a solution made by dissolving 5.05 mg K_2SO_4 in 125 g H_2O?

A. 0.232 ppm
B. 18.1 ppm
C. 87.4 ppm
D. 394 ppm

Question #: 21

What is the **molarity** of a 1.24 *m* glucose (180. g/mol) solution with a density of 1.011 g/mL?

A. 1.39 M
B. 1.18 M
C. 1.03 M
D. 0.722 M

Question #: 22

Which aqueous solution has the **lowest** boiling point? Assume ideal van't Hoff factors.

A. 0.10 *m* LiBr
B. 0.10 *m* $(NH_4)_3PO_4$
C. 0.25 *m* $C_{12}H_{22}O_{11}$
D. 0.15 *m* $Ca(OH)_2$

Question #: 23

Which substance has the correct van't Hoff factor indicated?

A. $Ca(C_2H_3O_2)_2$, $i = 3$
B. NH_4Br, $i = 6$
C. Na_2SO_4, $i = 1$
D. Li_3PO_4, $i = 2$

Question #: 24

A solution at 25 ºC contains 0.80 mol H_2O and 0.20 mol of a nonvolatile nonelectrolyte. If $P°(H_2O)$ is 23.8 torr, what is the vapor pressure of the solution?

A. 16.5 torr
B. 18.2 torr
C. 19.0 torr
D. 27.7 torr

Question #: 25

What is the osmotic pressure of a 0.125 M potassium chlorate (KClO3, 122 g/mol) solution at 300. K?

A. 1.07 atm
B. 3.48 atm
C. 2.86 atm
D. 6.15 atm

DRAFT

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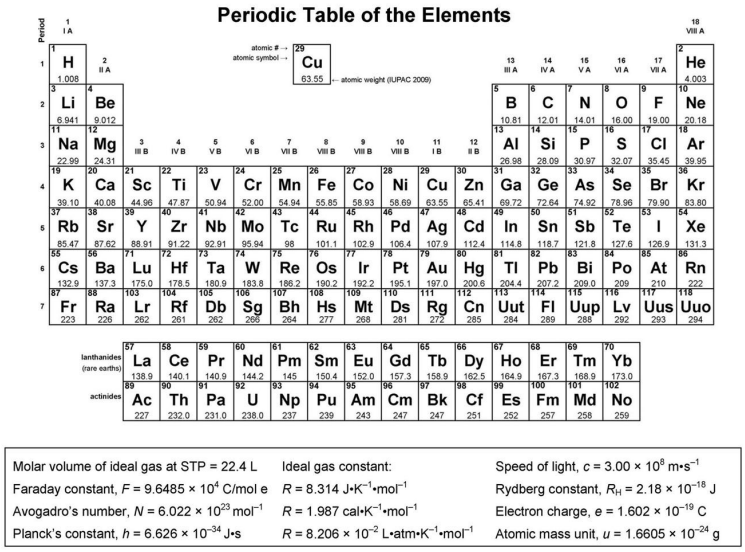
Your Name: _____ **Your ID:** _____



Molar volume of ideal gas at STP = 22.4 L	Ideal gas constant:	Speed of light, $c = 3.00 \times 10^{8}$ m•s^{-1}
Faraday constant, $F = 9.6485 \times 10^{4}$ C/mol e	$R = 8.314$ J•K^{-1}•mol^{-1}	Rydberg constant, $R_H = 2.18 \times 10^{-18}$ J
Avogadro's number, $N = 6.022 \times 10^{23}$ mol^{-1}	$R = 1.987$ cal•K^{-1}•mol^{-1}	Electron charge, $e = 1.602 \times 10^{-19}$ C
Planck's constant, $h = 6.626 \times 10^{-34}$ J•s	$R = 8.206 \times 10^{-2}$ L•atm•K^{-1}•mol^{-1}	Atomic mass unit, $u = 1.6605 \times 10^{-24}$ g

