The ones in **Times New Roman Bold** are the highly probable ones. MEMORIZE EVERY ONE.
The ones in plain Times New Roman are the medium ones, at least take a look at these and know the concepts
The ones in `Courier New` are the low probability ones. Just glance at these
DON'T GET LAZY AND ONLY LOOK AT THE BOLD ONES. YOU HAVE TO AT LEAST KNOW WHAT THE MEDIUM ONES ARE SAYING. REMEMBER, YOU'RE NOT HERE ONLY TO GET A GRADE, YOU ARE HERE TO LEARN SOME CHEMISTRY….

Why does it take longer to cook an egg in boiling water at high altitude than it does at sea level?

This is part of a larger problem that has nothing to do with what we're doing, but know the answer anyways

ANSWER:
(a) At the higher altitude the ambient pressure is significantly less than 1.0 atm. Under reduced pressure, water boils at less than 100 °C. (2 points)

Two points earned for " At the higher altitude water boils at less than 100 °C, and at the lower temperature the chemical/physical process ("the cooking") take longer.

(a) At ordinary conditions, HF (normal boiling point = 20°C) is a liquid, whereas HCl (normal boiling point = -114°C) is a gas.

ANSWER: - this is my answer, but it sounds ok…
Since HF has hydrogen bonding, it's boiling point is significantly higher than HCL, which uses standard dipole dipole. Since room temperature is high above -114, HCL is a gas, but since room temperature is about 20 degrees, and at times maybe even less, HF is a liquid

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6) The melting points of the alkali metals decrease from Li to Cs. In contrast, the melting of the halogens increase from F2 to I2.

(a) Using bonding principles, account for the decrease in the melting point of the alkali metals.

(b) Using bonding principles, account for the increase in the melting points of the halogens.

(c) What is the expected trend in the melting points of the compounds LiF, NaCl, KBr, and CsI? Explain this trend using bonding principles.
THIS IS A GOOD QUESTION

ANSWER:
a) two points

Alakali metals have metallic bonds: cations in a sea of electrons.

As cations increase in size (Li to Cs), charge density decreases and attractive forces (and melting points) decreases.

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b) two points

Halogen molecules are held in place by dispersion (van der Waals) forces: bonds due to temporary dipoles caused by polarization of electron clouds.

As molecules increase in size (F_2 to I_2), the larger electrons clouds are more readily polarized, and the attractive forces (and melting points) increase.

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c) four points

Melting point order: LiF > NaCl > KBr > CsI

Compounds are ionic

Larger radii of ions as listed

Larger radii leads to smaller attraction and lower melting points.

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a) Xenon has a higher boiling point than neon has.

(b) Solid copper is an excellent conductor of electricity, but solid copper chloride is not.

(c) SiO_2 melts at a very high temperature, while CO_2 is a gas at room temperature, event though Si and C are in the same chemical family.

(d) Molecules of NF_3 are polar, but those of BF_3 are not.
ANOTHER VERY VERY GOOD QUESTION

ANSWER:
a) two points

Xe and Ne are monatomic elements held together by London dispersion (van der Waals) forces. The magnitude of such forces is determined by the number of electrons in the atom. A Xe atom has more electrons than a neon atom has. (Size of the atom was accepted but mass was not.)

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b) two points

The electrical conductivity of copper metal is based on mobile valence electrons (partially filled bands). Copper chloride is a rigid ionic solid with the valence electrons of copper localized in individual copper(II) ions.

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c) two points

SiO_2 is a covalent network solid. There are strong bonds many of which must be broken simultaneously to volatize SiO_2. CO_2 is composed of discrete, nonpolar CO_2 molecules so that the only forces holding the molecules together are the weak London dispersion (van der Waals) forces.

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d) two points

A lone pair of electrons on the central atom results in a pyramidal shape. The dipoles don't cancel, thus the molecule is polar.

There is no lone pair on the central atom so the molecule has a trigonal planar shape in which the dipoles cancel, thus the molecule is nonpolar.

The normal boiling and freezing points of argon are 87.3 K and 84.0 K, respectively. The triple point is at 82.7 K and 0.68 atmosphere.

