

**SHORT ANSWER.** Write the word or phrase that best completes each statement or answers the question.

- 1) Atoms with the same number of protons but different numbers of neutrons are called \_\_\_\_\_.
- 2) The electron density of \_\_\_\_\_ orbitals has spherical symmetry.
- 3) An oxygen atom has \_\_\_\_\_ valence electrons.

**ESSAY.** Write your answer in the space provided or on a separate sheet of paper.

- 4) Draw a correct Lewis structure for boric acid, B(OH)<sub>3</sub>.
- 5) Draw a correct Lewis structure for acetonitrile, CH<sub>3</sub>CN.

**MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question.

- 6) The compound methylamine, CH<sub>3</sub>NH<sub>2</sub>, contains a C–N bond. In this bond, which of the following best describes the charge on the carbon atom?
  - A) +1
  - B) slightly positive
  - C) uncharged
  - D) slightly negative
  - E) -1
- 7) The formal charge on oxygen in dimethyl ether, CH<sub>3</sub>OCH<sub>3</sub>, is:
 

A) +2	B) +1	C) 0	D) -1	E) -2
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- 8) Which of the following terms comes closest to describing an electrophile?
 

A) nonpolar	B) Lewis acid	C) anion	D) nucleophile	E) Lewis base
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**ESSAY.** Write your answer in the space provided or on a separate sheet of paper.

- 9) Would you predict trifluoromethanesulfonic acid, CF<sub>3</sub>SO<sub>3</sub>H, to be a stronger or weaker acid than methanesulfonic acid, CH<sub>3</sub>SO<sub>3</sub>H? Explain your reasoning.
- 10) Use the curved arrow formalism to show the movement of electron pairs in the following reaction



- 11) Draw the other important resonance form of:

