

Things to think about

Many people have wondered what types of problems might be on the exam.

Here are some examples. They do not reflect what the actual exam looks like. The problems on the exam may include others that are “different” and topics that are not mentioned.

Objective questions

True False

When comparing two bonds the one with the largest ionic character will always be the strongest.

False. This might be true when comparing very similar covalent bonds but is not in any way true in general.

Multiple Choice

Which of the following has the lowest potential energy?

- a) an electron and a hydrogen nucleus separated by 4\AA
- b) an electron and a helium nucleus separated by 4\AA
- c) an electron and a hydrogen nucleus separated by 2\AA
- d) an electron and a lithium nucleus separated by 4\AA
- e) an electron and a gold nucleus separated by 10\AA

e. from coulombs law. The energies of each are proportional to $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{3}{4}$, and 7.9

Other problems with require an “explanation”.

True/False. If the statement is false explain what is incorrect.

Thompson’s famous experiment with cathode rays determined the mass of the electron.

False. The experiment determined the mass to charge ratio of the electron.

You might need to make a sketch of something.

Make a sketch of the potential energy of a NaCl molecule where $V = 0$ is defined as the energy of the neutral atoms separated by an infinite distance. On your graph label the bond dissociation energy and bond length.

See figure for ionic bond in book

Structure problems

What is the geometry of the SO_4^{2-} ion? What are the bond angles? What is the average formal charge on each atom? Does this ion have a permanent dipole?

Tetrahedral. Exactly 109.5° . S formal charge of zero. Each O atom $-1/2$
No dipole.

- Which of these two is the better choice of Lewis diagrams for N_2O . Explain your choice.



The one on the left as it has the negative formal charge on the most electronegative atom (O).

Or given that we can consider these two structure as resonance structure for N_2O , how would you expect the N,N bond in N_2O to compare to the bond in N_2 ? (stronger, weaker, slightly stronger, exactly the same,...) Why?

Slightly weaker than a N,N triple bond. The bond is between a double and a triple bond, but the structure with the triple bond will contribute more as it is the "better" structure.

Or numerical calculation problems

What is the change in potential energy for moving an electron that is initially 5\AA away from a Li nucleus to a distance that is 2\AA ?

Straight forward coulomb's law problem. $(-3e^2/4\pi\epsilon_0)(1/5-1/2)$