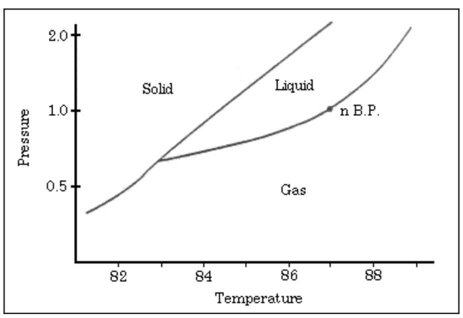
(a) Use the data above to draw a phase diagram for argon. Label the axes and label the regions in which the solid, liquid, and gas phases are stable. On the phase diagram, show the position of the normal boiling point.

(b) Describe any changes that can be observed in a sample of solid argon when the temperature is increases from 40 K to 160 K at a constant pressure of 0.50 atmosphere.

(c) Describe any changes that can be observed in a sample of liquid argon the pressure is reduced from 10 atmospheres to 1 atmosphere at a constant temperature of 100 K, which is well below the critical temperature.

(d) Does the liquid phase of argon have a density greater than, equal to, or less than the density of the solid phase? Explain your answer, using information given in the introduction to this question.
ANOTHER EXCELLENT QUESTION

ANSWER:
a) four points



One point each for:

correct identification of axes
diagram of correct shape
correct labeling of regions
correct position of normal boiling point

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b) one point

The argon sublimes.

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c) one point

The argon vaporizes.

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d) two points

The liquid phase is less dense than the solid phase. Since the freezing point of argon is higher than the triple point temperature, the solid-liquid equilibrium line slopes to the right with increasing pressure. Thus, if a sample of liquid argon is compressed (pressure increased) at constant temperature, the liquid becomes a solid. Because increasing pressure favors the denser phase, solid argon must be the denser phase.

(a) Discuss how the trend in the melting points of the substances tabulated above can be explained in terms of the types of attractive forces and/or bonds in these substances.

(b) For any pairs of substances that have the same kind(s) of attractive forces and/or bonds, discuss the factors that cause variation in the strengths of the forces and/or bonds.
GOOD QUESITON AGAIN

ANSWER
a) six points

H_2 and C_3H_2 have low melting points because the forces involved are the weak van der Waals (or London) forces.

HF has a higher melting point because intermolecular hydrogen bonding is important.

CsI and LiF have still higher melting points because ionic lattice forces must be overcome to break up the crystals, and the ionic forces are stronger than van der Waals forces and hydrogen bonds.

SiC is an example of a macromolecular substance where each atom is held to its neighbors by a very strong covalent bond.

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b) two points

$C_3H_8$and H_2: There are more interactions per molecule in C_3H_8than in H_2. Or C_3H_8 is weakly polar and H_2 is nonpolar.

LiF and CsI: The smaller ions in LiF result in a higher lattice energy than CsI has. Lattice energy U is proportional to 1 / (r^+ + r^-)

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17) Give an explanation for each of the following observations:

a) The boiling point of CBr_4 is distinctly higher than that of CCl_4.
b) The boiling point of CH_3OH is distinctly higher than that of CH_3Cl.

Good Question, no answer, but I'll come up with one later. However, try to find it yourself. Don't wait for me to do it, cuz if you do, you'll end up waiting till doomsday…

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20. Consider the melting points of the following subs tances:

Substance	Melting point
Iron	**1535 °C**
Carbon (diamond)	**3600 °C**
Hydrogen	**-259 °C**
Cesium iodide	**621°C**
Hydrogen chloride	**-115 °C**
Hydrogen fluoride	**-83 °C**

Account for these melting points in terms of the attractive forces present in these solids.

ANOTHER EXCELLENT QUESTION, I'LL COME UP WITH ANSWER LATER. Same deal though

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Consider the following melting points in degrees Celsius:

Alkali metals m.p. Halogens m.p.
Li 181 F2 -119
Na 98 Cl2 -101
K 63 Br2 -7
Rb 39 I2 +104
Cs 29

(a) Account for the trend in the melting points of the alkali metals.

(b) Account for the trend in the melting points of the halogens.

(Make sure that your discussion clarifies the difference between the two trends.)

