Convective boundary mixing and temperature gradient

This test checks the implementation of the extended convective penetration prescription for core boundary mixing.

A $5M_\odot$ model is evolved from the zero age main sequence to when the central hydrogen mass fraction drops below 0.4. At this point, MESA checks the mixing types and temperature gradients at 4 points in the star, specifically at mass coordinates 0.8, 0.95, 1.1 and $1.5M_\odot$.

We check at these mass coordinates if the temperature gradients are within a tolerance of 1D-4 of the expected temperature gradient, and if the mixing types match the expected ones.

1. At mass coordinate $0.8M_\odot$, we expect to be inside the convective core, and hence to have convective mixing with an adiabatic temperature gradient ($\nabla_T = \nabla_{ad}$).

2. At mass coordinate $0.95M_\odot$, we should be be in the convective penetrative part of the core boundary mixing region. So we expect the mixing type to be overshoot, and the temperature gradient to be adiabatic.
   Here, we also check if the mixing coefficient equals the the one at the convective boundary, to check if the coefficient behaves step-like in this region.

3. At mass coordinate $1.1M_\odot$ we expect to be in the exponentially decaying overshoot region, where the temperature gradient is making a gradual switch between the radiative and adiabatic gradients, $\nabla_T = f\nabla_{ad} + (1-f)\nabla_{rad}$, with f the fraction of the temperature gradient that is adiabatic.
   Here, we also check that the fraction f deviates from 1 and 0, so that ∇_T is actually making a gradual switch, and that the mixing coefficient is between 1d4 cm^2/s and 1% of the mixing at the core boundary, to confirm that it is decaying.

4. At mass coordinate $1.5M_\odot$, we should be outside the convective core and overshoot region, so that the mixing type is minimum diffusive mixing and that we have a radiative temperature gradient ($\nabla_T = \nabla_{rad}$).

Enabling the pgstar plots through the pgstar_flag in the inlist will show the mixing profile, was well as the MESA 'Grid4' preset plots, where the summary profile shows ∇_T, ∇_{ad} and ∇_{rad}.

Note that the choice of these mass coordinates is specific for this choice of input physics, and might be different if enabling different options in the inlist.

The controls for the timestep and mesh size are chosen for the purpose of a short runtime of this test suite, and may not produce completely converged models. These should be adjusted if used for scientific purposes.