E1.1:

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

\[15 \text{ protons} + 16 \text{ neutrons} = \text{mass number 31}\]

(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:
Below are full structural drawings, showing all carbons and hydrogens:

**E1.4:**

a) $\text{H}_2\text{C}(-\text{C})\text{O}(-\text{C})\text{O}^-$

malate

b) $\text{H}_2\text{C}(-\text{C})\text{O}(-\text{N})\text{H}$

alanine

c) $\text{H}_2\text{C}\text{O}(-\text{CH}_3)$

d) $\text{O}(-\text{P})\text{O}(-\text{C})\text{H}$

e) $\text{H}_2\text{N}(-\text{C})\text{O}^-$

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

6 hydrogens

a) $\text{C}_3\text{H}_4\text{O}_4$

dihydroxyacetone

5 hydrogens

b) $\text{C}_3\text{H}_4\text{O}_4$

isocitrate

15 hydrogens

c) $\text{C}_6\text{H}_{14}\text{N}_4$ arginine

d) $\text{C}_5\text{N}_2\text{H}_6$ gamma

**E1.8:**
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