attachment_for_pubExamUID_lnxp11466704896958215 3XX_80.jpg

Question #: 1

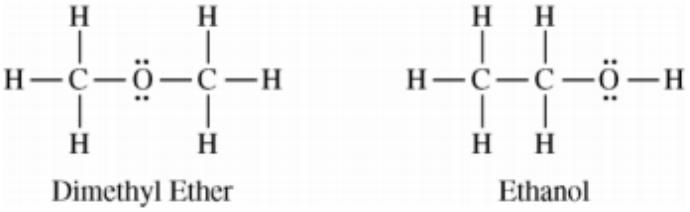
iew	State	Density	Shape	Volume	St Inte
	solid	high	definite	1 [definite, indefinite]	strong
	liquid	2 [high, low]	3 [definite, indefinite]	definite	modera

					
	gas	low	indefinite	indefinite	4 [

1. definite|definate|
2. high|hi|
3. indefinite|indefinate|
4. weak|Weak|week|Week|

Question #: 2

Select the **true** statement based on this image.



A. Dimethyl ether has the higher boiling point.
B. Since both compounds have the same molar mass, they have the same boiling point.
C. Both compounds display intermolecular hydrogen bonding forces.
✓D. Ethanol has the higher melting point.

Question #: 3

Which liquid has the **lowest** viscosity?

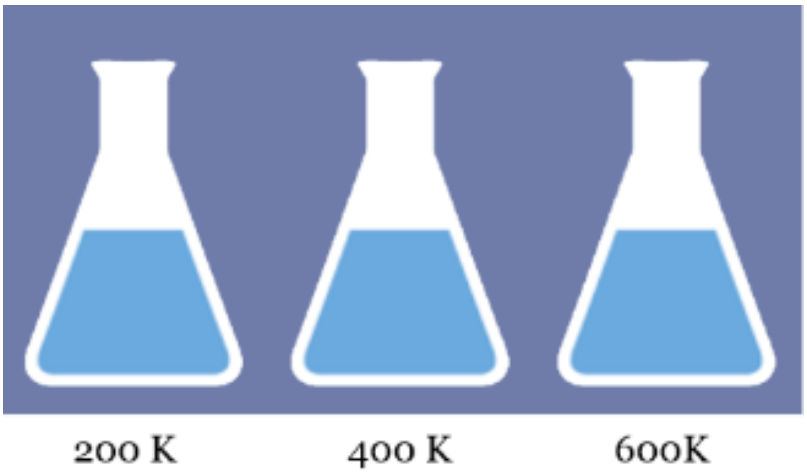
A. H_2O at 5 °C
B. H_2O at 55 °C
C. C_6H_{14} at 5 °C
✓D. C_6H_{14} at 55 °C

Question #: 4

Three sets of containers are shown below with their differences noted (assume all other parameters are identical). Which container from each set will have the **lowest rate of vaporization**?

1. Varying surface area:

2. Varying temperature:



3. Varying intermolecular forces:

A. 1. Round-bottom flask
   2. 600 K
   3. C_6H_6

B. 1. Volumetric flask
   2. 600 K
   3. CH_3CH_2OH

✓C. 1. Volumetric flask
   2. 200 K
   3. $HOCH_2CH_2OH$

D. 1. Conical (Erlenmeyer) flask
   2. 400 K
   3. $HOCH_2CH_2OH$

Question #: 5

The normal boiling point of benzene (C_6H_6) is 80.0 °C. What is benzene's vapor pressure at 45.0 °C?
The heat of vaporization, ΔH_{vap}, of benzene is 30.8 kJ/mol.

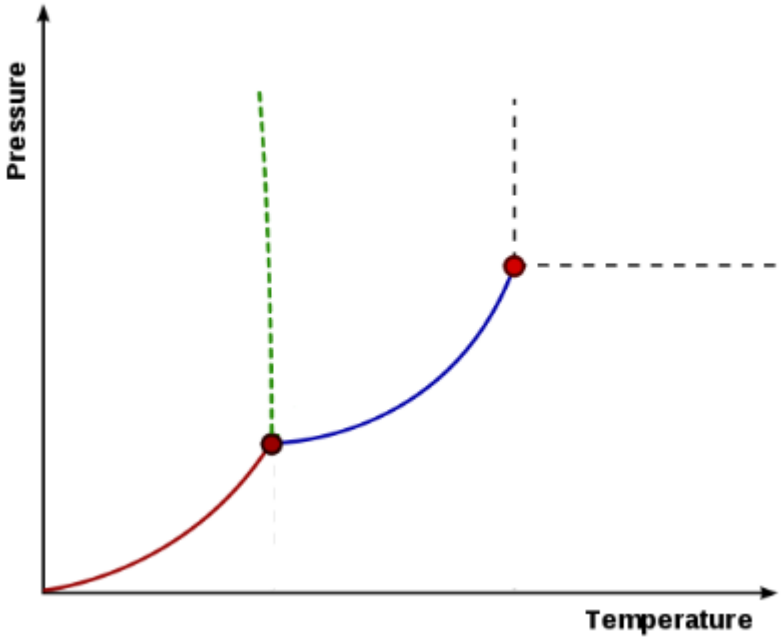
✓A. 0.315 atm

B. 0.217 atm

C. 1.10 atm
D. 0.868 atm

Question #: 6

Which statement is **false** about supercritical fluids?



A. The liquid phase cannot exist above a substance's critical temperature.
B. At the critical point of a substance, the densities of its gas and liquid phases become equal.
C. Supercritical fluids can act as good, selective solvents.
✓D. The gas phase cannot exist below a substance's critical pressure.

Question #: 7

The direct conversion from solid to gas is called __1__ and __2__ [completely, partially] overcomes a substance's intermolecular forces.
The direct conversion from solid to liquid is called __3__ (commonly known as "melting") and __4__ [completely, partially] overcomes a substance's intermolecular forces.

1. sublimation|sublime|subliming|sublamation|

2. completely|completly|complettally|
3. fusion|fuzion|fusing|fuse|
4. partially|partly|

Question #: 8

$C_{10}H_{20}O(s)$ (levomenthol) sublimes at 298 K (room temperature), resulting in a minty aroma. ΔH_{fus} = 11.9 kJ/mol and ΔH_{vap} = 83.9 kJ/mol for levomenthol at 298 K. How much heat is required to convert 1.25 moles of solid, crystalline $C_{10}H_{20}O(s)$ to gaseous $C_{10}H_{20}O(g)$?

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B. 94.2 kJ
C. 103 kJ
✓D. 120. kJ

Question #: 9

How much energy is required to convert 180. g (10.0 mol) of $H_2O(l)$ at 20.0 °C to $H_2O(g)$ at 100.0 °C?

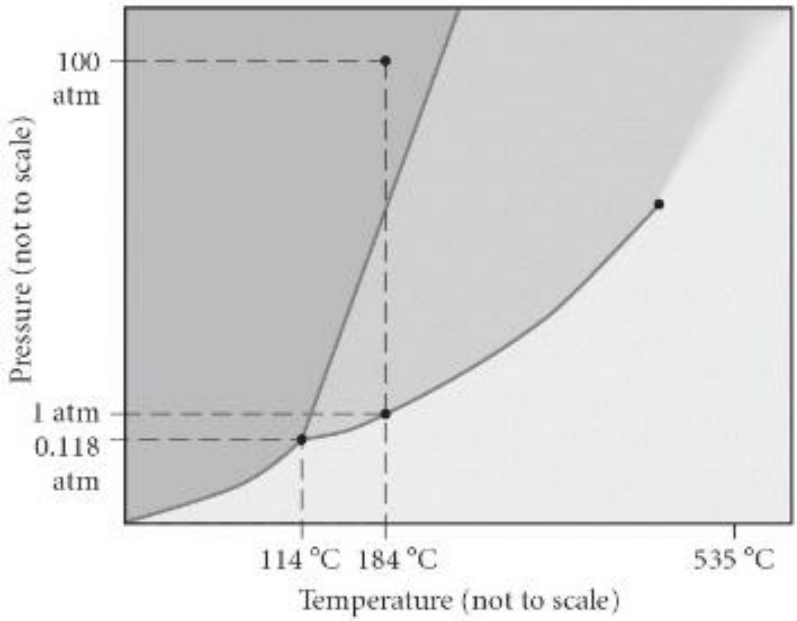
melting point = 0.00 °C
boiling point = 100.0 °C
ΔH_{fus} = 6.02 kJ/mol
ΔH_{vap} = 40.7 kJ/mol
C_s of $H_2O(s)$ = 2.09 J/g °C
C_s of $H_2O(l)$ = 4.18 J/g °C

