Entry Level Test Answer Key

1. In the covalent bond present in a molecule of hydrogen fluoride, the electrons spend a greater proportion of their time closer to the fluorine nucleus than to the hydrogen nucleus.

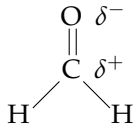
   Relevant section of *Organic Chemistry*, 8th ed.: 2.1

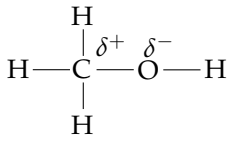
2. Electronegativities:

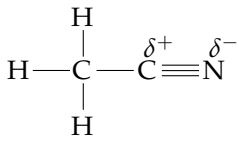
   F > O > N > C

   Relevant section of *Organic Chemistry*, 8th ed.: 2.1

3. Positive and negative ends of bonds:

   a. 

   b. 

   c. 

   Relevant section of *Organic Chemistry*, 8th ed.: 2.1

4. The C—H bond is regarded as being nonpolar in most organic compounds because the electronegativity of carbon is similar to that of hydrogen.

   Relevant section of *Organic Chemistry*, 8th ed.: 2.1

5. If H_2O was a linear molecule, H—O—H, it would be nonpolar. In such a molecule, the centre of gravity of the positive and negative charges would coincide. Because water is polar, we must conclude that the centres of gravity of the positive and negative charges do not coincide. This arrangement can occur only if the molecule is nonlinear.

   Relevant section of *Organic Chemistry*, 8th ed.: 2.2

6. The following molecules do not possess a dipole moment:

   b. CBr_4

   d. $H_2C{=}{=}CH_2$

   e. CO_2

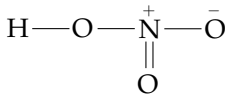
   f. C_4H_{10}

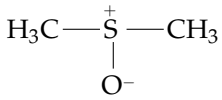
   Relevant section of *Organic Chemistry*, 8th ed.: 2.2

7. As carbon disulphide is nonpolar, you may conclude that it is a symmetrical, linear molecule.

   Relevant section of *Organic Chemistry*, 8th ed.: 2.2

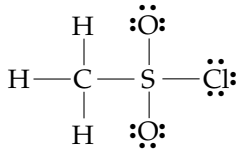
8. Atoms carrying formal charges:

   a. 

   b. 

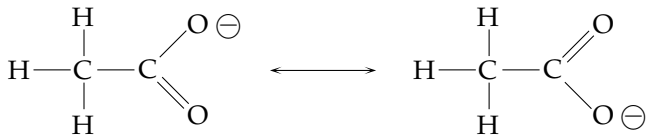
   Relevant section of *Organic Chemistry*, 8th ed.: 2.3

9. Lewis structure of CH_3SO_2Cl:

   Relevant section of *Organic Chemistry*, 8th ed.: 2.3

10. There are only two reasonable resonance forms:

    Relevant sections of *Organic Chemistry*, 8th ed.: 2.4 and 2.5

11. According to the Brønsted-Lowry definition, an acid is a substance that can donate a proton.

    Relevant section of *Organic Chemistry*, 8th ed.: 2.7

12. Brønsted-Lowry acids: $CH_3{-}C{\equiv}C{-}H$ and NH_3

    Brønsted-Lowry bases: $NaNH_2$ and $CH{-}C{\equiv}C^-Na^+$

    Relevant section of *Organic Chemistry*, 8th ed.: 2.7

13. The K_a of acetic acid is calculated by the following formula:

$$K_a = \frac{[CH_3CO_2^-][H^+]}{[CH_3CO_2H]} \text{ or } K_a = \frac{[CH_3CO_2^-][H_3O^+]}{[CH_3CO_2H]}$$

Relevant section of *Organic Chemistry*, 8th ed.: 2.8

14. The pK_a of acetic acid is

$$\begin{aligned} pK_a &= -\log_{10} K_a \\ &= -\log_{10}(1.8 \times 10^{-5}) \\ &= -(0.26 - 5) \\ &= 4.74 \end{aligned}$$

Relevant section of *Organic Chemistry*, 8th ed.: 2.8

15. Acids in order of decreasing strength:

formic > benzoic > propionic

Relevant section of *Organic Chemistry*, 8th ed.: 2.8

16. Bases in order of decreasing strength:

amide > ethoxide > hydroxide

Relevant section of *Organic Chemistry*, 8th ed.: 2.8

17. Compound B (pK_a = 4.76) is more acidic.

Relevant section of *Organic Chemistry*, 8th ed.: 2.8

18. According to the Lewis definition, a base is a substance that can donate a pair of electrons.

Relevant section of *Organic Chemistry*, 8th ed.: 2.11

19. Lewis acid: BF_3

Lewis base: CH_3NH_2

Relevant section of *Organic Chemistry*, 8th ed.: 2.11