The boiling points of the following compounds increase in the order in which they are listed below:

CH4 < H2S < NH3

Discuss the theoretical cons iderations involved and use them to account for this order.
GOOD QUESTION!!!!!!!. No answer, but here's my answer

My ANSWER:
In CH4, the strongest IMF are london forces. In H2S, the strongest IMF are dipole dipole attractions. In NH3, the strongest IMF's are Hydrogen Bonds (really strong dipole dipole's). Londen forces are weaker than Dipole Dipole, dipole dipole is weaker than H-bonds. The weaker the IMF's, the lower the boiling point, because less Kenetic energy is needed to overcome the IMF's. If a substance possess weak IMF's, such as CH4, then it will have a relatively low boiling point, because the kenetic energy does not have to be very high to overcome the IMF's. If a substance has very strong IMF's, such as the Covalently bonded SiC, the boiling point will be relatively high, because a large KE is needed to overcome the IMF's. Since CH4 has the weakest IMF's (london forces), it has the lowest boiling point. H2S has Dipole Dipole, which lies between H bonds and London forces, so it has the "middle" boiling point. NH3 has a very strong H Bond, much strong than both CH4 and H2S, so it has the highest boiling point.

Discuss briefly the relationship between the dipole moment of a molecule and the polar character of the bonds within it. With this as the basis, account for the difference between the dipole moments of CH2F2 and CF4
ONCE AGAIN, NO ANSWER,BUT HERE'S MINE

My Answer:
The dipole moment of a molecule is when the electron clouds are not evenly distributed around the molecule, and once sice becomes slightly negatively charged, and the other becomes slightly positively charged. However, since the electrons are constantly moving, these instantaneous dipoles are short lived. However, since they are constantly being "produced," they are considered a weak IMF. Polar molecules, however, are molecules that are not evenly charged at all places. H2O, for example is a polar molecule. However, it also has an H Bond. When a molecule is more negative or positive at one end than at another, it is a polar molecule. Gotta finish this later

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8) For each of the following, use appropriate chemical principles to explain the observation.

(a) Sodium chloride may be spread on an icy sidewalk in order to melt the ice; equimolar amounts of calcium chloride are even more effective.

(b) At room temperatue, NH_3 is a gas and H_2O is a liquid, even though NH_3 has a molar mass of 17 grams and H_2O has a molar mass of 18 grams.

(c) C (graphite) is used as a lubricant, whereas C (diamond) is used as an abrasive.

(d) Pouring vinegar onto the white reside in a kettle used for boiling water results in fizzing/bubbling phenomenon.

ANSWER:
a) two points

The addition of a solute lowers the freezing point of water.

A mole of NaCl contains (dissociates into) 2 moles of ions/particles, whereas a mole of $CaCl_2$ contains (dissociates into) 3 moles of ions. Therefore, $CaCl_2$ is more effective.

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b) two points

Hydrogen bonding is the most important intermolecular attractive force between molecules of H_2O and between molecules of NH_3.

Water is a liquid because the hydrogen-bonding forces are stronger between the adjacent H_2O molecules than between adjacent NH_3 molecules.

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c) two points

Graphite's structure consists of 2-dimensional sheets of covalently bonded carbon atoms.

The attractive forces between sheets (layers) are weak London (dispersion) forces, which allow the sheets to slide easily over one another. (Note: must indicate layers and sliding to earn point.)

Diamond consists of an extended 3-dimensional covalent network of carbon atoms. This makes diamond a very hard substance.

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d) two points

Vinegar, a dilute solution of acetic acid, reacts with the white solid, which contains metal carbonates, in a neutralization reaction to form gaseous CO_2.

What is meant by the lattice energy of an ionic compound? What quantities need to be determined and how are they used to calculate the lattice energy of an ionic compound.

At 20 °C the vapor pressure of benzene is 75 torr, and the vapor pressure of toluene is 22 torr. Solutions in both parts of this question are to be considered ideal.

(a) A solution is prepared from 1.0 mole of biphenyl, a nonvolatile solute, and 49.0 moles of benzene. Calculate the vapor pressure of the solution at 20 °C.

(b) A second solution is prepared from 3.0 moles of toluene and 1.0 mole of benzene. Determine the vapor pressure of this solution and the mole fraction of benzene in the vapor.

5) The freezing point and electrical conductivities of three aqueous solutions are given below.