C_s of $H_2O(g)$ = 2.01 J/g °C

✓A. 467 kJ
B. 92.3 kJ
C. 638 kJ
D. 359 kJ

Question #: 10

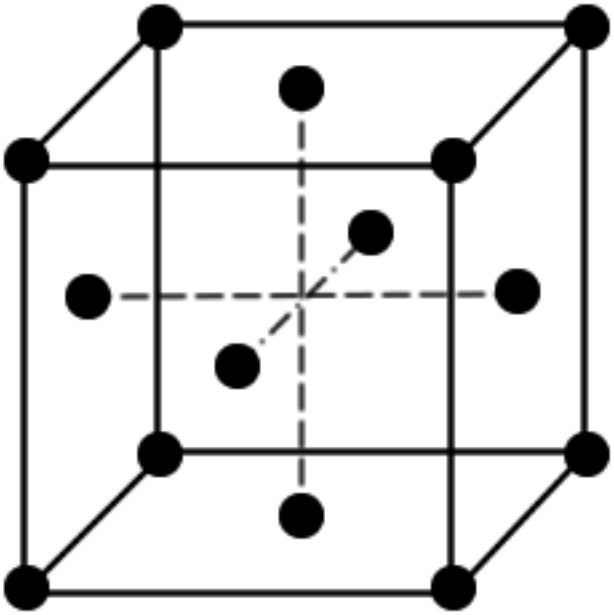
For the substance described by this phase diagram, what phase changes occur as the pressure is **increased** from 0.010 atm to 100 atm at a temperature of 184 °C?



✓A. condensation followed by freezing
B. sublimation followed by vaporization
C. freezing followed by vaporization
D. sublimation followed by condensation

Question #: 11

Iridium (192 g/mol) crystallizes in a face-centered cubic structure as shown below. The volume of the unit cell is 5.66×10^{-23} cm^3. What is the the **density** of iridium?



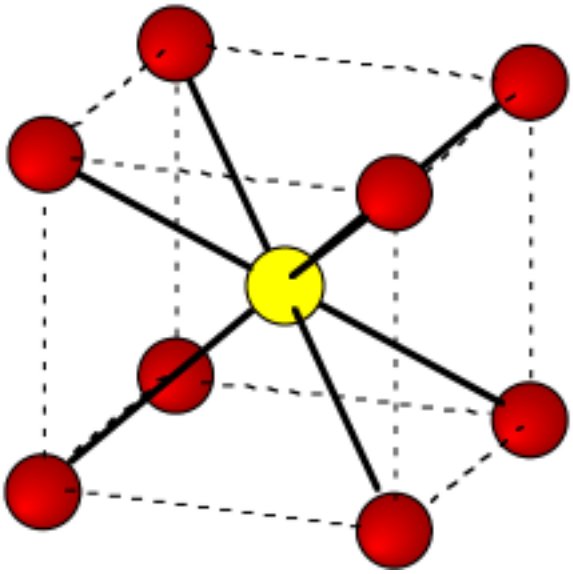
A. 4.49×10^{-8} g/cm^3
B. 18.1 g/cm^3
✓C. 22.6 g/cm^3
D. 8.92 g/cm^3

Question #: 12

β-Brass has the stucture shown below at 300 °C. The red circles represent Zn atoms and the yellow circle represents a Cu atom.

The formula of β-brass is __1__.

Enter your answer without spaces or subscripts, e.g., AlF3.



1. CuZn|ZnCu|Cu1Zn1|Zn1Cu1|

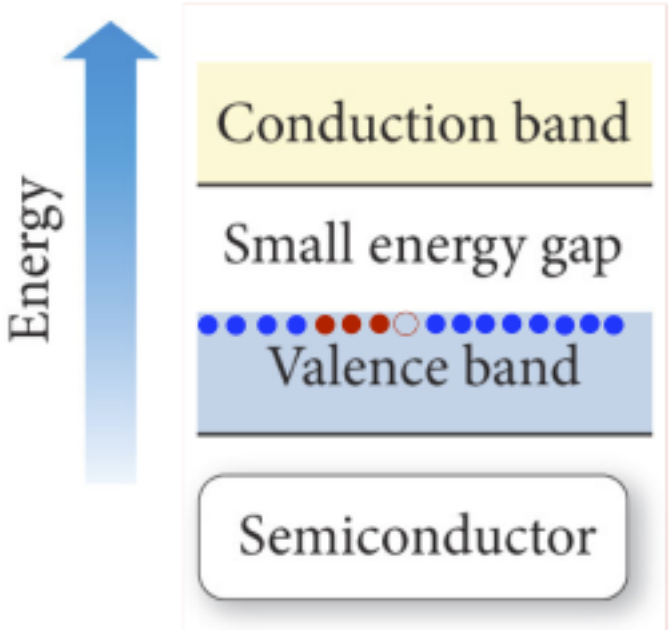
Question #: 13

Octasulfur, $S_8(s)$, is a(n) __1__ [molecular, ionic, nonbonding atomic, metallic, network covalent] crystalline solid.
As such, $S_8(s)$ has a relatively __2__ [low, high] melting point.

1. molecular|molecule|
2. low|lo|

Question #: 14

Germanium is doped, resulting in the material with the band diagram below.

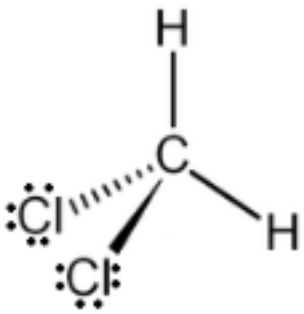


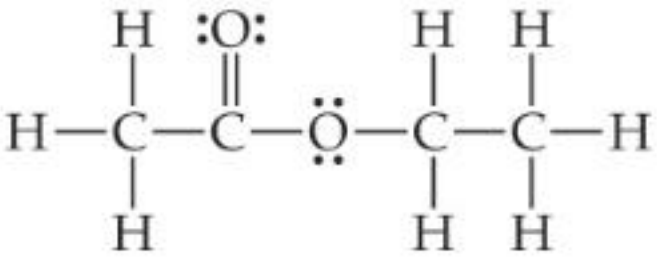
If the blue dots represent electrons from germanium, red dots represent electrons from the dopant, and the open circle represents an electron hole, what is the **identity of the dopant** and the **type of semiconductor** formed?

A. arsenic; n-type
✓B. indium; p-type
C. silicon; p-type
D. gallium; n-type

Question #: 15

Dichloromethane (CH_2Cl_2) and ethyl acetate ($C_4H_8O_2$) spontaneously mix with one another because





A. they form strong hydrogen bonds with one another.
B. there is a large increase in potential energy for the mixed liquids compared to the two pure liquids.
✓C. there is a large increase in entropy for the mixed liquids compared to the two pure liquids.
D. there are strong ion-dipole attractions between dichloromethane and ethyl acetate.

