Melting Points and Boiling Points of Organic Compounds

In order to melt or boil an organic compound the temperature (and related heat energy) must be increased to affect or completely overcome the intermolecular forces between molecules.

affect ➜ melting
overcome ➜ boiling

The greater the intermolecular force the harder it is to melt or boil and hence the higher the m.p. and b.p.

There are three types of intermolecular forces:

Name	Strength	Polarity	Special Conditions
van der Waals (or London Force)	low	non-polar	C and H only atoms present
dipole interaction	medium	medium polar	C to O bonds, or C to N bonds
hydrogen bond	high	very polar	–OH groups (or –NH) stronger for carboxylic acids

Two factors to consider:

1. The larger a molecule, the greater the van der Waal forces, the higher the m.p. or b.p.

2. The greater the polarity, the higher the m.p. or b.p.

Both factors must be considered.

eg test questions:

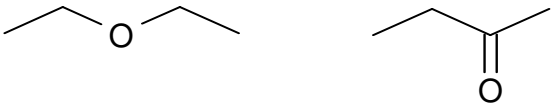
State which of the two compounds have a higher m.p. or b.p. and why:

eg #1 

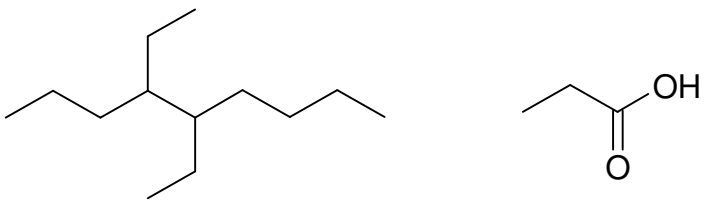
first because it is bigger, therefore greater van der Waals, etc.

eg #2 

first because a stronger more polar intermolecular force



second because the ketone has greater polarity

eg #4 

the first one because in this case, size beats polarity

Polarity Ranking				
non-polar	low	medium	high	very high
alkanes alkenes alkynes	ethers (amines)*	aldehydes ketones esters (amides)*	alcohols	carboxylic acids

* Amines and amides can have high to very high polarity depending on what is attached to the hydrogen. If hydrogen is attached to the nitrogen the polarity increases due to the formation of hydrogen bond intermolecular forces.