Solution	Freezing Point	Electrical Conductivity
0.010-molal sucrose	-0.0186 °C	almost zero
0.010-molal formic acid	-0.0213 °C	low
0.010-molal sodium formate	-0.0361 °C	high

Explain the relationship between the freezing point and electrical conductivity for each of the solutions above. Account for the difference in the freezing point among the three solutions.

Two beakers, one containing 100 milliliters of a 0.10-molal solution of sucrose (a nonvolatile nonelectrolyte) and the other containing 100 milliliters of pure water, are placed side by side in a closed system, such as under a bell jar. Explain in terms of the principles involved what changes, if any, occur to bring the system to equilibrium.

Alcohol dissolves in water to give a solution that boils at a lower temperature than pure water. Salt dissolves in water to give a solution that boils at a higher temperature than pure water. Explain these facts from the standpoint of vapor pressure.

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20) Point out significant differences in the physical properties of the four substances, neon, ammonia, silicon dioxide, and potassium chloride. Account for these differences in terms of chemical bonding theory.

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18) Discuss differences in the bonding between atoms in the following compounds: NaH, CH_4, HCl

DECENT QUESTION, I'LL COME UP WITH ANSWER LATER

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1. A student performs an experiment to determine the molar mass of an unknown gas. A small amount of the pure gas is released from a pressurized container and collected in a graduated tube over water at room temperature, as shown in the diagram above. The collection tube containing the gas is allowed to stand for several minutes, and its depth is adjusted until the water levels inside and outside the tube are the same. Assume that:

-the gas is not appreciably soluble in water
-the gas collected in the graduated tube and the water are in thermal equilibrium
-a barometer, a thermometer, an analytical balance, and a table of the equilibrium vapor pressure of water at various temperatures are also available.

a. Write the equation(s) needed to calculate the molar mass of the gas.

b. List the measurements that must be made in order to calculate the molar mass of the gas.

c. Explain the purpose of equalizing the water levels inside and outside the gas collection tube.

d. The student determines the molar mass of the gas to be 64 g mol-1. Write the expression (set-up) for calculating the percent error in the experimental value, assuming that the unknown gas is butane (molar mass 58 g mol-1). Calculations are not required.

e. If the student fails to use information from the table of the equilibrium vapor pressures of water in the calculation, the calculated value for the molar mass of the unknown gas will be smaller than the actual value. Explain.

ANSWER:
8 points:

a - 1 point PV = nRT AND n = m

, OR molar mass = mRT

, OR M = DRT

M PV P

B - 3 points
temperature, atmospheric pressure, volume of the gas, and mass of gas (mass of pressurized container before and after releasing the gas)

Note: 1 point earned for any two of the above, 2 points earned for any three of them. "The mass of the gas" is acceptable as a "measurement" for the 1st or 2nd point. Extraneous measurements (e.g., density, volume of liquid, etc.) are ignored. To earn 3rd point, "mass of pressurized container before and after releasing the gas", or "change in mass of container" must be indicated.

C - 1 point
to equalize internal pressure with room pressure (atmospheric pressure), or the pressure(s) will be the same.

1 point $\% \text{ error} = \frac{(64 - 58)}{58 \text{ g}} \times 100\%$ (or 6/58 x 100%, or 6/58)

Note: No points earned for generic response (e.g., | (expt. - theor.) | / (theor.) x 100), or for 6/64 x 100%. No penalty if "x 100%" is absent or if value (10%) is not calculated.

d. 1 point
Pressure will be larger, therefore number of moles will be larger

e. 1 point

molar mass = mass/moles, therefore calculated molar mass will be smaller

OR,

$M = \frac{mRT}{PV}$ (or, $M = \frac{DRT}{P}$), and the denominator, PV, will be too large.

Therefore, the value of the molar mass ($= \frac{mRT}{PV}$ or $\frac{DRT}{P}$) will be too small.

OR,

1 point only

The pressure is larger, or the number of moles is larger, or since Ptotal = (Punknown – Pwater) we know that Ptotal > Punknown.

Note: If n = m/M is missing in part (a) but present in part (e), 1 point is earned for part (a).

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5) The conductivity of several substances was tested using the apparatus represented by the diagram below. The results of the tests are summarized in the following data table.

