**E1.1:**

a) The atomic number of P (phosphorus) is 15, meaning there are 15 protons. The mass number for the $^{31}$P isotope is 31, so:

15 protons + 16 neutrons = mass number 31

(recall that mass number is number of protons and neutrons).

(for parts b-d, use the same reasoning as above)

b) 15 protons + 17 neutrons = mass number 32

c) 17 protons + 20 neutrons = mass number 37

d) 1 proton + 2 neutrons = mass number 3

e) 6 protons + 8 neutrons = mass number 14

**E1.2:**

a) $1s^22s^22p^3$

b) $1s^22s^22p^4$

c) $1s^22s^22p^5$

d) $1s^22s^22p^63s^2$

e) $1s^22s^22p^6$ (same as Neon atom)

f) $1s^22s^22p^63s^23p^64s^1$

g) $1s^22s^22p^63s^23p^6$ (same as Argon atom)

h) $1s^22s^22p^63s^23p^6$ (same as Argon atom)

i) $1s^22s^22p^63s^23p^4$

j) $1s^2$ (same as Helium atom)

k) $1s^22s^22p^63s^23p^6$ (same as Argon atom)

**E1.3:**
E1.4:

a) \(\text{HOOCCOO}^-\)  
    malate

b) \(\text{HCH}_3\)  
    alanine

c) \(\text{CH}_3\text{CH}_2\)  

E1.6: Below are full structural drawings, showing all carbons and hydrogens:

6 hydrogens

a) \(\text{HCOOH}\)  
    dihydroxyacetic acid

5 hydrogens

b) \(\text{HOOCCH}_2\text{COO}^-\)  
    isocitrate

e) \(\text{NH}_2\text{C}_6\text{H}_4\text{NH}_2\)  
    arginine

d) \(\text{H}\text{C}_6\text{N}_2\text{H}_4\text{N}\)  
    guanine
E1.10: There is only one constitutional isomer of ethanol: dimethyl ether \( \text{CH}_3\text{OCH}_3 \)

E1.11:

a) 

b) 

c)

E1.12:

a) carboxylate, sulfide, aromatic, two amide groups (one of which is cyclic)

b) tertiary alcohol, thioester

c) carboxylate, ketone

d) ether, primary amine, alkene

E1.14:

acetic acid: ethanoic acid

chloroform: trichloromethane

acetone: propanone (not 2-propanone, because the '2' in this case would be redundant: if the carbonyl carbon were not in the #2 position, the compound would be an aldehyde not a ketone)
E1.17: The linking group is a phosphate diester