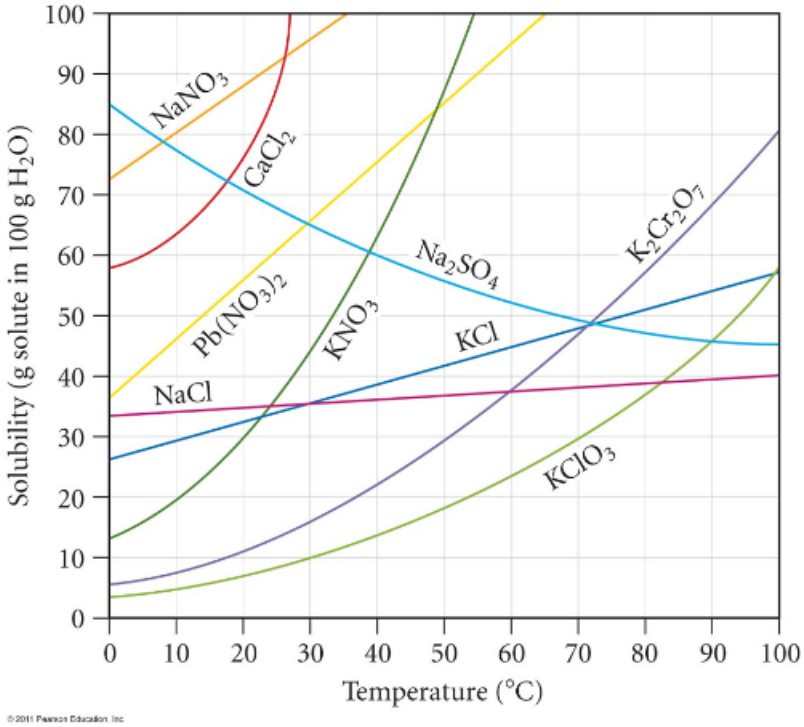
Question #: 16

In a(n) __1__ [saturated, supersaturated, unsaturated] solution, the dissolved solute is in dynamic equilibrium with any undissolved solute; additional solute will not dissolve.
Added solute will dissolve in a(n) __2__ [saturated, supersaturated, unsaturated] solution until equilibrium is reached.
A(n) __3__ [saturated, supersaturated, unsaturated] solution is an unstable solution in which more than the equilibrium amount of solute is dissolved.

1. saturated|Saturated|
2. unsaturated|Unsaturated|un-saturated|
3. supersaturated|Supersaturated|super saturated|super|supersaturate|super-saturated|

Question #: 17

A 35.0 g sample of solid KNO_3 is added, with stirring, to 200.0 g of water at 20.0 °C. What results?



✓A. All of the $KNO_3(s)$ dissolves at 20.0 °C and the solution remains unsaturated.

B. All of the $KNO_3(s)$ dissolves at 20.0 °C and the solution becomes saturated.

C. All of the $KNO_3(s)$ dissolves at 20.0 °C and the solution becomes supersaturated.

D. Most, but not all, of the $KNO_3(s)$ dissolves at 20.0 °C and the solution becomes saturated.

Question #: 18

Which set of conditions results in the **lowest** solubility of $O_2(g)$ in water?

✓A. high water temperature, low pressure of O_2 above the water

B. low water temperature, high pressure of O_2 above the water

C. low water temperature, low pressure of O_2 above the water

D. high water temperature, high pressure of O_2 above the water

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Question #: 19

What is the molality of a solution of 25.9 g $CuCl_2$ (134 g/mol) dissolved in 250. g of water?

✓A. 0.773 *m*
B. 0.00882 *m*
C. 0.119 *m*
D. 1.21 *m*

Question #: 20

What is the concentration in parts per million (ppm) of K^+ in a solution made by dissolving 5.05 mg K_2SO_4 in 125 g H_2O?

A. 0.232 ppm
✓B. 18.1 ppm
C. 87.4 ppm
D. 394 ppm

Question #: 21

What is the **molarity** of a 1.24 *m* glucose (180. g/mol) solution with a density of 1.011 g/mL?

A. 1.39 M
B. 1.18 M
✓C. 1.03 M
D. 0.722 M

Question #: 22

Which aqueous solution has the **lowest** boiling point? Assume ideal van't Hoff factors.

✓A. 0.10 *m* LiBr
B. 0.10 *m* $(NH_4)_3PO_4$
C. 0.25 *m* $C_{12}H_{22}O_{11}$
D. 0.15 *m* $Ca(OH)_2$

Question #: 23

Which substance has the correct van't Hoff factor indicated?

✓A. $Ca(C_2H_3O_2)_2$, $i = 3$
B. NH_4Br, $i = 6$
C. Na_2SO_4, $i = 1$
D. Li_3PO_4, $i = 2$

Question #: 24

A solution at 25 °C contains 0.80 mol H_2O and 0.20 mol of a nonvolatile nonelectrolyte. If $P°(H_2O)$ is 23.8 torr, what is the vapor pressure of the solution?

A. 16.5 torr
B. 18.2 torr
✓C. 19.0 torr
D. 27.7 torr

Question #: 25

What is the osmotic pressure of a 0.125 M potassium chlorate (KClO3, 122 g/mol) solution at 300. K?

A. 1.07 atm
B. 3.48 atm
C. 2.86 atm
✓D. 6.15 atm