	$AgNO_3$	Sucrose	Na	H_2SO_4
Melting Point (°C)	212°	185°	99°	Liquid at Room Temp.
Liquid (fused)	++	-	++	+
Water solution	++	-	++(1)	++(2)
Solid	-	-	++	Not Tested

Key: ++ Good conductor (1) Dissolves, accompanied by evolution of flammable gas
+ Poor conductor (2) Conduction increases as the acid is added slowly and carefully to water
- Nonconductor

Using models of chemical bonding and atomic or molecular structure, account for the differences in conductivity between the two samples in each of the following pairs.

(a) Sucrose solution and silver nitrate solution

(b) Solid silver nitrate and solid sodium metal

(c) Liquid (fused) sucrose and liquid (fused) silver nitrate

(d) Liquid (concentrated) sulfuric acid and sulfuric acid solution

ANSWER:
5) Two points are alloted for each of the four parts. One point is given for naming of the charge carriers which must be explicitly stated as mobile or free to move. The second point is given for the structure or bonding of the substance. A complete explanation of the conductivity of one sample in each pair is sufficient for credit providing that some minimal reference is subsequently made to the second substance of the pair.

The entire answer is scored holistically--that is, a principle once stated in one part need only be referenced later for credit to be awarded in that latter part. For example, a mobility reference in (a) or (c) is relevant to the other.

Ideas which contribute to correct responses:

(a) Sucrose Solution "-" AgNO3 Solution "++"
covalent bonding ionic bonding
Molecules in water ions in water are free to move therefore conduct
no ions formed therefore no charge flow

(b) Solid Na "+" Solid AgNO3 "-"
Na+ in a sea of electrons ionic bonding
conducts since electrons can move ions fixed in lattice therefore cannot move therefore no conductivity

(c) Sucrose Fused "-" AgNO3 Fused "++"
covalent bonding ionic bonding
fused but still molecular fused alows ions to move therefore conduct
no ions present; no motion; no conductivity ionic bonds broken when melted

(d) Conc. H2SO4 "+" Diluted H2SO4 "++"
not 100% dissociated 100% dissociated or more ions
forms ion pairs H2SO4 + H2O --> 2H3O+ + SO42¯
fewer ions therefore lower conductivity water addition allows production of many more ions and greater conductivity
[mobility not checked] Note SO42¯ alone is insufficient

Key Words
For 'conduction' point: For 'structure' point:
Good Poor Good
move conducts [merely repeats question] ionic bonds, ionic
free separate ions
transfer line up molecular
flow dissolve molecules
mobile break up crystal lattice
carry dissociate sea of electrons
travel pass through (?) metallic bonding (not just "metal")
sea of electrons transport or transfer of e¯ in a solution covalent
spread out
delocalized
conduction band, band theory

Irrelevant erroneous statements do not reduce credit. Relevant erroneous statements have more effect on a potential 2 point part score that on a potential 1 point part score.

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7) The van der Waals equation of state for one mole of a real gas is as follows:

$(P + a/V^2)(V - b) = RT$

For any given gas, the values of the constants a and b can be determined experimentally. Indicate which physical properties of a molecule determine the magnitudes of the constants a and b . Which of the two molecules, H_2 or H_2S has the higher value for a and which has the higher value for b ? Explain. One of the van der Waals constants can be correlated with the boiling point of a substance. Specify which constant and how it is related to the boiling point.

ANSWER:
7) Average score 4.28

Points awarded for each statement follow that statement.

Constant a is related to the attractive forces that exist between real molecules. (1 point)

Constant b is related to the fact that real molecules do have volumes. (1 point)

H_2S has a larger value for a. (1 point)

H_2S is a polar molecule and, therefore, has stronger intermolecular forces. (2 points)

H_2S has a larger value for b because an H_2S molecule has a larger volume than H_2 has. (1 point)

The constant a correlates with the boiling point since a is related to the intermolecular forces, which must be overcome in the process of boiling a liquid. (2 points)

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5) For the system $2\ SO_2(g) + O_2(g) \longrightarrow 2\ SO_3(g)$, DH is negative for the production of SO_3. Assume that one has an equilibrium mixture of these substances. Predict the effect of each of the following changes on the value of the equilibrium constant and on the number of moles of SO_3 present in the mixture at equilibrium. Briefly account for each of your predictions. (Assume that in each case all other factors remain constant).

(a) Decreasing the volume of the system

(b) Adding oxygen to the equilibrium mixture

(c) Raising the temperature of the system
