Lexical processes are those that take place inside the lexicon, we now believe. In English, these include word-building processes such as affixation and stress assignment. Taking a root like regular, we might prefix in- to it, applying the lexical rule of Complete Nasal Assimilation, in which the nasal takes on not only the place features but also the root and laryngeal features of the next consonant. We might suffix -ity to it, producing either irregularity or regularity, both with stress shifting from /reg/ to /lær/.

Processes like these can give us cues to the underlying representations of morphemes. We probably wouldn’t want to decompose regular any farther,¹ but we can see that its underlying form is something other than /reg]ələr/. That last [ə] must secretly be /æ/.²

When a process changes one underlying phoneme into another, or glues morphemes together to make words, you can be fairly sure that it is a lexical process. Here are some examples of lexical processes from languages other than English:

In Persian, verb stems alternate between their present and past forms, with most of the alternations left over (like the English ‘strong’ verbs such as seek/sought) from once-productive processes. Now there are only three or four verbs that have an alternation between a present stem ending in -r and a past stem ending in -f: [dor - dof] ‘have’, [guzar - guzaʃ] ‘pass by’, to name a couple. The process changing /r/ to /ʃ/ looks sort of phonological: it is caused by a following /t/, so you get voicing and root assimilation, and manner dissimilation. Indeed, you can write a nice rule to describe it: /r/ → /ʃ/ /t/.³

In a way, this can be viewed as neutralization, so I think it’s postlexical.⁴

If a process is exceptionless and allophonic, such as English aspiration/deaspiration, or nasalization, then it can be assigned to the post-lexical rules. These rules typically produce new sounds which are not underlying phonemes: obstruents with a value for [spread], or vowels which are [+nasal], in English. One case in which a change of an underlying phoneme into another can be classified as postlexical is that of neutralization. The appearance of only voiceless unaspirated obstruents word-finally in Thai (while voiced and aspirated obstruents can appear elsewhere) looks pretty post-lexical to me, as does German syllable-final devoicing. What about the Japanese assimilation, which turns /t/ and /s/ into [tʃ] and [ʃ] respectively before /i/? There is already an /ʃ/ which appears before vowels other than /i/, as in Shogun. But it is an exceptionless, phonetically motivated process, one which is mirrored in the back by the change of /t/ to [ts] before /u/ and in the voiced obstruents by /d/ becoming [dʒ] before /i/ and /dz/ before /u/. In a way, this can be viewed as neutralization, so I think it’s postlexical.

Many, but not all, assimilatory processes are postlexical.⁴ Nasal assimilation, in which a nasal consonant takes on the Place features of a following obstruent, is an example. Intervocalic weakening, such as Flapping in English, or the change of voiced stops to fricatives between vowels in Spanish, is another. Devoicing of word-final sonorants after voiceless obstruents in French, producing forms like [ʃifʁ] ‘figure’ contrasting with [ʃeʁ] ‘goat’, is still another.

¹ Though the -ar on the end certainly looks like the one on the end of circular, which presumably is made of circle + -ar. But what is ‘regle’?
² I’m not prepared to rule /ə/ out as an underlying phoneme. If you have no alternations to show it is derived from some other vowel, the only responsible thing to do is to put it in the lexicon: e.g. approximate. It’s got to be /əprəksəmənt/. You could try to claim that approximate had an [i] in the third syllable, but I’d bet money that if you did it would be the same as the one in approximant. And don’t try any tricks with proxy: you’re not Chomsky or Halle, and you won’t get away with it.
³ In the Old Days, a rule which changed one phoneme into another was called a Morphophonemic rule and had to be kept separate from Allophonic rules, which produced only allophones. We don’t worry about this any more.
⁴ Lexical assimilations include the irregular, illegal, impossible, etc. one mentioned above. An example of a lexical DISSIMILATION is the appearance of -ar instead of -al after stems with an /l/ not ‘protected’ by a following /t/; it’s a Latin rule, but we still obey it in English except for a couple of doublets like linear - lineal.